IFB NO. RTA/LR 95-10
UNIVERSITY LINK RAIL PROJECT
CONTRACT U250
UW STATION FINISHES

CONTRACT SPECIFICATIONS

100% SUBMITTAL

VOLUME 2           BOOK 1 OF 2           MAY 2009
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**BID SHEET**

*The lowest responsive/responsible Bidder will be determined based on the Total Bid Price.*

Having carefully examined the Contract Documents for this project as prepared by Sound Transit, as well as the site of the work, and the availability of materials and labor, we propose to perform the work identified in the Contract Documents under the terms and conditions contained herein for the price set forth below:

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Item Description</th>
<th>Estimated Quantity</th>
<th>Unit of Measure</th>
<th>Unit Price</th>
<th>Extended Amount /Lump Sum</th>
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Total Bid Price Including Retail Sales Tax: $ 

We agree that, if we are awarded this Contract, we will be entitled to payment only for actual unit quantities performed and that General Conditions Section 4.09 shall apply in the event there are quantity increases or decreases in any unit price bid item.

Signed this ________________ day of __________________, 20______.

By: ________________________________

(Signature)

Print Name ________________________________ Title: ________________________________

Firm: ________________________________

Address: ________________________________ City/Zip: ________________________________

State of Incorporation: ________ Contractor's License No: ________________________________

Federal Tax ID No. ________ WA Workers Comp. Acct. No.: ________________________________

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### Appendix A – Geotechnical Conditions Summary

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SEALS PAGE

The Professional seals and signatures affixed hereon indicate the professionals' review and participation in the preparation of the Contract Specifications.

Monica J. Moravec
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and
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Bruce V. Erickson
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John Nesholm
Divisions: 04, 06, 07 (Except 07 10 00), 08, 09, 10 (Except 10 14 53), 11, 14
and
Sections: 03 35 00, 03 45 00, 05 05 14, 05 40 00, 05 43 21, 05 51 00, 05 52 00, 05 53 33, 05 58 27, 12 10 00.

Barbara Swift
Sections: 12 93 00, 32 12 83, 32 14 13.19, 32 84 00, 32 90 00, 32 92 00.

Lawrence A. Moniz
Division: 14,
and
Section: 12 10 00.

Richard K. Johnson
Sections: 05 12 33, 31 63 00.

Pamela S. Moran
Section: 07 10 00.

Gabriel M. Grijalva
Sections: 10 14 53, 32 17 23, 34 41 13.
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Sean E. Cassady  
Division: 21.

Aaron P. Sharp  
Divisions: 22, 23 (Except Section 23 30 10).

Dilip S. Shah  
Section: 23 30 10.

Patricia L. Fordyce  
Divisions: 25, 26, 28.

Richard W. Smith  
Sections: 31 09 00, 31 23 19.

Debbie L. Maroon  
Sections: 33 40 00, 33 46 00.
PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes a summary of the Work in this Contract and other known work in the vicinity of the Contract Work.

B. The work to be performed under this Contract consists of furnishing all tools, equipment, materials, supplies, and manufactured articles; furnishing all labor, transportation, and services, including fuel, power, water, and essential communications; and performing all work or other operations required for the fulfillment of the Contract. Provide all work, materials, and services not expressly indicated in the Contract Documents which may be necessary for the complete and proper construction of the Work and administration of the Contract.

C. Sound Transit encourages the Contractor to submit Value Engineering Change Proposals (VECPs) which have the potential for cost or schedule savings or increased safety during construction, refer to the General Conditions Section 200 4.12 for more information.

1.02 WORK OF THIS CONTRACT

A. The Work of Contract U250 consists of:

1. University of Washington Station (UWS) top-down excavation and construction of all structural elements and finishes for the station box and finishes for the crossover box, including elevators/escalators, and accesses.

2. The following is a breakdown of the activities foreseen:

   a. Mobilization of UWS U250 site
   b. Excavate to bottom of roof slab
   c. Install roof slab concrete
   d. Install station structures on roof
   e. Excavate upper mezzanine level
   f. Backfill and grade U250 site
   g. Install upper mezzanine concrete
   h. Restore surface UWS
   i. Excavate lower mezzanine level
   j. Build out of upper mezzanine level rooms
   k. Finishes for upper mezzanine
l. Install lower mezzanine concrete
m. Install upper mezzanine mechanical and electrical
n. Excavate to base slab invert
o. Build out of lower mezzanine level rooms
p. Finishes for lower mezzanine
q. Install station invert slab concrete
r. Mobilize UWS crossover box
s. Install station platform slab concrete
t. Install crossover platform slab concrete
u. Install lower mezzanine mechanical and electrical
v. Install crossover walls to level 1
w. Build out platform level rooms
x. Install crossover slab and struts level 1
y. Finishes for Platforms
z. Install crossover walls to level 2
aa. Install platform mechanical and electrical
bb. Install crossover slab and struts for level 2
c. Install Elevators and Escalators
dd. Install crossover walls to roof
e. Build out crossover platform levels
ff. Install crossover roof slab
gg. Finishes for crossover platform level
hh. Build out crossover level 1
ii. Complete crossover roof structures
jj. Install crossover platform mechanical and electrical
kk. Finishes for crossover level 1
ll. Backfill crossover to grade
mm. Build out crossover level 2 rooms
nn. Complete station systems integration
oo. Restore surface (above and adjacent to crossover)
pp. Complete surface finishes and landscaping
qq. Finishes for crossover level 2
rr. Install crossover levels 1 & 2 mechanical and electrical
ss. Complete crossover systems integration
tt. Startup and test tunnel fans
uu. Startup and test emergency systems
vv. Fire Marshall testing

3. This work is scheduled for construction as follows:
a. Scheduled Start Date: Second Quarter 2011.
b. Scheduled Completion Date: First Quarter 2015.

B. The above description is not intended to be complete. The Work to be completed is provided for in the Contract Documents. The listing in Article 1.02A herein is not intended to relieve the Contractor of the responsibility for reading and understanding the Contract Documents.

1.03 WORK UNDER OTHER SOUND TRANSIT CONTRACTS OR BY SOUND TRANSIT STAFF

A. Contract U210 consists of all shallow utility relocations at University of Washington Station.

1. This work is scheduled for construction as follows:
a. Start Date: First Quarter 2009.
b. Completion Date: Third Quarter 2009.

B. Contract U211 consists of demolition and remediation of existing structures, construction of retaining walls and filling and grading at the future Capitol Hill Station Sites:

1. This work is scheduled for construction as follows:
b. Completion Date: Second Quarter 2009.

C. Contract U215 consists of the I-5 Crossing advance works.

1. This work is scheduled for construction as follows:
a. Start Date: First Quarter 2009.
b. Completion Date: Second Quarter 2010.

D. Contract U220 consists of approximately 11,400-foot long segmentally lined twin-bored tunnels between University of Washington Stations and Capitol Hill Station and civil and structural work for the University of Washington Station.

1. This work is scheduled for construction as follows:
a. Start Date: Second Quarter 2009
b. Completion Date: Second Quarter 2013

E. Contract U230 consists of approximately 6,300-foot long segmentally lined twin-bored tunnels and cross passages between Capitol Hill Station and Pine Street Stub Tunnel, and all civil and structural work for the Capitol Hill Station and the TBM Retrieval Shaft at Pine Street.

1. Final reinstatement and landscaping, utilities, and stormwater facilities.
2. This work is scheduled for construction as follows:
   a. Start Date: First Quarter 2010.
   b. Completion Date: Second Quarter 2013.

F. Contract U240 consists of Capitol Hill Station finishes work, elevators/escalators, electrical, mechanical, pedestrian/bike/van/bus access, and excavation, ground support and finishes work for the pedestrian tunnel under Broadway and the west entrance.

1. Final reinstatement and landscaping, utilities, and stormwater facilities.
2. This work is scheduled for construction as follows:
   a. Start Date: Third Quarter 2012.
   b. Completion Date: First Quarter 2015.

G. Contract U260 consists of trackwork from Pine Street Stub Tunnel to University of Washington Station, vibration and noise dampening, special track fixtures at the crossover, and Maintenance Base Facility modifications.

1. This work is scheduled for construction as follows:
   a. Start Date: Fourth Quarter 2011.
   b. Completion Date: Third Quarter 2014.

H. Contract U830 consists of signal systems, communications systems, and track electrification from University of Washington Station to Pine Street Stub Tunnel.

1.04 SPECIFICATION LANGUAGE

A. Contract Specifications are written mostly in imperative and streamlined form. Unless indicated otherwise, this imperative language is directed to the Contractor. Additionally, the words "shall be" shall be included by inference where a colon (:) is used within sentences or phrases.

1. Examples:
   b. Adhesive: Spread with notched trowel.

B. Related Sections: Individual Contract Specification Sections may include an article entitled “Related Sections”. Contract Specification Sections are listed within the article to assist the Contractor in locating certain but not all related work. The list is not to be considered all inclusive. All Contract Specifications are required to complete the work.
C. Whenever there is wording stating that an item is “as specified”, “as indicated”, or “as shown”, the reference is to all Contract Specifications and all Contract Drawings in the Contract Documents. Stating “as specified”, “as indicated”, or “as shown” does not refer necessarily to a Contract Drawing or Contract Specification, but refers to either.

D. The words “Provide” and “Furnish” shall mean supplying, installing, and incorporating into the Work including all labor, materials, supplies and equipment including testing and commissioning necessary to do so. The word “Supply” shall mean to acquire, deliver, and transfer the item to Sound Transit as specified.

E. Unless otherwise indicated, all materials and equipment incorporated into the Work shall be as specified and shall be new.

F. Federal, State, and Local Laws: Statutes and regulations are not individually referenced. This provision incorporates by reference the latest version of statutes, laws and regulations. In case of conflict between the requirements of the Contract Specifications and requirements of the statutes and regulations, the Contractor shall bring them to the attention of the Resident Engineer. Lacking a specific response, the more stringent shall control. In no case can this Contract be interpreted to override statutes and regulations of governing authorities.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION
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PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes specifications for completion times, milestones, work sequence, constraints, hours of work, incentive provisions, and liquidated damages.

B. Schedule and conduct all work in a manner consistent with the Contract, and comply with the approved construction schedule, the specific work sequence, Contract milestones and constraints of the work as specified.

C. Plan the sequence of construction to accommodate all Contract requirements and the work of other Interfacing Contracts.

D. Related Sections: The work of the following Sections is related to the work of this Section. Other Sections, not referenced below, may also be related to the proper performance of this work.

1. Section 01 12 19, Contract Interface.
2. Section 01 57 15, Temporary Construction Noise and Vibration Control.

1.02 SUBMITTALS

A. Procedures: Section 01 33 00, Submittal Procedures.

B. Construction Staging Plan, within 30 Days of NTP

1.03 CONSTRUCTION STAGING PLAN

A. For the University of Washington site, construction activities and use of the property shall be in accordance with the milestones and constraints listed Article 1.07 and Article 1.08 respectively, herein. Exhibits 2b, 2c, 2d, 3a, 3b, 3c and 4a, herein attached, depict a possible utilization of the Construction Work Area throughout the duration of the contract.

B. Prepare a construction staging plan describing the work area boundaries and utilization of the space within the work area for the University of Washington site during all Phases of the U250 Contract. Include expected start dates and end dates for each Phase.

1.04 START TIMES

A. A Limited Notice to Proceed (LNTP) will be issued shortly after the Notice of Award.

1. This LNTP will authorize commencement of all contract work except that work requiring site access.

2. Specifically included in this authorization are planning, submittals, site surveying, inspection of existing facilities, scheduling, and other administrative activities. Any activities, such as surveying or inspection that are to be performed on UW Property will require a Right of Entry (ROE) Permit from the University of Washington. See Article 1.04E, herein, for requirements.
3. Specifically excluded from this authorization is all mobilization of equipment or materials, or all disturbance of existing facilities or operations on the UW site.

B. Site access, including mobilization activities, on UW property may not proceed until an U250 Activation Letter is approved by the Resident Engineer. Submit the following information in support of the U250 Activation Letter:

1. A written request at least 30 days in advance of the Site Access date
2. A scaled plan view drawing of the Construction Work Area planned to be utilized during the initial phase of work at the UW site including the square footage of this area. See Article 1.04D for requirements to modify this area.
3. The approximate end date for occupation of the area utilized during the initial phase.

C. On the Site Access Date, ST will issue the full NTP effective as of that date, which will then allow mobilization of equipment, materials, and other elements to the site. This date will be agreed upon with both the UW and ST unless the conditions of 1.04 C. 2, herein, occur.

1. This NTP will be the start date for all Contract milestones, time-based incentives, and substantial completion dates established herein.
2. In the event the Initial Activation Letter is delayed as a result of the Contractor’s failure to comply with the requirements within a timely manner, ST reserves the right to issue NTP and start the time on milestones and completion as of February 18th, 2011.

D. Modification of the Construction Work Area at UW Site

1. Notify the Resident Engineer at least 4 weeks in advance of all potential modifications of the Construction Work Area.
2. Provide a preliminary scaled plan view drawing that includes square footage, of the Construction Work Area planned to be utilized in the next phase of work at the UW site.
3. Notify the Resident Engineer, in writing, 2 weeks prior to the proposed modification and include the following:
   a. The final version of the drawing referenced in Article 1.04D.2, herein.
   b. The proposed end date for areas previously used and are no longer needed.
   c. The proposed start date for the modified area.
   d. The approximate end date for the modified area.
4. Prior to the start of the modification, receive approval from the Resident Engineer and perform a walk through on areas no longer needed that are to be turned back over to UW.

E. For all work to be completed outside of the Construction Work Area Limits located east of Montlake Ave, the Contractor shall obtain a Right of Entry (ROE) permit from the University of Washington. Allow 90 days for UW approval of this permit. The application for this permit must provide a clear definition of activities the Contractor will perform under this permit and will include:
1. The Contractor’s Health & Safety Plan for work to be performed under this permit.

2. Scaled plan view drawing showing the area in which the work of the limited activities is proposed and all areas of the UW Site to be occupied by the Contractor during this work, including delineation of all parking spaces in the UW parking lots that will be displaced by construction activities.

3. A narrative description and drawings as appropriate to describe how the Contractor will restore the site for use by the UW for football home games. The site shall be restored for use as approved by the UW no later than 72 hours prior to the scheduled start of game.

4. If any parking stalls in the UW lots, other than those shown on the Contract Drawings, are taken out of use due to construction activities, the Contractor shall compensate the UW for loss of these parking stalls through an arrangement with UW Parking Services.

F. UW Event Day Planning

1. Prepared and submit a minimum of 90 days in advance a site plan describing the work site on the day of each UW event described in Article 1.08A.7, herein. The work site shall be completely enclosed and secured. Areas outside of the Construction Work Area, which are occupied by the Contractor or under construction, shall be vacated and restored

1.05 WORK SEQUENCE

A. Phase 2(b): Major construction activities include mobilization to site as well as excavation and construction of the north half of the station. The U220 Contractor will continue tunneling operations south of boundary F-1 during this Phase.

B. Phase 2(c): Major construction activities include continued construction of the north half of the station as well as work on the portion of UWS passed along from U220 with the shift of the boundary from F-1 to F-2. The U220 Contractor will continue cross passage and tunnel invert work south of boundary F-2 during this Phase.

C. Phase 2(d): Major construction activities include restoration of the southeast corner of the site as well as reestablishment of the access road from E-12 to the Montlake and Pacific Place intersection. At the completion of this phase, the site area shall be reduced to 4 acres. This Phase ends with Milestone 1.

D. Phase 3(a): Major construction activities include continued station crossover box construction and site restoration. All other interior work elements including station finishes, electrical and mechanical work continue.

E. Phase 3(b and c): Major construction activities include staged removal and restoration of the south temporary access road as well as continued station crossover box construction and site restoration. All other interior work elements including station finishes, electrical and mechanical work continue. At the completion of this phase, the site area shall be reduced to 2 acres. This Phase ends with Milestone 2.

F. Phase 4(a): Major construction activities include completion of station architectural, mechanical and electrical work and for continued testing of all equipment. Pedestrian bridge construction to be complete during this phase as well as surface restoration.
1.06 COMPLETION TIMES

A. Complete the work within 1353 days after the NTP. Work complete by this time shall include:
   1. Substantial completion of all Work.
   2. Demobilization from the UWS Site.

B. Achieve Final Acceptance within the specified time stated in the Certificate of Substantial Completion as required by the General Conditions.

1.07 MILESTONES

A. Milestone 1: Complete all work associated with the restoration and reestablishment of the northern access road no later than 800 days after NTP described in Article 1.04, herein.

B. Milestone 2: Complete all work associated with the restoration of the site outside of the Construction Work Area to be utilized in Phase 4a (no more than 2 acres of site), excluding the area west of Montlake Blvd. no later than 1160 days after NTP described in Article 1.04, herein.

C. Milestone 3: Substantial Completion of all Work no later than 1320 days after the NTP described in Article 1.04, herein. Complete all work associated with this Milestone which includes:
   1. Completion of surface restoration for site east of Montlake Blvd.
   2. Completion of the pedestrian bridge construction.
   3. Completion of the surface restoration for the sites west of Montlake Blvd.

D. Final Punch List and Demobilization:
   1. Complete all outstanding items indicated on the Punch List prepared by the Resident Engineer and Sound Transit no later than 1353 days after NTP. Complete all work associated with the milestone which includes:
      a. Complete all Punch List items listed in accordance with the contract documents.
      b. Demobilize from the University of Washington Site.

1.08 CONSTRAINTS

A. Site Availability and Staging:
   1. Construction and staging activities shall be limited to the Construction Work Area Limits defined on Contract Drawing N21-CS050.
   2. For duration of time prior to Milestone 1 (Phases 2b, 2c, 2d), the Construction Work Area shall be limited to Construction Work Area established during U220.
   3. For the duration of time between Milestone 1 and 2 (Phases 3a, 3b, 3c), the Construction Work Area shall be limited to 4 acres except during the demolition and restoration of the south access roadway. The site extents may be expanded to 4.75 acres for a period of 60 days to allow for the demolition and restoration of this roadway.
4. For the duration of time between Milestone 2 and 3 (Phase 4), the Construction Work Area shall be limited to 2 acres.

5. Plans showing the utilization of the Construction Work Area during all Phases of the U250 Contract must be submitted by the Contractor and approved by the Resident Engineer prior to the start of work during the specific phase. See Section 01 12 16, Work Sequence 250 Exhibit 2b through Section 01 12 16, Work Sequence Exhibit 4a for suggested utilization of Construction Work Area throughout the time period of the U250 Contract. The Construction Work Area may be revised during a period if a request is submitted to the Resident Engineer at least two weeks in advance of any changes and approved prior to the revised Construction Work Area being occupied. The Construction Work Area must be enclosed by a fence or barrier wall that clearly indicates the boundaries of the Construction Work Area at all times. As work in some areas is completed, the Construction Work Area boundaries may be changed to accommodate new areas of work. Whenever boundaries of the Construction Work Area are changed, the new boundary location must be recorded by survey and shown on a site plan, along with the effective date of the boundary change.

6. Interfaces with U220 and U260 contractors: Section 01 12 19, Contract Interfaces. The U220 contractor shall make available the construction schedule and site use information.

7. University of Washington Constraint Days
   a. No work on-site allowed during the following:
      1) UW home football games
         a) The north area of the site in the location of the moveable fence must be restored for use as approved by the UW no later than 72 hours prior to start of all scheduled UW home football games.
      2) Commencement
         a) No work on-site during Commencement weekend.
      3) Convocation
      4) Windermere Cup
      5) Two unspecified Special Events per year at University of Washington’s Husky Stadium
      6) UW home basketball games
         a) No work on-site from two hours prior to all UW home basketball games to two hours after the completion of the game.

   a. Move-in days for students will not be considered Constraint Days. Sound Transit and its contractors will take them into account when scheduling activities that require truck movement on those dates.
1.09 HOURS OF WORK

A. Comply with requirements of applicable jurisdictions regarding limitations on work hours.

B. Unless otherwise approved in writing by the Resident Engineer, the following maximum work hours have been established. The hours of work require all other Contract Specifications to be met:

1. UWS Site:
   a. All work at the UWS Site with the exception spoils hauling:
      1) Monday through Saturday: 7 am to 10 pm.
      2) Sunday: Restricted to maintenance operations only unless otherwise approved in writing by the Resident Engineer.

C. All work hours are subject to the noise level restrictions imposed by the City of Seattle. See Section 01 57 15, Temporary Construction Noise and Vibration Control.

1.10 LIQUIDATED DAMAGES

A. Liquidated damages for failure to achieve Substantial completion within 1275 Days (1320 Days less the 45 Days of Sound Transit Controlled Float), as provided in the General Conditions shall be as follows:

1. $5,000 per day.

B. Liquidated damages for failure to achieve Final Acceptance within 1353 Days, as provided in the General Conditions, shall be as follows:

1. $5,000 per day.

C. Liquidated damages for failure to achieve Substantial completion of the Milestones specified in the General Conditions shall be as follows:

1. Contract U250 University of Washington Station Finishes
   a. Milestone 1:
      1) $2,000 per day for each day after 800 days from the effective date of the NTP.
   b. Milestone 2:
      1) $20,000 per day for each day after 1160 days from the effective date of the NTP.

D. If Sound Transit authorizes the use of any or all of the 45 Days of Sound Transit Controlled Float, an adjustment would be made to the corresponding Days after NTP for the affected Milestone(s) and/or Substantial Completion.

1.11 INCENTIVE PROVISIONS

A. If the Contractor completes the work associated with specific milestones, as evidenced by receipt of a Certificate of Substantial Completion associated with the work of the milestone, before the milestone dates specified herein, Sound Transit will allow additional payment for such early completion as specified herein:
1. An incentive for achieving Substantial Completion of Milestone Two earlier than 800 days from the effective date of the NTP will be paid in the amount of $3,000 per day, up to a maximum of $180,000.

2. An incentive for achieving Substantial Completion (Milestone Three) of all Work earlier than 1275 Days (1320 Days less the 45 Days of Sound Transit Controlled Float) from the effective date of the NTP will be paid in the amount of $5,000 per day, up to a maximum of $300,000.

3. Payment of the incentive will be authorized on the progress payment following Sound Transit’s issuance of the Certificate of Substantial Completion associated with the milestone.

B. Award Fee Program

1. Sound Transit has included an Award Fee Program in the Contract that provides additional contract funds for performance exceeding Contract requirements. The Award Fee, or portion thereof, will be paid only for performance over and above Contract requirements in five areas of work. The Award Fee is intended to align ST, the Contractor, and other stakeholder’s interests in achieving superior performance on the overall Contract, but particularly in areas that ST has identified as critical to project success.

2. This Specification includes general guidelines for the implementation of the Award Fee Program. The Contractor, in conjunction with Sound Transit, shall develop a Draft Award Fee Program Plan within 60 days following Limited Notice to Proceed, in accordance with the requirements of this Specification section. The Draft Award Fee Program Plan shall clearly delineate what the Contract requirements include in the five categories of Award Fee evaluation and how the Contractor will be evaluated for performance above these Contract requirements. The Draft Award Fee Program Plan shall also delineate how all award fee payments to the Contractor will be distributed to the Contractor’s Subcontractors and labor. The Award Fee shall be distributed to Subcontractors in approximate proportional shares relative to the value of the Subcontractor’s work as a percentage of the total, as appropriate. Sound Transit will review the Draft Award Fee Program Plan and provide comments to the Contractor for incorporation. The Contractor shall revise the Draft Plan in response to those comments and submit a second Draft Plan within 30 days of receiving Sound Transit comments. Sound Transit will finalize the Award Fee Plan prior to issuing NTP and the Plan will be used for administering the Award Fee Program. Failure of the Contractor to produce a reasonable Draft or 2nd Draft Plan may result in elimination of the Award Fee Program at Sound Transit’s sole discretion.

3. In all Award Fee Program Plan and Award Fee determinations the decision of the Sound Transit Evaluation committee is made at their sole discretion and will be final and not subject to Dispute Resolution under the Contract Documents.

4. The Award Fee Evaluation Board will be chaired by the Sound Transit’s Construction Manager or his/her designee, and include representatives of ST Community Outreach, ST Safety and Security, the University of Washington, ST Environmental Staff and the ST Construction Management Consultant. Additional members may be appointed by the ST Construction Manager to assist in the evaluation. The Contractor shall provide all needed data as shown in the Award Fee Plan to the Resident Engineer each quarter at the same time as the payment application. The Evaluation Board will meet following the submittal of the Contractor data and develop a preliminary Award Fee determination. The Contractor shall be allowed to review the preliminary Award Fee and provide comments to the Evaluation Board, prior to the Evaluation Board making a
determination of final Award Fee for the quarter. All decisions of the Evaluation Board will be final and not subject to Dispute Resolution.

5. Award Fee Program available to Contractor for efforts exceeding the contract requirements in the following areas:
   a. Safety and Security
   b. Environmental Compliance and Environmental Stewardship
   c. Relationship with University of Washington and Local Community
   d. Small Business/Equal Opportunity Employment/Apprentice Utilization
   e. Interface Management with the U220 Contract, U260 Contract, and other ST Contractors.

6. Payments will be made no less than quarterly based on the Contractors rating in the above categories multiplied by a percentage of the overall Award Fee amounts.

7. The maximum Award Fee amount for the Contract is then divided into five separate categories as defined in 1.05 E. 1 with the following dollar amounts:
   a. Safety and Security - $1,000,000.
   b. Environmental Compliance and Environmental Stewardship - $750,000.
   c. Relationship with University of Washington and Local Community - $750,000.
   e. Interface Management with U220 and other ST Contractors - $300,000.
   f. Each category will then have the available Award Fee funds distributed over the estimated contract duration in which the Contractor shall be performing contract work directly relative to the eligible category.

8. The estimated contract durations, in whole quarters, and the proposed distribution of Award Fee funds for the various categories above are subject to adjustment based on Contractor’s Contract CPM Baseline Schedule but will be assumed to be:
   a. Safety and Security – 42 months (NTP to Substantial Completion) with even distribution of Award Fee over the time period.
   b. Environmental Compliance and Environmental Stewardship - 42 months (NTP to Substantial Completion) with even distribution of Award Fee over the time period.
   c. Relationship with University of Washington and Local Community - 42 months (NTP to Substantial Completion) with even distribution of Award Fee over the time period.
   d. Small Business/Equal Employment Opportunity/Apprentice Utilization – Duration will be adjusted to match the Contractors SBE and Apprenticeship Plan activities. Proposed distribution duration will be
determined after submittal of the Contractors SBE and Apprenticeship Utilization plan.

e. Interface Management with the U220 Contract – 13 months to coincide with the occupation of the University of Washington Station site by both the Contractor and the U220 contractor with even distribution of Award Fee over the time period.

9. Within each category of the Award Fee there will be various items which the Contractor shall be measured as the basis to determine the amount of payment (if any). It is proposed that the Award Fee calculation would be done on a monthly and/or quarterly basis with payments made to the Contractor quarterly based on overall performance in the previous quarter. For any given quarter, the total Award Fee amount becomes the maximum the Contractor may receive in that quarter for each category. The amount received will be the summation of each category. The category amount is the percentage score times the maximum amount for that category during that quarter. If the Contractor fails to achieve the quarterly maximum amount, all unachieved award amount for that quarter will be lost. The Award Fee award eligibility determination would be completed by the Award Fee Evaluation Board.

10. The evaluation guidelines to be used by the Evaluation Board for each of the categories will include the general methodology below:

a. Safety and Security – A defined number of items from the Monthly Safety Checklist and prepared by the Resident Engineer will be scored along with an evaluation of the cumulative monthly accident statistics (AFR/SR), and the Contractor will be given a number of points for each item in conformance with the contract.

b. Additionally, the Contractor will be evaluated based on the compliance and exceeding requirements in the completion of:

1) Timely completion of Construction Work Plans and quality of the work plans.

2) A Job Hazard Analysis (JHA) requirement including analysis and actions such as toolbox talks and general Contractor safe works practices.

3) Conduct of JHA meetings for each new task and completion of Pre-Task Analysis (PTA) cards.

4) Conduct of Task Safety Awareness (TSA) meetings.

5) Occupational health and safety program compliance including job safety training, emergency readiness and emergency drills.

6) Site security requirements including Worksite Threat Analysis (WTA).

7) Pedestrian safety requirements adjacent to the work sites

c. The Contractor shall commit to share 50 percent of the award payment directly with the Laborers working for the Contractor or all Subcontractors during the evaluation period.

d. Environmental Compliance and Environmental Stewardship – The Environmental Compliance and Environmental Stewardship category of
the Award Fee will be split into three sub categories. Each sub category will constitute 33 percent of the category overall percentage.

1) Water Discharge Quality (Stormwater, Sanitary Water, Industrial Discharge, High pH Muck). For each month of the quarter the Contractor does not exceed the water discharge quality limits, or the Contractor has not received a notice of violation by the controlling authority for work being completed within the NPDES permit, or the King County Industrial Waste Discharge permit, or all other water, stormwater, wastewater or process water regulatory approval the Contractor will receive 33 percent of the award for sub-category 1.

2) Sub category 2 - Dust Control, Street Cleaning, Lighting and Noise Impacts. The Resident Engineer will prepare a monthly summary of the Contractor’s performance for Environmental Compliance for these four environmental issues. Scoring will be based on measuring compliance with:
   a) Dust control requirements
   b) Street cleaning requirements,
   c) Performance of lighting controls and number of complaints of same;
   d) Noise control requirements.

3) The Resident Engineer evaluation will be done monthly. For a month without any registered complaints from the local entities, (City, County, UW, Residents). The Contractor will be eligible to receive the entire payment for this sub-category for that month in the quarterly payment

4) Sub category 3 – Environmental Stewardship and Reduced Greenhouse Gas (GHG) Emissions. The award fee amount will be based on the Contractor’s implementation of sustainable practices including successful steps taken to use materials with recycled content, use materials with less toxic effects to the environment than are typically used, reduce GHG emissions, reduce energy consumption (high efficiency engine use, other innovation by the Contractor), and use BMPs that exceed compliance requirements contained in the Contract Specifications related to environmental management. Following LNTP the Contractor and ST shall develop a baseline of typical recycling activities, proposed energy use, baseline Greenhouse Gas Emissions level, and develop a methodology for quarterly evaluation of improvements to the expected recycling and proposed energy use to be included in the Award Fee Program Plan. The Contractor shall be responsible for ongoing environmental monitoring and reporting compliance with permit conditions as well as what steps are being taken to exceed minimum environmental requirements as part of its monthly Progress Payment request, which will be used in the Quarterly Award Fee determination.

e. Relationship with University of Washington and Local Community - This category of Award Fee relates to the Contractor’s relationship with the
University of Washington and the surrounding community. The University of Washington and the Sound Transit community outreach staff will make quarterly assessments of the Contractor's performance in several areas including:

1) Responsiveness to the University of Washington issues of concern and the Contractor's reaction time to resolve issues

2) The degree of general legitimate complaints from the University population and surrounding community

3) The Contractor’s success in providing notice of upcoming activities to the University and surrounding community through community information, meetings, and notices.

4) Housekeeping of the Contractor outside the construction fence,

5) The success of Contractors efforts in controlling Contractor employee parking and maintaining traffic on Montlake Boulevard.

6) The success of Contractor's efforts meeting the access requirements during “event days” in the Contract.

f. Following LNTP, Sound Transit and the Contractor, shall meet to establish detailed methodology for the evaluation.

g. Contractor Small Business/Equal Employment Opportunity/Apprentice Utilization – The SBE/EEO/Apprentice Utilization performance measurement details would be set up between the issuance of the LNTP and the NTP.

1) The Contractor will be required to submit their Small Business Enterprise, Equal Employment Opportunity, and Apprenticeship Training work plan, and prepare, with input from Sound Transit, a schedule for its deployment. The plan will have goals established across the project schedule.

2) The SBE /EEO/Apprentice Utilization award payments will then be made based on a “performance score” relative to the Contractor’s plan. The score will be based on Contractor’s results and efforts over and above the contract requirements and Contractor’s plan. The award determination will take into consideration not only the goals established by the Contractor and the Contractor exceeding these goals, but also Contractor’s efforts in mentoring and training SBE firms in the spirit of graduating SBE firms from SBE status. The performance of the SBE contractors will be an evaluation measure to help gauge Contractor performance in this category.

h. Interface Management with the U220 Contract, U260 Contract, and other ST Contractors – The goal is to reward the Contractor for steps taken to avoid access and performance conflicts which may otherwise come up on the U220 Contract, U260 Contract, or other Sound Transit Contractors due to the overall management and scheduling of the work on the U250 Contract. Following contract award the Contractor and Sound Transit will develop a baseline of expected interface management efforts by U250 Contractor (e.g. submission of As-Built drawings as required, development of a shared Contractor truck staging area plan)
which will set the criteria for evaluation. The group will also establish a set of performance measurements which will set deductions in place (e.g. Notice of potential delay by U220). This will then be used to develop a methodology for quarterly evaluation of performance during the period of time that both U220 Contract, U260 Contract, or other ST Contractors and U250 occupy the same site.

11. Forfeiture of the entire Award Fee amount for a quarter will occur in the event of the following occurrences within that quarter:

   a. A fatality on work site,

   b. Not fulfilling minimum contractual requirements in work related to any of the five categories would result in forfeiture of entire award fee for a quarter in which contractual requirements are not being fulfilled.

12. Deductions will be made from the calculated Award Fee for the following occurrences within that quarter:

   a. Safety and Security. – The overall award would have a deductive amount of 10 percent of the calculated Award Fee award for the Safety and Security category for each lost time accidents, incidents, security breaches, or Contractor known utility damages

   b. Environmental Compliance and Environmental Stewardship - Deductions will be taken from the percentage in a methodology to be finalized after construction contract award for all exceedances of permit standards that do not rise to violations.

   c. Small Business/Equal Employment Opportunity/Apprentice Utilization - For each verified late payment to Small Business subcontractors the overall award would have a deductive amount equivalent to 1 percent of the award payment proposed for the Small Business/Equal Employment Opportunity/Apprentice Utilization category.

13. Interface Management with the U220 Contract, U260 Contract, and other ST Contractors - Deductions will be made for any Notices of potential delay by the U220 contractor or the U260 contractor caused by the U250 Contractor’s lack of coordination or sharing of the truck staging area or other shared facilities on site.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)
NOTES:

1. SEE CONTRACT SPECIFICATIONS SECTION 01 12 16, WORK SEQUENCE, FOR DURATIONS AND DESCRIPTIONS OF AREAS PHASE 2(b).

2. ACCESS ROADWAYS DEVELOPED BY U220 IN PHASE 1.
NOTES:

1. SEE CONTRACT SPECIFICATIONS SECTION 01 12 16, WORK SEQUENCE, FOR DURATIONS AND DESCRIPTIONS OF AREAS PHASE 2(c).

2. ACCESS ROADWAYS DEVELOPED BY U220 IN PHASE 1.
NOTES:

1. SEE CONTRACT SPECIFICATIONS SECTION 01 12 16, WORK SEQUENCE, FOR DURATIONS AND DESCRIPTIONS OF AREAS PHASE 2(d).

2. ACCESS ROADWAYS DEVELOPED BY U220 IN PHASE 1.
NOTES:

1. SEE CONTRACT SPECIFICATIONS SECTION 01 12 16, WORK SEQUENCE, FOR DURATIONS AND DESCRIPTIONS OF AREAS PHASE 3(a).

2. ACCESS ROADWAYS DEVELOPED BY U220 IN PHASE 1.
NOTES:

1. SEE CONTRACT SPECIFICATIONS SECTION 01 12 16, WORK SEQUENCE, FOR DURATIONS AND DESCRIPTIONS OF AREAS PHASE 3(b).

2. ACCESS ROADWAYS DEVELOPED BY U220 IN PHASE 1.
NOTES:

1. SEE CONTRACT SPECIFICATIONS SECTION 01 12 16, WORK SEQUENCE, FOR DURATIONS AND DESCRIPTIONS OF AREAS PHASE 3(c).

2. ACCESS ROADWAYS DEVELOPED BY U220 IN PHASE 1.
NOTES:

1. SEE CONTRACT SPECIFICATIONS SECTION 01 12 16, WORK SEQUENCE, FOR DURATIONS AND DESCRIPTIONS OF AREAS PHASE 4(a).
SECTION 01 12 19

CONTRACT INTERFACE

PART 1 - GENERAL

1.01 SUMMARY

A. This Section specifies the conditions of the University of Washington Station Site at specified times related to coordination required with other work on the site.

B. Related Sections: The work of the following Sections is related to the work of this Section. Other Sections, not referenced below, may also be related to the proper performance of this work. It is the Contractor’s responsibility to perform all the Work required by the Contract Documents.

1. Section 01 12 16, Work Sequence
2. Section 01 31 14, Coordination with Others
3. Section 01 50 00, Temporary Facilities and Controls
4. Section 01 57 13, Temporary Erosion and Sediment Control
5. Section 01 77 00, Closeout Procedures
6. Section 01 78 39, Project Record Documents

1.02 DEFINITIONS

A. Working Interface: Two or more contractors working in the same site area at the same time that requires close coordination between contractors.

1.03 SUBMITTALS

A. Procedures: Section 01 33 00, Submittal Procedures.
B. Letter of Agreement.
C. Warranty and Certification.
D. Record Drawings.
E. As-built drawings of the University of Washington Station.

1.04 GENERAL:

A. To reach Substantial Completion, complete all work as required by the Contract.

B. The Contractor can meet with the Resident Engineer and Sound Transit and agree that Sound Transit will take responsibility for some of the Contractor’s Temporary Close-Out requirements in meeting Substantial Completion. Temporary Close-Out requirements are those Milestone requirements that relate only to the completion or removal of temporary items, including, but not limited to, erosion control items, demolition of existing facilities,
construction fencing, construction lighting, temporary construction offices, temporary utility connections, and temporary paving. Temporary Close-Out requirements do not include Record Documents or any portion of permanent facilities indicated as completed in the Contract Documents.

C. If the Contractor proposes any modifications to the Close-Out requirements listed in Section 01 77 00, Closeout Procedures, a written agreement (Letter of Agreement) between the Contractor and Sound Transit on the specific Site of the Milestone, may be accepted by the Resident Engineer as part of support for Substantial Completion of the Milestone.

D. Details and requirements of the Letter of Agreement related to the Work shall be at no cost to Sound Transit.

E. Submit signed Letter of Agreement to the Resident Engineer in support of acceptability of identified parts of Milestones with the request for Substantial Completion of Milestone.

F. In the transitioning of the Sites to Sound Transit, coordinate, cooperate, and work with the Resident Engineer during the transition of the Sites in support of the Milestones.

G. Geotechnical Instrumentation System

1. Geotechnical instrumentation system, including measuring instruments (both permanent installations and temporary installations), data acquisition systems, and data loggers shall be handed over to the Resident Engineer at the Substantial Completion date.

2. Data Acquisition
   a. Provide data loggers and/or data acquisition system, including software and user manuals.

3. Data Format
   a. Provide all data acquired during the course of the work in an electronic format capable of being opened by MS Excel.

1.05 WARRANTY

A. Warrant that the work being turned over meets the requirements of the Contract and all regulatory requirements.

B. Certifications:
   1. Tunnel standpipe, refer to Section 01 50 00, Temporary Facilities and Controls, for Seattle Fire Department certification.

C. In the event that subsequent inspection discovers latent defects in the work, make repairs as directed.

1.06 RECORD DRAWINGS OF EXISTING FACILITIES AT TURNOVER MILESTONES

A. Format and Procedures: In accordance with Section 01 78 39, Project Record Documents.
1.07 CONDITIONS ON THE UNIVERSITY OF WASHINGTON SITE UPON SITE ACCESS

A. The following Articles B. through S. represent the site conditions which the U250 Contractor will receive from the U220 Contractor.

B. Construction power:
   1. Be responsible for access to temporary construction power service as required.
   2. See Section 01 50 00, Temporary Facilities and Controls.

C. Construction water service:
   1. Be responsible for access to temporary construction fire water service as required.
   2. See Section 01 50 00, Temporary Facilities Controls.

D. Fire water service:
   1. Be responsible for access to temporary construction fire water service as required.
   2. Use existing fire hydrant as indicated.

E. City water service:
   1. Be responsible for the service connection for temporary city water service supply.

F. Construction sanitary sewer:
   1. Be responsible for access to piping and special connections for temporary construction sanitary sewer service as required.
   2. Be responsible for sanitary facilities as required.

G. Construction lighting:
   1. Be responsible for temporary lighting facilities as required.
   2. See Section 01 50 00, Temporary Facilities and Controls.

H. Site access and security:
   1. Be responsible for existing construction fencing, gates and noise walls.

I. Site grading and asphalt condition:
   1. Be responsible for existing site grading and asphalt surfacing.

J. Wheel wash:
   1. Be responsible for operating and maintaining the wheel wash.

K. Erosion control system:
   1. Be responsible for the temporary erosion and sediment control (TESC) system facilities on site.
2. Be responsible for maintenance.

L. Dewatering and process water treatment system:
1. Be responsible for the dewatering and process water treatment system facilities on site.
2. Be responsible for maintenance.

M. Site Contractor’s office and parking:
1. Be responsible for the office and parking facilities on site.

1.08 CONDITIONS REQUIRED AT UNIVERSITY OF WASHINGTON SITE FOR SUBSTANTIAL COMPLETION

A. Construction power:
1. Be responsible for removing all Contractor furnished distribution equipment, cable and conduit in accordance with Section 01 50 00, Temporary Facilities and Controls, and the Contract Drawings.
2. Establish and test permanent power supply for the station equipment.

B. Construction water service:
1. Be responsible for removing service connection on the day of the Milestone.
2. Establish and test permanent water supply for the station equipment by the day of the milestone.

C. Fire water service:
1. Be responsible for removing service connection for temporary construction supply on the day of the Milestone.
2. Establish and test permanent fire water supply by the day of the milestone.

D. Construction sanitary sewer:
1. Be responsible for decommissioning and removing temporary construction sanitary sewer service by the day of the Milestone.
2. Establish and test permanent sanitary sewer connections by the day of the milestone.

E. Construction telephone and Internet services:
1. Be responsible for decommissioning service by the day of the milestone.

F. Construction lighting:
1. Be responsible for removing temporary lighting facilities by the day of the milestone.
2. Establish and test permanent power supply for lighting and other electrical equipment by the day of the milestone.

G. Site access and security:
1. Be responsible for removing existing construction fencing, gates, and noise walls by the day of the Milestone.

H. Site grading and asphalt condition:
1. Be responsible for preparing final site grading, landscaping, and hardscaping in accordance with the contract documents and complete these by the day of the milestone.

I. Wheel wash:
1. Be responsible for decommissioning wheel wash by the day of the Milestone.

J. Erosion control system:
1. Be responsible for decommissioning and removing the temporary erosion and sediment control (TESC) system for the site by the day of the Milestone.

K. Dewatering and process water treatment system:
1. Be responsible for removing all facilities of the dewatering and process water treatment system for the site by the day of the milestone.
2. Establish permanent dewatering system for the Station and complete connections to appropriate utility by the day of the milestone.

L. Site Contractor’s office and parking:
1. Be responsible for removing all facilities of the office and parking at the site by the day of the milestone.

1.09 CONDITIONS PROVIDED AT THE UNIVERSITY OF WASHINGTON STATION, CROSSOVER, AND TUNNELS SITE TO THE U260 CONTRACTOR DURING WORKING INTERFACES:

A. Site area
1. Do not provide.

B. Hoisting access
1. Do not provide.

C. Personnel access
1. Be responsible to provide stairway or service elevator to track way level for the U260 Contractor.

D. Track way possession
1. Be responsible to supply track way possessions in the crossover and station according to an agreed schedule for the U260 Contractor.

E. Temporary power
1. Be responsible to supply temporary power for ventilation, lights, and other requirements for the U260 Contractor.

F. Temporary tunnel dewatering
1. Be responsible to provide and maintain a dewatering system for the tunnel for the U260 Contractor.

2. Coordinate with U260 contractor and agree on dewatering requirement.

3. Be responsible to provide for the full-time operation and maintenance of temporary tunnel dewatering system for the U260 Contractor.

G. Temporary tunnel ventilation

1. Be responsible to provide and maintain ventilation for work associated in the tunnel for the U260 Contractor.

2. Coordinate with the U260 Contractor and agree on ventilation requirements.

3. Be responsible to provide for the full-time operation and maintenance of the temporary tunnel ventilation for the U260 Contractor.

H. Running tunnel access

1. Be responsible to provide access to tunnels for the U260 Contractor.

I. Construction power and water service

1. Do not provide.

J. Fire water service

1. Be responsible to allow access to the standpipe system indicated for the U260 Contractor.

K. Construction sanitary sewer

1. Do not provide.

L. Construction telephone and Internet services:

1. Do not provide.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION
PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes specifications for Measurement and Payment.

B. Payment for the various items on the Bid Sheet, as further specified herein, shall include all compensation to be received by the Contractor for furnishing all tools, equipment, supplies, and manufactured articles, and for all labor, operations, and incidentals as necessary to complete the various items of the work all in accordance with the requirements of the Contract Documents, including all appurtenances thereto and including all costs of compliance with the regulations of public agencies having jurisdiction, including safety and health requirements of the Occupational Safety and Health Administration of the U. S. Department of Labor (OSHA), and the Washington Industrial Safety and Health Act (WISHA), Department of Labor and Industry. No additional payment will be made for all items that is not specifically set forth in the Bid Sheet, and all costs therefore shall be included in the prices named in the Bid Sheet for the various items of work.

C. Allocate indirect costs, including but not limited to, supervision and overhead, profit, and General Conditions specified in the Contract to each Bid item as applicable for work defined in the Bid item. No separate payment will be made to the Contractor for these items.

D. References in the Contract Documents to referenced documents including Reference Standards are for technical and administrative provisions only. Measurement and payment provisions referenced in all such standards are not applicable to this Contract. All payment for Work done under the provisions of this Contract is provided for in the Bid Sheet set forth in the General Conditions, and described herein.

E. Related Sections: The work of the following Sections is related to the work of this Section. Other Sections, not referenced below, may also be related to the proper performance of this work. It is the Contractor’s responsibility to perform all the Work required by the Contract Documents.

1. Section 01 12 16, Work Sequence
2. Section 01 21 00, Fuel Price Adjustments
3. Section 01 32 13, Scheduling of Work.

1.02 BID ITEM MEASUREMENT AND PAYMENT

A. The Bid Sheet is divided into several Bid items whose definitions follow. Bid Item One through Sixteen represent the entire scope of work covered by the Contract Documents.

B. Refer to Section 01 32 13, Scheduling of Work, for further detail on Bid items.

C. BID ITEM ONE: Lump Sum Price for Mobilization and Demobilization
1. This Bid item is for all installation, maintenance, and turnover of work associated with site mobilization and demobilization. It includes a price for temporary erosion and sediment control (TESC) measures. It also includes a price to provide environmental management, equipment, controls and site preparation of equipment to perform Bid Items Two through Four.

2. Measurement: In accordance with a reasonable apportionment of the work as established in the Schedule of Values.

3. Payment: Based upon the percentage of completion for each appropriate line item in the Schedule of Values. A maximum of 0.5 percent of the total original Contract Price will be paid for demobilization after Final Acceptance of the work by Sound Transit.

D. BID ITEM TWO: Lump Sum Price for installation of structural and station finishes work within University of Washington station and crossover.

1. The Bid Sheet includes a lump sum price for installation of structural and station finishes work for University of Washington Station and crossover.

2. Measurement: In accordance with a reasonable apportionment of the work as established in the Schedule of Values.

3. Payment: Based upon the percentage of completion for each appropriate line item in the Schedule of Values.

E. BID ITEM THREE: Lump Sum Price for procurement, installation, testing and commissioning of electrical and mechanical equipment for University of Washington Station, crossover and tunnels.

1. The Bid Sheet includes a lump sum price furnishing and installation of all electrical and mechanical equipment at Capitol Hill station.

2. Measurement: In accordance with a reasonable apportionment of the work as established in the Schedule of Values.

3. Payment: Based upon the percentage of completion for each appropriate line item in the Schedule of Values.

F. BID ITEM FOUR: Lump Sum Price for Trench Safety Systems

1. This Bid item is for all work necessary for Trench Excavation Safety Systems in performing work under this Contract, for the installation and use of Shoring, Class A, to meet the requirements of RCW Chapter 39.04.180 and 49.17, in accordance with WAC 296-155-650.

2. Measurement: In accordance with a reasonable apportionment of the work as established in the Schedule of Values.

3. Payment: Based upon the percentage of completion for each appropriate line item in the Schedule of Values.

G. BID ITEM FIVE: Provisional Sum for Unidentified Contaminated Soil and Water, not indicated in Contract Documents.

1. The work of this item includes costs associated with Unidentified Contaminated Soil and Water not indicated in Contract Documents.

2. Measurement: No separate measurement will be made for this item.
3. Payment: This item will be paid for in accordance with the General Conditions for Payment on Time and Material Basis for work satisfactorily completed as approved by the Resident Engineer.

H. BID ITEM SIX: Provisional Sum for additional unidentified utility conflicts, unidentified road repair, and other Resident Engineer directed changes not indicated in Contract Documents.
   1. The work of this item includes costs associated with requirements of resolving unidentified utility conflicts, performing unidentified road repairs, and other Resident Engineer directed changes.
   2. Measurement: No separate measurement will be made for this item.
   3. Payment: This item will be paid for in accordance with the General Conditions for Payment on Time and Material Basis for work satisfactorily completed as approved by the Resident Engineer.

I. BID ITEM SEVEN: Provisional Sum for Sound Transit’s portion of costs related to Partnering.
   1. The work of this item includes direct costs associated with partnering.
   2. Measurement: No separate measurement will be made for this item.
   3. Payment: This item will be paid for in accordance with the General Conditions for Payment on Time and Material Basis for work satisfactorily completed as approved by the Resident Engineer. No Contractor markup will be allowed on these costs.

J. BID ITEM EIGHT: Provisional Sum for additional unspecified University of Washington/City of Seattle Requirements.
   1. The work of this item includes costs associated with Unspecified University of Washington/City of Seattle Requirements that are not indicated in Contract Documents.
   2. Measurement: No separate measurement will be made for this item.
   3. Payment: This item will be paid for in accordance with the General Conditions for Payment on Time and Material Basis for work satisfactorily completed as approved by the Resident Engineer.

K. BID ITEM NINE: Provisional Sum for Contractor Acquired Permit Fees.
   1. The work of this item includes costs direct permit fees associated with Contractor Acquired Permits.
   2. Measurement: No separate measurement will be made for this item.
   3. Payment: This item will be paid for in accordance with the General Conditions for Payment on Time and Material Basis for work satisfactorily completed as approved by the Resident Engineer.

L. BID ITEM TEN: Provisional Sum for fuel adjustments.
   1. The work of this item includes costs associated with Fuel Adjustments.
   2. Measurement: No separate measurement will be made for this item.
3. **Payment:** This item will be paid for in accordance with Section 01 21 00, Fuel Price Adjustments, as determined by the Resident Engineer.

**M. BID ITEM ELEVEN: Provisional Sum for Progress/Schedule Incentives.**

1. The work of this item includes costs associated with Incentives as specified in Section 01 12 16, Work Sequence.

2. **Measurement:** In accordance with the incentives provisions indicated.

3. **Payment:** This item will be paid for in accordance with the incentive provisions indicated for work satisfactorily completed as approved by the Resident Engineer.

**N. BID ITEM TWELVE: Provisional Sum for Additional Environmental Requirements, not indicated in the Contract Documents.**

1. The work of this item includes costs associated with additional environmental requirements, not indicated in the Contract Documents.

2. **Measurement:** No separate measurement will be made for this item.

3. **Payment:** This item will be paid for in accordance with the General Conditions for Payment on Time and Material Basis for work satisfactorily completed as approved by the Resident Engineer.

**O. BID ITEM THIRTEEN: Provisional Sum for Archeological Investigations not indicated in the Contract Documents.**

1. The work of this item includes costs associated with providing archeological investigations not specified in the Contract Documents, and as directed by the Resident Engineer.

2. **Measurement:** No separate measurement will be made for this item.

3. **Payment:** This item will be paid for in accordance with the General Conditions for Payment on Time and Material Basis for work satisfactorily completed as approved by the Resident Engineer.

**P. BID ITEM FOURTEEN: Provisional Sum for Additional Community Construction Mitigation not indicated in the Contract Documents.**

1. The work of this item includes costs associated with additional community construction mitigation not indicated in the Contract Documents.

2. **Measurement:** No separate measurement will be made for this item.

3. **Payment:** This item will be paid for in accordance with the General Conditions for Payment on Time and Material Basis for work satisfactorily completed as approved by the Resident Engineer.

**Q. BID ITEM FIFTEEN: Provisional Sum for Sound Transit's portion of Dispute Review Board (DRB) costs.**

1. The work of this item includes Sound Transit's costs associated with the DRB. Contractor costs associated with the DRB shall be covered in Bid Item One.

2. **Measurement:** No separate measurement will be made for this item.
3. **Payment:** This item will be paid for in accordance with the General Conditions. No Contractor markup shall be allowed on these costs.

**R. BID ITEM SIXTEEN:** Provisional Sum for Award Fee.

1. **The work of this item includes costs associated with award fee specified in Section 01 12 16, Work Sequence.**

2. **Measurement:** In accordance with the award fee provisions indicated

3. **Payment:** This item will be paid for in accordance with the award fee provisions as approved by the Resident Engineer

### 1.03 SUBMITTALS

**A. Procedures:** Section 01 33 00, Submittal Procedures.

**B. Formats for Submittals:**

1. **Hard Copy Formats**
   a. Schedule of Values: Medium 8-1/2 inches by 11 inches in size.

2. **Electronic Copy Format**
   a. Draft Schedule of Values, Final Schedule of Values and Revised Schedule of Values: Electronic file in Microsoft Excel format and in .PDF format.

**C. Schedule of Values:**

1. Draft schedule of values: One paper copy and two electronic copies (.XLS and .PDF). Submit at Limited Notice to Proceed

2. Final Schedule of Values: One paper copy and two electronic copies (.XLS and .PDF). Submit within 30 days following Limited Notice to Proceed.

3. Revised Schedule of Values: One paper copy and two electronic copies (.XLS and .PDF). Submit as required.

**D. Conform to the same requirements as the original submittals for all re-submittals.**

### 1.04 SCHEDULE OF VALUES

**A.** The Schedule of Values shall be developed and used to provide an allocation of the Contract Price for measurement and payment in accordance with the General Conditions.

**B.** The Schedule of Values shall be developed to an appropriate level of detail to ensure accurate payment for the work accomplished. The following is an example of a partial Schedule of Values depicting the minimum level of detail required.
Division 02 - Existing Condition

<table>
<thead>
<tr>
<th>Division</th>
<th>Description</th>
<th>Qty</th>
<th>Unit</th>
<th>Price</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>024100.001</td>
<td>Demolition Buildings &amp; foundations</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>024100.002</td>
<td>Disconnect, cut &amp; cap utility services</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>024100.003</td>
<td>Remove 225KVA transformer</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>024100.004</td>
<td>Debris Removal &amp; Disposal</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Division 31 - Clearing And Grubbing

<table>
<thead>
<tr>
<th>Division</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>311100.001</td>
<td>Clear &amp; Grub</td>
</tr>
<tr>
<td>312333.001</td>
<td>Trenching</td>
</tr>
<tr>
<td>312333.002</td>
<td>Backfilling</td>
</tr>
</tbody>
</table>

C. The Schedule of Values shall be agreed to between the Contractor and the Resident Engineer. No payment shall be made prior to an agreed-upon Schedule of Values.

D. An updated version of the Schedule of Values shall be included with each progress payment request. The Schedule of Values shall be updated to include:

1. Dollars earned and percent complete for prior month.
2. Dollars earned and percent complete this month.
3. Dollars earned and percent complete-to-date.

E. The Contractor shall ensure that:

1. The total value of the activities are equal to the current Contract Price
2. Overhead and profit are prorated proportional to the value of each activity.
3. Activity values are rounded to the nearest hundred dollars.
4. The value of stored material, as defined in the General Conditions, is identified in the Schedule of Values with a corresponding cost-loaded activity in the current schedule.

F. The Schedule of Values shall be revised and submitted to Sound Transit upon the execution of a Change Order. The Contractor shall incorporate all executed Change Orders into the Revised Schedule of Values and allocate costs appropriately.

G. If required by the Resident Engineer, the Contractor shall present documentation substantiating the cost allocations for line items within the Schedule of Values.

H. A maximum of two progress payments shall be made prior to the submittal of an acceptable Contract Baseline CPM Schedule.
1.05 ADDITIONAL PAYMENT PROVISIONS

A. The following articles include payment provisions for certain elements of work, the cost for which is included in Bid Item One. These elements of work shall be included in the Schedule of Values in accordance with Section 01 32 13, Scheduling of Work.

B. Mobilization:

1. The amount shall be 4 percent of the total original Contract Price.

2. Payments will be allowed as follows:
   a. 1.5 percent of the Contract Price will be paid in consideration of the Contractor’s furnishing of performance and payment bonds and specified insurance, and shall be included with the first Application for Payment.
   b. When 5 percent of the total original Contract Price is earned from other Schedule of Value items, excluding payments for Mobilization, materials, and equipment on hand, another 1.5 percent of the total original Contract price shall be included in the next scheduled Application for Payment.
   c. When 10 percent of the total original Contract Price is earned from other Schedule of Value items, excluding payments for Mobilization, materials, and equipment on hand, another 1 percent of the total original Contract price shall be included in the next scheduled Application for Payment.

C. Demobilization:

1. The amount shall be 0.5 percent of the total original Contract Price.

2. Payments will be made as follows:
   a. When Substantial Completion of all Work is achieved in accordance with the Resident Engineer, 75 percent of the amount allowed for demobilization shall be included in the next scheduled Application for Payment.
   b. When the Contractor has completed all documentation required for Sound Transit to release Final Payment, 25 percent of the amount allowed for demobilization shall be included in the next scheduled Application for Payment.

PART 2 - MATERIALS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION
PART 1 - GENERAL

1.01 SUMMARY

A. This Section specifies fuel and cement price adjustments.

B. The intent of the adjustments is to reduce the Contractor's risk of unpredictable price escalations for diesel fuel and cement, and to reduce the Contractor's "built-in" Bid contingencies to cover such escalations.

PART 2 - PRODUCTS

2.01 GENERAL

A. This Section only applies to diesel fuel and cement. Propose specific types of diesel and types of cement at time of Bid.

PART 3 - EXECUTION

3.01 FUEL PRICE ADJUSTMENT

A. Within five working days of the Notice of Contract Award, the Contractor will be asked to declare in writing whether or not they wish to participate in the Fuel Adjustment provisions outlined in this Specification. In the event the Contractor elects to participate in the Fuel Price Adjustment the Contract price will be adjusted up or down in accordance with this Section.

B. Sound Transit will compensate the Contractor for diesel fuel price escalation up to an aggregate Contract maximum of $250,000. This payment will be made from Bid Item B9.

C. The maximum aggregate Contract adjustment downward to the contract price shall not exceed $250,000.

D. For the purpose of determining the adjustment, the Base Fuel Cost per Gallon shall be the Weekly U.S. On-Highway Diesel Fuel Price for West Coast No. 2 Diesel Retail Sales by All Sellers (Cents per Gallon) dated on the nearest Monday occurring three weeks prior to the date that Bids are opened, published by the Energy Information Administration (Department of Energy), available at: http://tonto.eia.doe.gov/oog/ftparea/wogirs/xls/psw18vwall.xls.

E. The Base Fuel Cost per Gallon is fixed for the duration of the Contract and will be used for determining all adjustments.

F. Only fuel used for on-site equipment, for trucks hauling materials and equipment to the site, and for trucks hauling excavation material to disposal sites will be eligible for Fuel Price adjustment. Fuel for pickup trucks or automobiles used by Contractor staff will not be eligible for Price Adjustment.

G. The Monthly Fuel Cost per Gallon shall be the most recent Monthly U.S. On-Highway Diesel Fuel Price for West Coast No. 2 Diesel Retail Sales by All Sellers (Cents per Gallon) ...
Gallon), published by the Energy Information Administration (Department of Energy). If the specified index ceases to be available for any reason, the Contracting Agency at its discretion will select and begin using a substitute price source or index to establish the Monthly Fuel Cost per Gallon.

H. No adjustment will be made if the Monthly Fuel Cost per Gallon is within 10 percent of the Base Fuel Cost per Gallon. No adjustment will be made for work performed after the authorized Time for Completion.

I. If the Monthly Fuel Cost per Gallon is greater than or equal to 110 percent of the Base Fuel Cost per Gallon, then:

\[
\text{Adjustment} = \frac{(\text{Monthly Fuel Cost} - (1.1 \times \text{Base Fuel Cost})) \times Q}{100}
\]

If the Monthly Fuel Cost per Gallon is less than or equal to 90 percent of the Base Fuel Cost, then:

\[
\text{Adjustment} = \frac{(\text{Monthly Fuel Cost} - (0.9 \times \text{Base Fuel Cost})) \times Q}{100}
\]

J. Where \( Q \) = Contractor’s Documented Fuel Consumption in the approved current months progress estimate.

K. The Contractor’s Documented Fuel Consumption shall be the sum of the certified receipts for its fuel purchases for equipment used exclusively during the month on U220 by the Contractor and subcontractors’ performing Work under Bid Items 1.

PART 4 - PRODUCTS (NOT USED)

PART 5 - EXECUTION (NOT USED)

END OF SECTION
CONTRACT SPECIFICATIONS

SECTION 01 25 00
SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.01 SUMMARY
A. This Section includes administrative and procedural requirements for substitutions.
B. Refer to Request for Substitution Form, attached to this Section.
C. Applies to substitutions after Notice of Award.

1.02 DEFINITIONS
A. Substitutions: Proposed changes by the Contractor in products, materials, equipment, from those required by and Contractor elected changes to the Contract Documents.

1.03 SUBMITTALS
A. Procedures: Section 01 33 00, Submittal Procedures.
B. Substitution Requests: Submit each request for consideration on a separate request form.
C. Submit Request for Substitution Form provided in Attachment A. Supplement the form with the following documentation in addition to the requirements stated on the form.
   1. Statement indicating why specified product or fabrication or installation cannot be provided, if applicable.
   2. Coordination information, including a list of changes or modifications needed for other parts of the Work, and for construction performed by other Sound Transit contractors, that will be necessary to accommodate proposed substitution.
   3. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Include annotated copy of applicable Contract Specifications Section. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.
   4. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
   5. Samples, where applicable or requested.
   6. Certificates and qualification data, where applicable or requested.
   7. List of similar installations for completed projects with project names and addresses and names and addresses of architects, engineers, and owners.
8. Material test reports from a qualified Independent Testing Laboratory indicating and interpreting test results for compliance with requirements indicated.

9. Detailed Contractor’s construction schedule using original products, methods or materials and a detailed comparison of Contractor’s construction schedule using proposed substitution(s) with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer’s letterhead, stating date of receipt of purchase order, reasons for all lack of materials, lack of availability or delays in delivery, and normal lead time between receipt of purchase order and delivery lead time when purchase order is received.

10. Contractor’s certification that proposed substitution complies with requirements in the Contract Documents except as indicated in substitution request, is compatible with related materials, and is appropriate for applications indicated.

11. Contractor’s certification that it issued the purchase order in sufficient time to return original products.


1.04 QUALITY ASSURANCE

A. Compatibility of Substitutions: Investigate and document compatibility of proposed substitution with related products and materials. Engage qualified Independent Testing Laboratory to perform compatibility tests recommended by manufacturers.

1.05 PROCEDURES

A. Coordination: Modify or adjust affected work as necessary to integrate work of the approved substitutions.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

ATTACHMENT

A. Request for Substitution Form

END OF SECTION
SECTION 01 25 00 - ATTACHMENT A
REQUEST FOR SUBSTITUTION FORM

TO:
We hereby submit for your consideration the following item instead of the specified item for the above solicitation:

SPECIFICATION

<table>
<thead>
<tr>
<th>SECTION</th>
<th>ARTICLE</th>
<th>SPECIFIED ITEM</th>
</tr>
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<tbody>
<tr>
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</tbody>
</table>

Proposed Product Option/Substitution:____________________________________________________________________________

Attach complete technical data, including laboratory tests, and other information as required in Section 01 25 00, Substitution Procedures, to verify statements below.

Include complete information on changes to Contract Drawings and Contract Specifications that proposed product option/substitution will require for its proper installation.

Fill in Blanks Below:

A. Does the product option/substitution affect dimensions shown on Contract Drawings?

B. The Contractor agrees to pay for changes to the design, including engineering and detailing costs caused by the requested product option/substitution.

☐ Yes ☐ No

C. What effect does product option/substitution have on other work? __________________________________________

D. Differences between proposed product option/substitution and specified item?

E. Manufacturer’s guarantees of the proposed and specified items are:

☐ Same ☐ Different (explain on attachment)

F. VECP attached:

☐ Yes (attached) ☐ No

The undersigned states that the function, appearance, and quality of the proposed items are equivalent or superior to the specified item.

Submitted By: For Use by Sound Transit:

☐ Accepted ☐ Accepted As Noted

☐ Not Accepted ☐

Signature

By _______________________________ Date _______________________________

Firm

Address

Date _______________________________ Telephone _______________________________

Remarks

END OF FORM
PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes specifications for establishing and operating a Dispute Review Board (DRB) to assist in and facilitate the avoidance and timely, impartial resolution of disputes.

B. Refer to attached Three-Party Agreement Form (Agreement), Attachment A.

C. The provisions of the Agreement take precedence over the language herein.

D. Sound Transit and the Contractor acknowledge that DRB reports shall not be binding on either party, and shall not be admissible in subsequent dispute resolution proceedings.

E. All disputes referred to the DRB shall be subject to the dispute resolution process herein described as a condition precedent to initiating a subsequent dispute resolution process such as arbitration or litigation for that dispute.

1.02 DISPUTES ELIGIBLE FOR CONSIDERATION BY THE DRB

A. Except as explicitly otherwise provided, disputes exceeding $250,000.00 in proposed value and that are actionable under the provisions of the General Conditions may be referred to the DRB.

1.03 DRB QUALIFICATIONS

A. Board members shall be experienced in the interpretation of contract documents and the resolution of construction disputes and in the type of construction to be performed.

B. The following definitions apply for the purpose of setting forth experience and disclosure requirements.

1. Party directly involved: Sound Transit or the Contractor.

2. Contractor includes all joint-venture partners individually.

3. Party indirectly involved: The construction manager, designers, architects, engineers, or other professional service firms or Consultants, Subcontractors of any tier, and suppliers on this project.

4. Financial ties: all ownership interest, loans, receivables, or payables.

C. Eligibility:

1. Direct Employment:
   a. Current employees of any of the parties directly or indirectly involved are prohibited from serving as Board members.
b. Prospective Board members who were past employees of one of the parties directly involved must obtain permission from the other party prior to appointment.

c. Previous direct employment by one of the parties indirectly involved shall be disclosed.

2. Consulting Assignments:

a. Individuals who are employed in a consulting capacity by any of the parties directly involved are prohibited from serving as Board members.

b. Prospective Board members who are currently employed as consultants by one of the parties indirectly involved shall obtain permission from the other party prior to appointment.

c. Previous employment as a consultant by any party directly or indirectly involved shall be disclosed.

3. Financial Ties:

a. Individuals with financial ties to any of the parties directly involved are prohibited from serving as Board members.

b. Current financial ties to any of the parties indirectly involved shall be disclosed.

c. Previous financial ties with any party, directly or indirectly involved, shall be disclosed.

4. Close Personal or Professional Relationships:

a. Individuals with close personal or professional relationships with a key member of any party directly involved are prohibited from serving as Board members.

b. Such current relationships with a member of any party indirectly involved in the Contract shall be disclosed.

c. All past personal or professional relationships with a key member of one of the parties directly or indirectly involved shall be disclosed.

5. All past and current service as a Board member on projects where any of the parties directly or indirectly involved on this Contract were also involved shall be disclosed.

6. No member shall have had substantial prior involvement in the project, in the judgment of Sound Transit and the Contractor.

D. Ongoing Responsibilities: While serving as a Board member on this project, no member shall participate in any discussion contemplating the creation of an agreement or making an agreement with any party directly or indirectly involved in the Contract regarding employment or fee-based consulting services, or any other business arrangement after the Contract is completed.
1.04 ESTABLISHMENT OF THE DRB

A. After award of the Contract, Sound Transit and the Contractor shall meet to discuss and establish the qualifications upon which nominees are to be evaluated and to jointly select prospective nominees.

B. Sound Transit and the Contractor shall provide to the DRB nominees a list of the construction manager, designers, architects, engineers, professional service firms, consultants, joint-venture partners, Subcontractors, and suppliers involved, or likely to be involved in the project, with a listing of key personnel of each. DRB nominees shall provide the following, pursuant to the above requirements and in addition to the nominee’s full name and contact information, to both parties:

1. Resume showing construction experience qualifying the person as a DRB member.

2. Resume showing past DRB participation, if any. List each DRB assignment separately, indicating the name and location of the project, dates of DRB service, name of owner, name of contractor, contract value, nominating party if applicable, names of the other Board members and the number of disputes heard.

3. Disclosure statement describing past, present, and anticipated relationships, including indirect relationships through the nominee’s full-time employer, if any, to the project, and with all parties directly and indirectly involved in the Contract. Disclose close professional or personal relationships with key members of all these parties.

4. Disclosure is a continuing obligation of all Board members throughout the life of the Contract.

C. Sound Transit and the Contractor shall then have three weeks to solicit and receive information from prospective candidates, and another two weeks to review and to jointly agree on the final selection of the three members to serve on the DRB. In the event that all three members were not selected from the initial pool of nominees, the process shall be repeated.

D. If the DRB Chair has not already been appointed as part of the selection process, then as soon as is practicable the Board members shall nominate the Chair and submit the nominee’s resume and request approval by Sound Transit and the Contractor.

E. Sound Transit, the Contractor and the DRB shall execute the Three-Party Agreement at the first DRB meeting.

1.05 DRB MEETINGS

A. The DRB will visit the project site and meet with representatives of the parties at quarterly intervals and at other times requested by the parties.

B. Each meeting shall include an informal discussion and a field observation of the work in progress. The discussion and field observation shall be attended by personnel of Sound Transit and the Contractor.

1.06 DISPUTE RESOLUTION PROCESS

A. Prior Good-Faith Negotiation:
1. Sound Transit and the Contractor shall enter into good-faith negotiations to settle a dispute before referring such dispute to the DRB.

2. These good-faith negotiations shall be founded on the principle of full and timely disclosure of each party's position to the other party, including the exchange of pertinent supporting records, analyses, expert reports, and similar documentation, and shall proceed without delay following the inception of the dispute. Such good-faith negotiations may involve the solicitation and rendering of a DRB advisory opinion as described herein.

B. Dispute Referral:

1. A dispute may be referred to the DRB by either Sound Transit or the Contractor. The dispute referral shall be made in writing to the DRB Chair with a copy concurrently provided to the other Board members and the other party.

2. If the Contract stipulates a precedent dispute resolution process prior to referral to the DRB, and if one party fails to meet or adhere to the time requirements set forth under the Contract for this process, the other party may then refer the dispute to the DRB. In the event that the Contract does not specify such precedent process, or specifies a precedent process without time requirements, either party may refer the dispute to the DRB after passage of a reasonable period of time without progress toward a negotiated settlement and the DRB will determine if the dispute should be heard.

3. The dispute referral shall concisely define the nature and specifics of the dispute that are to be considered by the DRB and the scope of the recommendation requested.

4. The DRB Chair shall confer with the parties to establish a due date for delivering pre-hearing submittals, and a date, time, and location for convening the DRB hearing. Hearings shall be convened at the next periodic meeting, unless the parties agree to a shorter or longer period.

C. Pre-Hearing Submittal:

1. Sound Transit and the Contractor shall each prepare a pre-hearing submittal and transmit it to all three members of the DRB and the other party. The pre-hearing submittal, comprising a position paper with such backup data as is referenced in the position paper, shall be tabbed, indexed, and the pages consecutively numbered.

2. Both position papers shall, at a minimum, contain the following:

   a. A joint statement of the dispute, and the scope of the desired report, placed in a prominent location. The language of this joint statement shall summarize in a few sentences the nature of the dispute. If the parties are unable to agree on the wording of the joint statement of dispute, each party's position paper shall contain both statements, and identify the party authoring each statement.

   b. The basis and justification for the party's position, with reference to Contract language and other supporting documents for each element of the dispute. In order to minimize duplication and repetitiveness, the parties may identify a common set of documents that will be referred to by both parties and submit them in a separate package.
c. When the scope of the hearing includes quantum, the referring party shall include a schedule impact analysis and full cost details, calculated in accordance with methods set forth in the Contract. This requirement does not apply if the report is to be made for entitlement alone or for entitlement with guidelines for quantum.

3. The number of copies, distribution requirements, and time for submittal will be established by the DRB and communicated to the parties by the Chair.

D. DRB Hearings:

1. Sound Transit will arrange for or provide hearing facilities at or near the site.

2. Attendance:
   a. Sound Transit and Contractor shall both limit attendance at the hearing to personnel directly involved in the dispute and participants in the good-faith negotiations that were conducted prior to submittal to the DRB except as noted below.
   b. Prior to the date established for the hearing, each party shall provide a list of proposed attendees to the DRB and to the other party. In the event of any disagreement, the DRB shall make the final determination as to who attends the hearing.
   c. Attorneys shall not participate in the hearing. Attorneys representing the parties are permitted to attend dispute hearings, provided that prior permission is obtained from the other party.
   d. At DRB hearings regarding claims by a Subcontractor, including pass-through claims by a lower tier Subcontractor or supplier, against the Contractor which are actionable by the Contractor against Sound Transit, the Contractor shall require and ensure that each Subcontractor involved in the dispute has present an authorized representative with actual knowledge of the facts underlying the Subcontractor claims.

3. The conduct of the hearing shall be established by the DRB according to its operating procedures and generally be consistent with the following guidelines:
   a. The party that referred the dispute to the DRB shall present its position first, followed by the other party.
   b. Both parties shall be allowed successive rebuttals, ensuring a full and adequate opportunity to present their position, and to rebut the opposing party’s position, until, in the DRB’s opinion, all aspects of the dispute have been fully and fairly covered.
   c. The DRB shall be fully prepared to, and may at any time, ask questions, request clarifications, or ask for additional data and job records.
   d. Either party may request that the DRB direct a question to, or request a clarification from the other party. The DRB shall determine at what point in the proceedings such requests may be made and if they will be granted. In general, the DRB will not allow one party to be questioned directly by the other party.
   e. In difficult or complex cases, additional hearings may be necessary to facilitate full consideration and understanding of the dispute.
f. The DRB, in its discretion, may allow introduction of arguments, exhibits, handouts, or documentary evidence that were not included in that party’s pre-hearing position paper and have not been previously submitted to the other party. In such cases the other party will be granted time to review and prepare a rebuttal to the new material.

E. Failure to Prepare a Pre-Hearing Submittal or Attend a DRB Hearing:

1. In the event that either party fails to deliver a pre-hearing submittal by the date established by the DRB, the DRB shall, at its discretion, determine whether the hearing shall proceed as originally scheduled, or whether additional time shall be provided and a new date established. On the final date and time established for the hearing, the DRB shall proceed with the hearing utilizing the information that has been submitted.

2. In the event that some or all of the representatives of either party fails to appear at the appointed time of a DRB hearing, the DRB shall proceed with the hearing. The hearing shall take place as if all party representatives were in attendance, and the DRB shall consider all evidence brought before it and hear testimony from those party representatives that are present.

F. Use of Outside Experts:

1. By Sound Transit or the Contractor:
   
a. A party intending to offer an outside expert’s analysis at the hearing shall disclose such intention in writing to the other party and to the DRB no less than 30 Days prior to the due date for delivering the pre-hearing submittal. The expert’s name and a general statement of the area of the dispute that will be covered by his or her testimony shall be included in the disclosure.

   b. Upon receipt of the above disclosure, the other party shall have the opportunity to secure the services of an outside expert to address or respond to those issues that may be raised by the other party’s outside expert. The disclosure requirements shall be the same as that specified above, except the time requirement is 10 Days.

   c. The cost for securing outside expert services shall be borne by the party securing such services.

2. By the DRB:

   a. Prior to arranging for outside experts, the DRB shall obtain prior approval from Sound Transit and the Contractor by providing:

      1) A statement explaining why the expert assistance is needed.

      2) An estimate of the cost of the expert assistance.

      3) A disclosure statement, in accordance with the requirements of Article 1.04B.2, herein, using the criteria established in Article 1.03C, herein.

      4) A confidentiality statement, consistent with the DRB’s such agreement, executed by the proposed expert.
b. The DRB Chair shall include the cost of the outside expert in his or her regular invoice, and provide a copy of the invoice. Invoices shall be in accordance with the requirements for Board member invoices.

c. The Contractor and Sound Transit shall equally bear the cost of the services of the outside expert employed by the DRB.

G. DRB Report:

1. The DRB’s recommendations for resolution of a dispute will be formalized in a written report with format as determined by the DRB and signed by all Board members. The report should include a concise description of the dispute, short statements of each party’s position, findings as to the facts of the dispute, discussion and rationale for the recommendation(s), and the recommendation(s). The report shall be submitted concurrently to the parties, as soon as possible after completion of the hearing as agreed by all parties.

2. If the DRB cannot arrive at a unanimous report, the Board shall prepare minority findings and recommendation(s), which, together with the majority findings and recommendation(s) shall comprise the DRB report. The report shall identify the issues of disagreement, along with the reasons for disagreement.

3. Clarification:
   a. Either party may request clarification of a report within 10 Days following receipt of the report. Within a reasonable period of time, the DRB shall provide written clarification to both parties.
   b. Requests for clarification shall be submitted in writing simultaneously to the DRB and to the other party.
   c. Only one request for clarification per dispute from each party will be allowed.

4. Reconsideration:
   a. Either party may request reconsideration of a report, within 10 Days following receipt of the report, when new information is obtained or developed that was not known at the time of the hearing, or when, in the party’s opinion, the DRB misunderstood or failed to consider pertinent facts of the dispute. Within a reasonable period of time, the DRB shall provide written reconsideration to both parties.
   b. Requests for reconsideration shall be submitted in writing simultaneously to the DRB and to the other party.
   c. The Board will not entertain requests for reconsideration that amount to a renewal of prior argument or additional argument based on facts available at the time of the hearing.
   d. Only one request for reconsideration per dispute from each party will be allowed.

5. Acceptance:
   a. Sound Transit and the Contractor shall submit their written acceptance or rejection of the report concurrently to the other party and to the DRB
within 14 Days of receipt of the report or following receipt of responses to requests for clarification or reconsideration.

b. Failure by either party to accept or reject within the specified period shall be construed as acceptance of the report by that party.

c. Acceptance by Sound Transit of a report on entitlement only, or on entitlement with guidelines for quantum, does not obligate Sound Transit to any particular quantum amount.

H. Advisory Opinions:

1. An advisory opinion serves as a method for potentially avoiding a DRB hearing. It is not intended to replace the dispute resolution process specified herein, but may be implemented as part of the good-faith negotiations conducted between the parties.

2. When mutually agreed by Sound Transit and the Contractor, the DRB may, at its discretion, provide an advisory opinion on any issue.

1.07 COMPENSATION

1. Sound Transit and the Contractor shall each bear their respective in-house costs and costs of providing those DRB-related services for which such responsibility has been allocated herein.

2. Sound Transit and the Contractor shall equally bear the cost of the DRB’s services in accordance with and as set forth in the Contract.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

ATTACHMENTS

A. Three-Party Agreement Form

END OF SECTION
SECTION 01 27 00 - ATTACHMENT A
THREE-PARTY AGREEMENT FORM

I PARTIES

A. Puget Sound Regional Transit Agency, herein after referred to as Sound Transit.
B. _________________________________, herein after referred to as the Contractor.
C. Dispute Review Board, hereinafter referred to as the DRB, including three members:
   1. _________________________________,
   2. _________________________________,
   3. _________________________________

II CONTRACT

A. The Contractor has entered into a PRIME CONTRACT with Sound Transit for the
   construction of the U250, University of Washington Station Finishes, hereinafter referred
to as the PROJECT.
B. The PROJECT PRIME CONTRACT provides for the establishment and operation of a
   DRB to assist in resolving disputes.
C. The DRB is composed of three members, selected in accordance with Section 01 27 00,
   Dispute Review Board.

III PURPOSE OF DRB

A. Assist in and facilitate avoidance of disputes and the timely and impartial resolution of
   disputes that are referred to it.

IV DRB SCOPE OF WORK

A. General:

1. Stay abreast of project developments by means of periodic meetings and site
   visits, review of progress reports, meeting minutes, and other job documents,
   and by other means as mutually agreed by all parties.

2. Examine site conditions or specific construction problems relating to an existing
   or potential dispute, unless such examination is not practical, or, in the judgment
   of either Sound Transit or the Contractor, would result in a delay to the project.

3. One of the selected members shall serve as Chair.

4. Execute this Agreement at the first meeting with representatives of Sound Transit
   and the Contractor.

B. Establish DRB operating procedures consistent with the requirements and general
   guidelines set forth in Section 01 27 00, Dispute Review Board:

1. Establish operating procedures mutually agreeable to all parties, such as
   administrative duties; content and format of information, which may be presented
at DRB hearings; conduct of hearings; and invoicing details. Establish these procedures at the first meeting with representatives of Sound Transit and the Contractor.

2. Initiate new procedures or modify existing procedures as mutually agreed to by all parties.

3. Provide all parties with these operating procedures, including all modified procedures, in written form.

C. Recommend Resolution of Disputes:

1. Upon receipt by the DRB of a referral of a dispute from either Sound Transit or Contractor, schedule and conduct a hearing at a time and location set by the DRB following consultation with Sound Transit or Contractor.

2. When proper evaluation of the dispute requires expertise that is not within the collective experience of the DRB, engage, with the prior written approval of Sound Transit and the Contractor, the services of one or more outside consultants as may be needed to advise the DRB.

3. Convene internal meetings as needed to review and discuss the dispute, and to formulate the report.

4. Following each hearing and DRB deliberation, issue timely executed written reports to Sound Transit and the Contractor, including the supporting rationale.

5. When requested and deemed appropriate by the DRB, provide executed written responses to requests for clarification or reconsideration made by either Sound Transit or the Contractor.

6. All DRB reports and responses to requests for clarification or reconsideration shall be signed by all three Board members.

D. Perform services and assume responsibilities, as agreed by all parties, as may be required, including those necessary but not listed herein, to achieve the purpose of this Agreement.

V RESPONSIBILITIES OF THE PARTIES

A. DRB Responsibilities:

1. Maintain impartiality and avoid conflicts of interest by continuing to meet the specified requirements for nominees for Board members. Promptly advise all parties upon becoming aware of any development that could be perceived as a conflict of interest.

2. Do not discuss, individually or collectively, issues with Sound Transit or the Contractor that could possibly be construed as compromising the DRB’s ability to impartially resolve future disputes, such as the conduct of the work and the resolution of construction problems.

3. Do not express an individual or collective opinion of merit, in whole or in part, for any potential or other dispute at any time prior to the issue of a report, except in the case of an advisory opinion.
4. Except as required when performing the duties of the Chair or conducting a hearing which Sound Transit or Contractor refuses to attend, do not meet or communicate with either Sound Transit or Contractor in the absence of the other.

5. Consider the facts and conditions forming the basis for a referred dispute impartially and independently and evaluate the merits based on careful consideration of all contract requirements, applicable law and regulations, and the facts and circumstances of the dispute. Do not:
   
a. Ignore or undermine the clear intent of the Contract, or disregard or alter any requirements of the Contract or allocation of risk specified therein.

b. Supplant or otherwise interfere with the respective rights, authority, duties, and obligations of either Sound Transit or Contractor as set forth in the Contract Documents.

6. Make every effort to reach unanimous recommendations. If this cannot be accomplished, include written minority recommendations and supporting rationale with the report.

B. SOUND TRANSIT Responsibilities:

1. Except for participation in the DRB’s activities as provided in the Contract Documents and this Agreement, do not solicit advice or consultation from the DRB or its members on matters dealing with the conduct of the work or resolution of problems which might compromise the DRB’s ability to impartially resolve future disputes.

2. Furnish to each Board member one copy of the conformed Contract Documents, progress schedule and updates, weekly progress reports, minutes of progress meetings with the Contractor, Change Orders, and other documents pertinent to the performance of the contract and necessary for the DRB to conduct its operations.

3. Coordinate DRB operations in cooperation with the Contractor.

4. Arrange for or provide conference facilities at or near the site, and provide copying services.

5. Cooperate with the Contractor and the DRB to facilitate prevention of disputes and the timely and impartial resolution of disputes.

C. Contractor Responsibilities:

1. Except for participation in the DRB’s activities as provided in the Contract documents and this Agreement, do not solicit advice or consultation from the DRB or its members on matters dealing with the conduct of the work or resolution of problems which might compromise the DRB’s ability to impartially resolve future disputes.

2. Furnish to each Board member and to Sound Transit, one copy of pertinent documents other than those furnished by Sound Transit as may be requested.

3. Cooperate with Sound Transit and the DRB to facilitate prevention of disputes and the timely and impartial resolution of disputes that are referred to it.
VI  TIME FOR BEGINNING AND COMPLETION OF DRB ACTIVITIES

A. Unless the DRB Chair has been previously identified by the parties, the DRB shall begin its activities by selecting the Chair. After selection of the Chair, DRB activities shall proceed with preparation for the first meeting, including preparation of the DRB operating procedures.

B. This Agreement shall survive the termination, resignation or death of any member.

C. The DRB’s jurisdiction under this Agreement shall end on the date of final payment under the CONTRACT, unless terminated earlier by mutual agreement of Sound Transit and Contractor.

VII  PAYMENT

A. Payments made to the Board members shall constitute full compensation for work performed, travel time and services rendered, and for all materials, supplies and incidentals necessary to serve on the DRB.

B. Payment for services rendered by Board members shall be at the rate and conditions agreed to between Sound Transit and the Contractor and each Board member.

C. Board members shall be reimbursed for actual direct, non-salary expenses including automobile mileage, parking, travel expenses from the point of departure to the initial point of arrival, automobile rental, taxi fares, food and lodging, printing, long distance telephone, postage and courier delivery, subject to limitations imposed by the contract.

D. Payment made to Board members in the form of bonus, commission, or consideration of any nature other than that specified hereinabove for performance and service provided under this Agreement, before, during or after the period that this Agreement is in effect, is prohibited.

E. Board members shall individually submit invoices for work completed to the Contractor:
   1. Not more often than once per month.
   2. Based on the agreed billing rate and conditions and on the number of hours expended, together with direct, non-salary expenses including an itemized listing supported by copies of original bills, invoices, and expense accounts.
   3. Accompanied by a description of activities performed daily during that period.

F. The Contractor shall pay acceptable invoices, approved by Sound Transit, within 30 days of their receipt.

G. The Contractor shall be reimbursed for Sound Transit’s portion of the DRB costs in accordance with payment provisions specified elsewhere in the contract.

VIII  CONFIDENTIALITY AND RECORDKEEPING

A. No Board member shall divulge information identified as confidential that has been acquired during DRB activities without obtaining prior written approval from Sound Transit and the Contractor.

B. Board members shall maintain cost records pertaining to this Agreement for inspection by Sound Transit or the Contractor for a period of three years following the end or termination of this Agreement.
IX ASSIGNMENT

A. No party to this Agreement shall assign any duty established under this Agreement.

X. TERMINATION

A. This Agreement may be terminated by mutual agreement of Sound Transit and Contractor at any time upon not less than four weeks written notice to the other parties.

B. Individual Board members may be terminated only by agreement of both Sound Transit and the Contractor.

C. If a Board member resigns, is unable to serve, or is terminated he or she shall be replaced within four weeks in the same manner as he or she was originally selected. This Agreement shall be amended to indicate the member replacement.

XI LEGAL RELATIONS

A. The parties to this Agreement expressly acknowledge that each Board member, in the performance of his or her duties on the DRB, is acting in the capacity of an independent agent and not as an employee of Sound Transit or the Contractor.

B. Board members shall not participate in subsequent dispute proceedings.

C. Sound Transit and the Contractor acknowledge that each Board member is acting in a capacity intended to facilitate the resolution of disputes. Accordingly, it is agreed and acknowledged that, to the fullest extent permitted by law, each Board member shall be accorded quasi-judicial immunity for any actions or decisions associated with DRB activities.

D. Each Board member shall be held harmless for any personal or professional liability arising from or related to DRB activities. To the fullest extent permitted by law, Sound Transit and the Contractor shall indemnify and hold harmless all Board members for claims, losses, demands, costs, and damages (including reasonable attorney fees) for bodily injury, property damage, or economic loss arising out of or related to Board members carrying out DRB activities. The foregoing indemnity is a joint and several obligation.

XII DISPUTES REGARDING THIS THREE-PARTY AGREEMENT

A. Disputes among the parties arising out of this Agreement that cannot be resolved by negotiation and mutual concurrence and actions to enforce any right or obligation under this Agreement shall be initiated in the Superior Court of King County, Washington.

B. All questions shall be resolved by application of State of Washington law.

C. The Board members hereby consent to the personal jurisdiction of the Superior Court of King County, Washington.

XIII FUNDING AGENCY REVIEW

A. The Federal Transit Administration's Project Management Oversight Committee has the right to review DRB reports and to attend DRB hearings, but not to attend private DRB deliberations.
XIV  THREE-PARTY AGREEMENT

Entered into on ___________ __________, __________ between:

(month)  (day)  (year)

Board Members
By: ___________________________  ___________________________
    (Signature)                   (Name)
By: ___________________________  ___________________________
    (Signature)                   (Name)
By: ___________________________  ___________________________
    (Signature)                   (Name)

Contractor
By: ___________________________
    (Signature)
By: ___________________________
    (Name)
Title: __________________________
    (Signature)

Sound Transit
By: ___________________________
    (Signature)
By: ___________________________
    (Name)
Title: __________________________
    (Signature)
PART 1 - GENERAL

1.01 SUMMARY

A. This Section specifies the submittal, use, and preservation of Contractor’s Escrow Bid Documentation, as defined in Article 1.03, herein (hereinafter also referred to as “Bid Documentation”, “Bid Document” or “Documents”). The Bid Documents provided by the Contractor shall be specific enough that a third person could look at the Bid Documents and determine the labor, material, and equipment costs for each Contract Division and Specification Section within the Division. The Bid Documents shall also identify field and home office overhead and profit. The Contractor shall execute the enclosed Escrow Bid Documentation Instruction Agreement and submit it no later than the meeting to review the Bid Documents as set forth in Article 1.04A, herein.

B. An Escrow Bid Documentation Agreement is appended to this Section.

1.02 CONTRACTOR RESPONSIBILITIES

A. The Contractor shall submit a legible copy of all Escrow Bid Documentation used to prepare the bid for this Contract no later then the time set forth in Article 1.04A, herein.

1.03 ESCROW BID DOCUMENTATION DEFINITION

A. The terms “Escrow Bid Documentation”, “Bid Documentation” and “Bid Documents” as used in this Section include, but are not limited to, the following documents:

1. Anticipated, detailed project schedule at the time of the bid.
2. Scope of work on which the Contractor requested the Subcontractors and Suppliers to submit their proposals/quotations.
3. Proposals/quotations from Subcontractors and Suppliers with all backup documentation including the conditions and pricing.
4. Quantity takeoff documents including calculations.
5. Labor rates and the attendant development file(s).
6. Equipment rates and the attendant development file(s).
7. Equipment proposals / quotations including conditions and pricing.
8. Assumptions or details used to develop the production rates assumed in the estimate and project schedule.
9. All survey notes or calculations; site visit notes or documents and all notes from prebid meeting(s).
10. Takeoff sheets, cut and add sheets, and any and all backup documentation.
11. Bid estimate from summary level to the lowest level of detail commensurate with the capabilities of the Contractor’s estimating system including all notes and assumptions for each activity and bid item and including crew sizing, equipment utilization, material consumption rates, and Subcontractor pricing.

12. All writings, drafts, working papers, take off sheets, phone logs, computer printouts, charts, electronic data, spreadsheets, drawings, scope of work narratives or outlines, photographs, and all other documentation or data compilations which contain or reflect all information, data, and calculations compiled to, referred to, related to, and used for the above list of items.

13. All manuals, books, and/or reference guides which used by in determining the bid for this Contract. If such manuals, books, and reference guides are standard in the industry, they may be included in the Bid Documentation by reference provided the reference includes the title, edition, publication date, and author.

B. If the Contractor provides rolled up take off sheets or electronic data for all aspects of the Escrow Bid Documentation, the Contractor shall also provide the backup documentation supporting the rolled up take off sheets and electronic data.

C. The term Escrow Bid Documentation does not include the bid documents provided by Sound Transit for use by the Contractor in bidding on this Contract.

D. Unsuccessful Bidder(s) shall not destroy, throw away, or write over Escrow Bid Documentation or all other documentation used in, referenced, and referring to the its bid until the return of the its bid bond by Sound Transit.

1.04 DELIVERY OF BID DOCUMENTATION TO SOUND TRANSIT

A. Within 5 business days after being requested, the Contractor shall submit Bid Documentation to the Senior Contracts Administrator named in the Invitation to Bid at:

Sound Transit Procurement and Contracts
401 S. Jackson Street,
Seattle, WA 98104.

B. Escrow Bid Documentation shall be submitted as follows:

1. All Escrow Bid Documentation shall be in folder(s) or three-ring binder(s). The folder(s) or three ring binder(s) shall be clearly marked “Escrow Bid Documentation - Contract No. LR 95-10” and shall contain the Contractor’s name, contact person, phone number, and date of submittal. Such Escrow Bid Documentation shall be stored in an offsite document repository of Sound Transit’s choice.

2. Contractor shall mark all of pages of the Bid Documentation it considers proprietary or confidential, accordingly. Such information will be treated as such by Sound Transit; however, Sound Transit cannot ensure that this information would not be subject to release pursuant to a public disclosure request. In the event Sound Transit receives a request for such information, Sound Transit will immediately advise the Contractor and will not release the marked documents for a period of not less than 10 Days in order to give the Contractor an opportunity to
obtain a court order prohibiting the release of the information in response to the public disclosure request.

3. The writing on the pages shall be legible.

4. The paper shall be white in color or some other light (neutral) colored paper.

5. Documents shall be in the English language. Currency shall be expressed in U.S. dollars, and measurement units in either metric or U.S. units. Should the Contractor receive a quotation in a language other than English, the Contractor shall provide an English translation of that (those) document(s).

C. Contractor shall include with its Escrow Bid Documentation an affidavit signed under oath by an individual authorized by the Contractor to execute bids and contracts.

1. The affidavit shall list each document with sufficient specificity and reference page number(s) so that a comparison can be made between the list and the Bid Documentation to ensure that all Escrow Bid Documentation listed in the affidavit has been enclosed and that all documentation has been provided to Sound Transit.

2. The affidavit shall state that the affiant has personally examined the Escrow Bid Documentation and that all documentation that was used in preparing the bid and that supports how the bid price was calculated was provided to Sound Transit.

D. Documents listed in the affidavit but not included in the folder(s) or three ring binder(s) through error or oversight by the Contractor, shall be submitted to Sound Transit within two business days after notification from Sound Transit that Bid Documentation is missing or within 2 business days after the Contractor becomes aware of the error.

E. Prior to Contract execution, Sound Transit and the Contractor shall meet to review the Bid Documentation to ensure that the submitted Bid Documentation satisfies the requirements of this Section.

F. If Sound Transit determines that the Escrow Bid Documentation is illegible, not electronically accessible, or not submitted in accordance with this Section, the Contractor shall:

1. Provide legible copies of the Bid Documentation.

2. Supply the software necessary to access the Bid Documentation.

3. Comply with the requirements of this Section within 2 business days of Sound Transit’s request.

G. If Sound Transit believes that the Contractor has not provided all Escrow Bid Documentation, the Contractor shall, within 2 business days of Sound Transit’s request, supply additional documentation or an explanation as to why the documentation does not exist.

H. Failure to submit Escrow Bid Documentation within the times prescribed, failure to be cooperative with Sound Transit in providing the Bid Documentation, or destruction of Bid Documents is just reason for a Contractor to be found not responsible in which case Sound Transit may reject the Contractor as not responsible.
1.05 USE OF BID DOCUMENTATION

A. The Contractor agrees that the Escrow Bid Documentation shall contain all documentation used in preparing the Bid. No other Bid Documentation concerning the Contractor’s calculation of its bid shall be utilized by the Contractor during disputes or litigation of claims brought by the Contractor arising out of this Contract, unless otherwise approved by Sound Transit.

B. The Escrow Bid Documentation may be reviewed and used by Sound Transit to determine the Contractor’s bid concept, to evaluate the Contractor’s breakdown of Contract Price, evaluate productivity and schedule, in association with Claims or for all other reason related to the Contract.

C. Sound Transit may copy the Escrow Bid Documents and may provide the working copy(s) to Sound Transit personnel, agents, or consultants. Sound Transit, its agents, and consultants, may maintain such working copies of the Bid Documents and at the request of Resident Engineer, all copies of Escrow Bid Documents will be returned to Sound Transit.

D. If a Dispute Review Board is used to resolve disputed claims, the Board members shall have unrestricted use and access to the Escrow Bid Documentation for purposes of evaluating, understanding, resolving, and settling disputes/claims. The Dispute Review Board shall maintain submitted documents in a file marked confidential and proprietary which shall be returned to Sound Transit at the conclusion of the DRB process.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION
Public Body: Sound Transit

Contract No.: LR 95-10

Project Name: U250 UW Station Finishes

Estimated Contract Completion Date: ____________________________

This Agreement is for the retention of Escrow Bid Documentation submitted in accordance with Specification Section 01 27 23, Escrow Bid Documentation, Contract No. LR 95-10 by __________________, (Contractor) the company selected low bidder by Puget Sound Regional Transit Agency (Sound Transit) to perform all the work associated with the Project named above.

Pursuant to Contracts Documents, the parties agree to the following conditions of this escrow agreement:

1 DURATION AND USE OF BID DOCUMENTATION

A. The Escrow Bid Documentation and affidavit shall remain in a secured location under the control of Sound Transit during the life of the Contract and will be returned to the Contractor by Sound Transit within 30 Days after the resolution of all claims, disputes and/or litigation, and the issuance of Final Acceptance.

B. The Escrow Bid Documentation may be used to determine the Contractor’s bid concept related to Claims arising out of this Contract. Pursuant to the Contract Specifications Section 01 27 23, Escrow Bid Documentation, Sound Transit may copy the Escrow Bid Documents and utilize copies.

C. For purposes of protecting the Escrow Bid Documents, Sound Transit and the Contractor shall each designate three authorized representatives that may access the Escrow Bid Documents. Such designations shall be by letter to the other party. The Contractor and/or Sound Transit may change the authorized representatives with written notice to the other party. In the event that a Claim is submitted by the Contractor, Sound Transit may at its sole discretion review the escrowed Bid Documentation to verify the fairness and reasonableness of any proposed adjustment in the Contractor Price or Contract Time. If Sound Transit elects to obtain access to such materials, Sound Transit will notify the Contractor and permit the Contractor to obtain equal access. At no time shall the Contractor have access to the Escrow Bid Documents and affidavit located with the Escrow Bid Documents without the presence of a Sound Transit authorized representative.
representative. Following each examination, the Escrow Bid Documentation will be returned to Sound Transit’s offsite document repository.

D. The Article above does not apply when Sound Transit or Contractor accesses their working copies of the Escrow Bid Documentation.

2 AUTHORIZED REPRESENTATIVES

A. For the Contractor are:

_____________________________________________________________________
_____________________________________________________________________
_____________________________________________________________________

B. For Sound Transit are:

_____________________________________________________________________
_____________________________________________________________________
_____________________________________________________________________

3 REMEDIES FOR REFUSAL OR FAILURE TO PROVIDE OR ALLOW ACCESS TO BID DOCUMENTATION

A. If the Contractor fails or refuses to allow Sound Transit to access, examine, copy, and/or maintain a copy of the Escrow Bid Documentation, the parties agree that:

1. Sound Transit shall provide access to the Escrow Bid Documents to Senior Contracts Administrator if Sound Transit provides a declaration and supporting documentation showing that:
   a. Sound Transit provided the Contractor with a minimum of 24-hour written notice of its intent to access or copy the Escrow Bid Documentation;
   b. Sound Transit provided timely written notice to the Contractor regarding access to the Escrow Bid Documentation;
   c. The Contractor has either failed to acknowledge notice of Sound Transit’s request, is refusing to allow Sound Transit access to the Escrow Bid Documentation, or is refusing to allow Sound Transit to access the Escrow Bid Documentation and it has been more than two days (48 hours) since Sound Transit provided notice of its intents to access the Escrow Bid Documents.

2. An employee from Sound Transit shall be present when Sound Transit accesses the Escrow Bid Documentation to ensure the authenticity of the Escrow Bid Documents.
Contractor

By: ____________________________
Name: ____________________________
Title: ____________________________
Date Signed: ________________________
Notice to: ____________________________

Sound Transit

By: ____________________________
Name: ____________________________
Title: ____________________________
Date Signed: ________________________
Notice to: ____________________________

 Resident Engineer address

END OF AGREEMENT
PART 1 - GENERAL

1.01 DESCRIPTION

A. This Section includes specifications for coordination of Work of the Contract.

B. Coordinate scheduling, submittals, and work of the various Sections of Specifications to ensure efficient and orderly sequence of installation of construction elements, with provisions for accommodating items to be installed later.

C. Coordinate work among parts of the Contract Documents to avoid conflicts and omissions. Take special care to coordinate work, which is normally indicated in some but not all Contract, mechanical, electrical, and other major Divisions of the Contract Documents.

D. Related Sections: The work of the following Sections is related to the work of this Section. Other Sections, not referenced below, may also be related to the proper performance of this work.

1. Section 01 31 19, Project Meetings.
2. Section 01 32 13, Scheduling of Work.
3. Section 01 77 00, Closeout Procedures.

1.02 COOPERATION AND COORDINATION OF WORK

A. Coordination of work among the general and various Subcontractors will be a critical element in the success of this project. Coordinate the installation of the work and that of Subcontractors to ensure compliance with the contract documents and to expedite the progress of the project.

B. It is the responsibility of the Contractor to ensure that the work of Subcontractors complies with General and Special Conditions of the Contract. No additional payments or time extensions will be authorized for failure on the part of Subcontractors to be familiar with and in compliance with Contract Specifications.

C. Project Coordination and Scheduling Control: Responsibility for coordination and close adherence to schedules rests solely with the Contractor who shall maintain coordination and scheduling control at all times:

1. Each Subcontractor responsible to the Contractor shall cooperate diligently with the Contractor in the execution of their work so as to cause no delay in the completion of the Project. This responsibility includes the completion of work in a timely manner and items of equipment connected and fully operating at the time of Substantial Completion of each phase. Each Subcontractor shall diligently comply with the following requirements:

a. Cooperate in planning and layout of the work well in advance of operations to properly interface with work of other trades and Sound Transit's separate contractors.
1) Include Sound Transit Furnished Equipment (STFE) and Sound Transit Furnished Materials (STFM) items.

2) Include planning, layout, and review of mock-ups.

b. Inform other trades of requirements at proper time to prevent delay or revisions

c. Be informed on the requirements of other trades and check own work for conflicts with the work of other trades.

d. Ensure delivery of materials and performance of work on coordinated schedule with other trades.

e. Ensure that the Subcontractors and Equipment Suppliers are responsible for the integration, compatibility and completeness of the installation and operation of the equipment within their respective Contract Specification Sections. Such work shall include conformance with code requirements. If power, piping, ductwork, or other work required for complete installation is not provided by others to equipment location or is not adequate for complete installation, the Subcontractor or equipment Supplier shall be responsible for providing the necessary connections.

f. Ensure that the Subcontractors attend pre-installation conferences in conformance with requirements for Special meetings in Section 01 31 19, Project Meetings.

2. Notify Resident Engineer in a timely manner of items/issues requiring field verification by Resident Engineer and subconsultants.

3. Schedule and coordinate utility shutdowns with applicable agencies:

a. Submit a schedule of equipment and utility shutdowns in Construction Schedule, Section 01 32 13, Scheduling of Work.

b. Confirm requests for equipment and utility shutdowns in writing to the Resident Engineer not less than 14 Days prior to the proposed date. Include, as a minimum, the following information:

1) Equipment or utility services affected;

2) Reason shutdown is required;

3) Work to be accomplished during the shutdown;

4) Proposed date and time; and

5) Duration of the shutdown.

c. The actual time and date of shutdowns will be subject to approval of applicable agency and Resident Engineer.

d. The duration of shutdowns shall be held to a reasonable minimum as determined by applicable agency and Resident Engineer.

e. Materials and equipment required for the work to be accomplished during shutdown shall be complete and available on the job for review by Resident Engineer 3 Days prior to the shutdown, if requested. If
Contractor is not adequately prepared, the shutdown will be canceled and rescheduled.

f. Include in the bid all costs associated with equipment and utility shutdowns. Sound Transit will make no extra payment for overtime work, schedule changes, or failure to complete utility connections within authorized shutdown periods.

D. Notification and Correction of Defective Work:

1. Before starting a section of work, ensure each Subcontractor carefully examines preparatory work that has been executed to receive each Subcontractor's work. Check carefully, by whatever means required, to ensure that the work and adjacent, related work will finish to proper contours, planes, and levels.

2. Promptly notify the Contractor of all defects or imperfections in preparatory work which will in any way affect satisfactory completion of the work. Under no condition shall a section of work proceed prior to preparatory work having been completed, cured, dried, or otherwise made satisfactory to receive such related work.

3. Correction of defective work shall be the responsibility of the Contractor or Subcontractor providing the defective work. Correction of work due to underlying defects shall be the responsibility of the Contractor or Subcontractor providing work.

E. Dimensions:

1. The primary structural elements are dimensioned on the Contract Drawings. Not all secondary dimensions are shown, such as exact door and window locations, wall configurations, slab slopes and depression, curbs, and the like. Coordination of the structure with the dimensions as shown on the Contract Drawings and Contract items to be embedded, or attached to the structure, is the responsibility of the Contractor. Dimensional discrepancies between Contract Drawings shall be reported to the Resident Engineer before proceeding with the work.

F. Drawings:

1. The work of the Contractor and each Subcontractor shall conform to the intent of the Contract Drawings and Contract Specifications. Contract Drawings are partly diagrammatic and do not intend to show in detail all features of work. Each Subcontractor shall carefully review and understand the intent of the Contract Drawings and Contract Specifications for its work and the work to be performed by other trades. Each subcontractor shall compare related Contract Drawings and Contract Specifications, and thoroughly understand the building conditions affecting their work and the work of other trades.

2. Changes required in the work caused by failure to do so shall be at no expense to Sound Transit.

G. Interferences and Right-of-way:

1. Make proper provisions to avoid interferences

2. Where conflicts occur, resolve in the following order: Structural work has right-of-way over mechanical and electrical work; concealed mechanical work has right-
of-way over concealed electrical work; exposed electrical fixtures have right-of-way over mechanical fixtures.

3. Submit conflicts, which cannot be resolved by right-of-way to Resident Engineer for instructions.

4. Submit reflected ceiling coordination plan showing work by affected trades in accordance with requirements of Section 01 33 00, Submittal Procedures.

H. Equipment Connections: See mechanical and electrical Divisions. Work includes but is not limited to:

1. Verifying utility requirements characteristics of operating equipment are compatible with building utilities.

2. Providing motors and equipment for current characteristics as shown on Contract Drawings for electrical:
   a. Electrical Subcontractor:
      1) Contractor shall ensure that electrical Subcontractor furnishes and installs wiring and conduit as shown in the Electrical and Systems plans except:
         a) Temperature control wiring.
         b) Equipment control wiring
         c) Interlock wiring
      2) Contractor shall ensure that electrical Subcontractor furnishes and installs power wiring complete from power source to motor or equipment junction box, including power wiring through starters. Contractor shall ensure that electrical Subcontractor furnishes and installs starters not factory mounted on equipment. After circuits are completed, Contractor shall ensure that electrical Subcontractor is responsible for all power wiring.
   b. Contractor shall ensure that mechanical Subcontractor, regardless of voltage, furnishes and installs temperature control wiring, and interlock wiring and equipment control wiring for the equipment that the mechanical Subcontractor furnishes.

I. Cooperate and coordinate with all other separate Contractors and subcontractors under Contract with Sound Transit. Refer to Special Conditions.

J. Coordination Drawings:

1. Contractor shall prepare coordination drawings, consisting of plans, sections, and details of the facility. Drawings shall depict the interrelationships of components shown on separate shop drawings, the installation sequences, and how work is to be installed or constructed in relation to the work of other trades and existing conditions.

2. The purpose of coordination drawings is to resolve potential dimensional interferences and conflicts of the various trades prior to shop fabrication, construction of wall and floor penetrations or field installation of components and systems. While the designers have exercised the accepted standard of care in
performing overall dimensional coordination in the preparation of the construction documents, additional factors influence coordination which the Contractor and Subcontractors must address with coordination drawings. Such factors include, but are not limited to specific means and methods, the sequence of work, the characteristics of the specific equipment to be installed (where the documents allow multiple options), recognition of existing conditions, and the bidding assumptions made by each Subcontractor.

3. Areas for which coordination drawings are to be prepared include, but are not limited to:
   a. Light fixtures, conduit, mechanical piping and duct work.
   b. Embedded items in concrete, openings in concrete and concrete masonry.
   c. Mechanical and electrical equipment including electrical connections.
   d. Miscellaneous Contract:
      1) Masonry and ledger angle layouts.
      2) Precast to structure.
   e. Ceiling spaces (see following Articles, herein).

4. Detailed ceiling space coordination drawings:
   a. Contractor is responsible for the detailed coordination of all trades involved in installation of mechanical and electrical equipment. These trades and related items of work include, but are not limited to the following:
      1) Mechanical: Equipment, ductwork, fire sprinkler system, piping, and related devices
      2) Electrical: Equipment, panels, lights, conduit, and related devices
   b. Submit for review a coordination shop drawing for all items above as they relate to the new and existing conditions, prior to the start of all work. Include that area from 7'-0" above finished floor line to the bottom of structural slab above. This drawing shall be modified and updated as work proceeds and shall be submitted as a record "as-built" drawing.

5. Concrete lift drawings: Submit concrete lift drawings for review prior to placement of all cast-in-place concrete. Drawings shall include form materials, details of all openings and blockouts, location of all embeds, chamfers, anchor bolts, pipe, and HVAC penetrations, conduit penetrations, sills and thresholds, construction joints, water stops, expansion joints, finish designations, concrete hardeners, curing methods, sequence of placements, dowels, slopes, materials, subgrade, vapor barrier, drams, embedded conduits, conduit penetrations, and all other details inherent to a coordinated concrete placement.

6. Prepare coordination drawings in accordance with the same requirements as indicated for shop drawings.
a. Plans shall be at an appropriate scale to depict the necessary detail, but not less than 1/4" = 1'-0".

b. Sections shall be at an appropriate scale to depict the necessary detail, but not less than 1/2" = 1'-0".

c. Drawings shall contain elements of the construction in their correct dimensional relationship, including but not limited to, ceilings, roofs, walls, beams, columns, openings, supports, hangers, earthquake bracing, fixtures, and all other appurtenances.

7. Contractor and each Subcontractor shall sign the coordination drawings to indicate their participation in the coordination process and their agreement that the individual systems and components can be installed as indicated in the drawings and in the conformance with the Contract Documents.

8. These drawings shall be submitted for review and approval prior to installation of any components of the work to be included in order to demonstrate that the installation of the aforementioned items have been coordinated by the Contractor prior to commencement of the work.

1.03 MEETINGS

A. In addition to progress meetings specified in Section 01 31 19, Project Meetings, hold coordination meetings and pre-installation conferences with personnel and Subcontractors to ensure coordination of Work.

1.04 COORDINATION OF SUBMITTALS

A. Schedule and coordinate submittals specified Section 01 33 00, Submittal Procedures.

B. Coordinate work of various Sections having interdependent responsibilities for installing, connecting to, and placing in service equipment.

C. Coordinate requests for substitutions, if any, to assure compatibility of space, of operating elements, and effect on work of other Sections.

1. Note that substitutions are not permitted during construction except under the conditions outlined in General Conditions.

1.05 COORDINATION OF SPACE

A. Coordinate use of Project space and sequence of installation of mechanical, and electrical work, which is indicated diagrammatically on Contract Drawings. Follow routings shown for pipes, ducts, and conduits as closely as practicable, with due allowance for available physical space; make runs parallel with lines of building. Utilize space efficiently to maximize accessibility for other installations, for maintenance, and for repairs.

B. In finished areas, except as otherwise shown, conceal pipes, ducts, wiring and the like within the construction. Coordinate locations of fixtures and outlets with finish elements; furring, chases, and soffits are specifically not allowed.

1.06 COORDINATION OF CONTRACT CLOSEOUT

A. Coordinate completion and cleanup of work by the various trades involved in preparation for Substantial Completion.
B. After Sound Transit occupancy of premises, coordinate access to site by the various trades involved for corrections defective work and work not in accordance with Contract Documents, to minimize disruption of Sound Transit's activities.

C. Assemble and coordinate closeout submittals specified in Section 01 77 00, Closeout Procedures.

END OF SECTION
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SECTION 01 31 14
COORDINATION WITH OTHERS

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes specifications for constraints on construction, coordination with the Seattle Department of Transportation (SDOT), King County Metro (KCM), Seattle Department of Transportation (SDOT), Seattle Fire Department (SFD), Seattle Public Utilities (SPU), Seattle City Light (SCL), University of Washington (UW), and community relations.

B. This Section is in addition to the coordination requirements contained in the General Conditions Article 3.02, Coordination with Others.

C. Related Sections: The work of the following Sections is related to the work of this Section. Other Sections, not referenced below, may also be related to the proper performance of this work. It is the Contractor’s responsibility to perform all the Work required by the Contract Documents.
   1. Section 01 12 16, Work Sequence.
   2. Section 01 12 19, Contract Interface.
   3. Section 01 41 26, Permits.
   4. Section 33 11 00, Water Utility Distribution Piping.
   5. Section 33 30 00, Sanitary Sewerage Utilities.

1.02 HOURS/DAYS OF WORK, AND CONSTRAINTS ON CONSTRUCTION

A. The Contractor’s attention is directed to the City of Seattle Noise Ordinance. The Contractor shall review the Ordinance with respect to the anticipated Work to ensure that the noise limitations imposed are not exceeded. The Ordinance permits normal Work hours as indicated in Section 01 12 16, Work Sequence.

B. If noise from Work outside of the above hours conducted outside the limits of the designated construction staging areas is anticipated to exceed the City of Seattle Noise Ordinance, the Contractor shall obtain a noise ordinance variance from the City of Seattle and comply with its requirements. The Contractor’s attention is directed to the City of Seattle Street Use Division at (206) 684-5253, for noise ordinance variance limitations and application procedures.

C. Sound Transit has applied for a Technical Variance to the City of Seattle Noise Ordinance to allow for certain construction activities and the operation of construction equipment to proceed 24 hours per day and 7 days per week within the limits of the construction staging areas at the University of Washington. The Nighttime Construction Noise Variance Application, when approved by the City of Seattle, shall be incorporated into the Contract.

D. The standard work week for the Contract will be five consecutive 8-hour days Monday-Saturday, with the work scheduled between 7:00AM and 10:00PM.
E. For planned work shifts outside the established work day during the established work week, the Contractor shall give the Resident Engineer 48 hours advance notice.

F. When coordinating with Sound Transit and Project Stakeholders, the Contractor shall note that the following are recognized holidays:

1. Recognized holidays shall be as follows: New Year’s Day, Martin Luther King Jr.’s Birthday, Presidents’ Day (Third Monday in February), Memorial Day, Fourth of July, Labor Day, Veterans’ Day (Eleventh day of November), Thanksgiving Day, the Friday after Thanksgiving Day, and Christmas Day. In the event a holiday falls on Sunday, the following day, Monday, shall be observed as such holiday. In the event a holiday falls on Saturday, the preceding day, Friday, shall be observed as such holiday. Monday holidays shall be honored in keeping with Federal law.

G. The Contractor’s schedule shall comply with the additional construction constraints contained in the General Conditions and elsewhere in the Contract Documents. For University of Washington constraints refer to Section 01 12 16, Work Sequence.

1.03 COORDINATION WITH OTHER SOUND TRANSIT CONTRACTORS

A. The Contractor shall coordinate its Work with the following Sound Transit contractors. Dates of construction are estimated, and are subject to change.

1. U220, U260, and U830 Contracts refer to Section 01 11 00, Summary of Work and Section 01 12 19, Contract Interfaces.

B. The Contractor shall attend meetings scheduled by the Resident Engineer to coordinate work, which potentially impacts the work of others.

1.04 COORDINATION WITH UNIVERSITY OF WASHINGTON

A. The Contractor shall coordinate its work with Sound Transit and the Construction Manager, whom will coordinate with the University of Washington to obtain the appropriate permits, refer to Section 01 41 26, Permits.

1.05 COORDINATION WITH KING COUNTY METRO

A. The Contractor shall coordinate its work with the Resident Engineer and King County Metro Transit/King County (KCM) for all street work that affects the operations of Metro bus operations including those within the Pine Street Stub Tunnel.

B. Coordination with KCM shall include:

1. Allowing for salvage, relocation and installation of bus stop shelters, bus stop signs, bus stop trash receptacles, overhead power for electric trolley buses, or other KCM facilities.

2. Accommodation for KCM buses when the Contractor is modifying traffic patterns.
   a. Thirty days notice shall be given to KCM before traffic control changes are made that will impact the trolley bus wire alignment or bus zones.

3. Assistance and coordination with KCM facility modifications during construction.
   a. KCM shall be invited to participate in weekly coordination meetings with the other Stakeholders. The Contractor shall report on work completed,
upcoming work scheduled and all long-range work issues requiring KCM coordination.

4. Temporary relocation of bus zones and restoration of permanent zones. When the Contractor's upcoming Work will interfere with the use of existing bus zones (bus stops) on the corridor, the Contractor shall submit temporary bus zone locations and designs as part of the traffic control plan. The Contractor shall construct approved temporary bus zones at no additional cost to Sound Transit to the following requirements:
   a. A raised landing of 6-inch curb height;
   b. accessible for wheel chair lift deployment;
   c. safe walkways to adjacent cross streets;
   d. lighted for night use;
   e. at least 75 feet long; and
   f. at least 9 feet wide.

5. KCM will provide and install signage and rider alert information at no cost to the Contractor. Existing bus shelters, bus stop signage, and related items will remain the property of KCM. KCM will be responsible for removal and installation of these items.

6. A KCM safety watch or line crew shall be present at the site at all times when the Contractor's operations will be within 10 feet of energized trolley wires such as when installing traffic signals and poles with mast arms or modifying existing signal heads.
   a. A KCM line crew is required when necessary to barrier the energized trolley wire.
   b. Notify KCM Power Distribution headquarters at (206) 264-6580 at least 10 working days before support work is required.
   c. Costs charged by KCM for a safety watch or line crew required by the Contractor will be borne by Sound Transit.

1.06 COORDINATION WITH SEATTLE DEPARTMENT OF TRANSPORTATION

A. The Seattle Department of Transportation (SDOT) has jurisdiction over the streets and roadways. The Contractor shall closely coordinate its activities with SDOT.

B. Coordinate through the Resident Engineer for SDOT reviews of traffic control plans, proposed modifications to traffic signals, and haul route plans.

C. If surface construction activities affect access to surrounding businesses, notice signs shall be posted prior to date of construction.

1.07 COORDINATION WITH SEATTLE PUBLIC UTILITIES

A. Coordinate Work affecting Seattle Public Utility’s (SPU) utilities through the Resident Engineer with SPU Water Engineering Division and Sewer/Drainage Division.
B. Procedures for coordination with SPU for Work affecting SPU water lines are covered in Section 33 11 00, Water Utility Distribution Piping, and as indicated on the Contract Drawings.

C. Procedures for coordination with SPU for Work affecting SPU sewer lines are covered in Section 33 30 00, Sanitary Sewerage Utilities.

1.08 COORDINATIONS WITH SEATTLE CITY LIGHT

A. Coordinate Work affecting Seattle City Light (SCL) utilities through the Resident Engineer with SCL.

B. Procedures for coordination with SCL for Work affecting SCL power lines are covered in Section 01 51 15, Temporary Electrical Power, and as indicated on the Contract Drawings.

1.09 COORDINATIONS WITH SEATTLE DEPARTMENT OF PLANNING AND DEVELOPMENT

A. The Seattle Department of Planning and Development (DPD) has jurisdiction over building permits and compliance. The Contractor shall closely coordinate its activities with DPD.

B. Coordinate Work affecting Seattle Department of Planning and Development (DPD) through the Resident Engineer and DPD.

1.10 COORDINATIONS WITH SEATTLE FIRE DEPARTMENT

A. Obtain Seattle Fire Department approval of fire systems and testing thereof.

1.11 COMMUNITY RELATIONS

A. Sound Transit will establish a program of public contact for conducting effective relationships with communities and businesses in proximity to the construction areas. As part of these programs, establish and maintain a continuing liaison with persons occupying property or doing business in the immediate area of the worksite for the purpose of minimizing inconveniences resulting from construction.

B. Jointly contact with Sound Transit those residents and business owners who might reasonably be expected to be affected by the construction and make known to them the name of the Sound Transit representative on the worksite with responsibility for community relations and explain to them the means by which the representative can be contacted expeditiously. Stay informed of problems caused by the construction. Post advance notice signs as necessary to inform public and surrounding businesses of upcoming construction activities.

C. Designate an on site, community relations liaison with 24-hour on-call availability for the duration of the Contract. Community relations liaison duties include:

1. Assisting Sound Transit in notifying adjacent owners of upcoming work.

2. Assisting Sound Transit in responding to complaints.

3. Attending public outreach meetings, as necessary. Meetings can include regular construction information meetings, quarterly open houses, media inquiries, tours, ground breaking, and other milestone events.
D. Accommodate site tours on an average of once per quarter. Tours shall be arranged through the Resident Engineer.

E. Quarterly diversity awareness training shall be scheduled for all Contractor staff. Training will be provided by Sound Transit.

F. Assume an average of 10 hours per week for community relations activities.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

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PART 1 - GENERAL

1.01 DESCRIPTION

A. This Section includes specifications for project meetings prior to and during construction.

B. Related Sections: The work of the following Sections is related to the work of this Section. Other Sections, not referenced below, may also be related to the proper performance of this work.

1. Section 01 32 13, Scheduling of Work.

2. Section 01 45 00, Quality Control.

1.02 SPECIAL MEETINGS

A. Special meetings will be scheduled and conducted by Sound Transit throughout the course of construction as Sound Transit deems necessary.

1.03 PRECONSTRUCTION MEETING

A. A pre-construction meeting will be scheduled and conducted by Sound Transit not more than 21 working days after the effective date of the Notice of Contract Award. Attendance is required by the Contractor project manager, superintendent, and other necessary personnel. Sound Transit will provide written notice of this meeting not less than 4 working days prior to the date of the meeting.

B. At this meeting, Sound Transit will:

1. Introduce representatives of Sound Transit, governmental agencies, and public and private utilities.

2. Explain and discuss the responsibilities and authorities of the Resident Engineer.

3. Discuss Equal Employment Opportunity (EEO), Small Business and Disadvantaged Business Enterprises (SBE and DBE), and apprenticeship program requirements.

4. Discuss Community Relations functions.

5. Discuss construction quality control requirements, as specified in Section 01 45 00, Quality Control.

6. Discuss Contract quality assurance requirements.

7. Discuss Safety Certification process requirements.

8. Define and establish requirements for safety, first-aid, emergency actions, security, and full-time safety representatives.
9. Explain and discuss selected laws, codes, traffic regulations, and permit requirements of public agencies and their regulations.

10. Discuss procedures for processing Change Notices (CNs), Change Orders (COs), correspondence, Requests for Information (RFIs), shop drawings, submittals, product data, and samples.

11. Discuss monthly progress payments.

12. Discuss Construction Progress Meetings and bi-weekly Quality Control Meetings.

13. Discuss final payments.

14. Discuss project schedule

15. Discuss special conditions

C. Plan to discuss the following at this meeting:

1. Introduce project representatives and briefly describe each person's responsibilities.

2. Distribute and discuss the list identifying major Small Business and Disadvantaged Business Enterprises (SBE and DBE) Subcontractors including their areas of responsibility.

3. Discuss use of office, streets, rights-of-way, haul routes, storage areas, staging areas, construction areas, and temporary easements.

4. Define housekeeping procedures.

5. Discuss construction means and methods.

6. Describe anticipated means and methods for worksite layout, erosion and sedimentation control plans, haul routes, noise abatement, vibration monitoring, air and water pollution control, excavation support systems, grading paving and fencing, site drainage, and street restoration.

7. Discuss coordination and notifications required for utility work and services.

8. Discuss deliveries and priorities of major equipment.

9. Discuss breakdown of schedule of values for lump sum items.

10. Discuss construction progress schedule, including critical path activities.

11. Discuss public safety measures.

1.04 CONSTRUCTION PROGRESS MEETINGS

A. Construction progress meetings will be scheduled and conducted by the Resident Engineer and held each week during the period of performance of the Contract for the competent and timely execution of the Contract. Include representatives of Subcontractors who are or will be performing work during the current and following month in the progress meetings.

B. Distribute notices of these meetings before such meetings to Subcontractors.
C. The agenda for construction progress meetings will be prepared by the Resident Engineer and will generally include the following:

1. Introduce new attendees and areas of responsibility.
2. Review minutes of previous meetings, amend minutes if necessary, and accept minutes.
3. Discuss Construction Safety.
4. Discuss Community Outreach
5. Discuss SBE/DBE Utilization and Apprenticeship Program issues
6. At each meeting, display and discuss the status of the Critical Path activities. If they are behind schedule, describe the methods intended to be used to bring these activities back on schedule.
7. Discuss corrective measures to maintain progress.
8. Discuss the Three-Week Look-Ahead Schedule submitted as specified in Section 01 32 13, Scheduling of Work, and last work plan for the previous period showing activities accomplished and those not completed in accordance with the prior submittal. Discuss the reasons for failure to complete the work as shown in the schedule and the methods to be implemented to complete the unfinished activities.
9. Confirm that all related submittals have a satisfactory disposition as “No Exceptions Taken” or “Exceptions as Noted – Resubmission Not Required” unless this is not in conjunction with the Readiness Review Meeting indicated in Section 01 45 00, Quality Control. If the submittal is “Exceptions as Noted – Resubmission Not Required”, confirm that all comments have been implemented.
10. Discuss quality observations, audit or surveillance reports, failed tests, non-conformances, and employee work standards.
11. Discuss coordination of utility work.
12. Discuss utility strikes.
13. Discuss changed conditions, time extensions, and other relevant subjects as they affect the progress of the Work.
14. Discuss the status of Contract changes: new changes, status of negotiations, and completed changes.
15. Discuss Temporary Erosion and Sedimentation Control open items found on field inspection report.
16. Discuss the status of Requests For Information.

D. Answers will be provided for each of the Contractor’s inquiries, requests for information, or requests for solutions of problems presented during such meetings, when possible, during the meeting itself; those not answered during the meeting will be answered, the answer documented and presented by the Contractor at the next meeting. Sound Transit will record answers provided orally at the meetings in the minutes.
E. Review the minutes of the meeting prepared by Sound Transit and submit all requested corrections. Minutes will be prepared in action-item format with named responsible parties and dates for completion indicated for each item.

1.05 QUALITY CONTROL MEETINGS

A. Attend Quality Control Meetings every 2 weeks with Sound Transit’s Representative, the Contractor’s Quality Representative, inspectors and Third Parties (if required) to discuss Contract quality issues. Items discussed will be documented by the Contractor’s Quality Representative and agreed upon Sound Transit’s Representative with due dates for assigned action items. Minutes will be distributed to all attendees and other interested parties. At a minimum, the Quality Meetings shall cover topics of:

1. Construction Work Plans;
2. Inspections;
3. Test Plans, Procedures, and Test Results;
4. Non-conformance Reports;
5. Safety Critical submittals;
6. Audit / Surveillance Findings;
7. Off-site activities;
8. Materials received;
9. Special inspections and tests.
10. Updates to As-built Contract Documents

1.06 PROGRESS PAYMENT MEETINGS

A. On the 25th of each month, or subsequent Monday if the 25th falls on a weekend, meet with the Resident Engineer to discuss the monthly progress payment.

1.07 CHANGE ORDER MEETINGS

A. Every two weeks or as necessary, meet with the Resident Engineer to negotiate Change Orders.

1.08 CONSTRUCTION WORK PLAN READINESS REVIEW MEETINGS

A. Attend a Readiness Review Meeting after each Construction Work Plan has been accepted and before beginning associated work activities, as specified in Section 01 45 00, Quality Control

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION
SECTION 01 31 23.10
INTERNET-BASED DOCUMENT MANAGEMENT SYSTEM

PART 1 - GENERAL

1.01 SUMMARY

A. This Section specifies an Internet-based document management system, the selected software required for use by the Contractor and Sound Transit for collaboration, and communications of all Contract related work.

B. Related Sections: The requirements of this Section are applicable across all Sections of the Contract Documents. Unless otherwise indicated, be responsible to utilize the Internet-based document management requirements of this Section when performing all document communications.

C. Related Sections: The work of the following Sections is related to the work of this Section. Other Sections, not referenced below, may also be related to the proper performance of this work.

1. Section 01 78 39, Project Record Documents.

1.02 SUBMITTALS

A. Procedures: Section 01 33 00, Submittal Procedures.

B. Initial and Updates of User Identification Information.

C. Proposed schedule of attendance for the selected software training sessions.

D. Signed verification of training attendance for all users.

1.03 DEFINITIONS

A. Document Communication(s):

1. All written documentation and written communications required by the Contract Documents including, but not limited to: correspondence, reports, notices, submittals, transmittals, requests for information (RFI’s), request for Change Order, payment applications, Change Orders, claims, change proposals, field directives, meeting agendas, meeting minutes, substitutions, Value Engineering (VE) Change Proposals (VECP), test reports, monitoring reports, Punch Lists, and all other formal Contract communications.

2. Documents required by the Contract that include written documents, demands, instruments, or directives, unless otherwise indicated in this Section.

3. Communications including sketches, suggestions, e-mails, and similar communications.

B. Electronic Documents:

1. The electronic form or image of document communications that can be stored on and retrieved from an electronic storage device through a collaboration system over the Internet.
2. Includes all written and graphic products produced with computer software or converted to electronic form or electronic image by computer software.

C. Secure Documents: A secure form of the original or created electronic document that communicates the content and information of the original document and prevents alteration of the original document.

D. Notice:
   1. As defined in the Contract.
   2. Notice for documents transmitted through the selected software is the time and date when the document is sent to the other party as recorded in the selected software.

E. Document Team: The associated members of Sound Transit, Sound Transit's Consultants, Construction Management, Contractor, Subcontractors, and Vendors.

F. The selected software:
   1. The Internet-based document management system developed by Sharepoint and Sound Transit.
   2. Document management system for document workflows, communication, and collaboration.
   3. Serves as a single source for project information for communication and collaboration among all project participants by automating various tasks in an organization of modules.
   4. Provides a secure, permissions based access requiring the identification of all users and their approved access rights.
   5. More information may be obtained via the World Wide Web at selected software url.

G. Document Guide: The selected software users guide that demonstrates the modules in the software program and the step-by-step use of the modules.

H. Snapshot:
   1. A read-only archive of select document data on a compact disc (CD) or digital video disc (DVD) medium that is independent of the selected software application.
   2. Includes only selected document data in the selected software at the time the Snapshot is produced.
   3. Data contained on the Snapshot is static such that no edits can be made to the data.
   4. Provides an archive of document data and allows permanent access to the data after the selected software user accounts are no longer available.

1.04 USER IDENTIFICATION INFORMATION

A. Submit the following for each proposed authorized software user within ten Days of the effective date of the Notice to Proceed:
   1. Name, title, and company affiliation.
2. Address, phone number, email address, and fax number.

3. Specific job related functions.

4. Level of authority within the Contractor’s organization.

5. Level of authority requested for each user, for accessing the selected software modules.

6. Date at which the selected software access is required.

B. Submit an updated list of authorized users on a quarterly basis or more frequently as needed, to indicate users to be added or removed.

1.05 DOCUMENT COMMUNICATIONS

A. Submit and process all Document Communications using the selected software. Communication through the selected software is the primary written communication tool for all Document Communications. Unless otherwise indicated, no other form of written Document Communication will be recognized.

B. Submit scanned documents of machine quality (not rescans) unless the original exists in no other form than a copy.

C. Use Scans from Optical Character Recognition (OCR) no less than 300 dpi.

D. In addition, provide Sound Transit with a hard copy/paper copy of each Document Communication for which there is a paper-based source document, photograph, map or drawing which is either scanned or otherwise converted to electronic form or electronic image by computer software. Do not destroy all paper-based Document Communications, even if the Document Communication has been converted to an imaging system or to the selected software.

E. This Section shall not relieve the Contractor of its obligations to provide Sound Transit with Record Drawings in the physical form specified in Section 01 78 39, Project Record Documents.

F. Document Communications and requirements of the Contract that are not to be implemented through the selected software are as follows:

1. Notice to Proceed: Delivered in written form as a paper document.

2. Notice of Termination or Suspension: Delivered in written form as a paper document in accordance with the General Conditions.

3. Exceptions noted in specific Sections of the Contract.

4. Substantial Completion: Delivered in written form as a paper document in accordance with the General Conditions.

5. Final Acceptance: Delivered in written form as a paper document in accordance with the General Conditions.

1.06 ACCESS REQUIREMENTS

A. Maintain the list of authorized users to reflect current authorized users of the selected software.
B. Protect the security of the selected software system by limiting access to authorized users only. Take appropriate precautions to maintain the security of the system. Immediately notify the Resident Engineer of all changes to the list of authorized users.

C. Access will only be permitted to certain modules, in accordance with permission levels configured by the selected software administrator.

1.07 USE REQUIREMENTS

A. Use and implement the selected software in accordance with the Document Guide.

B. Use the selected software as the Document file storage system with a file folder structure created by Sound Transit, unless otherwise agreed to, to organize the Document documents.

C. Follow Sound Transit data/document naming and numbering conventions identified in the Document Guide.

D. The use of the selected software is used for collaboration and written Contract communication and to record the flow of Contract documentation.

E. Encourage the major Subcontractors and key vendors to utilize the Internet-based document management system, as appropriate, to improve communications and coordination within the Contractor’s team.

F. Abide by all policies, procedures, and standards established by Sound Transit for the use and application of the selected software.

G. Comply with applicable laws and regulations regarding electronic transmission of documents requiring professional engineering stamps or signatures, including provision of hard copies of such documents as appropriate.

H. Document Communications that require the signature of authorized persons will use either:
   1. An approved digital signature in accordance with Washington State law, including but not limited to the Washington Electronic Authentication Act (WEAA).
   2. An approved “image” of the official signature affixed to the document. Also provide Sound Transit with the original signed hard copy/paper document.
   3. An electronic copy or electronic image of a fully executed document containing the required signatures. Also provide Sound Transit with the original signed hard copy/paper document.

1.08 DOWNTIME

A. In the event that the selected software system is temporarily unavailable, continue with Document Communications utilizing other electronic means (email) or hard copies to transmit and receive Document Communications.

B. Maintain records of all Document Communication during the selected software downtime and upload the records to the selected software when it is operational.

C. Notify Sound Transit by telephone or email when the selected software is not functional.

1.09 TRAINING

A. Submit a proposed schedule of attendance for the selected software training sessions including a list of back up personnel.
B. Mandatory for listed users of the selected software prior to use, including all training sessions as requested.

C. Ensure each authorized selected software user attend a minimum of two 1/2-day training sessions. Submit signed verification of attendance for these sessions.

D. Be responsible for all costs of attendance by the selected software users at training sessions.

E. Training will be held in the general area of the Document.

1.10 DOCUMENT MANAGEMENT SYSTEM REQUIREMENTS

A. Provide computer hardware and software that meet the requirements of the selected software at both field office and home office location(s) where Document Communications on this Contract are generated or processed.

B. Modifications:

1. The selected software is continually modified and improved in order to enhance the product and provide additional functionality.

2. The selected software has many methods of alerting clients to changes and providing support to the end users.

3. Methods to be used in order to maintain this knowledge base will be specified.

C. Software, hardware, and Internet access:

1. Minimum software requirements are as follows:
   a. A 32-bit operating system such as Windows XP or later.
   b. An Internet browser Explorer Version 6.1 or later.
   c. A document capture software such as Kofax Virtual Re-Scan (VRS) for automated image cleanup.

2. Minimum hardware requirements are as follows:
   a. Pentium-based (or equivalent) workstation or laptop with a minimum of 256 MB of RAM.
   b. A scanning device capable of scanning a minimum of 11-inch x 17-inch color document into electronic Portable Document Format (PDF) with a minimum density of 300 dpi.

3. Minimum access requirements are as follows:
   a. Broadband connection using Integrated Services Digital Network (ISDN), Digital Subscriber Line (DSL), or better.

4. Be responsible for all costs associated with the provisions, maintenance, and upgrade of the hardware, software, and Internet access for the duration of the Contract.

5. Software necessary to create documents in format compatible with the selected software or to convert non-electronic documents to such formats. Compatible formats include: Word 2003, Excel 2003, AutoCAD 2006, and PDF.
1.11 RESTRICTIONS AND LIMITATIONS

A. All Document Communications submitted to Sound Transit through the selected software after 3:00 PM, Monday through Friday, will be acknowledged no earlier than the following business day.

B. For Document Communication purposes, business days and hours are defined as Monday through Friday, 8:00 AM to 5:00 PM, Pacific Time, excluding Sound Transit’s holidays.

C. User access rights to the selected software site will restrict access to this Contract only.

D. Access permission levels will be established by agreement with the Resident Engineer.

1.12 SOUND TRANSIT RESPONSIBILITY

A. Provide the Contractor with a Document Guide within 7 Days of the effective date of Notice to Proceed.

B. Provide user access to the selected software system for the duration of the Contract.

C. Manage the permissions level for all users of the system.

D. Provide the selected software training for personnel using the system for each selected software user identified by the Contractor.

E. Provide the selected software licenses to use the project database for the duration of the Contract.

F. Provide technical support (administration) for the selected software through the selected software system vendor, acting solely through and at the request of Sound Transit.

G. Provide guidelines regarding the organization and format of the selected software modules and the access permission requirements for each module or element thereof.

H. Allow users to upload, download, view, and markup files, based on permissions.

I. Track history of revisions and activities with respect to each document submitted or managed within the selected software.

J. Adjust and revise the folder structure as necessary to facilitate management of Document Communications.

K. With the prior approval of Sound Transit, exceptions may be made to allow specific items to be transmitted, submitted, responded to, or distributed in hard copy only. In these instances, use the selected software to track and expedite processing of these items.

L. At Final Acceptance, provide one copy to the Contractor of a Snapshot from the selected software of data that the Contractor had access to during the Contract.

M. When notified by the Contractor, remove unauthorized users.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION
SECTION 01 32 13
SCHEDULING OF WORK

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes specifications for the preparation, revision, and submittal of cost loaded Contract Critical Path Method (CPM) Schedule.

B. Related Sections: The work of the following Sections is related to the work of this Section. Other Sections, not referenced below, may also be related to the proper performance of this work.

1. Section 01 11 00, Summary of Work.
2. Section 01 12 16, Work Sequence.
3. Section 01 31 14, Coordination with Others.
4. Section 01 31 23.10, Internet-Based Document Management System.

1.02 DEFINITIONS

A. Scheduler: The individual or entity assigned by Contractor the responsibility for the development, preparation, and management of all required CPM schedules and submittals.

1.03 SUBMITTALS

A. Procedures: Section 01 33 00, Submittal Procedures.

B. Formats for Submittals:

1. Hard Copy Formats

a. Preliminary Baseline CPM Schedule, Contract CPM Baseline Schedule, and Re-Baseline Contract CPM Schedule: Time-scaled network diagram; clearly indicating critical activities; sheets no smaller than 22 inches wide by 34 inches long, and no larger than 34 inches wide by 44 inches long.

b. Monthly CPM Schedule Update and Monthly Statused CPM Schedule: Time-scaled network diagram, clearly indicating critical activities; sheets no smaller than 22 inches wide by 34 inches long, and no larger than 34 inches wide by 44 inches long.

c. Three-Week Look-Ahead Schedule: Sheets no larger than 11 inches by 17 inches and no smaller than 8-1/2 inches by 11 inches using landscape orientation.

d. Schedule Narratives: Medium 8-1/2 inches by 11 inches in size. Charts may be submitted in a medium up to 11 inches by 17 inches in size for reports.
e. Monthly Progress Status Report: Medium 8-1/2 inches by 11 inches in size. Charts may be submitted in a medium up to 11 inches by 17 inches in size for reports.

2. Electronic Copy Format

   a. Preliminary Baseline CPM Schedule, Contract CPM Baseline Schedule, and Re-Baseline Contract CPM Schedule: Electronic backup file in its native form (.XER) and in .PDF format.

   b. Monthly CPM Schedule Update and Monthly Statused CPM Schedule: Electronic backup file in its native form (.XER) and in .PDF format.

   c. Monthly Progress Status Report and Schedule Narrative: Electronic file in its native form (.doc) and in .PDF format.

C. Schedule submittals, as stated and in accordance with Section 01 31 23.10, Internet-Based Document Management System:

   1. Preliminary Baseline CPM Schedule: One paper copy, two electronic copies (native file and .PDF) and narrative. Submit at Limited Notice to Proceed.

   2. Contract CPM Baseline Schedule: One paper copy, two electronic copies (native file and .PDF) and narrative. Submit within 60 Days following Limited Notice to Proceed.

   3. Monthly Statused CPM Schedule: One paper copy, two electronic copies (native file and .PDF) and narrative. Submit with each application for payment.

   4. Monthly CPM Schedule Update: One paper copy, two electronic copies (native file and .PDF) and narrative. Submit with each application for payment.

   5. Re-Baselined Contract CPM Schedule (if required): One paper copy, two electronic copies (native file and .PDF) and narrative. Submit as requested.


   7.

D. Monthly Progress Status Report: Five paper copies, two electronic copies (DOC and PDF). Submit with each progress payment request.

E. Conform to the same requirements as the original submittals for all re-submittals.

1.04 GENERAL

A. The Contractor shall designate a full time scheduler that will be responsible for the development, preparation, and management of all required CPM schedules. The designated Scheduler/s shall have at least five years of prior experience developing, creating, managing, and reporting on schedules of similar size and complexity to this contract and experience in the designated scheduling software system. A resume outlining the qualifications of the Scheduler shall be submitted to Sound Transit for review at the Pre-Construction Meeting. Should the Scheduler leave the employ of the Contractor, leave the Project, or Sound Transit find the Contractor’s Scheduler to be incompetent or objectionable, the Contractor will be required to find a replacement meeting all original qualification requirements within 30 Days. Progress payments will not be processed or authorized until an acceptable Scheduler is provided.
B. Schedules shall represent a practical and logical plan to complete the work within the Contract time, and convey the plan to execute the work.

C. Be responsible for the scheduling and execution of construction in accordance with the Contract Documents.

D. The submittal of schedules shall be understood to be the Contractor's representation that the schedule meets the requirements of the Contract Documents and that the work will be executed in the sequence and duration indicated in the schedule.

E. Failure to include any element of work required for performance of the Contract or failure to properly sequence the work shall not excuse the Contractor from completing all work with the Contract Time.

F. All schedule submittals, excluding monthly progress reports, are subject to Sound Transit approval. Sound Transit retains the right to withhold appropriate monies (up to the full value of the progress payment) from progress payments until the Contractor submits a schedule in accordance with these provisions.

G. A maximum of two progress payments shall be made prior to the submittal of an acceptable Contract Baseline CPM Schedule.

H. The Contractor shall certify in writing and have signed by major Subcontractors that the Preliminary Baseline CPM Schedule, Contract Baseline CPM Schedule and Re-Baseline CPM Schedule (if required), have been discussed in detail with all Subcontractors and major suppliers as it relates to their respective work, and submit a copy of the certificate to Sound Transit.

I. Utilize Primavera Project Planner (P6), Version 6.0 software to prepare all required schedules.

J. The Contractor shall use the “Retained Logic” preference for scheduling activities.

K. All schedules, including monthly schedule CPM Updates, shall be developed utilizing industry standard ‘best practices’ including, but not limited to:

1. No open-ended activities.

2. No use of constraints other than those defined in the Contract Documents without the prior approval of Sound Transit.

3. No negative leads or lags.

4. No excess leads or lags without prior justification and approval from Sound Transit.

L. With the exception of those activities in the Preliminary Baseline CPM Schedule that are scheduled after the first 90 Days following Limited Notice to Proceed, all individual construction activities shall not exceed 21 Days in duration without prior approval of Sound Transit. Subdivide activities exceeding 21 Days in duration to an appropriate level of detail.

M. Subdivide all concrete activities, as a minimum, into formwork, rebar placement, concrete placement and finish sub-activities, and curing periods.

N. Sufficiently describe schedule activities to include what is to be accomplished in each work area. Express activity durations in whole days. Clearly define work that is to be performed by Subcontractors.
O. The Contractor shall create all schedules in conformance with the work-hours, constraints, and Activity Code Structure, set forth in these Contract Documents.

P. Sound Transit-Required Activities:

1. Include a “Sound Transit Controlled Float” activity (duration of 45 Days) following the last Contractor activity that is prior to Substantial Completion. This float shall be under the sole control of Sound Transit. The Contractor shall have no right to this float and no right for additional compensation of any kind for Sound Transit’s use of this float. Sound Transit intends to use this float for Sound Transit (or third party) delays caused during the contract in accordance with the requirements in the Special Conditions. This activity is only to be utilized and distributed in the schedule at the direction of Sound Transit.

2. In order for Sound Transit to monitor progress on Sound Transit’s overall program at the same level of detail the Contractor shall incorporate Sound Transit-provided level-of-effort activities into its schedule.

3. Sound Transit has provided the following activities and associated Global Codes.
   a. Sound Transit provided activities
      1) Prepare and submit staging plans for UW approval
      2) Mobilization

4. If required, Sound Transit will provide additional level-of-effort activities and associated global codes for incorporation into the current schedule.

5. The activities to be added will encompass the whole scope of the Work at a summary level, will be level-of-effort type, will not drive the logic or progress of the schedule and will be exclusively for Sound Transit’s internal reporting purposes.

6. Contractor-developed detailed activities are to be incorporated into one of the Sound Transit-provided level-of-effort activity. If no level-of-effort activity appears to represent the detailed activities’ scope the Contractor shall immediately notify Sound Transit for direction.

7. The Contractor is required to incorporate these into the schedule as ‘hammocks’, so that each Sound Transit-provided, level-of-effort activity encompasses the start and finish dates for a number of representative Contractor-developed, detailed-level activities.

8. The Sound Transit-provided level-of-effort activities should status automatically as the tasks they summarize progress and should not require manual statusing.

9. If activities are added or deleted from Monthly CPM Schedule Updates, the Contractor is required to update the Sound Transit-provided level-of-effort activities to ensure they represent the correct detailed activities’ start and finish dates and notify Sound Transit of all changes.

These activities are required to be filtered (hidden) for all Contractor-related reporting.

Q. Sound Transit Required Activity Codes:
1. In order for Sound Transit to monitor progress on Sound Transit’s overall program at the same level of detail the Contractor shall incorporate Sound Transit provided global activity codes into its schedule.

2. The global activity codes will be finalized by Sound Transit prior to the pre-construction meeting. The following is an example of the types of Sound Transit global activity codes to be incorporated into the schedules:
   a. Sound Transit provided Global Activity Codes
      1) Milestone Activities
         a) Global Activity Code Name: LR Contract Milestones
         b) Global Activity Code Value: M220
         c) Global Activity Code Description: U220 Milestones
      2) Summary Activities
         a) Global Activity Code Name: LR Work summary
         b) Global Activity Code Value: S220
         c) Global Activity Code Description: U220 Summary
   b. If required, Sound Transit will provide additional level-of-effort activities and associated global codes for incorporation into the current schedule.

R. Activity Code Structure:

1. Each activity shall be identified with codes including as a minimum:
   a. The party responsible for performing the work.
   b. Where work is to be subcontracted, the Subcontractor to be responsible for performing the work.
   c. The Construction Specifications Institute (CSI) classification associated with the work.
   d. Phasing of the Work in accordance with the Contract Documents and associated milestones.
   e. Area or location of the work.
   f. Cost and resource coding as set forth in these Contract Documents.

2. Cost and Resource Loading:
   a. All schedules, with the exception of the Three-Week Look-Ahead Schedules are required to be cost-loaded, cost-coded and resource-loaded.
      1) All Contractor activities are required to be cost-loaded and cost-coded unless fully explained and agreed to by Sound Transit. The sum of all identical cost-codes shall correlate on a one-to-one match with line items in the Schedule of Values. Sound Transit will provide a cost-loaded and cost-coded schedule
sample (FRAGNET) to illustrate expected level of effort no later than the Pre-Construction Meeting.

2) Cost-loading shall be updated monthly with modifications made to the cost-loading taking into account actual payment requests or additions, deletions or revisions to activities in the Updated Monthly Updated CPM Schedule.

b. All Contractor construction activities are required to be resource-loaded with estimated labor, material, and equipment.

1.05 PRELIMINARY BASELINE CPM SCHEDULE

A. The Contractor shall submit a CPM schedule covering the complete Contract work at Limited Notice to Proceed.

1. The purpose of the Preliminary Baseline CPM Schedule is to depict the detailed work activities for the first 90 Days following Limited Notice to Proceed. Subsequent activities can be in more summary-level detail. The schedule will assist and serve as the basis of payment between Limited Notice to Proceed and the submittal and acceptance of the Contract Baseline CPM Schedule.

B. Include with the submittal a written narrative that describes the schedule in detail and the approach to the work that will be employed during the initial 90-Day period of the Contract.

C. Include all submittal and fabrication activities required to supply construction for the duration of the Contract.

D. The Preliminary Baseline CPM Schedule shall be cost-coded, cost-loaded and resource-loaded as set forth in these Contract Documents.

E. Indicate on the schedule diagram a clearly defined critical path.

F. If in the opinion of the Resident Engineer the schedule is determined to be impractical or not in compliance with the Contract Documents, the Contractor shall revise the schedule and resubmit within 7 Days.

G. A Contract Schedule showing the work completed in less than the Contract time, which is found practical by Sound Transit, shall be considered to have float (in addition to Sound Transit Controlled Float). Impractical early-completion schedules will not be accepted by Sound Transit. The float shall be the time between the scheduled completion of the work and the Contract completion date.

1.06 CONTRACT CPM BASELINE SCHEDULE

A. The Contractor shall submit a Contract CPM Baseline Schedule covering the complete Contract within 60 Days following the date of the Limited Notice to Proceed.

B. The schedule shall replicate the detailed activities, and correlate to the summary-level activities, developed in the Preliminary Baseline CPM Schedule.

C. If in the opinion of the Resident Engineer the schedule is determined to be impractical or not in compliance with the Contract Documents, the Contractor shall revise the schedule and resubmit within 14 Days.

D. Show clearly on the Contract Schedule the sequence and interdependence of activities and list specifically:
1. Delivery of Sound Transit-furnished equipment, if any.

2. Inspection of the work including punch list and Acceptance.

3. Work to be performed by other agencies or utilities that affect the schedule.

4. Acquisition of construction permits.

E. For individual schedule construction activities, do not exceed 21 Days in duration without prior approval of Sound Transit. Subdivide activities exceeding 21 Days in duration to an appropriate level.

F. Indicate on the schedule diagram a clearly defined critical path.

G. Include lines for Incentives, Liquidated Damages and Provisional Sums.

H. Include with the schedule submittal a detailed written narrative describing the approach and methods for completion of the work. Include all assumptions and specific schedule risks identified in development of the schedule. Use understandable narrative that conveys schedule information to Sound Transit.

1.07 MONTHLY STATUSED CPM SCHEDULE

A. The Contractor shall submit a Monthly Statused CPM Schedule with each progress payment request.

B. The Monthly Statused CPM Schedule shall be the prior month's current accepted schedule with all actual progress, resources and cost included.

1. The current schedule shall be the later of:

a. The Preliminary Baseline CPM Schedule (prior to the acceptance of the Contract CPM Baseline Schedule);

b. The Contract CPM Baseline Schedule (prior to submittal and acceptance of the first Monthly CPM Schedule Update);

c. The most current approved Monthly CPM Schedule Update

C. The Monthly Statused CPM Schedule shall have a data date (statused) as of the last day of the corresponding month (i.e. for schedules submitted at the beginning of February 2009 the data date shall be 31 January 2009).

D. Incorporate accurate actual progress, start dates, completion dates, resources and costs so that the Monthly Statused CPM Schedule will act as the Project’s As-Built schedule.

1. If requested provide documentation to substantiate as-built information.

2. No actual start or finish dates shall be changes or corrected without a narrative explaining the reason for the change and Sound Transit approval.

E. If in the opinion of the Resident Engineer the information contained in the Monthly Statused CPM Schedule is inaccurate and the Contractor cannot substantiate otherwise, the Contractor shall revise the schedule accordingly and resubmit within 7 Days.

F. Payment shall not be made without a current approved Monthly Statused CPM Schedule.
G. The Monthly Statused CPM Schedule will be used as a basis justifying payment, to measure the impacts to the schedule as a result of actual progress on the Project.

1.08 MONTHLY CPM SCHEDULE UPDATE

A. The Contractor shall submit a Monthly CPM Schedule Update with each application for payment.

B. The Monthly CPM Schedule Update shall have a data date (statused) as of the last day of the corresponding month (for example; for schedules submitted at the beginning of February 2009 the data date shall be 31 January 2009).

C. The Monthly CPM Schedule Update shall incorporate all progress to-date, in correlation with the Monthly Statused CPM Schedule.

D. All changes and revisions made in the Monthly CPM Schedule Update shall be addressed in the detailed narrative accompanying the submittal.

E. Change Orders shall be addressed in accordance with the General Conditions and incorporated into the Monthly CPM Schedule Update as additional schedule activities.

F. Any changes made to the schedule shall also include changes to the cost and resource loading as required. All the remaining Contractor activities to be completed shall sum to the remaining cost of the Work.

G. If in the opinion of the Resident Engineer the schedule is determined to be impractical or not in compliance with the Contract Documents, the Contractor shall revise the schedule and resubmit within 7 Days.

H. If, according to the current updated Monthly CPM Schedule Update, the work is more than 14 Days behind the current Milestone, or the schedule contains more than 14 Days of negative float, considering all granted time extensions, submit, prior to the next progress payment, a recovery schedule, showing a work plan to complete the work within the required schedule period. Include with the submittal a detailed narrative describing the means and methods proposed to achieve the work in the time period. Sound Transit may withhold approximate progress payments until a revised schedule, acceptable to Sound Transit, is submitted by the Contractor at no additional expense to Sound Transit.

1.09 RE-BASELINED CONTRACT CPM SCHEDULE

A. If, in the opinion of and at the request of, Sound Transit, the work has significantly fallen behind schedule and/or the nature of the work has changed from that which was originally portrayed in the Contract Baseline CPM Schedule, a Re-Baselined Contract CPM Schedule shall be submitted that portrays the plan to complete the remaining Contract Work.

B. The Re-Baselined Contract CPM Schedule shall be cost and resource-loaded and be the basis for all subsequent Monthly CPM Schedule Updates.

1.10 THREE-WEEK LOOK-AHEAD SCHEDULE

A. Submit a Gantt chart format depicting the intended work activities for the upcoming three-week period plus a one-week retrospective.

B. All activities in the Three-Week Look-Ahead Schedule must correlate to an activity in the current Monthly CPM Schedule Update either as a one-to-one match, or as a subset of
activities whose cumulative duration correlate to an activity in the Monthly CPM Schedule Update.

C. Note and explain in writing all deviations, including but not limited to sequences of work, timing, and durations of activities, from the most current Preliminary Baseline CPM Schedule, Contract Baseline CPM Schedule, or Monthly CPM Schedule Update.

D. Portray all activities clearly and legibly on the schedule and include logical activity numbers.

E. Submit the schedule at the weekly progress meeting

### 1.11 SCHEDULE NARRATIVES

A. Include with the Preliminary Baseline CPM Schedule the Contract Baseline CPM Schedule and the Re-Baselined CPM Schedule submittal a written narrative describing the approach and methods for completion of the work. Use understandable narrative that conveys schedule information to Sound Transit.

B. Include with the Monthly Statused CPM Schedule a listing of all activities that were planned on being completed, or worked on during the reporting period but were not and the reason for the lack of activity.

C. Include with the Monthly CPM Schedule Update submittal a written narrative describing:
   1. All changes, additions or deletions that have been made to the schedule since the prior month and, with the exception of adding actual durations, a reason for each of the changes.
   2. Provide for activities that were planned on being completed, or worked on during the reporting period but were not, the actions taken that have addressed any adverse impacts to the project.

D. All narratives shall include all assumptions that the Contractor has made in developing and updating the schedule.

E. All narratives shall include all major risk items that could potentially have an adverse impact to the schedule and how these risks are to be addressed.

### 1.12 MONTHLY PROGRESS STATUS REPORT

A. Sound Transit shall provide the format for the Monthly Progress Status Report at or prior to, the Pre-Construction Meeting.

B. The Monthly Progress Status Report shall at a minimum include the following:
   1. Executive Summary
   2. Contract Status
   3. Schedule Status (baseline versus current forecast)
      a. Milestones
      b. Contract Completion
      c. Critical Path
4. Planned (Baseline) versus actual resources (early and late start)
5. Planned (Baseline) versus actual costs (early and late start)
6. Planned (Baseline) versus actual material (early and late start)
7. Earned value of accepted work based on physical percent complete
8. Work activities accomplished in the reporting period
9. Small Business status report
10. Intended work activities for upcoming reporting period
11. Work that is being performed out of sequence with the current accepted schedule
12. Problem and risk areas and planned mitigation actions
13. Status of Change Orders
14. Notices of potential claims
15. Status of submittals
16. Status of Contractor procurement items,

C. Community Relations activities as specified in Section 01 31 14, Coordination with Others.

1.13 REVIEW, UPDATE AND REVISIONS

A. Allow for Sound Transit review with comments according to the following schedule from the date of receipt:

1. Preliminary Baseline CPM Schedule: 21 Days
2. Contract CPM Baseline Schedule: 21 Days
3. Monthly Statused CPM Schedule: 7 Days
4. Monthly CPM Schedule Update: 14 Days
5. Three-Week Look-Ahead Schedule: 2 Days

B. Make all corrections to the schedule requested by Sound Transit and resubmit the schedule for approval. If the Contractor does not agree with Sound Transit's comments, provide written notice of disagreement within 7 Days from the receipt of Sound Transit's comments for the Contract CPM Baseline Schedule. Sound Transit's comments to the schedules for which the Contractor disagrees shall be resolved in a meeting held for that purpose, if necessary.

1.14 REQUESTS FOR TIME EXTENSIONS

A. Be responsible for submitting a written request for all extensions of Contract Time in accordance with the General Conditions. Requests not submitted in writing, without the required documentation and not submitted in a time consistent with the General Conditions will not be considered.
B. Include in the request documentation with written justification for the extension of time, supporting evidence and specific references to the current approved schedule at the time the qualifying event occurred.

C. Also include with request an analysis of a calendar time-scaled CPM network schedule (FRAGNET) and reports depicting the time impact basis of the request with the affected areas prominently highlighted. Use only the current and accepted schedule at the time the qualifying event occurred when determining time extension request.

D. If Sound Transit finds that the Contractor is entitled to an extension of time of any completion date under the General Provisions of the Contract, Sound Transit's determination of the total number of days extension will be based upon the current analysis of the current schedule and upon data relevant to the extension. Extensions of time for performance under all of the General Provisions of the Contract will be granted only to the extent that equitable time adjustments for the activity or activities affected exceed the total float along the paths involved of the accepted and current schedule.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

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PART 1 - GENERAL

1.01 SUMMARY

A. This Section specifies the general requirements and procedures for preparing and submitting construction information, shop drawings, product data, and samples for information and review.

B. Related Sections: The work of the following Sections is related to the work of this Section. Other Sections, not referenced below, may also be related to the proper performance of this work.

1. Section 01 31 23.10, Internet-Based Document Management System.
2. Section 01 32 13, Scheduling of Work.
3. Section 01 45 00, Quality Control.
4. Section 01 78 23, Operations and Maintenance Data.

1.02 REFERENCES

A. This Section incorporates by references the latest revisions of the following documents.

1. American National Standards Institute (ANSI)
   a. ANSI Y 14.5 Dimensioning and Tolerances

1.03 DEFINITIONS

A. Shop Drawings: For the purpose of this Section, shop drawings and working drawings are understood to be interchangeable terms. Shop drawings are required for falsework, shoring, formwork, and for other temporary work and methods of construction the Contractor proposes to use.

1.04 SUBMITTAL

A. Schedule of Submittals: Within 21 Days after the effective date of Notice to Proceed, submit a completed submittal list and add to CPM schedule.

1. Include for each planned submittal:
   a. Date on which each submittal will be submitted.
   b. Shop drawings, product data, and samples. Include description of the item and name of manufacturer, trade name, and model number.
   d. Intended submission/resubmission date(s).
e. Lead time to delivery/anticipated delivery date(s).

2. Highlight submittals that will require expedited review to meet the Contract schedule.

3. Highlight submittals that are on the critical path.

4. Annotation of Safety Critical submittals based upon a list of Contract Specifications’ Section and Article numbers provided by Sound Transit. Include in the annotation the Sound Transit Safety Certification Specification Checklist item number.

5. Present in a form that is readily reproducible.

6. Update and resubmit on a monthly basis.

1.05 CONTRACTOR’S RESPONSIBILITIES

A. Contractor's Review

1. Stamped, and signed as reviewed and approved by the Contractor before submission including subcontractor submittals.

2. If the submittal is designated to be sent to the Resident Engineer for information, obtain approval by the designated approval authority before submission to the Resident Engineer.

3. Coordinate each submittal with the requirements of the Work, placing particular emphasis upon ensuring that each submittal of one trade is compatible with other submittals of that trade and with the submittals of other trades. Submit complete with all relevant data required for review.

4. Be responsible for the correctness of the drawings, for shop fits and field connections, and for the results obtained by the use of such drawings.

B. Submittal Quantities: Unless noted otherwise, provide submittals in accordance with Section 01 31 23.10, Internet Based Document Management System. Where permits and licenses and other such documents are obtained in Sound Transit’s name, submit the original and conform to requirements of Section 01 31 23.10, Internet Based Document Management System.

C. Review documents or other approval methods of the various designated approval authorities may not be the same as those of Sound Transit. Work with the various designated approval authorities and obtain approvals in the clearest and most straightforward manner possible.

D. Attend meetings as requested by the Resident Engineer to address issues related to the review of submittals.

E. Samples. Submit samples as required by these Contract Specifications and supply to the Resident Engineer for information and approval.

1.06 RESIDENT ENGINEER’S REVIEW

A. The Resident Engineer will indicate its reviews of submittals and the action taken by means of his/her submittal review document. The submittal document will be posted electronically by the Resident Engineer, and the submittal review document will be recorded automatically by the software with the time and date of posting.
B. The submittal review document will be filled out with the following statements and have the following meanings:

1. The mark NO EXCEPTIONS TAKEN means that every illustration and description appears to conform to the respective requirements of the Contract Documents; that fabrication, assembly, manufacture, installation, application, and erection of the illustrated and described product may proceed; and that the submittal need not be resubmitted.

2. The mark EXCEPTIONS AS NOTED - RESUBMISSION NOT REQUIRED means that every illustration and description appears to conform to the respective requirements of the Contract Documents upon incorporation of the reviewer's corrections, and that fabrication, assembly, manufacture, installation, application, and erection of the illustrated and described product may proceed. Submittals so marked need not be resubmitted unless the Contractor challenges the reviewer's exception.

3. The mark EXCEPTIONS AS NOTED - RESUBMISSION REQUIRED means that every illustration and description appears to conform to the respective requirements of the Contract Documents upon incorporation of the reviewer's corrections, and that fabrication, assembly, manufacture, installation, application, and erection of the illustrated and described product may proceed after incorporation of the reviewer's corrections and verification by the Resident Engineer that the reviewer's corrections have been properly incorporated in the submittal. Resubmission is also required if the Contractor challenges the reviewer's corrections.

4. The mark REJECTED means that the submittal is deficient to the degree that the reviewer cannot correct the submittal with a reasonable degree of effort, has not made a thorough review of the submittal, and that the submittal needs revision and is to be corrected and resubmitted.

C. The Resident Engineer will post the disposition of the Contractor's submittal within 21 Days after submittals have been received in accordance to Section 01 31 23.10, Internet Based Document Management System.

D. Include at least 21 Days in the Contractor's CPM schedule for Sound Transit and other parties to review submittals, unless otherwise specified.

E. Allow 21 Days for review by Sound Transit of all re-submittals.

1.07 SHOP DRAWINGS

A. General:

1. Shop drawings shall be approved by the Resident Engineer before work involving such drawings is performed. Submit shop drawings not less than 21 Days before work involving such drawings is to be performed as indicated on the Contractor's CPM schedule.

2. To the following standard sizes (in inches), except as otherwise permitted by the Resident Engineer:

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</tbody>
</table>
3. Include a title block in the lower right hand corner that identifies the Contractor, Subcontractor, Contract by number and title, subject matter of the drawing, sheet number, and date of the original issue of the drawing, and the serial number and date of each revision.

4. Submittal Stamp and Action Block Space: Include a 5-inch square blank space, in the lower right corner, just above the title block, in which the Resident Engineer may indicate the action taken.

B. Provide sufficient dimensions on drawings so that size, shape, and location may be determined without calculation. As a minimum, the following are required:

1. Drawings are fully legible
2. Show each dimension clearly so that only one interpretation is possible.
3. Show dimensions between points, lines, or surfaces having a necessary and specific relationship to each other or which control the location of mating parts or components.
4. Select dimensions and arrange to avoid accumulation of tolerances that might ultimately permit more than one interpretation resulting in unsatisfactory mating of parts and failure in use.
5. Show each dimension for a feature once.
6. When possible, dimension each feature in the view where it appears in profile or the one depicting its true profile.
7. Follow applicable dimensioning and tolerance practices as specified in ANSI Y14.5.
8. Update each shop drawing to reflect the latest configuration, which includes all Change Orders.
9. Include on the shop drawings details necessary for the installation, maintenance, and repair of all equipment provided.

C. Sample Drawings: The first drawings submitted by Contractor, Subcontractor, or vendor will be reviewed for conformance. Once approval is given, use this approved drawing format as the standard and prepare subsequent drawings to a quality equal to the approved standard.

1.08 PRODUCT DATA

A. Modify manufacturers' standard schematic drawings to delete information that is not applicable to the Contract. Supplement standard information with additional information applicable to this Contract.

B. Modify manufacturers' standard catalog cuts, brochures, diagrams, schedules, performance charts, illustrations, calculations, and other descriptive data to delete
information that is not applicable to the Contract. Indicate dimensions, clearances, performance characteristics, capacities, wiring and piping diagrams, and controls.

C. Modify manufacturer’s printed installation, erection, application, and placing instructions to delete information, which is not applicable to the Contract.

D. Include the following:
   1. Contract title and number.
   3. Applicable Contract Specifications Section numbers.
   4. Applicable standards, such as ASTM or Federal Specification numbers.
   6. Contractor’s stamp, initialed or signed, certifying:
      a. Dimensional compatibility of the product with the space in which it is intended to be used.
      b. Review of submittals for compliance with the specified requirements.
      c. Compatibility of the product with other products with which it is to perform or with which it will be contiguous.

E. Certificate of Compliance:
   1. The Resident Engineer may permit the use of certain materials prior to sampling and testing if accompanied by a certificate of compliance stating that the materials involved comply in all respects with the requirements of these Contract Specifications.
      a. Signed by the manufacturer of the material.
      b. Furnished with each lot of material delivered to the work and the lot so certified is clearly identified in the certificate.
   2. Materials used based on a certificate of compliance may be sampled and tested at any time. The fact that material is used on the basis of a certificate of compliance shall not relieve the Contractor of responsibility for incorporating material in the work which conforms to the requirements of the Contract Drawings and Contract Specifications and all such material not conforming to requirements will be subject to rejection whether in place or not.
   3. The Resident Engineer reserves the right to refuse to permit the use of material based on a certificate of compliance without test data.

1.09 CONSTRUCTION WORK PLANS

A. Format Construction Work Plan in order of items listed in Section 01 45 00, Quality Control, Article 3.02A (Construction Work Plans).
1.10 SAMPLES
   A. Refer to Article 1.04E, herein.

1.11 OTHER SUBMITTALS
   A. General.
      1. Title Block: Provide the following information for data, reports, or other
         submittals which are not drawings:
         a. Date and revision dates;
         b. Contract title and number;
         c. The names of the Contractor, Subcontractors, Suppliers, and
            manufacturers as applicable;
         d. Identification of product by either description, model number, style
            number, serial number, or lot number; and
         e. Subject identification by Contract Drawing or Contract Specification
            reference.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 SUBMITTAL PROCESS
   A. Unless otherwise directed, submit shop drawings, and product data in accordance with
      Section 01 31 23.10, Internet-Based Document Management System.
   B. Transmittal Form: Accompany submittals with Sound Transit furnished transmittal forms
      provided by the Resident Engineer.
   C. Submittal includes the following document type:
      1. Each shop drawing, or product data.
      3. Manufacturers’ calculations, and a copy of manufacturer’s standard data.
      5. As specified in the various Specification Sections, unless otherwise specified.
      6. A copy of inspection reports, test reports, and certificates of compliance.
   D. Final approved shop drawings or product data annotated to reflect installation details:
      1. Upon completion of work.
      2. Marked “as-built.”
   E. List of sources for materials.
3.02 CONTRACTOR’S RESPONSIBILITIES

A. Do not start work for which submittals are required until submittal review forms have been completed by the Resident Engineer, and said forms indicating review and approval have been received.

B. The Contractor may proceed at its own risk with work on all submittal review forms with the following disposition: “NO EXCEPTIONS TAKEN”, or “EXCEPTIONS AS NOTED – RESUBMISSION NOT REQUIRED.”

3.03 REVIEW PERIOD:

A. Prepare submittals sufficiently in advance so that review may be given before commencement of related work.

B. Allow 21 Days after receipt by the Resident Engineer for review of Work Plans, Shop Drawings, RFIs, Field Clarifications, and Submittals.

C. Be responsible for determining whether or not certain governmental entities require longer review periods. Where longer review periods are required, schedule the Work accordingly, so that the Work and construction schedules are not adversely impacted.

3.04 CHANGES

A. Changes in Reviewed Submittals: Changes in reviewed submittals will not be permitted unless those approved submittals with changes have been resubmitted and reviewed, in the same manner as the original submittal.

B. Changes in products for which shop drawings, product data, or samples have been submitted will not be permitted unless those changes have been accepted and approved, in writing, by the Resident Engineer.

C. Supplemental Submittals: Initiated by the Contractor for consideration of corrective procedures contain sufficient data for review. Make supplemental submittals in the same manner as initial submittals.

D. Incomplete submittal packages will be returned without review.

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PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes specifications for complying with applicable laws and regulations related to worker safety and health. It is not the intent of Sound Transit to develop or manage the safety and health programs of the Contractor, its Subcontractors, or Suppliers, or in any way assume the responsibility for the safety and health of their employees.

B. The Construction Safety and Security Manual (CSSM) is a Contract Document that specifies minimum requirements for the Contractor’s Site Safety Plan. Adhere to the CSSM and applicable federal, state, and local safety and health standards.

C. Related Sections: The work of the following Sections is related to the work of this Section. Other Sections, not referenced below, may also be related to the proper performance of this work. It is the Contractor’s responsibility to perform all the Work required by the Contract Documents.

1. Section 01 50 00: Temporary Facilities and Controls.

1.02 REFERENCES

A. This Section incorporates by reference the latest revisions of the following documents.

B. United States Code (USC)

1. USC 651 et seq. Federal Occupational Safety and Health Act

C. Code of Federal Regulations (CFR)

1. 29 CFR 1910 OSHA General Health and Safety Standards
2. 29 CFR 1926 OSHA Construction Safety and Health Standards
3. 40 CFR 300 Emergency Planning and Community Right-to-Know

D. Revised Code of Washington (RCW)

1. RCW 49.17 Washington Industrial Safety and Health Act

E. Washington Administrative Code (WAC)

1. WAC Chapter 173-802 SEPA Procedures
2. WAC Chapter 296-24 General Safety and Health Standards
3. WAC Chapter 296-27 Recordkeeping and Reporting
4. WAC Chapter 296-36 Safety Standards – Compressed Air Work
5. WAC Chapter 296-45 Safety Standards for Electrical Workers
6. WAC Chapter 296-46A Safety Standards -- Installing Electric Wires and Equipment -- Administrative Rules
7. WAC Chapter 296-62 General Occupational Health Standards
8. WAC Chapter 296-155 Safety Standards for Construction Work

1.03 SUBMITTALS
A. Procedures: Section 01 33 00, Submittal Procedures.
B. Construction Site Safety Plan (CSSP) that meets the requirements of the CSM,
   1. Within 30 Days after receipt of Notice of Award of Contract
   2. Prior to start of any work.
   3. The CSSP will be submitted for review, but not approval. Sound Transit will verify that the minimum requirements are met, in accordance with the LINK CSSM and reference documents listed in Article 1.02, herein. Comments will indicate whether or not the CSSP contains the minimum necessary information in accordance with requirements.

1.04 SAFETY PRECAUTIONS
A. Immediately notify the Resident Engineer if, during the course of the Contract, there should be a discovery of any undetermined substance.
B. Adhere to the applicable regulations for the entire duration of the Contract.
C. Perform electrical work within this Contract in accordance with the requirements of NFPA 70.
D. Take responsibility for the health and safety of the Contractor’s employees, Subcontractors, vendors, and other individuals on the Site of Work or who may be impacted by the Work.

1.05 ACCIDENTS
A. Provide such equipment and facilities as are necessary or required, in the case of accident, in order to provide for first aid service to any whom may be injured in the progress of the work. Have a standing arrangement for the transportation and hospital treatment of any person who may be injured or may become ill.
B. Report immediately to the Resident Engineer and Sound Transit’s Area Safety Manager every accident to persons or damage to property; and furnish the required reports in writing within the times specified in the CSSM. An accident, injury, or illness is any occurrence that results in a bruise, breaking the skin, or loss of time of more than 15 minutes of work time; an impairment of vision or mobility; or that adversely affects job performance as a result of equipment, material, vapors, lighting liquid, or solid materials. Include in the report full information, including testimony of witnesses regarding all accidents.
1.06 FIRST AID
   A. Refer to Section 01 50 00, Temporary Facilities and Controls.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

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SECTION 01 35 43.15
UNKNOWN HAZARDOUS AND CONTAMINATED SUBSTANCES

PART 1 - GENERAL

1.01 SUMMARY
A. This Section specifies responses to unknown hazardous and Contaminated Substances unexpectedly encountered during construction, as defined herein.

1.02 REFERENCES
A. This Section incorporates by reference the latest revisions of the following documents:

   a. 29 CFR 1910 Occupational Safety and Health Standards
   b. 29 CFR 1926 OSHA Construction Standards

2. The National Institute for Occupational Safety and Health (NIOSH)
   a. NIOSH Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities

3. Environmental Protection Agency (EPA)
   a. SW-846, Test Methods for Evaluating Solid Waste Physical/Chemical Methods

4. Washington Administrative Code (WAC)
   a. WAC 173-303 Dangerous Waste Regulations
   b. WAC 173-340 Model Toxics Control Act - Cleanup
   c. WAC 296-62 General Occupational Health Standards
   d. WAC 296-155 Safety Standards for Construction Work

5. Washington State Department of Ecology
   a. Publication 94-49 Guidance on Sampling and Data Analyses Methods
   b. Publication 97-602 Analytical Methods for Petroleum Hydrocarbons

6. University of Washington
   a. Project Manager’s Reference Document for Environmental Stewardship (PMRDES)
1.03 DEFINITIONS

A. Certified Industrial Hygienist (CIH) – A trained specialist with at least five years experience in hazardous material processing and working knowledge of selection and use of PPE, air monitoring, regulation, and other health and safety issues.

B. Site Safety and Health Officer (SSHOO) – A trained specialist in health and safety with minimum three years’ experience and working knowledge of use of PPE, regulations and hazard identification.

C. Contaminated Groundwater – Groundwater containing levels of contaminants in excess of MTCA Method A, B, or C (whichever is more restrictive) Cleanup Levels for groundwater.

D. Contaminated Substance – General term for debris below the ground surface that contains contaminants including but not limited to petroleum hydrocarbons, vinyl chloride, trichloroethylene, tetrachloroethylene, and metals, in excess of MTCA Method A Cleanup Levels for Unrestricted use.

E. Contaminated Soil – Soil containing levels of contaminants in excess of MTCA Method A Cleanup Levels for Unrestricted use, or other relevant cleanup levels established by state, local, or federal regulation, law, or permit condition, if no Method A Level has been developed.

F. Hazardous Material – General term for demolition debris that contains asbestos, lead, polychlorinated biphenyls, or mercury.

G. Suspected Contaminated Substance – Soil, groundwater, or other debris in contact or close proximity to known Contaminated Substance, or having visual or odor evidence of contamination, and that has not been tested yet for verification of contamination levels.

H. Contamination Reduction Zone – Area that provides a physical separation between the Exclusion and Support Zones to decontaminate personnel, equipment, and vehicles prior to entering the Support Zone from the Exclusion Zone.

I. Exclusion Zone – Area designated for hazardous or Contaminated Substance storage, excavation, or removal. Work is to be performed inside the Exclusion Zone.

J. Support Zone – Area to provide an entry and exit for personnel, materials, and equipment to the Exclusion Zone. An area for support facilities and storage of clean work equipment. Workers may rest, eat, and drink in this area.

K. Hazardous and Contaminated Substance Health and Safety Plan (HCSHSP) – A supplemental plan to the LINK Construction Safety Manual which establishes in detail the protocols necessary for protecting workers, on-site personnel, visitors, potential off-site personnel, and the public from potential hazards that may be encountered during excavation, stockpiling, handling, sampling, transportation, and disposal of contaminated soils, water, and other material, or of hazardous materials.

L. Dangerous Waste – Solid wastes which have been determined to meet the definitions of dangerous waste contained in WAC 173-303-070 through WAC 173-303-100.

M. MTCA – Model Toxics Control Act, as defined in Chapter 70.105D, RCW.

N. Permissible Exposure Levels (PEL) – Maximum amount or concentration for each contaminant that a worker may be exposed to under OSHA regulations.
O. Personal Protective Equipment (PPE) – All clothing and other work accessories designed to create a barrier against workplace hazards. Examples include safety goggles, blast shields, hard hats, hearing protectors, gloves, respirators, aprons, and work boots.

1.04 SUBMITTALS
A. Procedures: Section 01 33 00, Submittal Procedures.
B. HCSHSP: Prior to start of site work.
C. Hazardous and Contaminated Substance Screening and Handling (HCMSH) Plan: Within 14 days from identifying unknown hazardous and/or Contaminated Substances.
D. Qualifications: Prior to start of site work.
E. Certifications: Prior to start of site work.
F. Reports
   1. Security and training logs and worker compliance agreements.
   2. Safety inspection logs, daily health and safety reports, and a closeout safety report.
   3. Emergency and accident report(s) within 24 hours following each occurrence.

1.05 QUALITY ASSURANCE
A. Qualifications
   1. CIH:
      a. Minimum of 5 years experience in hazardous material processing.
      b. Demonstrable experience in Personal Protective Equipment (PPE) selection and use, hazardous material identification and disposal procedures, air monitoring techniques, and site control measures.
      c. Working knowledge of federal OSHA and state WISHA regulations.
      d. Completion of required OSHA Training in accordance with 29 CFR 1910.120, including completion of 40-hour supervisory training and 8-hour annual update and completion of 3 days on-site training by a fully qualified instructor.
   2. SSHO:
      a. Minimum of 3 years experience in hazardous substance and waste site remediations or related work, including air monitoring techniques and the development of health and safety programs for personnel working in potentially hazardous or toxic environments.
      b. Current certification in first aid and cardiopulmonary resuscitation (CPR).
      c. Working knowledge of federal, state, and local occupational health and safety regulations.
d. Completion of required OSHA Training in accordance with 29 CFR 1910.120, including completion of 40-hour supervisory training and 8-hour annual update and completion of 3 days on-site training by a fully qualified instructor.

B. Responsibilities

1. CIH:
   a. Responsible for certifying the HCSHSP and all additions and/or modifications thereto.
   b. Required to be accessible to the SSHO as necessary, to assist in the identification and evaluation of potential hazards and the development of appropriate procedures for addressing suspected conditions or activities that may pose routine occupational hazards or immediate danger to life or health of work site personnel, Sound Transit personnel, utility crews working in the project construction area, personnel related to third party stakeholders or the public.

2. SSHO:
   a. Required to be on Site and present if hazardous and Contaminated Substance work is required. Such work includes, but is not limited to: air monitoring, and work related to the presence or potential for unknown hazardous and/or Contaminated Substances.
   b. Responsible for the development, implementation, enforcement, and monitoring of the HCSHSP for the project.
   c. Responsible for conducting the pre-construction indoctrination, Pre-Entry Briefings, and other periodic training of on-site personnel with regard to contents of the HCSHSP and other safety requirements to be observed during construction.
   d. Responsible for performing air monitoring as required by the HCSHSP.

C. Authority

1. The CIH and the SSHO have the authority to:
   a. Suspend field activities if health and safety of work site personnel, Sound Transit personnel, other crews working in the Project Site, or the public is endangered.
   b. Suspend individuals from field activities due to infractions of the HCSHSP.

D. Certifications

1. CIH and SSHO current certifications:
   a. OSHA 29 CFR 1910.120 Training.
   b. CPR Training.
2. That work site and Subcontractor personnel assigned for the purpose of performing or supervising hazardous materials work in accordance with the provisions of the HCSHSP.

3. Have the CIH certify the HCSHSP.

E. Calibrate screening devices as specified in instrument user manuals.


1.06 HAZARDOUS AND CONTAMINATED SUBSTANCE HEALTH AND SAFETY PLAN

A. General requirements for inclusion in the HCSHSP:

1. Perform work in a safe and environmentally acceptable manner. Provide for the safety of site personnel, Sound Transit personnel, personnel representing third party stakeholders, and the public for the duration of the Contract.

2. Maintain a current HCSHSP conforming to applicable federal, state, and local statutes, rules, regulations, and ordinances, in effect at the time the Work is performed.

3. Ensure that personnel working in hazardous or Contaminated Substance areas are trained in accordance with applicable regulatory requirements and thoroughly briefed on the anticipated hazards, safety equipment to be employed, safety practices to be followed, and emergency procedures and communications.

4. Adhere to applicable federal, state, and local statutes, rules, regulations, and ordinances for the duration of the Contract.

5. Develop and maintain on site industrial hygiene information including right-to-know information, such as Material Safety Data Sheets (MSDS).

6. If an emergency condition arises during the Contract:

   a. Immediately suspend work activities associated with this Contract in the vicinity of the area of the emergency.

   b. Notify the Resident Engineer.

   c. Secure the area as needed to restrict and protect work site personnel and the public from exposure to the emergency condition.

7. Meetings: Conducted daily and weekly by the SSHO, health and safety meetings with the workers throughout the duration of all hazardous substance work. The SSHO shall discuss each day’s activities and associated health and safety issues with the workers and address concerns and issues that the workers may have. Hold the weekly meeting at the beginning of the workweek.

B. Prepare and implement the HCSHSP in accordance with the requirements of OSHA 29 CFR 1910.120 and WISHA Standard WAC 296-62. Include, as a minimum, the following site specific information:
1. Site Description and Evaluation
2. Names of key personnel and alternates responsible for site safety and health (responsible party and chain of command)
3. Site specific safety and health hazard assessment and risk analysis based on contaminants encountered.
4. Training
5. Personal Protective Equipment
6. Medical Surveillance
7. Air Monitoring
8. Site Control Measures (Work Zones, Communications and Security)
9. Personnel Hygiene and Decontamination
10. Equipment Decontamination
11. Logs, Reports, and Record Keeping
12. Heat and/or Cold Stress Monitoring
13. Emergency Response including excavation routes and procedures
14. Site Specific Hazard Communication
15. Material Safety Data Sheets (MSDS)
16. Accident Prevention Plan
17. General Sampling, Screening and Analysis Plan for Possible Contaminates

C. Distribute the HCSHSP to contract employees. Require employees to read the plan, sign a compliance statement, and abide by its provisions. Display or make the plan available at the site.

D. Any review, acceptance, or approval of the Contractor’s HCSHSP by the Resident Engineer shall be construed merely to mean that Sound Transit is unaware of any reasons at the time to object thereto. Review by the Resident Engineer of the plan shall not impose any liability upon Sound Transit nor shall any such review relieve the Contractor of any responsibilities under the Contract.

E. Prepare an addendum for each additional unknown hazardous or Contaminated Substance that may be discovered during the course of the Project.

1.07 HAZARDOUS AND CONTAMINATED SUBSTANCE SCREENING AND HANDLING PLAN

A. If unknown hazardous or Contaminated Substances are encountered during construction, prepare a HCMSH Plan for each material discovered. At a minimum, include the following items in the plan:

1. Schedule of activities
2. Methods and procedures of excavation and equipment to be used
3. Shoring or side-wall slopes proposed
4. Staging and storage methods, procedures, and locations
5. Borrow sources and haul routes
6. Methods and procedures for the transportation, disposal, and off-site treatment of materials, in compliance with applicable federal, state, local and University of Washington laws and regulations, including the identification of disposal and treatment facilities, and the use of certified, licensed transporters.
7. Decontamination procedures
8. Sampling, screening and analysis plans and responsibilities
9. Spill contingency plan
10. Spill prevention plan
11. Water Management Plan
12. Procedures for documenting and reporting encounters with and releases of hazardous or contaminated substances

B. Coordinate with requirements of the Stormwater Pollution Prevention Plan (SWPPP), as specified in Section 01 57 19, Temporary Environmental Controls, and Section 01 57 24, Site Water Discharge.

C. Obtain all required permits and notifications for removal, excavation, dewatering, storage, transportation, and disposal of Contaminated Substances. In furtherance of this requirement, the Resident Engineer will provide sampling results and other information developed by Sound Transit, if any. Obtain permits at no additional cost to Sound Transit.

PART 2 - PRODUCTS

2.01 PERSONAL PROTECTIVE EQUIPMENT

A. Provide appropriate personnel safety equipment and protective clothing and ensure that it is kept clean and well maintained. Include, as minimum levels of protection, the following:

1. Level D Protection:
   a. Hard hat
   b. Safety glasses
   c. Work clothes
   d. Steel-toed shoes
   e. Hearing protection, if needed

2. Modified Level D Protection:
   a. Hard hat
b. Safety glasses

c. Chemical protective, disposable overalls/coveralls

d. Inner and outer gloves (Neoprene, Nitrile, Vitron or Butyl)

e. Chemical protective, steel toe and shank, or steel-toed safety boots with chemical-resistant, disposable boot covers.

f. Hearing protection, if needed.

3. Level C Protection:

a. All protection in modified Level D

b. Air purifying respirators with organic vapor and/or HEPA cartridge – NIOSH/MSHA accepted

B. CIH shall establish upgraded or downgraded “action levels” from the specified minimum levels of protection based upon air monitoring results and direct contact potential. Define within the HCSHSP the protocols for formally changing the level of protection.

C. Decontaminate and/or properly dispose of personal protective equipment worn on Site. Decontaminate and inspect personal protective equipment for integrity before being reissued. Unless agreed otherwise by Sound Transit, handle used PPE and disposable equipment in accordance with the requirements for the contacted waste.

2.02 AIR MONITORING EQUIPMENT

A. Instruments: As required by the CIH.

B. Suitable for providing continuous readings.

C. Capable of detecting the contaminants of concern.

2.03 FIELD SCREENING EQUIPMENT

A. Utilize a photoionization detector (PID) or flame ionization detector (FID) and organic vapor analyzer (OVA) to perform screening for hazardous and Contaminated Substances. Use a PID/FID able to perform headspace analysis and able to detect contaminants of concern.

PART 3 - EXECUTION

3.01 GENERAL REQUIREMENTS

A. Perform work covered under this Section in accordance with the Hazardous and Contaminated Substance Health and Safety Plan (HCSHSP) as specified herein, as well as applicable federal, state, and local laws and regulations. Resolve discrepancies in favor of the more stringent provision.

B. Provide Resident Engineer with appropriate documentation to assist in notifying federal, state, and local agencies, as part of the removal, cleanup, mitigation, handling, transportation, and disposal of unexpected hazardous and Contaminated Substances.

C. Secure necessary and applicable permits, certificates, licenses, and approvals required for the performance of this work.
D. Perform the work using only qualified personnel who are fully trained and certified, as required, for hazardous or Contaminated Substance site work in accordance with WAC 296-155, 29 CFR 1910.120 and all other applicable federal, state, and local statutes, rules, regulations, and ordinances. Do not allow personnel who are not properly trained to enter or work in areas identified as containing or potentially containing hazardous and Contaminated Substances.

E. Comply with reporting and record keeping requirements in accordance with the provisions of this Contract and applicable federal, state, and local statutes, rules, regulations, and ordinances.

3.02 NEW DISCOVERIES

A. Upon discovery of an abnormal condition, or a potential indicator of a hazardous or Contaminated Substance:

1. Immediately suspend work activities associated with this Contract in the vicinity of the area of concern.

2. Notify the Resident Engineer immediately after discovery of such abnormal condition or potential indicator.

3. Secure the area as needed to restrict and protect Contractor personnel, Sound Transit personnel, other project site workers, and the public from exposure to potential hazardous and Contaminated Substances.

4. Delineate and establish site control measures for:
   a. Exclusion Zone
   b. Contamination Reduction Zone
   c. Support Zone

5. Provide reasonable assistance to the Resident Engineer in the performance of Sound Transit duties under this Section. Such assistance includes providing access to collect soil and water samples and otherwise document site conditions. Such assistance may also include collecting soil samples with a backhoe at the direction of the Resident Engineer, the sampling and analysis of the contents of unknown containers, the arrangement for disposal of the Contaminated Substances, and attendance at regular project meetings.

B. When a hazardous or Contaminated Substance is confirmed by field screening techniques as specified herein, remove the material in accordance with the HCMSH Plan.

C. Do not resume construction operations in the vicinity of the area where an unknown hazardous or Contaminated Substance has been discovered or encountered until so directed by the Resident Engineer.

D. Conduct any removal or cleanup work, where feasible, to accommodate continued construction activities. Perform work in accordance with the HCMSH Plan. Coordinate the Work with other Site activities. Use staging to contain hazardous or Contaminated Substances, and keep isolated from clean materials.

E. Off-Site Disposal

1. Load hazardous or Contaminated Substance for offsite disposal.
2. Provide transportation in accordance with Department of Transportation (DOT) Hazardous Material Regulations and federal, state, and local requirements. Obtain necessary permits, licenses, and approvals.

3. Treatment, Disposal, and Recycling
   a. Perform treatment, disposal, and recycling of materials in accordance with all applicable laws and regulations, and conditions specified herein. Include all necessary personnel, labor, transportation, packaging, equipment, and reports for this work.
   b. Contaminated soil can be treated or landfilled
   c. If landfilled, dispose of contaminated soils in a licensed landfill in accordance with applicable requirements. Use only landfill sites included in the University of Washington PMRDES.
   d. Documentation of Treatment or Disposal:
      1) Transfer the materials to a treatment, storage, disposal facility which has EPA or appropriate state permits and hazardous or special waste identification numbers and complies with the provisions of the disposal regulations.
      2) Furnish the original return copy of the hazardous waste manifest, signed by the owner or operator of a facility legally permitted to treat or dispose of those materials furnished to the Resident Engineer not later than five Days following the delivery of those materials to the facility.
      3) Furnish a statement of agreement from the proposed treatment, storage or disposal facility and certified transporters to accept hazardous or special wastes in the CMH Plan.
      4) If a different facility from that identified in the CMH Plan is proposed, provide documentation for approval to certify that the facility is authorized and meets the standards specified in 40 CFR 264 and applicable state, local and University of Washington regulations.

3.03 PERSONAL HYGIENE AND DECONTAMINATION
   A. Define personnel decontamination protocols in the HCSHSP to be followed by workers performing or supervising work within designated areas or exposed to hazardous chemicals vapors, liquids or Contaminated Substances.
   B. Perform decontamination procedures inside the Contamination Reduction Zone.

3.04 EQUIPMENT DECONTAMINATION
   A. Decontaminate vehicles and equipment used during the handling of hazardous chemicals and materials inside the Contamination Reduction Zone before leaving the Site. Collect, treat, or dispose of decontamination rinsate at an approved off-site facility.
   B. Keep roads inside the Contamination Reduction Zone free of contamination. Carefully load to avoid contamination of exterior truck surfaces.
3.05 LOGS, REPORTS AND RECORDKEEPING

A. Maintain logs and reports covering the implementation of the HCSHSP including the Air Monitoring Program. Include daily logs, weekly reports, audits, and a close out report.

B. Include in Daily Safety Logs, at a minimum, the following:

1. Date
2. Area (site specific) checked
3. Employees in particular area
4. Equipment being utilized by employees
5. Protective clothing being worn by employees
6. Protective devices being used by:
   a. Contractor’s personnel
   b. Visitors
   c. Designated State and Federal representatives
7. Air Monitoring Equipment and Data
8. Work activities for the day and associated health and safety issues discussed during the daily Health and Safety meeting.
9. SSHO signature and date

C. Include pertinent information from the daily logs in the weekly log. This report shall be a summary of the daily reports filed during that work week.

D. Conduct health and safety audits of the work area and procedure monthly. Prepare an audit report/check list and attach to the weekly report.

E. Prepare and submit a health and safety closeout report at the completion of the project. The report shall summarize the health and safety issues and associated procedures and resolution for the project.

F. Comply with federal and state laws such as OSHA (29 CFR) that require the retention of chemical exposure records and medical records for a specified length of time after the termination of the job.

3.06 AIR MONITORING

A. The CIH shall design, develop, and implement an Air Monitoring Program to detect and quantify airborne contaminants present during the Work. Submit the details of this program as part of the HCSHSP.

B. Information gathered during the Air Monitoring Program shall be used by the CIH to determine appropriate safety and personnel protective measures to be implemented during excavation, stockpiling, handling, sampling, transporting and disposing of contaminated and potentially contaminated soils and debris.

C. Assess off-site migration of contaminants released during work activities.
D. Calibrate and maintain air monitoring instruments, in accordance with manufacturer’s recommendations.

E. Monitor air for potential explosive hazards, during excavation of suspected Contaminated Substances, and during handling of materials suspected of containing hazardous materials.

F. Action Levels

1. The CIH shall develop appropriate action levels to minimize exposure by Contractor personnel, Sound Transit personnel, personnel representing third-party stakeholders, and the public. Include action levels in the HCSHSP.

2. Ensure that action levels are appropriate for the contaminants of concern.

G. Action: If concentrations of contaminants exceed the action levels established by the CIH, cease all work in the area until potential risks can be evaluated further and immediately notify the Resident Engineer.

3.07 SCREENING, SAMPLING AND ANALYSIS

A. Perform required sampling and chemical analyses relating to generation, use, release, and disposal of hazardous or Contaminated Substances in the course of operations, in accordance with the HCMSH Plan.

B. Perform required sampling and chemical analyses relating to existing potentially hazardous or Contaminated Substances unless otherwise provided herein or in the Contract Documents. Include characterization sampling and the sampling necessary to determine disposal methods in this sampling. Do not dispose of material until directed to do so by the Resident Engineer.

C. After suspected hazardous or Contaminated Substance is removed, confirmation samples will be collected and analyzed by the Resident Engineer. Based on test results, proceed with additional removal that may be required to remove material that is above action levels, as directed by the Resident Engineer. Mark locations of samples in the field and document on the surveys and the as-built drawings.

D. Action levels: Establish site-specific action levels for this project, dependent on the specific suite of contaminants expected at the project location, set as the Permissible Exposure Level (PEL).

END OF SECTION
PART 1 - GENERAL

1.01 SUMMARY

A. This Section specifies requirements and procedures established to facilitate the investigation and protection of cultural resources and archaeological monitoring during construction.

B. Comply fully with the requirements set forth in Chapter 27.53 RCW—Archaeological Sites and Resources. Immediately notify Sound Transit and the Resident Engineer if any artifacts, skeletal remains, or other archaeological resources (as defined under RCW 27.53.040) are unearthed during excavation or otherwise discovered on the site. If directed by the Resident Engineer, immediately suspend all construction activity that would be in violation of Chapter 27.53 RCW. The suspension of Work shall remain in effect until permission to proceed has been obtained by Sound Transit in consultation with FTA from the State Historic Preservation Officer or private landowner, as applicable. Should suspension of Work occur, Sound Transit will work with the Contractor to develop a Work-around Plan to minimize disruption to the Contractor’s work and schedule. Such suspension and/or Work-around Plan will be developed to minimize disruption to the Contractor’s work and schedule. Such suspension and/or Work-around Plan may allow the Contractor an adjustment in Contract Time or Contract Price, in accordance with Article 4 of the General Conditions, Changes and Change Order Process. Sound Transit shall have sole and exclusive title to all discovered articles.

1.02 REFERENCES

A. This Section incorporates by reference the latest revisions of the following documents.

1. Revised Code of Washington (RCW)
   a. RCW Chapter 27.44 – Indian Graves and Records
   b. RCW Chapter 27.53 – Archaeological Sites and Resources

2. Code of Federal Regulations (CFR)
   a. 43 CFR Part 10 – Native American Graves Protection and Repatriation Regulations

1.03 BACKGROUND:

A. Sound Transit has developed Archaeological Resources Monitoring and Treatment Plans (ARMT Plans) to govern the actions to be taken when cultural resources are discovered during the implementation of the University Link Project. The Plan describes the general research, design, field techniques, and analytic methods that will guide cultural resource investigations if archaeological deposits are identified during construction of the University Link Light Rail Project. Detailed data recovery plans, or supplements to the ARMT Plans, will be developed by the Project Archaeologist on a case-by-case basis if archaeological deposits are identified.
1.04 IMPLEMENTATION

A. General

1. Unless specifically identified otherwise, all costs associated with the Contractor’s participation, or the participation of all Subcontractors, at all tiers, in activities relating to implementation of the ARMT Plans will be incidental to the performance of the Contract Work. There will be no separate measurement or payment for these activities.

B. Insert these implementation provisions in all Subcontracts for which Work on-site is likely to disturb land.

C. Sound Transit has contracted with a Project Archaeologist, who will work with Sound Transit and the Contractor to implement the ARMT Plans. The roles and responsibilities are generally as described herein.

1.05 CONTRACTOR’S RESPONSIBILITIES PRIOR TO CONSTRUCTION

A. Require all Contractor personnel who perform Work on-site that is likely to disturb land, to attend an orientation briefing (approximately 45 minutes) about procedures established to investigate and protect cultural resources if encountered during construction which covers procedures established to investigate and protect cultural resources, if encountered during construction.

B. Sound Transit will plan and schedule the Pre-Construction/Training session(s), at Contractor’s request, prior to the commencement of land disturbing construction activities. Subsequent orientation briefings and training programs may be scheduled at Contractor’s request to accommodate new personnel arriving on-site. Do not allow Contractor’s employees to participate in land-disturbing construction without first having attended the orientation briefing and as applicable, the training program.

C. The Contractor’s Project Manager, Project Superintendent and other individuals responsible for land disturbing field operations, as designated by the Contractor, will be required to participate in Archaeological Pre-Construction meeting(s) to be held with representatives of Sound Transit and the Project Archaeologist. Meetings will serve to:

1. Review construction plans, schedules, and areas that archaeologists will monitor;

2. Describe the role of field archaeologists in the construction process as established in the ARMT Plans;

3. Establish a chain of command for communication and decision-making among Sound Transit, Project Archaeologist, and Contractor personnel;

4. Provide introductions of the Sound Transit representatives, the Project archaeologists and the Contractor’s personnel who will be working together on a daily basis; and

5. Clarify all questions about schedules, construction locations, construction techniques, or notification procedures.

6. Distribute copies of the ARMT Plans and other briefing materials.

1.06 CONTRACTOR’S RESPONSIBILITIES DURING CONSTRUCTION

A. Undiscovered archaeological materials may exist on the Site, even though the site has been designated as “low cultural resource potential.” The Contractor shall be watchful for
changes in soil color and the presence of ash, shell layers, bones, structures, or artifacts that might indicate the presence of unidentified cultural materials. If any field crew member, employee, or contractor believes that he or she has uncovered any cultural resource at any point in the project, the Contractor shall direct crew to stop work adjacent to the discovery. The discovery site should be large enough to ensure the integrity of the cultural deposit and not be left unsecured at any time. Vehicles, equipment, and unauthorized personnel will not be permitted to traverse the discovery site.

B. Notify the Project Archaeologist, Resident Engineer, and Environmental Manager in the event that cultural resources, suspected cultural resources, or human remains are discovered during construction.

1.07 RESPONSIBILITIES OF THE PARTIES IF CULTURAL RESOURCES ARE DISCOVERED

A. If the Project Archaeologist observes cultural deposits, more intensive identification work may be required. First, the Project Archaeologist will notify the Resident Engineer who will stop the Work in an area large enough to ensure the integrity of the cultural deposit. This directed Work stoppage will be in the form of a written Stop Work Order. The Project Archaeologist may request the use of Contractor’s equipment to provide a better vertical exposure or to remove fill or slump that may obscure deposits. The Project Archaeologist may enter the trench and make an assessment of stratigraphy, matrix, characteristics, evidence of previous disturbance, resource type, and the spatial extent of the resource. The assessment will determine if the find is significant according to criteria specified in the ARMT Plans.

B. If cultural resources are discovered, the Contractor will be required to cooperate with the Project Archaeologist to enable the Project Archaeologist to monitor the Work. Examples of cooperation may include moving equipment to provide access for observation, placing excavated material for examination, accessing trench or foundation excavations, excavating in thin lifts or otherwise reasonably modifying construction excavation procedures to provide exposures of subsurface stratigraphy. Generally, the Project Archaeologist will make all requests for cooperation through the Resident Engineer. However, there may be times when it is necessary for the Project Archaeologist to communicate directly with Contractor’s equipment operators. Contractor operators are hereby directed to cooperate with all requests made by the Project Archaeologist, unless so doing would create an unreasonable safety risk or hazard. In that case, refrain from complying with the request and immediately notify the Resident Engineer.

C. If cultural resources are discovered, Project Archaeologists will want to observe equipment work and soil removal from multiple perspectives around and in front of working equipment, which may require close communication with Contractor’s supervisors and equipment operators.

D. If cultural resources are discovered, Project Archaeologists will often stand on the edge of an excavation to observe materials as they are excavated. Archaeologists may want to clean trench walls, obtain matrix samples, or quickly record the stratigraphy. Project Archaeologists will observe construction excavation in areas where native soil may be encountered or fill areas with historic artifacts, which may assist in developing a chronology of fill placement and/or filling techniques. At times, close, direct examination of excavation sidewalls may be necessary to identify native soils or possible cultural deposits, requiring an archaeologist to enter an excavation zone. Excavated material may be examined in concert with monitoring of the excavation.

E. If cultural resources are discovered, instruct Contractor personnel to cooperate with requests made by the Project Archaeologist for access to excavations unless so doing would create an unreasonable safety risk or hazard, in which case, refrain from allowing access and immediately notify the Resident Engineer.
F. In the event that cultural resources are found during construction, the Project Archaeologist will be responsible for the following:

1. Determining the significance of such cultural resources;
2. Determining whether any such cultural resources require mitigation by archaeological investigation and, if so, what mitigation measures;
3. Preparing detailed Data Recovery Plans according to guidelines established in the ARMT Plan.
4. Preparing all requirements under the ARMT Plan

G. Non-significant finds will be recorded and collected. Provenance information will be recorded, such as the construction station, depth below surface, stratum, date, and name of person finding the material.

H. Sound Transit shall have sole and exclusive title to any discovered artifacts.

I. Re-commence construction only at the written direction of the Resident Engineer with the Project Archaeologist and Environmental Manager, in consultation with FTA and DAHP's consent. The cost of Sound Transit directed Work stoppages will be reimbursed on a Time and Materials Basis in accordance with the General Conditions under the Provisional Sum item in the Contract Price Schedule.

1.08 DISCOVERY OF HUMAN REMAINS OR BURIAL SITES

A. If the Project Archaeologist or the Contractor identifies anything that remotely appears to be human remains, halt construction Work immediately in an area large enough to maintain integrity of the deposit. Notify the Resident Engineer and Environmental Manager if the Project Archaeologist is not monitoring the excavation at the time of the discovery. Notify the local law enforcement agency and King County Medical Examiners Office at (206) 731-3232.

B. If human graves and associated cultural items are discovered during construction, the applicable federal and state laws require the Contractor and Sound Transit to cease activity in the area of discovery (activities may continue elsewhere in the Project area).

C. Do not remove or handle human remains. Flag the area of discovery and instruct all construction equipment and personnel not to enter the area. Make no assumptions concerning the origin of the human remains and avoid public disclosure of the find.

D. If Native American burials are encountered during construction-related activity, follow required specific procedures of the Washington Indian Graves Act (RCW 27.44) and applicable sections of the Native American Graves Protection and Repatriation Regulations (NAGPRR) (43 CFR Part 10), as appropriate.

E. Following the identification of all human remains and associated cultural materials that are subject to NAGPRR and required notification, Sound Transit will coordinate directly with affected Indian Tribes to determine their wishes with regard to the schedule for return of remains and associated cultural items. The Project Archaeologist will hold all materials that meet the definition of NAGPRR in a secure location until they are reburied under the direction of the Tribes. The Project Archaeologist may conduct non-destructive study of the human remains, subject to approval by the affected Tribes.
1.09 CULTURAL RESOURCES ON THIS CONTRACT

A. The entire work area of this Contract has a moderate to high cultural resource potential and may be monitored by the Project Archaeologist. There are no known cultural resource sites within the work area, however the areas with the highest cultural potential are:

1. Site NL – 178, on Broadway Ave E, and the area south of Denny Way
2. Site NL – 166, Victorian House.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

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PART 1 - GENERAL

1.01 SUMMARY

A. This Section specifies permit, easement, and right of entry acquisition, requirements, and conditions.

B. Related Sections: The Work of the following Sections is related to the work of this Section. Other Sections not referenced below may also be related to the proper performance of this work.

1. Section 01 12 16, Work Sequence.

2. Section 01 57 24, Temporary Site Water Discharge.

1.02 SUBMITTALS

A. Procedures: Section 01 33 00, Submittal Procedures.

B. Permits and easements obtained by the Contractor, submitted prior to performing work covered by the permit or easement.

C. Approvals when work is complete for permits obtained by the Contractor. Include a copy of the permit.

D. Easement releases.

E. Permit Review Acceptance forms.

1.03 PERMITS

A. Sound Transit has acquired, or will acquire prior to Notice to Proceed for the following permits:

1. City of Seattle, Department of Planning and Development (DPD)
   a. Master Use Permits (MUPs)
      1) Shoreline
      2) Staging and Grading
   b. Construction Permits
      1) Demolition Permit
      2) Electrical/Utility Relocation Permits
      3) Building (Grading, Shoring, Excavation, Drainage)
   c. Noise Variance Permit
1) Technical Noise Variance

2. Washington State Department of Ecology (DOE)
   a. Construction Stormwater Waste Discharge Permit
      1) National Pollutant Discharge Elimination System Permit. See Article 1.05C, herein, for Contractor responsibilities associated with this permit.

3. King County Department of Natural Resources and Parks, Industrial Waste Program
   a. Construction Wastewater Permits
      1) Major Discharge Authorization. See Article 1.05C, herein, for Contractor responsibilities associated with this permit.

4. United States Army Corps of Engineers
   a. Coastal Zone Management Act (for work in US waters)
      1) Section 10 Permit

5. City of Seattle Department of Transportation (SDOT)
   a. Project Construction Permit (PCP)

6. Washington State Department of Transportation (WSDOT)
   a. Right-of-Way Permit

B. Terms and conditions of the permits obtained by Sound Transit prior to bid submittal that are applicable to the Contractor are included in the Contract Documents.

C. Copies of permits obtained by Sound Transit will be transmitted to the Contractor at the Preconstruction Meeting.

1.04 EASEMENTS AND AGREEMENTS WITH UNIVERSITY OF WASHINGTON

A. Sound Transit has acquired or will acquire prior to Notice to Proceed the following easements and agreements:
   1. Memorandum of Agreement (MOA) with the University of Washington
   2. Master Implementation Agreement (MIA) with the University of Washington
   3. UW Temporary Construction Easement:
      a. See Section 01 12 16, Work Sequence, for Contract responsibilities associated with the execution of this easement.

1.05 PERMITS OBTAINED BY CONTRACTOR

A. Be responsible for and obtain all other permits and right of entry, including requirements for Sound Transit Permits and right of entries listed in Articles 1.05B and 1.05C, herein, required to perform the work that are not listed in Articles 1.03 and 1.04, herein.

B. University of Washington Right Of Entry
1. Right of Entries shall be acquired by Contractor for elements of work that occur outside of the Construction Work Limits. These activities include, but are not limited to:
   
   a. Surveying.
   b. Geotechnical Investigation and Instrumentation Installation.
   c. Catch Basin Inlet Protection.
   d. Vibration, Noise and Settlement Monitoring.
   e. Routing of Temporary Power from UW Stadium.
   f. Crane swing areas
   g. Traffic detour and haul route sign installation

2. See Section 01 12 16, Work Sequence, Article 1.04 E, for requirements to obtain Right of Entry permit.

C. Washington State Department of Ecology (DOE)

1. Prepare and resubmit to the DOE a request to be named as a Co-Permittee to the Link Light Rail’s Project Systemwide NPDES Waste Discharge Permit, WA-003192-5.

2. Prepare and submit to the DOE, for review and approval, a construction stormwater prevention plan (SWPPP) and a construction stormwater monitoring plan (MP). Reference Section 01 57 24, Temporary Site Water Discharge, for additional information for this requirement.

D. City of Seattle Department of Transportation (SDOT)

1. Street Use Permits (as necessary for temporary closure of sidewalks and City right-of-way)

E. City of Seattle, Department of Planning and Development (DPD)

1. Prepared and submit a Construction Parking and Staging Area Management Plan, Temporary Erosion and Sediment Control (TESC) Plan and an Access and Haul Plan for review and approval by Sound Transit and the City of Seattle DPD, in accordance with requirements in Section 01 55 00, Vehicular Access and Parking, and Section 01 57 13, Temporary Erosion and Sediment Control.

2. Per the Shoreline Permit, prepare a Sampling Analysis Plan (SAP) for DPD review and approval prior to first ground disturbance site inspection. The SAP shall include the following information:
   
   a. Whether contaminated soil and/or groundwater is present in the proposed areas of excavation
   b. Where contaminants are identified during the SAP
   c. Where avoidance of contamination is not feasible
   d. Volume of contaminated soil and/or groundwater encountered.
e. All contaminated soil and/or groundwater will be disposed of following local, state, and federal regulations.

3. Per the Shoreline Permit, prepare an Excavation and Dewatering Plan for DPD review and approval prior to first ground disturbance site inspection. Refer to Section 31 23 19, Dewatering. The Excavation and Dewatering Plan shall include the following measures:

a. Proper shoring or sloping of the excavation should be performed to mitigate potential sloughing of soils and lateral movement or settlement of nearby roadway, structures, and utilities.

b. Control the entry of water into excavations. Dewatering of soils within and below excavations should be performed to control inflow, remove water from excavations, and reduce hydraulic forces on shoring.

c. Proper maintenance of the pumping wells shall be performed to assure that they are working as designed.

d. Monitoring of the groundwater table and settlement outside of the excavation shall be performed to confirm that the dewatering system is working as designed.

F. Prepare and submit to the proper authority or Sound Transit all information, including but not limited to the Storm Water Pollution Prevention Plan (SWPPP), required for the issuance of such permits or easements. Pay all costs thereof including agency inspections and easement costs unless specifically provided otherwise in the Contract. Sound Transit will pay all permit fees, costs of agency inspections, and easement costs for the permits and rights-of-entry listed in Articles 1.03 and 1.04, herein.

G. When required by the permit and during work progress covered by the permit, ensure the work be inspected by the issuing agency.

1.06 POSTING PERMITS

A. Post permits required by law only.

B. Post permits, including those obtained by the Contractor, at the site of the work. Post in a location on the property line that is visible and accessible to the public and to construction personnel from the street right-of-way. The placards, which will be issued along with the building permit, shall be laminated with clear plastic or other waterproofing material and shall remain posted at the site for the duration of the construction.

1.07 PERMIT REVIEW ACCEPTANCE FORM

A. Form provided by the Resident Engineer.

B. Read and understand conditions and provisions of all Orders, permits, and approvals relevant to this Contract.

C. The Contractor’s Project Manager, and, if required, the Contractor’s Erosion and Sediment Control Lead, sign each form.

D. Use a separate Form for each individual Order, permit, and approval and submit at least 14 Days prior to start of Work.
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SECTION 01 42 00

REFERENCES

PART 1 - GENERAL

1.01 SUMMARY
A. This Section includes a list of references for this Contract.

1.02 REFERENCES
A. The following documents are made available for reference in Sound Transit’s office:
   1. Link Cadd/Drafting Manual
   2. Sound Transit Link Light Rail Transit Design Criteria Manual (DCM)
   3. WSDOT Standard Specifications for Road, Bridge, and Municipal Construction
   5. City of Seattle Standard Specifications for Road, Bridge, and Municipal Construction
   6. City of Seattle Standard Plans for Municipal Construction
   7. City of Seattle Energy Code
   8. University Link Final Environmental Impact Statement
  11. Manufacturers Standardization Society Standards

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

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PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes specifications for performing and complying with the Quality Control (QC) requirements specified in the Contract Documents. Prepare, implement, and maintain a quality program that defines how the Work is planned, monitored, and controlled, and who is responsible to ensure Work meets Contract Document requirements.

B. Related Sections: The work of the following Sections is related to the work of this Section. Other Sections not referenced below may also be related to the proper performance of this work.

1. Section 01 66 00, Product Storage and Handling Requirements.
2. Section 01 31 23.10, Internet-Based Document Management System.

1.02 REFERENCES

A. This section incorporates by reference the latest revisions of the following documents. They are part of this Section as specified and modified. In case of a conflict between the requirements of this Section and those of a listed document, the requirements of this Section shall prevail.

1. Federal Transit Administration (FTA):

2. American Welding Society (AWS):
   a. AWS QCI Standard for AWS Certification of Welding Inspectors

1.03 CONTRACTOR QUALITY CONTROL REQUIREMENTS

A. Assign a Quality Control (QC) Manager dedicated to this Contract responsible for managing and acting on all quality matters and who has the authority to act on all quality matters as a representative of the Contractor. The Quality Control Manager can not be subordinate to Contractor’s personnel that directly perform, supervise, or progress the Work, and; can not be responsible for directly performing, supervising, or progressing the Work or have responsibilities for this Contract that conflict or appear to conflict with his primary responsibility for quality matters.

B. Qualification of Contractor Quality Control (CQC) Manager: At least five years prior experience as a Project Engineer, CQC Manager, superintendent, or QC Supervisor on a project of comparable complexity to this Contract which includes at least three years experience as quality control manager, inspector, or engineer. The CQC Manager must be approved by the Resident Engineer before Work on this Contract can begin. At the sole discretion of Sound Transit, the Contractor may be required to replace the CQC
Manager. Contract Work is not permitted to be performed without an approved CQC Manager on site.

C. Develop a Quality Program Plan (QPP) that addresses the fifteen quality elements identified in the FTA QA/QC Guidelines FTA-IT-90-5001-02.1. Include the following elements in the Contractor QPP:

1. QA/QC Organization and staff, including job description and an organizational chart showing the relationship between the Contractor’s General Manager, Project Manager, Quality Manager, subcontractors and consultants.

2. Documented Quality System.

3. Design Control.


5. Subcontractor, Consultant and Supplier Control.

6. Receiving, handling, storage and control of materials and equipment.

7. Process Control and control of special fabrication processes, i.e. welding, plating, soldering, etc.

8. Inspection and Test Plans.

9. Control of measuring and test equipment.

10. Inspection and Test status.

11. Identification, Control and Correction of Non-conforming Conditions.

12. Corrective Actions.


14. Contractor internal audits and audits of Subcontractors and Suppliers.

15. Training.

D. The Contractor QPP submittal must be acceptable to Resident Engineer with a No-Exceptions-Taken or Exceptions as Noted, No resubmittal required disposition, before Work can begin. No extension of time or monies is entitled to the Contractor for failure to secure a QPP acceptable to Resident Engineer.

E. As work progresses, periodically evaluate, revise as necessary and re-submit QPP to Resident Engineer for review.

F. Flow down to Subcontractors the Quality Program Plan requirements and quality requirements defined herein applicable to the work they perform.

G. Inspector’s Daily Reports (IDRs): Create and maintain daily quality control reports for each workday containing factual records with numerical data of the Work and quality control activities with format and content acceptable to the Resident Engineer. Obtain the verification and signature of the CQC Manager on all IDRs. Provide verification statement on IDRs that states: “All supplies and materials incorporated into the Work are in compliance with the terms of the Contract except as noted.” Sign and date each IDR.
H. Employ the services of an Independent Testing Laboratory to perform on-site testing, as well as, off-site testing to confirm the acceptable quality of materials, parts, and equipment required by the Contract Documents. Employ an Independent Testing Laboratory that is currently certified by a nationally and/or state recognized regulatory agency. Obtain the approval to use the Independent Testing Laboratory from Sound Transit before commencing Work for which testing is required by Contract Documents. Independent Testing Laboratory must have special inspection capability and certification.

I. Special Inspections Coordination: Performed by the CQC Manager, including the following measures:

1. Preparation of schedule of the special inspections required.
2. Notification of the Resident Engineer of special inspection at least 48 hours in advance of performance of the special inspections.
3. Coordination with the work to ensure the next step in the process does not obscure the ability to inspect until the required special inspections have been completed.
5. Monitoring of the correction of all discrepancies and notation in the Daily QC Report.

J. Employ quality control inspectors with a minimum of three years construction quality control experience for the Work they are responsible for inspecting, or; with a minimum of one year quality control inspection plus a minimum two years construction engineering experience in the engineering and inspection in the disciplines for the Work they are responsible for inspecting. Upon request from the Resident Engineer, provide qualifications of the quality control inspectors within three days.

K. Mobilize the number of experienced quality control inspectors necessary to perform the Quality Control requirements commensurate with the ratio of work crew size to inspectors and the type of work requiring specific types of inspectors.

L. Achieve control of On-Site and Off-Site Construction through the development of Contractor Construction Work Plans (CWPs), approval of CWPs by the Resident Engineer, execution of the Work in accordance with CWPs and Contract requirements, and timely reporting of required inspections and tests.

1.04 SUBMITTALS

A. Procedures: Section 01 33 00, Submittal Procedures.
B. Quality Program Plan, within 30 Days after Notice to Proceed
C. Name and qualifications of Contractor’s Quality Control Manager, within 15 Days after Notice to Proceed.
D. List of Construction Work Plans, within 45 Days after Notice to Proceed.
E. Construction Work Plans required by the Contract Specifications, a minimum of 24 Days prior to commencement of the applicable Work activity.
F. Name and qualifications of the Contractor's Independent Testing Laboratory and all subcontracted Testing Laboratories, within 45 Days after Notice to Proceed.
G. Inspection and Test Plan, within 45 Days after Notice to Proceed.
H. Notification of all failed non-qualifying tests or rejected work within one working day of test or inspection.
I. Inspection and Test Reports, within three working days after completion of the test.
J. IDR form within 15 Days after Notice to Proceed.
K. IDRs, within five working days.
L. Non-conformance Reports within three working days of non-conformance discovery.
M. List of Subcontractors, within 45 Days after Notice to Proceed. Provide updates at least 30 Days prior to each new Subcontractor beginning work on the Contract.
N. Quality Assurance Audit Schedule, within 45 Days after Notice to Proceed.
O. Document Control Procedure, within 15 Days after Notice to Proceed.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 QUALITY PROGRAM
A. Describe the plans, procedures, and organization necessary to comply with the requirements of the Contract Documents. Identify all the Work processes and their Quality Control inspection and testing requirements. Develop detailed Construction Work Plans (CWPs) and other procedures for processes and work activities determined by the Resident Engineer or the Contractor to be complex, involve multiple Subcontractors and/or multiple activities, involve special processes, require interfacing with third parties, or require job hazard analysis to be developed.
B. Include construction operations, both on-site and off-site including fabrication, manufacturing and suppliers. Include Sound Transit and third party imposed hold points in CWPs.

3.02 CONSTRUCTION WORK PLANS:
B. The Resident Engineer, in consultation with the Contractor, will determine which Work activities require submission and approval of a CWP. Prepare and submit a list of CWPs to the Resident Engineer. The Resident Engineer and the Contractor may add CWPs to the list. Update the CWP list when new CWPs are added and resubmit within 5 working days to the Resident Engineer for approval. Prepare and submit a CWP for each of the Work activities identified on the CWP list. Do not begin Work without Sound Transit acceptance of a CWP and convening of a Readiness Review Meeting. All Readiness Review Meetings shall be included in the updated Monthly Schedule. As a minimum include the following in each CWP:
   1. Scope of Work.
   2. List of persons responsible for supervision of the Work.
3. List of required approved submittals (for example; traffic control plans, and special processes), drawings (with latest revisions), and the job hazard analysis.

4. Planned start-work and completion dates, progress rate expected, and work hours.

5. Sequence of events and construction methods for performing the Work. Include Sound Transit hold points and inspection requirements.

6. Handling and storage of materials and equipment.

7. Inspection and Test hold points required where the next process step or activity will cover up the work.

8. Inspections and tests required by Contractor, Third Parties and/or Sound Transit.

9. Individuals responsible for performing inspections and providing input to as-built drawings.

10. Prerequisite activities and related construction safety issues.

11. Off-site inspection and test activities and their locations.

12. Procedures for controlling hazardous materials, as applicable.


14. Actions defined as “Special Events”, which may expose the general public to danger or inconvenience, and which may require a third party to be notified.

15. Safety-critical installations, inspections, and tests listed on the safety certification checklist (provided by Sound Transit).

16. Specific Job Hazard Analysis (JHA) for each CWP.

3.03 CWP READINESS REVIEW MEETING

A. After the CWP has been returned by the Resident Engineer annotated with a “No Exceptions Taken” (NET) or “Exceptions as Noted, Resubmittal Not Required”, and before beginning associated Work activities, a Readiness Review Meeting will be conducted by the Resident Engineer with the Contractor, Subcontractors, and applicable third party representatives who are involved in executing, supervising, inspecting, testing and monitoring the Work activity to discuss all CWP elements identified in Article 3.02, herein. The Resident Engineer will document the meeting with an agenda and minutes of the meeting including an attendance record.

3.04 INSPECTION AND TESTING

A. Independent Testing Laboratory

1. Obtain the approval to use Independent Testing Laboratory from Sound Transit before commencing Work for which testing is required by Contract Documents. Obtain approval from Sound Transit before changing Independent Testing Laboratories.

B. Inspection and Test Plan
1. Prepare an Inspection and Test Plan with a Matrix defining the types and frequency of inspections and tests and the entity responsible for performing each inspection and test (i.e.: laboratory, Contractor, Subcontractor or Third Party). The Inspection and Test Matrix included at the end of this Section is provided to assist the Contractor with preparation of an Inspection and Test Plan. The Inspection and Test Matrix includes minimum testing requirements defined in the Contract Documents and does not relieve the Contractor of responsibility from performing inspections and tests not referenced in the matrix that are required in the Contract Documents or tests that are necessary to confirm the accuracy or completeness of work. Update the Inspection and Test Plan whenever an Independent Testing Laboratory is added or deleted, or when an inspection or test is deleted or added by Change Order or a Change Notice-Work Directive.

C. Control of Inspection, Testing, and Monitoring Equipment

1. Calibrate and certify all testing equipment and monitoring devices. Calibration and certification requirements include the following and apply to the Contractor and all Subcontractors, suppliers and Independent Testing Laboratories:
   a. Be able to trace calibration to known national standards.
   b. List inspection, test, and monitoring equipment with the name and serial number, date of current calibration, due date of next calibration, and name of person or agency conducting the certification or calibration with a brief description of use.
   c. Store all testing equipment and monitoring devices in a safe and secure location, maintained throughout the Contract and used only for testing or monitoring Work for which they are designed.
   d. Re-calibrate, re-test, and re-inspect materials, parts and equipment if the inspection or testing equipment is suspected of being out of calibration, broken, dismantled, or damaged.
   e. Make all testing and inspection equipment calibration records available and display calibration sticker showing the last date of calibration and the due date of the next calibration.

D. Inspection and Test Reports

1. Inspection and test reports are considered Contract Record documents. Require parties performing testing and inspections to verbally transmit information regarding failed inspections and tests on the same day as discovery to the Contractor. Upon receipt of the failed inspections or test information, notify the Resident Engineer by e-mail within one working day of the failed inspection or test results. Submit all inspections and test reports to the Resident Engineer within three working days after receipt of the report from the Independent Testing Laboratory or within three working days after testing or inspection performed by the Contractor or a Third Party.

2. Include the following minimum requirements in Inspection and test records:
   a. Sound Transit Contract number
   b. Reference to Contract Specification Section requirement or test procedure
   c. Identification of items tested
d. Location where sample was taken (i.e. stationing and intersection corner)
e. Quantity of items inspected or tested
f. Date inspection or test was conducted
g. Name of technician
h. Acceptance criteria
i. Pass or Fail disposition
j. Results
k. Authorized signature

E. Contractor-performed and Subcontractor-performed inspections and tests are subject to verification and approval by the Resident Engineer.

F. Inspection and testing conducted by agencies other than the Contractor's approved Independent Testing Laboratory does not relieve the Contractor of the responsibility of meeting the requirements of the Contract Documents.

3.05 INSPECTION

A. The Contractor is responsible for performing all inspections, unless otherwise stated in the Specifications. The CQC Manager is responsible for verifying that quality standards are maintained throughout the Contract through in-process inspections, substantial completion inspections and final inspections. Adjustments to control procedures and CWPs may be required based upon results of inspections and tests. Document inspection and test results of the in-process inspections in the IDRs.

B. Provide 48-hour notice to the Resident Engineer where Sound Transit inspection or test is required.

C. Arrange and coordinate inspections and tests requiring Washington State Labor (i.e. electrical work) and Industry and/or other jurisdictional approval (for example; City of Seattle). Provide advanced notification of third party inspections to Sound Transit. Do not proceed with the Work until a hold point has been released by the Resident Engineer.

D. Coordinate special inspections performed by local jurisdictions with third party local jurisdictions, as required by the International Building Code or other applicable codes or standards. Cooperate fully with these special inspectors and provide them with assistance necessary to complete their inspections. Provide payments for special inspections.

E. Report inspection and test compliance or non-compliance with the contract requirements specified or indicated in the Contract Documents.

3.06 CONTROL OF PRODUCTS, MATERIALS, AND EQUIPMENT

A. Control products, materials, and equipment in accordance with Section 01 66 00, Product Storage and Handling Requirements.

B. Inspect all products, materials and equipment received for identification, damage and quantity. Large lots may be inspected by an industry approved standard sampling method (i.e.: ANSI/American Society for Quality ASQ Z1.9 Sample Procedures and Tables for Inspection by Variables for Percent Nonconforming)
C. All products, materials, and equipment are subject to receipt inspection by Sound Transit.

3.07 CONTROL OF SPECIAL PROCESSES

A. Perform special processes (i.e.: welding, brazing, soldering, etc) only with personnel certified in accordance with the requirements of the specific processes. Maintain qualification records of personnel performing special processes in the worksite files, submit to the Resident Engineer, and reference in the applicable CWPs.

B. Obtain Sound Transit approval of qualifications of personnel performing special processes prior to starting work.

3.08 CONTROL OF NON-CONFORMING ITEMS

A. Document and submit to the Resident Engineer nonconforming items on a Non-Conformance Report (NCR) within one working day of discovery. Failure to do so will result in the Sound Transit Resident Engineer documenting and issuing a Non-Conformance Report to the Contractor.

B. Document the root cause of the nonconformance and the corrective action taken in the NCR.

C. Sequentially number and log all Non-Conformance Reports.

D. Upon receipt of a Non-Conformance Report, the Contractor is responsible for: investigating and describing the root cause of the nonconformance, providing remedial correction for the nonconforming item(s), except for “USE AS IS” dispositions, providing preventive actions to prevent recurrence, and recommending a disposition within 21 Days of the issuance date of the NCR. Failure to provide this information within 21 Days will result in a reduction of the amount approved for payment for the affect Work on the next payment. Complete all rework within 30 days from the date that the non-conforming condition was documented. Complete all repairs within 30 days of the written approval of the repair procedure by the Sound Transit Resident Engineer. The applicable disposition codes for NCRs are:

1. USE AS IS: allows the use of an item that does not meet specified Contract requirements without the need for corrective action, but may require some form of compensation to Sound Transit.

2. REPAIR: item may be repaired if it cannot be reworked to its full compliance with the Contract requirements, but it can be made suitable for use.

3. REWORK: item may be reworked to bring it into conformance with the requirements of the Contract.

4. REJECT: item is unsuitable for its intended use, is economically or physically incapable of being reworked or repaired, and must be replaced to bring it into conformance with the Contract Requirements.

E. Nonconforming items dispositioned as USE AS IS or REPAIR require review and approval of the Resident Engineer and the Sound Transit Material Review Board. Transmit corrective and preventative action responses for Non-Conformance Reports (NCRs) to the Resident Engineer by the due date stated on the NCR.

F. Nonconforming items requiring REWORK shall be tagged or otherwise identified and no follow-on work that integrates with that item can be performed until rework is completed and accepted.
G. Red-tag and remove all nonconforming items, identified as REJECT, from the Site within 72 hours of discovery.

3.09 UTILITY STRIKES

A. Document all utility strikes involving the hitting or damaging on an existing utility in a correspondence to the Resident Engineer in a Utility Strike Log within 30 Days after strike.

B. Include:
   1. Location
   2. Date and time of occurrence
   3. Survey coordinates and elevation
   4. Utility Type
   5. Size of Utility
   6. Name of Utility
   7. Circumstances leading to the strike
   8. Date and time of repair

C. Document to the Resident Engineer each utility strike on a nonconformance report within one work day of the occurrence. The Resident Engineer and the affected utility entity determine the disposition of non-conforming work.

D. Record all utility strikes on the as-built drawings within three days after strike.

3.10 DOCUMENT CONTROL

A. Prepare and maintain a Document Control Procedure for detailing the control of receipt, status, maintenance, and transmittal of Contract records and documents using the Internet Based Document System in Section 01 31 23.10, Internet-Based Document Management System.

B. Establish a document control system to store and record the large quantity of correspondence, drawings, progress reports, technical reports, as-built records, specifications, Contract Documents, Submittals, calculations, and administrative documents generated under the Contract. Establish correspondence routing, filing, control, and retrieval methods that are compatible with the system currently in use by Sound Transit.

C. Provide technical document control, storage, and retrieval methods for both hard copies and electronic records. Provide technical document control methods capable of handling documents being developed (progress), finalized documents (for construction), and documents representing as-built conditions.

D. Serialize and maintain all correspondence of the Contractor to and from Sound Transit and its representatives (including the Resident Engineer) and separate incoming and outgoing correspondence logs. At a minimum, use a serialization similar to the following:
   Serial No: [      ]
   Prefix - Letter No. [      ]
Example Prefixes:

CRE: Contractor to Resident Engineer

REC: Resident Engineer to Contractor

E. Within 5 working days of issuance of the Notice to Proceed, the Contractor and the Resident Engineer each designate, in writing, their respective authorized representatives to receive copies of all or specified correspondence. Include in all correspondence the Project Name, Contract Name, and Contract Number, along with the specific subject of the letter. For all replies, refer specifically to prior correspondence to which they relate.

F. Do not change or alter Contract records or documents without Resident Engineer’s written approval.

G. Provide current revisions of procedures, instructions, Contract Drawings, and other documents at Work locations.

H. Identify and maintain records and documents in an organized manner. Make records available and provide copies to Sound Transit upon request.

I. Protect records and documents from damage, deterioration, and loss. Keep records in fireproof cabinets at the Contractor’s work-site or maintain a duplicate set at another location. The off-site duplicate set may be an electronic image format (i.e. PDF).

3.11 RECORDS

A. Records are defined as documentation required by the Contract. Record documents include, but are not limited to, correspondence, submittals, test reports, Contract and shop drawings, schedules, certificates of compliance, pay requests, change documents, requests for information (and their responses), schedules and as-built documents.

B. Maintain and retain all records in accordance with the Contractor's Document Control Procedure.

C. Make available and provide copies of all record documentation to Sound Transit for audits, assessments and surveillances performed by Sound Transit, State of Washington or Federal Agencies upon request.

3.12 AUDITS

A. Schedule, perform, document and retain the results of QA audits, assessments and surveillances for the Work and the Project Records. Audit each element of the Contractor's QP at least once within 180 days after NTP and at least every six months thereafter plus an audit no more than 60 days before the substantial completion date. Contractor QC Manager or Contractor corporate Quality Manager to perform QA audits.

B. Facilitate audits, assessments, and surveillances performed by Sound Transit, the State of Washington and Federal Agencies by providing access to its facilities, personnel, and records.

C. Respond to audit, assessment, and surveillance report findings with corrective actions that have and are to be taken to correct non-conforming conditions and preventative actions that have and are to be taken to prevent a recurrence of the non-conforming conditions. Document corrective and preventive actions to the Resident Engineer within 21 days of the issuance date of the audit, assessment or surveillance report. Document the dates of implementation of the corrective and preventive actions in the response.
Failure to provide this information within 21 days will result in a reduction of the amount approved for payment for the affected Work on the next payment. Provide copies to Sound Transit of record documents as requested during audits or surveillances.

3.13 TEST MATRIX (WILL BE CREATED FOLLOWING 100% SUBMITTAL)

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SECTION 01 46 01

SYSTEM ASSURANCE - TUNNEL VENTILATION

EQUIPMENT INSTRUMENTATION AND CONTROL

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes specifications for the System Assurance requirements applicable to the tunnel ventilation and smoke exhaust systems. These requirements have been established to provide for the attainment of performance requirements. They are divided into System Safety, Reliability, and Maintainability, as described herein.

B. Related Sections:
   1. Section 23 09 00, Instrumentation and Control for HVAC.
   2. Section 23 30 10, Tunnel Ventilation Equipment.

1.02 REFERENCES

A. This Section incorporates by reference the latest revisions of the following documents.
   1. U.S. Department of Transportation (USDOT)
      a. System Safety Glossary
   2. FTA Hazard Guidelines for Transit Properties
      a. DOT-FTA-MA-26-5005-00-01
      a. MIL-STD-882C

1.03 DEFINITIONS

A. The USDOT, System Safety Glossary dated June 1986, contains terms and definitions that are generally applicable to these Contract Specifications. Terms and definitions are contained within these Contract Specifications. In the event of conflict between definitions contained in the referenced document and those contained herein, the definitions of these Contract Specifications shall govern.

B. Availability (A): The probability that the system is completely operational at any point in time when used under stated conditions, where the time considered is operating time, diagnostic time and active repair time.

C. Independent Failure: A failure that occurs without being caused by the failure of another item.

D. Relevant Failure: A relevant failure of an item is an independent failure that results in a loss of function of that item caused by either of the following:
1. A fault in the item while operating within its design and environmental specification limits.

2. Improper operation, maintenance, or testing of the item as a result of Contractor-supplied documentation.

E. Non-relevant Failure: Any failure condition of an item not included in the definition of relevant failure, such as the following:

1. A failure caused by malfunctions of other equipment.

2. A failure by human error, except error caused by improper operation, maintenance, or testing of the item as a result of Contractor-supplied documentation.

3. A failure caused by operating the item outside its design or environmental specification limits.

F. Lowest Line Replaceable Unit (LLRU): The lowest assemblage of components or piece parts to which a malfunction can be isolated and that can be readily replaced in its field application.

G. Mean Time Between Failure (MTBF): The arithmetic average of the times between successive failures of an individual item or each of the members of a population of items expressed as a ratio of the total operating time, t, accumulated by the total population of identical items to the total number of relevant failures, F, occurring within the population of identical items during time, t. MTBF is expressed quantitatively by the following equation:

\[
MTBF = \frac{t}{F(t)}
\]

H. Corrective Maintenance Time: The corrective maintenance time is the summation of elapsed time intervals actively expended to troubleshoot and fault-isolate a failure, remove and replace/repair faulty items, and perform functional checkouts to verify restoration to operational status.

I. Mean Time To Repair (MTTR): The ratio of the total active corrective maintenance time, tcm, expended during a given time interval, t, by the total population of identical items to the total number of relevant failures, F, which require corrective maintenance and which occur within the population of identical items during time, t. MTTR is expressed quantitatively by the following equation:

\[
MTTR = \frac{tcm(t)}{F(n)}
\]

J. Maximum mean baseline time to repair (MAXMBTTR): The 90th percentile of the distribution of baseline MTTR, in hours, for major subsystems.

1.04 SYSTEM DESCRIPTION

A. Ventilation Equipment Quantitative Requirements (Emergency Fans and Smoke Control System Fans). If Station Exhaust fans are included in the Emergency Evacuation Scenarios, they need to be included.

1. Submit the major equipment-level requirements, expressed in MTBF (hours) for the following equipment:

   a. Motors
b. Supervisory Controls

c. Mechanical Equipment

2. Submit proposed MTBF hours for the above noted equipment based upon current manufacturers product lines that meet the equipment performance characteristics and capable of meeting these requirements for 100,000 hours or 2,000,000 cycles of pressure transients. (Emergency Fans & Smoke Control System Fans only)

1.05 SUBMITTALS

A. Procedure: Section 01 33 00, Submittal Procedures.

B. System Assurance Program Plan within 90 Days after Notice to Proceed

C. Hazard Analyses
   1. Fault Hazard Analysis (FHA) 120 Days after Notice to Proceed
   2. Operating Hazard Analysis (OHA) 240 Days after Notice to Proceed

D. Reliability Prediction Analysis within 120 Days after Notice to Proceed

E. Single Point Failure Analysis within 120 Days after Notice to Proceed

F. Microprocessor/Processor Software Documentation and its Reliability Analysis Report 120 Days after Notice to Proceed

G. Reliability Demonstration Test Plan within 240 Days after Notice to Proceed (not required if equipment is UL listed)

H. Reliability Demonstration Test Procedure and Test Forms 60 Days prior to Reliability Testing (not required if equipment is UL listed)

I. Reliability Demonstration Test Reports within 3 Work Days after completion of test (not required if equipment is UL listed)

J. Maintenance Program Plan 30 Days prior to Reliability Test

K. Corrective Maintenance Analysis & Preventive Maintenance Schedule

L. Incident/Failure Reports within 3 Days after Incident or Failure

M. Preliminary Failure Analysis Reports within 30 Days after Incident or Failure

N. Failure Analysis Report updates every 15 Days after the Preliminary Failure Analysis Report is issued and every 15 Days thereafter until the Final Failure Analysis report is issued.
PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 PREPARATION

A. System Assurance Program Plan – Establish, maintain, and submit to Sound Transit for approval a System Assurance Plan (SAP), and include, individually or collectively, program plans for System Safety, Reliability and Maintainability disciplines.

1. General System Assurance Program Plan Requirements - Identify the activities, organization, and means of implementing each of the three disciplines. Address the following in the plan for each discipline, as applicable:

   a. Systems Assurance Objectives
   b. Organization of the Systems Assurance effort, including the authority, duties, qualifications, and responsibilities of personnel
   c. Interfaces, including the lines of authority and relationships of subcontractors, suppliers, component selection, procurement, manufacture, assembly, installation, testing, logistics planning, and other elements of the organization, in-service support, and warranty-related support.

2. Systems Assurance Schedule - includes identification of milestones, submittal schedules for analyses, major inspections, tests, and audits.

3. System Safety Program Plan - Submit the System Safety Program Plan, as part of the SAP, describing how the identification, elimination, and/or control of hazards that could lead to injury or loss of life will be achieved. Include the following in the description, as a minimum:

   a. Specific information on how the attainment of System Safety Requirements is verified during the design, manufacture, test, and installation phases
   b. A preliminary list of safety-critical items, functions, circuits, and interfaces
   c. The means of assuring that suppliers and sub-suppliers are meeting the System Safety requirements, and how specific information is disseminated to designers as well as to the Contractor's vendors
   d. Methodology used to eliminate or control identified hazards.
   e. A list of Lowest Line Replaceable Units (LLRU)

B. Hazard Analyses - A preliminary safety review of the fire detection system has determined that the ventilation equipment is critical life safety system. Submit the following analyses, in accordance with the FTA Hazard Analysis Guidelines for Transit Properties.

1. Fault Hazard Analysis (FHA). The FHA must exhaustively answer the following questions:

   a. What are the effects of all failure modes on the employees and patrons using the transit system?
b. How is each failure detected by the operator, Link Control Center (LCC) and/or maintenance personnel?

c. What are the effects of secondary failures?

d. Should the system be removed from service following the failure? Immediately? At the end of the run? Failure to be repaired at the next maintenance period?

e. If the failure is not detected, are there special maintenance or operations actions required on a periodic basis to detect the failure and ensure the exposure to a secondary, hazardous failure is limited?

2. Operating Hazard Analysis (OHA). Identify, classify, and format hazards in accordance with the above FTA Guidelines, and present a means for resolving the identified hazards. Documented verification of past analyses that show compliance with the specified requirements may be submitted for approval to the Commission or its designee. The OHA must thoroughly answer the following questions:

   a. What are the effects of personnel not performing the required maintenance and operation actions or of performing the actions incorrectly?

   b. Do the maintenance tasks expose personnel to any hazards?

   c. What special training is required to perform tasks safely?

C. Reliability Prediction Analysis – Prepare a reliability prediction analysis and submit to the Authority for evaluation and comment. Base the reliability analysis on historical performance of like equipment in an application and environment similar to that of Sound Transit or prior test data from other Transit Agencies. As a minimum, identify the following with the historical performance reliability analysis:

1. Equipment identification by LLRU part number

2. Prior application and environment

3. Precise design use of LLRU in the Sound Transit System

4. For part numbers, exact description of modifications since accumulation of prior use data

5. Adjustment factors and related rationale used to modify historical data to the Sound Transit equivalent performance. Consider differences in application including level of use and duty cycle, environment, and modification as a minimum for adjustments.

6. User identification by name and geographical location

7. Date of use

8. Number of individual LLRU’s in use

9. Number of hours of use per unit and total

10. Number of independent failures experienced during the operating hours for which the analysis is presented
11. Calculated MTBF
12. Comparison of calculated MTBF with the required MTBF

D. Reliability Plan - as part of the SAP, describe the establishment and maintenance of an approved reliability effort that is planned and developed in support of the specified Reliability requirements. As a minimum, include the following in the description:

1. Reliability objectives
2. The methodology whereby compliance is predicted with the specified requirements
3. The organization and the personnel responsible for managing the reliability effort
4. Controls for subcontractors and vendors, and methods for assuring compliance
5. Demonstration testing for verification of compliance with the specified reliability requirements.

E. Reliability Calculations and Substantiating Data - Prior to release of design for manufacturing, obtain Sound Transit's approval of reliability calculations and allocations. Submit reliability calculations and allocations to substantiate the design of the equipment. Include the following, as a minimum:

1. Subsystem reliability apportionment
2. Statement of characteristics
3. Description of operation
4. Component failure rates (or MTBF) assumed in the calculations and their bases

F. Single-Point Failure Analysis - Emergency Fans & Smoke Control System only

G. Microprocessor/Processor Software Documentation - Identify the hardware required, other software required, execution timing programs, displays, and database in software documents. Annotate all source code in higher level language. Supply top down documentation for all microprocessor/processor software including:

1. top-level flow chart
2. functional descriptions
3. applicable program compilation listings
4. detailed design descriptions of all algorithms
5. program flowcharts
6. program design languages or pseudo code
7. data base descriptions
8. detailed operating instructions
9. program logic and data interface diagrams and descriptions
10. hardware interfaces
11. Fault Tree Analysis

H. Reliability Demonstration Test Plan - Submit to Sound Transit, the Reliability Test Plan for approval and include the following:

1. Description of the tests to be performed
2. The success/failure criteria for measuring MTBF values for individual equipment items, subsystems and system under test
3. Test schedule
4. Detailed reliability test procedures
5. Recommended accept/reject decision criteria for the reliability test that can be quantitatively measured

I. Reliability Demonstration Test Procedure - Prepare a Reliability Demonstration Test Procedure to substantiate the Reliability Calculations and Substantiating Data in 3.5 D

J. Reliability Demonstration Test Report – Prepare a Reliability Demonstration Test Report to document the test results. Report all failures and the MTBF for each individual equipment, items, subsystems and system under test.

3.02 APPLICATION

A. Reliability Performance Validation Tests - Perform tests on equipment on the Contractor's premises.

1. Exhibit availability equal to, or greater than, 99.997 percent for the ventilation equipment. Base this system reliability value on the following formula:

\[
R_o = \frac{N_{toa} - N_{tof}}{N_{toa}} \times 100
\]

Where:

\( R_o \) = Operational Reliability

\( N_{toa} \) = Number of test operations attempted

\( N_{tof} \) = Number of test operations failed

2. Perform the minimum number of test operations required to achieve the specified reliability with a 95% confidence level. Record test operation failures in the test data when a detected cessation or error in the specified response of the operation being tested occurs. Record the failure of the system to furnish all correct responses to a test operation.

3. Maintain a failure summary record that contains all the information necessary to calculate the reliability values of the subsystems. Maintain equipment to verify the successful demonstration of the Reliability requirements. Make the failure record available for review by Sound Transit or its designee.
4. Test for validation of sensitivity, adjustment of range, reset, durability and environmental performance. Conduct sufficient testing to adequately demonstrate the confidence levels of performance specified. Develop a comprehensive test plan to demonstrate all of the preceding by a series of tests at facilities approved by Sound Transit or its designee.

B. Reliability Demonstration Test

1. Perform the Reliability Demonstration Test to show compliance with specified Reliability requirements. Commence the test following the conclusion of the System Integration Tests and continue for a period of one year during the pre-revenue and revenue operations periods under full system operations. Sound Transit or its designee operates and maintains the system according to procedures described in approved Contractor documentation.

2. If the system and its subsystems and assemblies do not meet the specified reliability requirements, make the necessary corrections so that the specified reliability requirements are met.

3. Maintain a failure summary record which contains all the information necessary to calculate the reliability values of the system and its subsystems in order to verify the successful demonstration of the reliability requirements. Make failure records available for review by Sound Transit or its designee. Capture maintainability data during this test.

C. Corrective Action for Test Rejection – Perform failure analysis of reported failures in order to identify the cause of the failure and the need for corrective action. Submit a plan for corrective action that includes proposed restart procedures, proposed changes, and appropriate supporting data, and clearly identify a specific method of verifying the effectiveness of the correct actions. Do not discount or change and the specified performance and required characteristics of the equipment to achieve specified reliability requirements.

D. Submit a final report summarizing all aspects of the System Assurance Program Plan. Include analyses, test procedures, actual values, assumptions, descriptions of the program, final audit results, and problems encountered.

3.03 MAINTENANCE

A. Establish, maintain and submit to Sound Transit for approval a Maintenance Program Plan that addresses the following:

B. Optimize considerations of equipment downtime, maintenance costs, technical skills, and spare equipment costs.

1. Maintenance Concept - The maintenance concept employs the maximum use of modular LRU items such that restore to service is accomplished by LRU removal and replacement. Minimize the use of external test equipment by using suitably buffered, built-in annunciation of an LRU fault condition.

a. Preventive maintenance and inspection for equipment using accepted industry standards for equipment of the type specified herein. Determine the requirements for preventive maintenance and inspection, and submit to Sound Transit for review and approval.

b. Maintenance will be performed at three discrete levels: on-line, off-line, and depot, as follows:
1) Level 1 - On-line maintenance is that performed on an in-place and operational equipment element without disrupting service. Facilitate identification of interfaces with other system elements using test points or built-in indicators.

2) Level 2 - Off-line maintenance is that performed on in-place but out-of-service equipment elements. Periodically test equipment that frequently enters and leaves revenue service to verify proper operation. Thoroughly exercise each equipment function with special test equipment. Facilitate fault isolation to the functional module level using the test equipment. Allow maintenance to lowest line level replaceable unit with this equipment and procedures.

3) Level 3 - Depot maintenance is that which is performed on out-of-place and out-of-service equipment elements. Perform this maintenance a shop or depot area where standard test equipment and fixtures are available. Allow maintenance of the lowest line level replaceable unit with this equipment and procedures.

2. Maintenance Analyses (Emergency Fans and Smoke Control System Fans)
   a. Develop a detailed system/equipment maintenance plan based upon the operational and support concepts and requirements established in this Contract. Develop inputs to the Plan for a detailed Contractor-furnished maintenance concept with inputs to the Plan as the initial step, and evolve the Plan through repetitive maintainability analysis into detailed maintenance.

3. Maintainability Calculations and Substantiating Data
   a. Provide a quantitative allocation of maintainability requirements to significant functional levels of the system, subsystems, and equipment.
   b. Predict the adequacy of the design to meet maintainability quantitative requirements.
   c. Predict design features that will require corrective action during early stages of design and development.
   d. Provide Corrective Maintenance Analysis and Preventive Maintenance Schedules prepared in accordance with ST procedures.

4. Quantitative Requirements – Meet or improve maintainability requirements stated in mean time to repair (MTTR) through design and analysis for equipment. These requirements are the following:
   a. Maintainability Demonstration Plan
      1) Proposed selection of representative tasks (corrective- and preventative-maintenance tasks) that constitute the maintainability test sample. For purposes of maintainability demonstration, a task is defined as all necessary steps (i.e., troubleshooting, disassembling, removing, replacing, repairing, and verifying) that constitute one sample task.
2) Identification of facility/resources needs, safety procedures to be followed, personnel skill levels and training, support equipment or special tools, spare parts, and the Commission or its designee coordination requirements.

3) The criteria for measuring MTTR values for individual equipment items, subsystems and system under test.

4) Test schedule.

5) Detailed maintainability test procedures, and the maintenance procedures to be followed.

6) Recommended accept/reject decision criteria for the maintainability demonstration test that can be quantitatively measured.

7) Attain Sound Transit’s approval of the Plan prior to the start of maintainability demonstration testing. Base the extent of calculations and data submittals on the complexity and intended use of the products. Existing data and calculations for standard manufactured products may be submitted.

8) Meet MTTR of 4 hours for Emergency Fans and Smoke Control Fans.

9) Meet MTTR of 2 hours for Station Exhaust Fans.

10) Perform supplemental failure analysis for any unit where the time to repair exceeds 2 times the MTTR.

END OF SECTION
PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes specifications for general requirements for Systems Assurance for Reliability, Maintainability, and Availability that is applicable to the Static Uninterruptible Power System (UPS)

B. Related Sections: The work of the following Sections is related to the work of this Section. Other Sections, not referenced below, may also be related to the proper performance of this work.

   1. Section 26 33 53, Static Uninterruptible Power Supply.

1.02 REFERENCES

A. This Section incorporates by reference the latest revisions of the following documents.

   1. U.S. Department of Transportation (USDOT)
      a. System Safety Glossary
   2. Hazard Analysis Guidelines for Transit Projects
      a. FTA-MA-26-5005-00-01
      a. MIL-STD-882C
   4. Underwriters Laboratory (UL)
      a. UL 1778

1.03 DEFINITIONS

A. The USDOT, System Safety Glossary dated June 1986, contains terms and definitions that are generally applicable to these Contract Specifications. Terms and definitions are contained within these Contract Specifications. In the event of conflict between definitions contained in the referenced document and those contained herein, the definitions of these Contract Specifications shall govern.

B. Availability (A): The probability that the system is completely operational at any point in time when used under stated conditions, where the time considered is operating time, diagnostic time and active repair time.

C. Independent Failure: A failure that occurs without being caused by the failure of another item.
D. Relevant Failure: A relevant failure of an item is an independent failure that results in a loss of function of that item caused by either of the following:

1. A fault in the item while operating within its design and environmental specification limits.
2. Improper operation, maintenance, or testing of the item as a result of Contractor-supplied documentation.

E. Non-relevant Failure: Any failure condition of an item not included in the definition of relevant failure, such as the following:

1. A failure caused by malfunctions of other equipment.
2. A failure by human error, except error caused by improper operation, maintenance, or testing of the item as a result of Contractor-supplied documentation.
3. A failure caused by operating the item outside its design or environmental specification limits.

F. Lowest Line Replaceable Unit (LLRU): The lowest assemblage of components or piece parts to which a malfunction can be isolated and that can be readily replaced in its field application.

G. Mean Time Between Failure (MTBF): The arithmetic average of the times between successive failures of an individual item or each of the members of a population of items expressed as a ratio of the total operating time, $t$, accumulated by the total population of identical items to the total number of relevant failures, $F$, occurring within the population of identical items during time, $t$. MTBF is expressed quantitatively by the following equation:

$$MTBF = \frac{t}{F(t)}$$

H. Corrective Maintenance Time: The corrective maintenance time is the summation of elapsed time intervals actively expended to troubleshoot and fault-isolate a failure, remove and replace/repair faulty items, and perform functional checkouts to verify restoration to operational status.

I. Mean Time To Repair (MTTR): The ratio of the total active corrective maintenance time, $t_{cm}$, expended during a given time interval, $t$, by the total population of identical items to the total number of relevant failures, $F$, which require corrective maintenance and which occur within the population of identical items during time, $t$. MTTR is expressed quantitatively by the following equation:

$$MTTR = \frac{t_{cm}(t)}{F(n)}$$

J. Maximum mean baseline time to repair (MAXMBTTR): The 90th percentile of the distribution of baseline MTTR, in hours, for major subsystems.

1.04 SYSTEM DESCRIPTION

A. UPS Reliability Requirements

1. A guaranteed minimum MTBF for each UPS assembly is 50,000 hours under indicated environmental conditions. This value includes the contribution of the Static Bypass Switch that applies to the UPS itself, whether the bypass source is available or not.
2. A guaranteed minimum MTTR for each UPS assembly is not to exceed 90 minutes.

3. Demonstrate that each UPS assembly has an Availability (A) of not less than 99.997 percent. This value includes the availability of the utility bypass source.

4. Complies with UL 1778

1.05 SUBMITTALS

A. Procedure: Section 01 33 00, Submittal Procedures.

B. Reliability Prediction Analysis Report within 120 Days after Notice to Proceed

C. Reliability Demonstration Test Plan within 240 Days after Notice to Proceed (not required if equipment is UL listed)

D. Reliability Demonstration Test Procedure and Test Report Forms 90 Days prior to Reliability Testing

E. Reliability demonstration Test Report(s) within 3 Work Days after completion of test

F. Fault Isolation and Troubleshooting Plan within 240 Days after Notice to Proceed

G. Incident/Failure Reports within 3 Days after Incident or Failure

H. Preliminary Failure Analysis Reports within 30 Days after Incident or failure

I. Failure Analysis Report updates every 15 Days after the Preliminary Failure Analysis Report is issued and every 15 Days thereafter until the Final Failure Analysis report is issued.

J. Maintenance Program Plan 30 Days prior to Reliability Testing

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 PREPARATION

A. Reliability Prediction Analysis – Prepare a Reliability Prediction Analysis Report and submit to Sound Transit for review and approval. Base the reliability analysis on historical performance of like equipment in an application and environment similar to that of prior test data from other rail transit agencies. As a minimum, the historical performance reliability analysis is to identify the following:

1. Equipment identification by LLRU part number.

2. Prior application and environment.

3. Precise design use of LLRU.

4. For part numbers, exact description of modifications since accumulation of prior use data.

5. Adjustment factors and related rationale used to modify historical data to the Sound Transit equivalent performance. Adjustments shall consider differences in
application including level of use and duty cycle, environment, and modification as a minimum.

6. User identification by name and geographical location.

7. Date of use.

8. Number of individual LLRUs in use.

9. Number of hours of use per unit and total.

10. Number of independent failures experienced during the operating hours for which the analysis is presented.

11. Calculated MTBF.

12. Comparison of calculated MTBF with the required MTBF in a table for each LLRU.

13. Estimated infant mortality failure, if any.

14. UL listed identification and comparison of use for any LLRU without a MTFB.

B. Incident/Failure Reporting System - Employ controlled data collection system for collecting, analyzing, and recording all functional non-conformances and suspected non-conformances that occur during in-plant tests and those that occur at installation or test site prior to acceptance. Prepare Failure Analysis Report in accordance with FTA Hazard Analysis Guidelines for Transit Projects. Differentiate between failures due to design or workmanship and those due to other causes such as error in handling, transporting, storing, and operating the equipment in the Incident/Failure Reports and in the Failure Analysis Reports. Include provisions to ensure that problems are detected and investigated, and that effective corrective actions are taken on a timely basis to reduce or prevent repetition of the incidents/failures. Provide copies of Incident/Failure Reports and Failure Analysis Reports to Sound Transit.

C. Develop a detailed system/equipment maintenance plan based upon the operational and support concepts and requirements established in this Contract. The initial step in the development of the inputs to the plan includes development of inputs to a detailed Contractor-furnished maintenance concept, which evolves through repetitive maintainability analysis into a detailed maintenance plan for supporting the timely operation of the system/equipment in the planned operational environment. Provide manufacturer’s recommendations for the following:

1. Frequency of maintenance required for each lowest level replaceable unit, subassembly and assembly.

2. Facilities required.

3. Support equipment and tools required.

4. Skill level and number of personnel required.

5. Equipment, component, and piece part repair policy.

6. MTTR (repair and replace)

7. MTBF
D. Fault Isolation and Troubleshooting Plan - Prepare and maintain a Fault Isolation and Troubleshooting Plan as part of the submittals, and is a working document to ensure that fault isolation and troubleshooting features essential to the achievements of specified requirements are incorporated in the equipment.

E. Provide detailed Maintenance Plan and Fault Isolation and Troubleshooting Procedures. Follow these procedures during the contractually required maintenance period.

F. Follow the approved Maintenance Plan for the UPS. Follow this plan during the period for which the Contractor is responsible for maintenance.

3.02 APPLICATION

A. Reliability Testing

1. Perform reliability and availability testing in accordance with Contractor developed, and Sound Transit approved test procedures.

2. Exhibit availability equal to or greater than, 99.99 for the UPS. Base this system reliability value on the following formula:

\[
R_o = \frac{N_{toa} - N_{tof}}{N_{toa}} \times 100
\]

Where:

- \( R_o \) = Operational Reliability
- \( N_{toa} \) = Number of test operations attempted
- \( N_{tof} \) = Number of test operations failed

3. Reliability test requirement shall be equal to, or greater than, the minimum MTBF specified herein to be acceptable.

4. Demonstrate that availability test requirement are equal to, or greater than, those specified herein.

5. Maintain a failure summary record that contains all the information necessary to calculate the reliability values of the subsystems. Maintain equipment to verify the successful demonstration of the Reliability requirements. Make the failure record available for review by Sound Transit or its designee.

B. Maintainability

1. Optimize considerations of equipment downtime, maintenance costs, technical skills, and spare equipment costs in the Maintenance Plan.

2. Maintenance Concept - The maintenance concept employs the maximum use of modular LLRU items such that restoration to service is accomplished by LLRU removal and replacement. Minimize use of external test equipment by the use of suitably buffered, built-in annunciation of an LLRU fault condition.

   a. Utilize accepted industry standards for equipment of the type specified herein for preventive maintenance and inspection for this equipment.
Determine the requirements for preventive maintenance and inspection and submit to Sound Transit for review and approval.

b. Perform maintenance at three discrete levels: on-line, off-line, and depot, as follows:

1) Level 1 - On-line maintenance performed on an in-place and operational equipment element. Facilitate identification of interfaces with other system elements using test points or built-in indicators without disrupting service.

2) Level 2 - Off-line maintenance performed on in-place, but out-of-service equipment elements. Periodically test equipment that frequently enters and leaves revenue service to verify proper operation. Use special test equipment shall thoroughly exercise each equipment function. Use test equipment to facilitate fault isolation to the functional module level. Use equipment and procedures to allow maintenance to lowest line level replaceable unit.

3) Level 3 – Perform depot maintenance on out-of-place and out-of-service equipment elements, in a shop or depot area where standard test equipment and fixtures are available. Utilize equipment and procedures to allow maintenance of the lowest line level replaceable unit.

C. Failure Reports

1. Prepare detailed Failure Reports on all failures on forms approved by Sound Transit. Replace any unit that can not be repaired in 2 times the MTTR. Redesign to be repairable or to perform without replacement for 1.5 times the original identified MTBF any unit or assembly requiring more than 3 replacements.

D. Reliability Demonstration Testing

1. Prepare a Failure Report for any unit that fails during Reliability Demonstration Test period. Issue a Failure Report within 3 days of the original failure. Issue a Preliminary Failure Analysis Report within 30 Days of the original failure. Issue Failure Analysis status update reports every 15 Days thereafter until the Final Failure Analysis Report is issued.

2. Reliability demonstration testing shall be performed for one year, excluding a period sufficient to rule out burn-in or infant mortality failures.

E. If the equipment is listed U.L. for the intended application, failure reports and demonstration reliability testing may be waived subject to the approval by the Resident Engineer.

END OF SECTION
PART 1 - GENERAL

1.01 SUMMARY

A. This Section specifies general requirements for furnishing, installing, and operating temporary facilities and controls. Maintain and transfer all temporary facilities as indicated in 01 12 19, Contract Interface.

B. Related Sections: The work of the following Sections is related to the work of this Section. Other Sections, not referenced below, may also be related to the proper performance of this work.

1. Section 01 12 19, Contract Interface.
2. Section 01 51 15, Temporary Electrical Power
3. Section 01 57 24, Temporary Site Water Discharge.
4. Section 21 12 00, Fire Suppression Standpipes.
5. Section 32 31 13, Chain Link Fences and Gates.
6. Section 33 01 00, Operation and Maintenance of Utilities.

1.02 REFERENCES

A. This Section incorporates by references the latest revisions of the following documents:

   a. ASTM A392 Zinc-Coated Steel Chain-Link Fence Fabric

2. National Fire Protection Association (NFPA):
   a. NFPA 130 Fixed Guideway Transit and Passenger Rail Systems
   b. NFPA 14 Installation of Standpipes and Hose Systems

3. Manufacturers Standardization Society (MSS):
   a. MSS SP 58 Pipe Hangers and Supports – Materials, Design and Manufacture
   b. MSS SP 69 Pipe Hangers and Supports – Selection and Application
   c. MSS SP 89 Pipe Hangers and Supports – Fabrication and Installation Practices

4. City of Seattle (COS):
5. Washington State Department of Transportation (WSDOT):
   a. WSDOT Standard Specifications for Road, Bridge and Municipal Construction, Section 9-28
   b. WSDOT Standard Plans

6. Occupational Safety Health Administration (OSHA):
   a. 29 CFR Underground Construction - 1926.800

7. Washington Industrial Safety and Health Administration (WISHA):
   a. Underground Construction WAC 296-155 Part Q

1.03 SUBMITTALS
   A. Provide a joint procedure and interface schedule to demonstrate how the working interfaces between U220, U260 and U830 contractors will be coordinated and managed.

1.04 TEMPORARY UTILITIES
   A. Determine the need for temporary utility service as may be required to prosecute the Work and make arrangements with utility companies for such services. Remove all materials and equipment involved with temporary utility services as part of final cleanup, except as otherwise indicated.
   B. Provide and maintain during the course and progress of the Work all electrical power and wiring requirements to facilitate the work of all trades and services associated with the Work. Provide electrical power at own expense. Furnish all temporary wiring, feeders, and connections, as required.
   C. Provide utilities and power for Sound Transit Construction Offices, as specified herein.
   D. Refer to Section 01 51 15, Temporary Electrical Power, for details of the interim University of Washington feed and permanent site feeder.

1.05 TEMPORARY SANITARY FACILITIES
   A. Provide the necessary toilet conveniences and washing facilities, secluded from public observation. Keep facilities in a clean, sanitary condition.
   B. The use of sanitary facilities in adjacent commercial buildings, tenant areas, or other private facilities will not be permitted.
   C. Service temporary toilet facilities regularly, and secure them to prevent damage by vandals.

1.06 TEMPORARY FIRST AID FACILITIES
   A. Furnish, install, maintain, and remove temporary first aid facilities and services at each Site of the Work throughout the construction period.
   B. First aid personnel:
      1. Trained in the rendering of first aid.
      2. Possess a valid first aid certificate issued by the American Red Cross.
3. The number of first aid-trained personnel shall comply with the applicable safety regulations.


5. First aid personnel training shall conform to the requirements of OSHA and WAC 296-800-150.

C. First aid supplies:

1. Approved by a physician licensed to practice in the State of Washington.

2. Conform to the requirements of OSHA and WAC 296-800-150.

3. Accessible for immediate use.

D. Furnish at least one sixteen-unit first aid kit (or equivalent) for every twenty-five persons, or fraction thereof, present on Site. Store first aid supplies such that they can be moved to the location of an injured or acutely ill worker. Provide stretchers, and maintain, protect, and make stretchers readily accessible at all times.

E. Clearly identify a first aid station as such. Provide an enclosed space protected from the weather, cooled in hot weather, warmed in cold weather, and lighted. Furnish station with facilities to render medical services appropriate to the occupational working conditions and response time of the local emergency medical service. Position station adjacent to either access road or public street.

1.07 TEMPORARY OFFICES FOR SOUND TRANSIT CONSTRUCTION MANAGEMENT

A. Provide a field office as a combination of stackable mobile units, with utilities, power, telephone and parking facilities, hereinafter called "field office", for the exclusive use of Sound Transit. Situate the field office in the work areas at locations indicated. Completely furnish the field office at the project site, and make it ready for occupancy within the period specified in these Contract Specifications. Maintain and service as specified herein until the Final Acceptance of the Contract or as otherwise permitted by Sound Transit, whichever occurs sooner. Furnish each mobile unit with the features specified herein:

1. Flush-toilet and washing facilities for Sound Transit personnel within the temporary trailer.

B. The field office complex shall include one 24-foot by 60-foot 2-story unit. (Stacked four units of 12 feet by 60 feet each) with stairs, access ramps, decks, utilities, power, and parking facilities.

C. The 24-foot by 60-foot office shall have the following rooms/areas:

1. Six offices with interior doors (approximately 144 sq ft each)

2. One conference room (approximately 340 sq ft in a rectangular shape) on 1st floor.

3. Reception area

4. Common/bull pen area

5. Men’s and women’s restrooms (approximately 64 sq ft each)
6. Computer server/network closet (approximately 48 sq ft)
7. Storage closet with shelves (approximately 48 sq ft)
8. Copy machine room/area
9. Kitchen area with double stainless steel sinks, 8-foot counter with storage above and below, refrigerator, microwave and trash bin.
10. ADA access to first floor.
11. Ceiling mounted projection screen.

D. Construction and Materials: Obtain and pay all costs for hauling, building, and connection permits. Construct the field office satisfactory to Sound Transit. Provide all materials in good commercial quality. Provide field office with a minimum of 2,880 square feet of usable area for the worksite, and with the following features and facilities:

1. Exterior and interior surfaces, other than factory finish: painted with two coats of an approved paint of a color or colors approved by Sound Transit. No painting is required on aluminum or stainless steel surfaces.
2. Interior walls and ceiling panel: finished plywood or gypsum wallboard of not less than 1/2 inch thickness, or other suitable material,
3. Floor cover: resilient flooring material such as vinyl composition tile or sheet vinyl flooring. Construct floors to withstand a live load of 150 pounds per square foot (psf).
4. Lighting: Provide a minimum of 100 foot-candles at desk height uniformly in all areas except rest room.
5. Duplex electrical receptacles around interior walls at approximately ten-foot spacing. Provide one 20 amp circuit with 20 amp plug for the unit for two Sound Transit provided copy machines. The circuit shall be dedicated to the copy machine.
6. Internet and telecom receptacles pre-wired from the computer server/network closet around interior walls and floor that correspond to the desk requirements outlined in Article 1.06E, herein.
7. Automatically controlled heating/cooling system.
8. Electrical utility connections.
9. Fire extinguishers on both floors and at each exit.
10. First aid kit for thirty people.
11. Provide adequate access from public streets to the field office, together with space for parking twelve cars. Grade access and parking areas for drainage and surface with pavement in an approved manner.
12. Pedestrian access ramps meeting the requirements of the “Persons with Disabilities (Equal Opportunities, Protection of Rights & Full Participation) Act”.
13. Flush-toilets, washing facilities, and hook-ups to sewer and water utilities. Bathrooms shall comply with ADA Accessibility requirements.

14. Tie down field office to meet state and local wind and seismic construction criteria.

15. Exterior Hose Bib with boot scrape

16. Telecommunication connections for phones and computers consisting of two 2-inch underground conduits extending from street services to the server closet.

17. Intrusion alarm, and call-up security system.

E. Furnish the 24-foot by 60-foot two-story field office with the following:

1. Two of the offices shall include one desk (30 inches by 60 inches), ergonomic swivel chair with armrests, side table, bookcase, 2-drawer file cabinet, round table with four side chairs, 3-foot by 4-foot whiteboard, waste basket, and coat hook.

2. Four of the offices shall include two desks, two ergonomic swivel chairs, two side chairs, two bookcases, two two-drawer file cabinets, two waste baskets, two coat hooks, one side table, 3-foot by 4-foot whiteboard.

3. The reception and open bull pen area shall be provided with soft wall dividers for eight work stations. Each workstation shall have a desk, ergonomic swivel chair, bookcase, two-drawer file cabinet, side chair, and waste basket or an integrated work station that provides the equivalent furnishings.

4. The conference room shall have a 5-foot by 15-foot conference table, fourteen swivel chairs, ten stack chairs, a 4-foot by 8-foot whiteboard and a waste basket.

5. Eight four-drawer, legal size file cabinets (two shall be lockable).

6. One 36-inch by 60-inch minimum drafting table with drafting chair.

7. Entry area shall have a 3-foot by 4-foot whiteboard, a tack board (approx 3 feet by 4 feet), and a coat rack.

8. Twenty keys to the field office.

F. Provide maintenance and service throughout the specified period as follows:

1. Repair and daily cleaning of the field office, parking and access area. Cleaning service shall include providing paper towels and toilet tissue.

2. Furnish all utilities excluding telephone and internet service.

3. Provide security measures and area protection equivalent to that used for the Contractor field office. Minimum security shall include security bars on windows. At least two windows to have bars that are removable during emergencies. All doors shall have additional steel plate security hardware to protect door hardware and jamb.

4. Bottled water and water dispenser with hot and cold water.

G. Sound Transit will provide the following:
1. Installation of the phone and computer network
2. Phone and internet service
3. Printers, copier, scanner, and fax machine

H. Field offices and furnishings shall become the property of Sound Transit at the conclusion of the Contract.

I. Additional requirements as indicated on Contract Drawings.

J. Submittals:
1. Procedures: Section 01 33 00, Submittal Procedures.
2. Detailed Construction Drawings of Field Office, furniture and equipment layout, and utility hookup sizes and locations.
3. Manufacturer’s product data for materials used to construct trailers, heating and cooling systems, and various required amenities as listed above.

1.08 PROJECT IDENTIFICATION


1. Design:
   a. Construct F.T.A. Project and General Construction Signs from a sheet of plywood 4 feet by 8 feet in size, mounted on two posts set in the ground. See Exhibit A.
   b. Provide Resident Engineer's field office signs of similar design, 3 feet by 6 feet in size, for wall or post mounting, as required by Sound Transit.


3. Construction: Set the plywood signs into the frame, and miter and screw the frame corners together. Screw the sign to two, 2-by-6 Douglas-fir cleats that are in turn bolted to the posts with at least two 1/4-inch bolts per post.

4. Installation: Set the sign posts in the ground 3 feet 6 inches, with the top of the sign horizontal and even with the top of the posts, 4 feet 6 inches above the ground.

5. Painting: Apply one coat of primer sealer and two base coats of exterior semi-gloss enamel with the wording dimensions and colors for each sign as shown in Exhibit A.

6. Maintenance: Keep signs clean and in good repair. Upon completion of the work, either leave the signs in place, or remove and dispose of as directed.
7. Other Signs: Additional identical signs desired and paid for by the Contractor may be placed at intermediate points as approved by Sound Transit. Place no other signs on the right-of-way or within the work limit line, unless approved by Sound Transit.

B. Business Access Signs During Construction: Provide ten signs for directing access to impacted businesses or University of Washington facilities during construction, including directions for parking.

1. Sound Transit will supply layout and design of each sign. Each sign will be 4 feet by 4 feet in size. See Exhibit B for an example.

2. Materials: Engineer-grade reflective sheeting applied to 0.080-inch aluminum sheeting. Mount sign on metal tripod stand as manufactured by AABCO Barricade Co. or approved equal.

3. Construction: In accordance with these Contract Specifications and WSDOT Standard Specifications for Road, Bridge and Municipal Construction, Section 9-28. Secure sign assembly to remain stationary during high winds.

C. Install signs provided by Sound Transit.

1.09 TEMPORARY FENCING

A. Furnish, construct, maintain, and later remove temporary fencing around the jobsite perimeter as indicated.

B. Temporary Fencing and Gates shall be a minimum of 8 feet tall and shall be able to completely secure the site as shown in the Contract Drawings. Fence shall be Zinc-Coated Chain Link Fence complying with the requirements of ASTM A392-07.

C. All Type 1 and Type 2 fencing and the 12-ft high Temporary Construction Wall along the south end of the work site shall be painted or be provided with a presentable finish to be approved by the Resident Engineer. Refurbish finish of fences annually or as directed by the Resident Engineer.

D. Used materials may be employed for temporary fencing, provided such used materials are good, sound, and suitable for the purpose intended.

E. Repair or replace temporary fencing that is damaged from any cause during the progress of the Work at no additional cost to Sound Transit.

F. When no longer required for the Work, remove temporary fencing from the jobsite, except as otherwise provided herein. Removed fencing and related materials will remain the property of the Contractor.

1.10 SITE LIGHTING

A. Provide lighting of sites as required to complete the work. Provide lighting at the Sound Transit Field Offices site and the Pine St. Staging area.

B. Keep lighting as low as possible (in both height and foot-candles) while providing safe working conditions.

C. Provide perimeter lighting adequate for the safety and wayfinding of pedestrians.

D. Provide cut-off luminaires to direct the light onto the construction site and eliminate glare skyward or onto surrounding properties.
E. **Temporary Lighting in tunnels**

1. Provide temporary lighting in the tunnel during construction.
2. Remove temporary lighting at the end of Work, when permanent tunnel lighting is operational.

### 1.11 WORK AND STORAGE AREAS

A. The staging areas available are shown on the Contract Drawings.

### 1.12 ENCLOSED STORAGE AND SHOPS

A. Provide all temporary storage and shop rooms that may be required at the Site for safe and proper storage of tools, materials, and equipment.

B. Remove such facilities within three days of receipt of notices from the Resident Engineer that removal is necessary, and incur all expenses for such removal.

C. Storage of gasoline or similar fuels shall conform to NFPA regulations and local fire department regulations.

### 1.13 UTILITY MAINTENANCE

A. Support and protect all utilities indicated to remain in place as required by the utility owner. Avoid service disruptions and maintain access to all utilities during construction.

B. Conform to requirements of Section 33 01 00, Operation and Maintenance of Utilities.

### 1.14 TEMPORARY TUNNEL VENTILATION AFTER COMPLETION OF TUNNELLING

A. Provide, install, operate and maintain temporary ventilation in the tunnels following breakthrough of the tunnel boring machine TBM(s) and removal of the tunnel ventilation used during excavation to meet OSHA and WISHA requirements. As a minimum, delivering fresh air at an airflow rate necessary to meet the requirements indicated below.

1. Provide the system ready for operation at the moment that temporary TBM ventilation is no longer required or otherwise effective.

2. Maintain minimum of 60 feet per minute velocity throughout the tunnel, via mechanical ventilation system at all times work is being carried out in the tunnel. During periods when the tunnel is unoccupied this requirement may be reduced to 50 percent with the approval of the Resident Engineer.

3. Submit a temporary pre-construction ventilation system design for review and approval by the Resident Engineer.

4. Include a design that will deliver a minimum 100 cfm per horse power for all diesel operated equipment, 50 cfm air per person.

5. Install fans with screens, anchored with seismic vibration isolators, motors, controls and size to maintain noise level within the defined construction limits.

6. Divert air flow to provide proper air movement and maintain flow as defined above.

7. Be responsible for ductwork, isolation damper, electrical power and all system associated accessories.
8. The location and installation of the temporary ventilation shall not create hazard to construction or interfere with other temporary facilities.

1.15 TEMPORARY TUNNEL DRAINAGE PUMPS AND DISCHARGE

A. Provide temporary pumps, piping, and controls to remove drainage water from the U220 tunnel low point (Cross Passage No. 18) to the University of Washington Station site. Drainage water includes normal drainage from seepage, storm, and process water, and emergency flows from the temporary tunnel standpipe. Select and size pump(s) and discharge piping to remove normal and emergency flows throughout the project. Emergency flows include the required discharge flow from the temporary tunnel standpipe.

B. Provide temporary power for pumps during tunnel boring operations as required by this Contract Specification. Ground pumps in accordance with the National Electric Code.

C. Temporary pumps shall be operational 24 hours a day, seven days per week, and until the end of this Contract. Maintain an inventory of spare pump(s), of quantity and capacity equal to the installed pumps, at the project site at all times. Provide hoist or other means to remove and replace pumps.

D. Treat tunnel drainage discharge water as required by Section 01 57 24, Temporary Site Water Discharge.

E. The location of the temporary pumps and discharge piping shall not create any hazard to construction or interfere with other temporary facilities.

F. Existing Tunnel Drainage Pumps

1. Refer to Section 01 12 19, Contract Interface.

   a. Maintain operation of existing temporary pumps, including but not limited to, the existing pumps located at the existing sump in the tunnel at Cross Passage No. 18 and within the University of Washington station box.

   b. Coordinate removal of temporary pumps at pump stations designated to receive final pumps and associated work.

G. Use of Sumps at the Low Point Pump Station:

1. The existing sump(s) may be utilized for collection of tunnel drainage and installation of temporary sump pumps. The use of the sump for temporary tunnel drainage shall be coordinated with the work shown on the Contract Drawings and in these Contract Specifications. Drainage discharge shall be treated in accordance with these Contract Specifications.

   a. Coordinate removal of temporary pumps at pump station designated to receive final pumps and associated work.

1.16 TEMPORARY STATION STANDPIPE

A. Provide and maintain a temporary standpipe system as described below in accordance with the following:

1. National Fire Protection Association (NFPA) 14, Standard for the Installation of Standpipes and Hose Systems

2. City of Seattle, Seattle Fire Code, Chapter 9.
B. Design standpipe for the pressure required to deliver a minimum flow of 500 gpm, originating from the University of Washington site, with a 130 psi residual pressure at the hydraulically most remote hose connection, together with a simultaneous flow of 500 gpm at the next most remote hose connection on the same standpipe and for the test pressure requirements of the these Contract Specification.

C. Support the standpipe in accordance with the requirements of MSS SP 58, MSS SP 69 and MSS SP 89 and the support design requirements of NFPA 13. In case of conflict the more stringent requirements will apply.

D. Employ means to prevent freezing of the pipes in winter.

E. Provide straight through or angle type fire hose valves at all levels and a maximum 150 feet apart or as directed by the Seattle Fire Department and of a design similar to that specified in section 21 10 00.

F. Provide pressure reducing fire hose valves (PRFHV) where directed by Seattle Fire Department (SFD). As a minimum, provide PRFHV’s where the pressure exceeds 180 psi while flowing 300 gpm.

G. Installation, testing, and maintenance of the standpipe shall be performed by individuals who have obtained specific SFD certification in accordance with the SFC.

H. The temporary standpipe shall be provided with minimum 4-inch riser to the ground surface level, terminating in an SFD approved fire department 4-way, 2.5-inch connection manifold located not more than 100 ft from a fire hydrant.

I. Hydro test the entire system when new lengths of pipe are added as construction progresses. The test pressure shall be 50 psi greater than the maximum piping system pressure during the flow conditions stated above. Repair all leaks and retest before system is put back in use.

J. The location the temporary standpipe shall not create a hazard to construction or interfere with other temporary facilities.

K. The temporary standpipe system will remain in place until the permanent stairwell standpipe system installation is complete or as directed by the Resident Engineer.

1.17 EXISTING TUNNEL STANDPIPE

A. Maintain the existing wet tunnel standpipe and fire department connection, charged by the fire department, in each bore from the Capitol Hill Station Site to the University of Washington Site. Maintain each standpipe system as described below in accordance with the following:

1. National Fire Protection Association (NFPA) 130, Standard for Fixed Guideway Transit and Passenger Rail Systems

2. National Fire Protection Association (NFPA) 14, Standard for the Installation of Standpipes and Hose Systems

3. City of Seattle, Seattle Fire Code (SFC), Chapter 9

B. Modify existing fire department connection piping manifolds to accommodate construction and as construction progresses.

C. Employ means to prevent freezing of the pipes in winter.
D. Maintenance of the standpipe shall be performed by individuals who have obtained specific SFD certification in accordance with the SFC.

E. Maintain standpipe during construction until the entire tunnel and station fire-suppression system is complete or as directed by the Resident Engineer. See Section 21 10 00, Water-Based Fire-Suppression Systems, for testing requirements of the tunnel and station fire-suppression system.

1.18 TEMPORARY WATER SERVICE

A. Seattle Public Utilities will only allow one domestic meter and one fire service connection to serve the Sound Transit project site. The U220 contractor will obtain temporary service connections from SPU for their work. For the duration that the U220 contractor and U250 Contractor both occupy the site, the U250 Contractor may purchase water from and connect to the U220 contractor’s construction water system. The U220 contractor will provide sub-meters for the U250 Contractor’s connections and bill the U250 Contractor for water used in accordance with the City of Seattle SPU’s current water use billing rates.

B. Once the U220 contractor completes construction they will retire their service meters with SPU and then the U250 Contractor will then need to coordinate directly with SPU to obtain service from the existing meters.

1.19 TEMPORARY SEWER CONNECTIONS

A. Construct side sewer piping as necessary for the Sound Transit Construction Offices and contractor’s convenience on the University of Washington property. Discharge to existing sewer manholes within the construction site. Additional temporary sewer connections to MH-1 are not acceptable. Submit drawings of proposed temporary sewers to the Resident Engineer for approval. Obtain all necessary side sewer permits.
PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

EXHIBIT A

EXHIBIT B

END OF SECTION
PART 1 - GENERAL

1.01 SUMMARY

A. This section includes specifications for providing temporary electrical power for construction.

B. Related Sections: The work of the following Sections is related to the work of this Section. Other Sections, not referenced below, may also be related to the proper performance of this work.

1. Section 01 50 00, Temporary Facilities and Controls.

1.02 COORDINATION

A. During the time period when U220 and U250 operations overlap in the construction area, grant the U220 contractor access to the Seattle City Light (SCL) construction power. The U220 contractor will likewise be obliged to grant the U250 Contractor access to the SCL construction power.

1.03 COORDINATION WITH SEATTLE CITY LIGHT (SCL)

A. Coordinate Work affecting Seattle City Light (SCL) source power throughout the limits of the Contract with SCL through the Resident Engineer.

B. Contractor to coordinate with Seattle City Light (SCL) for the 26 kV temporary power supply needed for construction. Contractor to review the indicated location of conceptual underground raceways and vaults for 26 kV SCL power feeders’ to ensure it will not interfere with other construction activities and site improvements and is acceptable to SCL.

C. Contractor to make complete analysis of the temporary construction loads and power needs based upon the temporary power needed for all electrical loads at the site such as but not limited to temporary site lighting, power to construction trailers, tunnel lighting and sump pumps.

D. Electrical demand included under Part 2, Products is for reference only and should be verified after performing load flow and voltage calculations engineering analysis based upon the actual equipment that will be used by the Contractor.

E. Contractor is responsible for preparing necessary documentation as required by SCL for service to ensure that there will not be any power quality problems for the power grid.

F. Contractor is responsible for getting all approvals from SCL for equipment to be used.

G. Contractor will coordinate with the SCL through the Resident Engineer for scheduling and termination of the 26 kV cables.

1. Contractor will coordinate through the Resident Engineer for the low voltage 480Y/227 V power supply needs for station construction work and later interfacing with SCL to reroute 26 kV feeders for permanent power Attend
meetings called by the Resident Engineer to schedule and plan coordination activities with Seattle City Light.

PART 2 - PRODUCTS

PART 3 - EXECUTION

3.01 ELECTRICAL DEMAND
A. Coordinate with the U220 Contractor for construction power as required by the Contractor.

3.02 CONTRACTOR INSTALLED TEMPORARY POWER (SCL)
A. Temporary power will be installed as shown in the plans to the construction site. The 250 Contract will be required to provide power to the tunnel loads installed in previous contracts. It is the Contractor’s responsibility to determine actual loads and demands

B. Temporary Pad-Mounted Metering Cabinet to meter power from the SCL construction power feeder has been provided for the following items:
   1. 26KV/13.8 KV, 3 ph, (estimated) Transformer sized to provide tunnel construction power:
   2. 26KV/480Y/277V, 3PH, 4W Transformer sized for the sum of the following loads:
      a. Required Tunnel Power: 200kva
      b. Station construction power:
         1) Existing 400amp rated 480Y/277V 3PH, 4W switchboard has been provided as indicated on Contract Drawings.
         2) Construction needs are estimated at approximately 400KVA.
         3) Construction trailer: determined by Contractor
   C. Coordinate with SCL for rerouting of power from temporary switchgear to permanent switchgear inside station as shown in the contract plans. Permanent 26kv connection will be provided in future contract.

3.03 BACKUP POWER
A. Provide backup power sufficient to meet the secondary power requirements.
   1. Anticipated for additional essential power at the construction site.

B. After the SCL construction power feeder is installed, connect essential loads via a manual transfer switch to the SCL construction power feeder.

3.04 CLOSEOUT ACTIVITIES
A. Permanent connections to the SCL power source will be provided in the 830 contract.

B. At the conclusion of the 250 contract, permanent power connections for all loads in the station including tunnel loads fed by the station panels shall remain in place.
C. All station and tunnel loads will be energized from the temporary power source through the permanent switchgear at the conclusion of the 250 contract.

END OF SECTION
CONTRACT SPECIFICATIONS

SECTION 01 55 00
VEHICULAR ACCESS AND PARKING

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes specification for haul routes, site access, and parking for the construction sites.

B. Related Sections: The work of the following Sections is related to the work of this Section. Other Sections, not referenced below, may also be related to the proper performance of this work.

1. Section 01 12 16, Work Sequence.
2. Section 01 12 19, Contract Interface.
3. Section 01 55 26, Traffic Control.
4. Section 01 57 19, Temporary Environmental Controls.
5. Section 32 12 16, Asphalt Paving.
6. Section 32 13 13, Concrete Paving.

C. References:


1.02 SUBMITTALS

A. Procedures: Section 01 33 00, Submittal Procedures.

B. Access and Haul Plans, Locations, and Certifications.

1. Initial Plan
2. Updates to reflect modifications and/or alternative plans.

C. Haul Summary Reports.

1. Weekly Reports.

D. Parking and Staging Area Plan.

1.03 ACCESS AND HAUL PLANS

A. Written plan with drawings, which include the following:

1. Detailed Access and Haul Plan for the Work, including:
   a. Truck routes and access information from:
1) I-5
2) SR520
3) Montlake Blvd
4) Pacific Place and Pacific Street
5) Other roadways used for access and hauling required by the Contractor

b. Access into and out of the construction staging areas.
c. Coordination with U220 Contractor’s Access and Haul Plans

2. A copy of all necessary street use permits in connection with Contractor’s operations.

3. On-site roads required to transport materials.

4. Survey and document pre-existing roadway conditions along proposed haul routes on Montlake Blvd, NE Pacific St and NE Pacific Place from SR520 to the UWS and around the Triangle garage. This work will assist in determining necessary roadway maintenance and repairs as stated in Article 3.02, herein.

5. Copies of truck drivers driver licenses and certifications kept on record or file and made available upon request.

B. Truck Haul Route Plan will be based on the Contract Drawings and this Section.

C. Haul locations:

1. List all haul locations for all types and classification of material to be removed from the Site.
   a. If haul locations are to be added or location of material haul is changed, submit new haul location and types and classification of material.

2. Certifications that all haul locations are legally permitted for the type and content of the material to be disposed.
   a. Submit new certifications if the haul location is changed or if the type or content of the materials being disposed varies from that previously approved.

D. Truck Site access hours:

1. Submit truck Site access work hours based on the following hours that have been established for removal of spoils from the Site at NE Pacific Street:
   a. Monday through Friday: 9 am to 2 pm; 10 pm to 7 am
      1) From 7am to 9 am, no spoils removal will be allowed due to anticipated traffic congestion.
      2) From 9 am to 2 pm, spoils removal can occur. Trucks shall use designated haul route to SR 520 around the Triangle Garage.
      3) From 2 pm to 10 pm, no spoils removal will be allowed due to anticipated traffic congestion.
4) From 10 pm to 7 am, spoils removal may occur. Trucks may turn left at Montlake Blvd and NE Pacific St. from the Site to SR 520 using traffic signal control.

   a) These hours may be expanded during construction as approved by the Resident Engineer and City of Seattle (COS) based on allowable traffic congestion conditions.

b. Saturday: All Day.

   1) During 10 pm to 10 am, trucks may turn left at Montlake Blvd and NE Pacific St. from the Site to SR 520 using traffic signal control.

   a) These hours may be expanded during construction as approved by the Resident Engineer and COS based on allowable traffic congestion conditions.

c. Sunday: All Day.

   1) Spoils removal will be allowed on Sundays. Work will be limited at the Site for spoils removal, materials deliveries, and maintenance operations, as approved by the Resident Engineer.

   2) During 10 pm to 7 am, trucks may turn left at Montlake Blvd. and NE Pacific St. from the Site to SR 520 using traffic signal control.

   a) These hours may be expanded during construction as approved by the Resident Engineer and COS based on allowable traffic congestion conditions.

2. Submit truck Site access work hours based on the following hours that have been established for material deliveries to and from the Site at NE Pacific Street:

   a. Monday through Saturday: 5 am to 9 pm. Trucks leaving the Site shall use the designated haul route from the Site, around the Triangle Garage to SR 520. If material delivery trucks are leaving the Site between 10 pm and 7 am, trucks may turn left at Montlake Blvd. and NE Pacific St. to SR 520 using traffic signal control.

   b. Sunday: All Day. Work will be limited at the Site for spoils removal, materials deliveries and maintenance operations, as approved by the Resident Engineer.

   c. Trucks delivering special loads, such as steel/rail segments, and tunnel lining segments, will coordinate deliveries with the Resident Engineer.

3. Submit truck Site access work plan to use NE Pacific Place:

   a. The Contractor will be required to obtain approvals from the University of Washington (UW) and the Resident Engineer for use of the stadium exit at NE Pacific Place for all trucking operations.

4. Restrict trucks servicing the Site during Special Events. Special Events are described as UW home football game days; Commencement ceremonies; Windermere Cup Rowing Regatta; Convocation ceremonies; UW basketball home games; and two unspecified Special Events per year at University of Washington Husky Stadium.
a. Restricted truck site access hours shall conform to the Special Event Traffic Management Plan, see Section 01 55 26, Traffic Control.

b. For additional Site work requirements, see Section 01 12 16, Work Sequence.

5. For activities that require continuous work and hauling and cannot be completed within the hours specified in Article 1.03D.1, herein, and for which hauling of truck traffic would compromise the quality of the finished work, such as continuous concrete pours and slurry diaphragm wall panel installation, obtain the written approval of the Resident Engineer for hauling outside the hours specified in Article 1.03D.1, herein, a minimum of 24 hours prior to the start of the activity.

1.04 HAUL SUMMARY REPORTS

A. Include the following daily information for each Site:
   1. Material type.
   2. Material weight.
   3. Identity of each truck.
   4. Total number of trucks per day entering the Site.
   5. Origin of material for material brought on Site.
   6. Location of material disposal removed from the Site.

B. Format as approved by the Resident Engineer.

1.05 PARKING AND STAGING AREA PLAN

A. Written plans with drawings and narrative describing parking and staging areas. Include the following details:
   1. Location, size (number of stalls), and access requirements, if any, for Contractors off-site parking and staging areas.
   2. Sign location and text to be posted at each work site and at the Site access locations so employees are knowledgeable where parking is allowed.
   3. When parking or staging is provided on private property, include copy of lease, easements, or other agreements from the property owner prior to accessing the property.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 CONSTRUCTION

A. Contractor shall coordinate with other contractors, U220 contract, on a day-to-day basis as necessary to avoid conflicts and to maintain truck and general purpose traffic operations to and from the Site.
B. Access to E10, E12 and E17 lots must be maintained at all times.

C. Approved routes and parking requirements shall be used by all Subcontractors, Suppliers, and individuals associated with Contract activities.

D. Contractor employees will not be eligible for parking within the UW parking areas unless coordinated with UW.

E. Provide required signage and Contractor oversight for approved route requirements to comply with traffic routing requirements. If Contractor fails to abide by the accepted haul routes, Resident Engineer will assign City of Seattle off-duty police officers for enforcement of haul route restrictions at the expense of the Contractor.

F. Provide lighted or reflective signage to direct drivers along truck haul routes to enhance sign visibility during nighttime work hours.

G. UW requirements do not allow signs to be displayed other than those needed for staging, traffic control, or safety regulations. All visible signs shall be approved by the Resident Engineer and UW.

H. Inspect haul routes daily to ensure compliance with Section 01 57 19, Temporary Environmental Controls.

I. Provide a legal, off-site debris disposal site for all material that leaves the Site.

J. When hauling is done over highways or city streets, trim and cover loads. Clean vehicle shelf areas after each loading.

K. Trucks: Vehicles with three or more axles.

L. All Contractor employee parking is prohibited on city streets. All parking within the UW parking lots will be coordinated with UW.

M. Due to the high volume of pedestrians and bicyclists, provide traffic control measures indicating the use of extreme caution at all motorized and non-motorized crossings.

3.02 MAINTAIN/REPAIR/RESTORATION

A. During the Work, be responsible for all maintenance and repair of roads used as haul routes related to construction use. The routes include: Montlake Blvd from SR 520 to NE Pacific Pl.; NE Pacific St. and NE Pacific Pl. around the Triangle garage, and other associated UW parking lot roadways and driveways.

B. Share haul routes with businesses, residential, pedestrian, and bicycle traffic and maintain in good condition.

C. Maintain haul routes smooth, level, clean and free of debris and suitable for the public to drive passenger cars on without damage to vehicles, pedestrians, and cyclists to travel safely at all haul route crossings.

D. The Contractor is responsible for maintaining all temporary and permanent pavement markings for minimum levels of visibility around the work site, within the UW parking lots, driveways, and the area described in Article 1.03A.4, herein, as approved/directed by the Resident Engineer.

E. The Contractor is responsible for maintaining clean and upright temporary and permanent signing around the work site, within the UW parking lots, driveways and the area described in Article 1.03A.4, herein, as approved/directed by the Resident Engineer. This work would be necessary due to contractor work activities.
F. If pavement, curb, or sidewalk damage results on or near the roads in Article 3.02A, including potholes or loose chunks of pavement due to Contractor’s work, be responsible to promptly, within 48 hours, remove damaged asphalt/concrete/curb/sidewalk. Replace with a minimum of 4 inches of asphalt concrete in accordance with Section 32 12 16, Asphalt Paving. Replace concrete in accordance with Section 32 13 13, Concrete Paving. Perform these and any other needed repair work in accordance with City of Seattle Standard Specifications. See Article 1.03A.4, herein for preconstruction survey to be performed.

END OF SECTION
1.01 SUMMARY

A. This Section includes specifications for the general requirements for furnishing, installing, and operating temporary traffic control, including requirements for providing and implementing a Special Event Traffic Management Plan.

B. Related Sections: The work of the following Sections is related to the work of this Section. Other Sections, not referenced below, may also be related to the proper performance of this work.

1. Section 01 12 16, Work Sequence.
2. Section 01 12 19, Contract Interface
3. Section 01 55 00, Vehicular Access and Parking.

1.02 REFERENCES

A. This Section incorporates by reference the latest revisions of the following documents.

1. City of Seattle (COS)
   a. Traffic Control Manual for In-Street Work
2. Seattle Department of Transportation (SDOT) Standard Specifications
3. Washington State Department of Transportation (WSDOT)
   a. Standard Specifications for Road, Bridge and Municipal Construction
   b. Standard Plans for Road, Bridge, and Municipal Construction
4. U. S. Department of Transportation, Federal Highway Administration (FHWA)
   a. Manual on Uniform Traffic Control Devices (MUTCD)

1.03 SUBMITTALS

A. Procedures: Section 01 33 00, Submittal Procedures.

B. Traffic Control Plan.

C. Special Event Traffic Management Plan (Updated from the U220 Contract).
D. Qualifications for Traffic Control Manager (TCM) and Traffic Control Supervisor (TCS).

1.04 TRAFFIC CONTROL PLAN (TCP)

A. Prepare in accordance with these Contract Documents, the City of Seattle’s Traffic Control Manual for In-Street Work and the City of Seattle’s Standard Specifications. The Traffic Control Plan shall include, but not be limited to:

1. Providing details for maintenance of traffic for general purpose traffic, pedestrian, bicycle and transit operations during each phase of construction. Include traffic control details for:
   a. Auto operations along Montlake Blvd, NE Pacific Place, NE Pacific St., and E. Roanoke St;
   b. Bus operations along Montlake Blvd; NE Pacific Place, NE Pacific St. and E. Roanoke St.;
   c. Impacts within the E10, E11, E12, and E17 parking lots;
   d. Widths of pedestrian and bicycle pathways/sidewalks reroutes and detours, including impacts to the Burke-Gilman Trail;
   e. Traffic control devices;
   f. Name, contact details, and qualifications for the TCM and TCS;
   g. Plans during non-working hours;
   h. Emergency vehicle ingress and egress; and
   i. Details of flaggers and police staff for the closure of Montlake Blvd for the placement of the overhead pedestrian bridge during weekend evenings.

2. The Traffic Control Plan shall include the above along with description of all devices and management to be used during working and non-working periods of operation and submitted for approval within 30 Days after the Notice to Proceed

1.05 UPDATED SPECIAL EVENT TRAFFIC MANAGEMENT PLAN (SETMP)

A. Update the U220 SETMP and revise in conjunction with the current UW’s special event management plans and procedures in relation to activities at the Site. Special Events shall be those listed in Section 01 12 16, Work Sequence. Update/revise/address the following items, as necessary:

1. All construction activities occurring during each special event.
2. Hours of operation before and after each special event.
3. Anticipated staffing levels for Contractor, if any, during each special event.
4. Provide details of impacts and mitigation to general purpose traffic, pedestrian, bicycle, and transit operations during each special event. Include details for:
   a. Auto operations along Montlake Blvd, NE Pacific Place, and NE Pacific St.;
b. Bus operations along Montlake Blvd; NE Pacific Place and NE Pacific St.;
c. E11 and E12 parking lot operations, both charter buses and auto vehicles;
d. Widths of special event pedestrian pathways/sidewalks;
e. Auto parking and pedestrian flows, in the grassy area south of E12;
f. Pedestrian flows from the stadium to and from the bus stops on Montlake Blvd;
g. Traffic control devices and traffic personnel required;
h. Plans for installation and removal of traffic control devices; and
i. Emergency vehicle ingress and egress.

5. Coordination, line of authority, and roles to be performed by the UW, Sound Transit, King County Metro, and the City of Seattle Police Department to maintain proper traffic control, transit operations, parking management and pedestrian circulation during all Special Event occurrences near the Site.

6. Name, contact details, and qualifications for the TCM and TCS.

1.06 QUALIFICATIONS FOR TRAFFIC CONTROL MANAGER (TCM) AND TRAFFIC CONTROL SUPERVISOR (TCS)

A. Requirements for the Traffic Control Manager are as specified in WSDOT Standard Specification Section 1-10.2(1)A. Requirements for the Traffic Control Supervisor are as specified in WSDOT Standard Specification section 1-10.2(1)B.

B. The TCS and the TCM will have a valid certificate as a Traffic Control Supervisor as issued by the Evergreen Safety Council or approved equal.

PART 2 - PRODUCTS

2.01 TRAFFIC CONTROL DEVICES

A. Provide or construct all traffic control devices, including temporary concrete barriers and temporary construction fencing, in conformance with applicable COS and WSDOT specifications and standard requirements. Include descriptions of traffic control devices in the Traffic Control Plan for the Resident Engineer’s review and approval.

PART 3 - EXECUTION

3.01 GENERAL CONSTRUCTION

A. For temporary traffic control on City of Seattle streets, roadways, pedestrian, and bicycle facilities that are to be owned or maintained by jurisdictions other than Sound Transit, perform work of this Section in conformance with the applicable requirements of the jurisdictional agency’s specifications.

1. For Montlake Blvd, NE Pacific St and NE Pacific Pl., use City of Seattle Traffic Control Manual.
2. For Burke Gilman Trail, sidewalks and pathways around Site, parking lot areas, and driveways/roadways within the parking lots, use City of Seattle Traffic Control Manual and UW standards and requirements, as applicable.

3. For SR 520, I-5, and I-90, use WSDOT Standard Specifications, as applicable.

B. The traffic control/traffic signal installed for the U220 contractor will remain in effect during the U250 contract. The traffic signal modifications shown for U250 will be installed after all hauling operations and major material deliveries are complete.

C. Obtain prior approval from the City of Seattle, UW, WSDOT, and KCM for closing or partial closing of all streets, sidewalks, bike routes, or the Burke-Gilman Trail, as applicable. After approval of the TCP, give at least 10 working days advance notice of all full street closures to all agencies providing emergency services, including, without limitation, police, fire, and ambulance services, and at least two working days advance notice of any partial closure to the same agencies. Include, at the least, the dates and times of commencement and completion or work, names of streets or location of sidewalks and alleys to be closed or partially closed, and schedule of operations and routes of detours where applicable.

1. Notify KCM 30 days in advance of all road work activities that involve relocating, de-energizing or other work that impacts overhead trolley wires.

D. Ensure that reliable emergency access is maintained to avoid delays in response time.

E. During the development of the SETMP, work with the University of Washington(UW), the City of Seattle (COS), Seattle Department of Transportation (SDOT), City of Seattle Police Department (SPD), and King County Metro (KCM) to provide required traffic, transit and pedestrian circulation and management during Special Events occurring near and due to the activities at the Site. Coordinate with the entities listed above through the Resident Engineer.

F. When the work involves use of public ways, follow standard construction safety measures which include but are not limited to installing advance warning signs, highly visible construction barrier and providing necessary flaggers, all as required by the local authorities, and install and maintain means of reasonable access to all fire hydrants, parking garages, and other property.

G. During nighttime work hours, use lighted or highly reflective signage to direct drivers, pedestrians and bicyclist through the work zones and to direct truck drivers to truck haul routes.

H. Clearly delineate all sidewalks and bike paths detoured or rerouted by construction.

I. TCP for the Burke Gilman Trail will clearly show safe and paved rerouted and/or detoured pathway for pedestrians and bicyclists. The TCP will include advance warning signs for users of the path and 10 days advance notification of the reroutes.

J. Identify the use of flaggers and Police staff for traffic control in the Traffic Control Plan and obtain prior approval from the Resident Engineer. Police staff shall be used at signalized intersections or for traffic signal countermand.

3.02 FIELD QUALITY CONTROL

A. Requirements for Traffic Control Management will be as specified in WSDOT Standard Specifications Section 1-10.2, Traffic Control Management, and the City of Seattle Traffic Control Manual.
B. Before beginning work on the project, designate an individual or individuals to perform the duties of Traffic Control Manager and Traffic Control Supervisor. These individuals shall be in continuous responsible charge of traffic control. A TCM and TCS are required on all projects that require traffic control. The TCM can also perform the duties of the TCS. Identify an alternate TCM and TCS that can assume the duties of the assigned or primary TCM and TCS in case of that person’s inability to perform. Employ alternates who are adequately trained and certified to the same degree as the primary TCM and TCS.

C. Patrol the traffic control area as often as necessary, but at least daily, and reset all disturbed signs and traffic control devices. Remove or cover signs and other traffic control devices during periods when they are not necessary.

D. Employ the TCM to work with Sound Transit, the University of Washington, King County Metro, and the City of Seattle to maintain proper traffic control, transit operations and pedestrian circulation during Special Event occurrences near the Site.

END OF SECTION
PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes specifications for:

1. Development of a Landscape Protection Plan approved by the Resident Engineer for all landscape requiring protection, and all associated tree protection elements that are in place at the beginning of the Contract prior to commencement of construction activity.

2. Furnishing all labor, materials, equipment, supplies, and operations as required to install and maintain tree and plant protection as indicated and as required by the approved Landscape Protection Plan.

3. Maintenance of existing (installed under previous Contract), as well as newly installed tree protection elements, including, but not limited to, fencing, woodchip mulch, landscape fabric, cabling, and signs.

B. Related Sections: The Work of the following Sections is related to the Work of this Section. Other Sections, not referenced below, may also be related to the proper performance of this work.

1. Section 31 11 00, Clearing and Grubbing
2. Section 31 20 00, Earth Moving
3. Section 32 84 00, Planting Irrigation
4. Section 32 90 00, Planting
5. Section 32 92 00, Turf and Grasses

1.02 REFERENCES

A. This Section incorporates by reference the following documents:

1. City of Seattle (COS):
   a. Standard Plans for Road, Bridge and Municipal Construction.

2. Council of Tree and Landscape Appraisers:
   a. Guide for Establishing Values of Trees and Other Plants, issued by the Council of Tree and Landscape Appraisers.

1.03 DEFINITIONS

A. Landscape requiring protection and trees requiring protection:

1. All existing trees as indicated on the Contract Drawings.
2. All existing trees, plants, and lawn identified to remain including areas of tree critical root zones which are within the Construction Work Area Limits as identified in the Contract Documents.

3. All existing trees, plants, and lawn identified to remain in the Contract Documents including areas of tree critical root zones within the vicinity of the Project Site, which may be affected by construction.

B. DBH: Diameter of a tree at breast height, as measured 4-1/2 feet above root crown.

C. CRZ: The critical root zone of a tree is described as an area equal to 1 foot radius for every 1 inch diameter of DBH.

D. Project Arborist: International Society of Arborists (ISA) certified arborist as approved by Sound Transit.

E. Most current Guide for Establishing Value of Trees and Other Plants, issued by the Council of Tree and Landscape Appraisers.

F. ISA: International Society of Arborists.

G. Dripline: The dripline of a tree is described as the area on the ground beneath the tree’s canopy.

H. UW CPO: University of Washington Capital Projects Office.

1.04 SUBMITTALS

A. Procedures: Section 01 33 00, Submittal Procedures.

B. A Landscape Protection Plan accepted by the Resident Engineer. Include in the Landscape Protection Plan:

1. Final landscape protection fence locations and phasing plan.

2. List of all intended landscape maintenance practices to be provided, with a schedule.

3. Tree labels including UW CPO tree tag numbers (located on the trees).

4. The watering schedule for temporary watering of landscape requiring protection.

5. All work activities within 50 feet of landscape requiring protection.

6. Proposed tree and root avoidance techniques and anticipated work methods within CRZs.

7. Documentation of Project Arborist’s on-site confirmation or re-designation of the CRZ for each tree.

C. Photo documentation, tagging, and inventory reports to be performed by Project Arborist prior to any construction activities:

1. Photo Document all landscape requiring protection: Photograph trees from the cardinal directions (north, south, east, west). Label all photographs with:

   a. Tree tag number, unique for each tree.

   b. Direction and description that the photograph was taken.
c. Date photograph was taken.

2. Written inventory of trees requiring protection confirming location, type, and size of all trees requiring protection.

3. Provide 2 hard copies of photographic documentation and inventory and 2 electronic copies to the Resident Engineer 30 days prior to work commencing on Site.

D. Submit in addition to Photo Documentation, Tagging, and Inventory an appraisal provided by the Project Arborist for all trees requiring protection identified by the Contract Documents and listed herein as not appraised. Base appraisal upon the current *Guide for Establishing Value of Trees and Other Plants*.

E. Qualifications of Project Arborist.

F. Product Data for:

1. Mycorrhizae fungal inoculant.
2. Slow release fertilizer.
3. Landscape protection fencing.

G. Samples:

1. Landscape protection signage.
2. Tree appraisal value signage.
3. Cabling material.
4. Chain link mesh.
5. Wood chips.

H. Laboratory Test Reports:

1. Employ an accepted agricultural testing laboratory to perform wood chip testing. The testing laboratory must be accepted by the Resident Engineer in advance.

2. Submittal for wood chips:
   a. Test sample of wood chips for protection areas. Follow testing laboratory instructions for wood chip sample collection.
   b. The test shall measure and confirm pathogen levels for the following: Phytophthora (1 ppg maximum), Pythium (450 ppg maximum), Fusarium (1800 maximum), and Rhizoctonia (10 ppg).
   c. The test shall identify and measure heavy metals and other chemicals including: lead, cadmium, arsenic, and potassium.
   d. Wood chips with laboratory test results confirming pathogens at higher than the maximums levels indicated, unacceptable levels of heavy metals, or other chemicals will be rejected.
1.05 PROJECT CONDITIONS

A. The Resident Engineer may order the Work stopped if landscape protection is not complete prior to site work, if unauthorized use of protected area is occurring, or if tree protection fencing is not restored within 24 hours of notice to do so.

B. Tree Identification: In all correspondence regarding trees requiring protection and tree protection systems, refer to the specific tree number on the Contract Drawings or as listed herein.

C. Area requiring special attention: Refer to tree and plant protection Contract Drawings and Section 31 11 00, Clearing and Grubbing.

D. Refer to Contract Drawings for complete list of trees requiring protection and their values to date.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Landscape Protection Fencing Type 1 and Type 2:
   1. Chain link fence materials including footings, posts, braces, and mesh to be used to form a 6 foot high enclosure.
   2. Footings:
      a. Type 1: no footings required.
      b. Type 2: above ground precast concrete block type footings, 100 pounds minimum.
   3. Posts: 1-1/2 inch steel pipe, minimum. Use with approval by Resident Engineer in areas where fence must cross existing paved surfaces or where indicated by Contract Drawings or accepted Landscape Protection Plan.

B. Landscape Protection Signage:
   1. Provide weather resistant, fluorescent green or yellow signs 48 inch by 48 inch with minimum of 3 inch high letters indicating the following:
      a. Tree Protection Warning: No Trespassing on the critical root zone of this/these tree/trees without direct approval of Resident Engineer. Unauthorized activities or work within the critical root zone will result in a fine of $1,500, or the appraised landscape value, whichever is greater.
      b. Botanical/common names.
      c. Appraised value of tree.
      d. Submit sample.

C. Cabling: Meet landscape industry standards for permanent cabling of trees.

D. Tree Tags: as provided and installed by UW CPO.

E. Water: Potable water supplied by the Contractor.
F. Mycorrhizae Fungal Inoculant: Mycogrow Gel, manufactured by Fungi Perfecti, Olympia, WA, (800) 780-9162, or Mycorrhizal Landscape Inoculant as manufactured by BioOrganics, Santa Monica, CA, (888) 332-7676, or accepted equal.

G. Slow Release Fertilizer: Osmocote 14-14-14 slow release pellets, Osmocote Controlled Release Fertilizer 13-13-13, Sierra Controlled Release Fertilizer Plus Minors 17-6-12, or accepted equal.

H. Wood Chips: Chipped wood mulch or hog fuel, which has composted for a minimum of 1 year.

PART 3 - EXECUTION

3.01 PREPARATION

A. Contractor shall ensure that the Project Arborist will:

1. Prior to any construction activities:

a. Verify adequacy of the extent of area defined in the Contract Documents as landscape requiring protection. Review Contract Documents and periphery of site for any additional landscape which may be affected and therefore needing to be protected. Review periphery of site to identify any additional trees whose critical root zones may be affected and therefore needing to be protected. Report any deficiencies or concerns to Resident Engineer immediately. Implement adjustments to Landscape Protection Plan as directed by the Resident Engineer as needed.

b. Photograph, inventory, and determine the CRZ of all trees requiring protection as defined herein, as a condition of approval for the Landscape Protection Plan and acceptance of photo documentation and inventory prior to any site work.

1) Photograph Tree Requiring Protection immediately following Notice to Proceed and again after trees produce a full canopy of leaves if initial photographs are taken when trees are bare of leaves.

c. Prepare appraisal for all trees requiring protection identified on the Contract Drawings which are not already valued herein. Base appraisal upon the most current Guide for Establishing Value of Trees and Other Plants.

d. Prepare appraisal for any trees requiring protection identified in the field by Project Arborist, which are in addition to those listed in the Contract Drawings or herein. Base appraisal upon the most current Guide for Establishing Value of Trees and Other Plants.

e. Review all trees requiring protection to confirm tagging by UW CPO. Notify Resident Engineer of any untagged trees for coordination with UW CPO for additional tagging.

f. Use an air-spade to locate and protect roots within the CRZ. Supervise any root pruning required for trees 3 months prior to the commencement of construction activity.

2. At commencement of construction activities:
a. Monitor Contractor’s maintenance of all landscape requiring protection to ensure it is in a healthy condition. Report deficiencies or concerns to the Resident Engineer immediately. Implement adjustments to Landscape Protection Plan as directed by the Resident Engineer as needed during the course of the Work. Provide maintenance site visits and field reports to review and respond to site conditions and health status of all landscape requiring protection including:

1) construction activities affecting protected areas.
2) status of protection elements.
3) maintenance and watering conditions.

3. Perform on-site reviews as needed during construction activities that are adjacent to or affecting all landscape requiring protection.

4. Monitor clearing and grubbing in areas requiring special attention as identified on tree and plant protection Contract Drawings and as specified in Section 31 11 00, Clearing and Grubbing, in order to preserve roots.

5. Monitor any work within CRZ of all trees requiring protection including all excavation, demolition, and resurfacing. See Section 31 11 00, Clearing and Grubbing, for excavation requirements for select trees.

B. Signage:

1. As a condition of approval for the Landscape Protection Plan, post tree preservation area/restrictions signage and appraised value signage on all trees requiring protection as specified herein.

C. Protection:

1. Before any construction activities begin:
   a. Protect trees in accordance with approved Landscape Protection Plan.
   b. Coordinate with Project Arborist regarding areas requiring special attention as identified on tree and plant protection Contract Drawings and as specified in Section 31 11 00, Clearing and Grubbing.
   c. Locate tree protection in accordance with the Contract Drawings and approved Landscape Protection Plan unless otherwise directed by Project Arborist.
   d. Protect soil and roots within the CRZ of all trees requiring protection with a layer of 4 inches of wood chips. Provide a 12 inch radius zone clear of mulch at the base of each tree.
   e. In areas requiring attention for measures of special protection:
      1) Protect soil and roots within the CRZ of all trees with a 12 inch layer of wood chips.
      2) Provide a 24 inch radius zone clear of mulch at the base of each tree.
f. In areas of landscape requiring protection with understory landscape (such as lawn or shrubs) as indicated by Contract Drawings, provide wood chips when directed to do so by the Resident Engineer as needed to protect soils and roots from any work taking place within the fencing.

2. Protect against cutting, breaking or skinning of roots, skinning or bruising of bark, compaction of root zones, and breaking of branches.

3. Root protection: Under direction of Project Arborist, hand dig trenches within CRZs, landscape requiring protection, and in areas with extensive roots. Leave intact and undamaged roots larger than 2 inches in diameter. Place utility conduit either under roots by tunneling or over roots using adequate sand bedding. The Project Arborist will determine adequacy of bedding. Do not tear or pull roots. Cut off roots cleanly as directed by Project Arborist when roots are exposed due to work activities. Eliminate all tears and breaks in root surfaces. During the time of exposure, keep roots moist with wet soil, mulch, burlap, or equivalent. During work within CRZ, and landscape requiring protection, maintain all elements of tree and landscape protection as specified herein including woodchip layer and watering.

4. Carefully plan and execute operations to avoid damaging all landscape requiring protection.

5. Use of heavy equipment: Under direction of Project Arborist, place heavy equipment outside of CRZ or on hard surface adequate to support equipment and prevent soil and root compaction. Perform work from outside the CRZ. Work at angles and directions that minimize compaction to roots of Trees and landscape requiring protection. Under the supervision of the Project Arborist, tie back all flexible limbs and overhead branches which may, in the opinion of the Project Arborist, be damaged by the passage or activity of equipment. No tree limbs may be removed without the written approval of the Resident Engineer.

6. Removal of existing pavements: Carefully remove existing pavement within CRZs to avoid root damage and only under direction of Project Arborist. Use heavy equipment as specified herein. As hardscape is removed, the Project Arborist will identify existing subgrade and assist in establishing final grade or new pavement subgrade by providing direction for root protection. Where new pavement is planned, Project Arborist will direct the cutting of roots 6 inches clear of planned paving edge.

D. Tree and landscape maintenance:

1. Provide maintenance as specified herein throughout the duration of the Contract to promote the health and vigor of all landscape requiring protection as defined by the Contract Drawings and the accepted Landscape Protection Plan.

2. Perform all pruning, thinning and other maintenance under the direction of the Project Arborist.

3. Prune as necessary for safety, to promote the health of the tree, and to allow clearance for construction activities within the dripline or CRZ (whichever is greater) of all trees requiring protection. Do not move tree protection fence prior to consultation with the Project Arborist and approval by the Resident Engineer.

4. Fertilize all trees requiring protection, throughout the duration of the Contract. Under direction of Project Arborist, aerate and inject mycorrhizae and slow release fertilizer into the root zone surrounding all trees requiring protection. Perform injection with a soil injection needle attached to a spray gun approved by Project Arborist.
5. Water landscape requiring protection up to three times per week according to Project Arborist direction. Ensure continuous uninterrupted water supply to each area of landscape requiring protection throughout the duration of the Contract. Do not allow water to run off or cause erosion at any time during watering. As specified herein, develop and submit a watering schedule and plan, which includes proposed source of water and application method, to be approved by the Resident Engineer prior to start of construction activities.

6. Maintain the woodchips at the specified depth. Should the depth of wood chips measure less than the specified depth at anytime, replenish the wood chips to bring to the specified depth. Do not allow the depth of wood chips in the CRZ to measure less than the specified depth for more than 48 hours.

7. Notify Resident Engineer 48 hours prior to all work to be performed within 20 feet of CRZs of trees requiring protection.

8. Remove weeds in planting areas throughout the duration of the Contract.

3.02 INSTALLATION

A. Landscape Protection Fencing and Signage:

1. Type 1 fencing: Drive posts a minimum of 2 feet below existing grade and deep enough to remain rigid during subsequent excavating and grading.

2. Type 2 fencing: Install fence on above ground precast concrete block type footings in locations as indicated by Contract Drawings.

3. Take care not to compact soil or damage roots inside the fence line during placement of posts. Do not use heavy equipment for this operation.

4. Provide diagonal bracing to vertical posts at corners of enclosures and wherever needed to ensure rigidity of the fencing.

5. Install chain link fabric tight to grade at the bottom edge, and stretched uniformly between posts. Install top of fabric 6 feet above grade, minimum.

6. Install fabric to form continuous fencing as indicated on Contract Documents. Attach fabric to posts 12 inches on center with 11 gage wire ties securely fastened, or with bolted ring clips, and to top rail not over 3 feet on center.

7. Attach orange flag strips 12 inches long at 3 feet on center along the fence, 5 feet above grade.

8. Place landscape protection signs at every 30 lineal feet of protection fencing.

9. Place two tree value signs on each Tree Requiring Protection. Attach to trees with Project Arborist approved method.

10. Provide 1 locked gate at each fenced area.

B. Fence Maintenance:

1. Maintain fence in good condition at the specified location until Final Acceptance of site operations, except where directed otherwise in writing by the Resident Engineer. Immediately repair fencing when damaged, regardless of cause of damage.
2. Protection fencing may be removed temporarily for specific construction operations only under discretion of Project Arborist or Resident Engineer.

C. Use of area within protection fences and within 20 feet of all landscape requiring protection:

1. Do not use area within protection fence for any activity.
2. Notify the Resident Engineer 24 hours in advance of the need to move a tree protection fence.
3. Upon relocation of fence, continue all other protection efforts and maintenance of landscape requiring protection in accordance with approved Landscape Protection Plan and watering plan.
4. Alter no grades within the protection fence.
5. Control soil moisture within the protected area to prevent flooding of the soil and roots.
6. Prevent contamination of protected areas from leachate, cement, oil, fuel and lubricating oil, and all contaminants.
7. Do not store materials potentially harmful to roots within 20 feet of outside limit of protected areas. Potentially harmful materials include, but are not limited to: petroleum products, cement and concrete materials, cement additives, lime, paint coatings, waterproofing agents, form coatings, detergents, acids, and cleaning agents.

D. Landscape damage inflicted by construction outside the construction areas and designated access routes shall be repaired and restored according to University standards, which include damaged landscape removal, complete soil preparation, approved planting, and adequate irrigation to establish the replaced landscape.

3.03 REPAIR/RESTORATION OF DAMAGED TREES

A. Damages for loss or injury to trees requiring protection including loss or injury as a result of vandalism:

1. In the event of damage or loss to any tree due to Contractor's failure to protect and maintain said tree, Contractor shall pay to Sound Transit as liquidated damages a sum equal to:
   a. The value of each lost tree, as determined by the Project Arborist appraisal using the most current *Guide for Establishing Values of Trees and Other Plants*, issued by the Council of Tree and Landscape Appraisers,
   b. The cost to remove and dispose of the said tree, and
   c. $1,500 per tree in compensation for the efforts of Sound Transit in administering and overseeing the replacement.
2. In the event of injuries to the crown, trunk, branches, or root system of any tree that are the result of the Contract's failure to protect and maintain such tree, the Resident Engineer may elect to retain the tree and hold the Contractor liable for compensation.
3. Completely remove and dispose of any tree killed or irreparably damaged including those trees damaged or killed as a result of vandalism, natural acts, and diseases or
as a result of Contractor’s failure to protect or maintain said tree. Remove and dispose the entire tree including stump and roots to a depth of 2 feet below finished grade.

4. Replace at Resident Engineer’s direction any tree lost or, in the opinion of the Resident Engineer, irreparably damaged as a result of failure of the Contractor to protect or to adequately maintain trees. Replacement conditions will not apply to plant losses due to abnormal weather conditions such as floods, excessive wind damage, drought, severe freezing, or abnormal rain, as determined by the National Weather Service. Trees, which fail to fully foliate in the spring following completion of construction operations, may be presumed to have been lost due to construction operations.

B. Locate and install replacement trees in accordance with the instructions of the Project Arborist and by direction of the Resident Engineer. The Resident Engineer may require lost trees be replaced in areas other than in their original location.

C. Warranty replacement trees as follows:

1. Make warranties in addition to and not in lieu of all other liabilities, which the manufacturers or the Contractor may have by law or by other provisions of the Contract Documents.

2. Contractor is responsible for maintenance of all replacement trees during the Warranty Period. The Resident Engineer will periodically review and notify the Contractor of any areas needing attention.

3. Replace plants which, in the opinion of the Resident Engineer, are in unhealthy or unsightly condition, or that have lost their natural shape due to dead branches, excessive pruning, or excessive defoliation.

4. Replace unacceptable plants no later than the next succeeding planting season.

5. Replace unacceptable plants in accordance with original Specification. Cost is considered to be included in the Contract. Warranty all replaced material for a period of 1 year from date of replacement.

6. Any tree and shrub material that is 25 percent or more dead or disfigured will be considered dead and must be replaced at no charge. Plants are considered disfigured when excessive dead wood has been removed or when the symmetry, typical habit of growth, or sculptured form has been impaired by the removal of dead wood.

7. The above warranty is applicable to any growing conditions through which plants of like kind could be expected to survive and any deformity or cause of death which could be attributed to, or affected by, the physiological conditions of the plant. The warranty would not apply to plant losses due to abnormal weather conditions such as floods, excessive wind damage, drought, severe freezing, or abnormal rain, as determined by the National Weather Service.

D. Pruning of Damaged Trees:

1. Under the direction of the Project Arborist, cleanly cut off limbs and branches that have been broken to the nearest crotch in accordance with good horticultural practice. Sterilize equipment with alcohol prior and during trimming and pruning operation. Carry out all pruning of damaged trees to the approval of the Resident Engineer.
2. Maintain trees requiring protection in as good condition at completion of the work as at the commencement of the work. If such a condition does not exist at the completion of the work, assume responsibility to provide corrective measures or replacement with new material as directed by the Resident Engineer.

3. All costs for the repair of any damage to trunks or major limbs 3 inches in diameter or greater requiring, in the opinion of the Resident Engineer, the attention of a professional tree surgeon shall be borne entirely by the Contractor. All costs incurred in the protection of trees requiring protection shall be considered incidental to the Contract.

3.04 FENCE REMOVAL

A. Remove protection fencing and wood chips only at Resident Engineer’s direction. Fence removal is subject to all protection measures for landscape requiring protection being satisfied as stated in this Section and stated in the Landscape Protection Plan prepared by the Project Arborist.

END OF SECTION
SECTION 01 57 13
TEMPORARY EROSION AND SEDIMENT CONTROL

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes specifications for constructing and maintaining the surface water drainage and temporary erosion and sediment control system. Contractor is wholly responsible for control of water, including ground water, onto and exiting the construction site or staging areas under the conditions and limitations imposed by the National Pollution Discharge Elimination System (NPDES) Permit No. WA-003192.

B. Related Sections: The work of the following Sections is related to the work of this Section. Other Sections, not referenced below, may also be related to the proper performance of this work.

1. Section 01 12 19, Contract Interface.
2. Section 01 31 19, Project Meetings.
3. Section 01 41 26, Permits.
4. Section 01 55 26, Traffic Control.
5. Section 01 57 19, Temporary Environmental Controls.
6. Section 01 57 24, Temporary Site Water Discharge.
7. Section 01 78 23, Operation and Maintenance Data.

1.02 REFERENCES

A. This Section incorporates by reference the latest revisions of the following documents.

1. American Society for Testing and Materials International (ASTM)
   c. ASTM D1004 Standard Test Method for Tear Resistance (Graves Tear) of Plastic Film and Sheeting.
   f. ASTM D3776 Standard Test Method for Mass Per Unit Area (Weight) of Fabric.
   g. ASTM D4355 Standard Test Method for Deterioration of Geotextiles by Exposure to Light, Moisture and Heat in a Xenon Arc Type Apparatus.


2. American Association of State Highway and Transportation Officials (AASHTO)
   a. AASHTO M252 Corrugated Polyethylene Drainage Pipe, Nominal Sizes of 75 to 250 mm in Diameter.
   b. AASHTO M294 Corrugated Polyethylene (PE) Pipe, Nominal Sizes 300 to 1500 mm in Diameter.

3. Washington State Department of Ecology (DOE)

4. City of Seattle (COS)
   a. COS Critical Area Ordinance.
   b. COS Standard Specifications for Road, Bridge, and Municipal Construction.
   f. Shoreline Permit – MUP (3008164)

5. King County CODE (KCC) – Industrial Waster Rules and Regulations
   a. KCC 28.84.060

6. University of Washington (UW)
   a. UW Facility Design Information Manual (FDI)

7. American Public Health Association (APHA), the American Water Works Association (AWWA), and the Water Environment Federation (WEF)
   a. Standard Methods for the Examination of Water and Wastewater

1.03 DEFINITIONS

A. Plan: Temporary Erosion and Sediment Control Plan(s) (TESC).

B. Wet season: October 1 through April 30.

C. Dry season: May 1 through September 30.

E. CSEMS: Construction Site Environmental Management Supervisor: See Section 01 57 19, Temporary Environmental Controls for requirements.


G. City of Seattle Standard Specifications: City of Seattle Standard Specifications for Road, Bridge, and Municipal Construction.


I. Operation and Maintenance Manuals: Submit operation and maintenance instructions and data for equipment provided under this Division, in accordance with the requirements of Section 01 78 23, Operation, and Maintenance Data. Include recommended maintenance materials and spare parts list for installed equipment.

1.04 SUBMITTALS

A. Procedures: Section 01 33 00, Submittal Procedures.

B. Temporary Erosion and Sediment Control Plan(s).

C. Manufacturer Data and Test Results for all products: Section 01 33 00, Submittal Procedures.

D. TESC BMPs (Best Management Practices) inspection log:
   1. Maintained on a daily basis.
   2. Kept on-site.
   3. Submit copies to the Resident Engineer weekly for the previous week.

E. Designee’s qualifications for Certified Erosion and Sediment Control Leads (CESCL).

1.05 QUALITY ASSURANCE

A. Be solely responsible for all damages, fines, levies, or judgments incurred as a result of Contractor, Subcontractor, or Supplier failure to comply with the requirements of this Section. All damages, fines, levies, or judgments incurred as a result of Contractor, Subcontractor, or Supplier failure to comply with the requirements of this Section will be deducted from payments due. Be solely responsible for all schedule impacts from damages, fines, levies, judgments, or stop work orders incurred as a result of Contractor, Subcontractor, or Supplier failure to comply with the requirements of this Section. The project schedule will not be changed to accommodate the time lost.

B. Implement the Plan, including design of and all revisions to, and the construction, maintenance, replacement, and modification of the erosion and sedimentation control facilities, until Final Acceptance of current work, in accordance with Section 01 12 19, Contract Interface.
   1. Employ Construction Site Environmental Management Supervisor (CSEMS) as defined in Section 01 57 19, Temporary Environmental Controls, with the following responsibilities:
      a. Installation, operation, and maintenance of the facilities.
b. Ensure that daily log of TESC BMP performance is prepared and maintained and that all TESC BMPs are inspected as specified herein.

c. Available to accompany the Resident Engineer and Washington State Department of Ecology (DOE) personnel during weekly inspections of all BMPs at a time designated by the Resident Engineer.

C. Make revisions to the Plan(s) and the work to meet the requirements of this Section.

D. Meet the discharge requirements of Section 01 57 24, Temporary Site Water Discharge. Provide treatment methods, such as sedimentation systems, sand filtration, or other means, as necessary, to meet the discharge requirements.

E. Use of Experimental BMP’s:

1. Obtain approval for all experimental BMP’s from Resident Engineer for water treatment of water discharged to surface water prior to implementation.

   a. With approval requests, include a description of:

      1) The experimental BMP.
      2) Why the experimental BMP is being requested.
      3) Why the BMPs in the SMMWW are not adequate.
      4) Applicable construction techniques.
      5) The characteristics of the site or sites where the experimental BMP is proposed.
      6) If chemical treatment is proposed, include bench test data which cites the optimum polymer dosage rate to achieve colloidal capture at a range of anticipated turbidities and the aquatic toxicity of treated stormwater on Daphnia and on Salmonid fishes. Determine effectiveness by bench testing using soils and water from the Site. Determine effluent toxicity using Standard Methods for the Examination of Water and Wastewater, Methods 8-10B and 8-04B, except temperature is ambient.
      7) Engineering description of the chemical feed systems.
      8) Design criteria for the experimental BMP and the expected results.
      9) Maintenance procedures.
     10) Cost estimates.
     11) Monitoring procedures and duration.
     12) An Ecology approved BMP that could be used if the experimental BMP fails.

1.06 SEQUENCING AND SCHEDULING

A. Minimize the transport of sediment to surface waters, drainage systems, and adjacent properties. Prior to and in conjunction with all site activities, including initial utility relocation, demolition, site restoration, clearing, earthwork activities, construction of walls,
utility trenching and tunneling, complete installation of appropriate erosion and sediment control systems including but not limited to perimeter control, and catch basin inserts.

B. Obtain applicable permits, approval of stormwater discharge treatment methods, BMPs and necessary equipment in place prior to land disturbing activities.

1.07 SYSTEM STARTUP

A. Pre Construction Meeting

1. See Section 01 31 19, Project Meetings.

1.08 EROSION AND SEDIMENT CONTROL PLAN

A. Contractor Erosion and Sediment Control Personnel: Designate sufficient employees as responsible representatives in charge of erosion and sedimentation control. The employees’ responsibility includes overseeing of all water discharge issues. One of these designees is onsite at all times when work activity is taking place.

1. All designees shall be certified as Certified Erosion and Sediment Control Leads (CESCL) in accordance with the Washington State Department of Ecology's training course requirements.

2. One of the designated employees responsible for erosion and sedimentation control shall be the Contractor’s Construction Site Environmental Management Supervisor (CSEMS). The CSEMS shall:

   a. Be solely responsible for developing, maintaining, and modifying the TESC Plan for the life of the Contract and ensuring compliance with all requirements of this Section.

   b. Be currently certified as a Certified Professional in Erosion and Sediment Control (CPESC) offered by CPESC, Inc. (www.cpesc.org).

   c. Have the authority to act on behalf of the Contractor and shall be available on call 24 hours per day through the life of the contract.

B. Prepare and submit a separate Erosion and Sediment Control Plan for each location and its major construction activities, and as required by the Resident Engineer. Not all major activities will occur at each location and the plans for more than one major activity can be combined on a single Plan if the BMPs shown are appropriate to all major activities shown:

   a. The University of Washington Station construction for this Contract is comprised of the following locations:

      1) The area between the University of Washington Stadium and Montlake Blvd and the parking areas located south and south west of the stadium.

      2) The triangular area located on the south side of Pacific Place, the north side of Pacific Street, and the west side of Montlake Blvd.

      3) The Burke Gilman Trail located on the north side of Pacific Place.

   b. Major Activities occurring within the above sites:

      1) Mobilization.
2) Excavation to bottom of roof slab and installation of roof slab.
3) Excavation to upper mezzanine level.
4) Backfilling and grading of site.
5) Restoration of surface.
6) Excavation to lower mezzanine level and installation of lower mezzanine concrete.
7) Excavation to base slab invert and installation of invert slab concrete.
8) Installation of station platform slab concrete.
9) Installation of crossover platform slab concrete.
10) Installation of crossover walls, slab, and roof.
11) Backfilling of crossover to grade
12) Restoration of surface above and adjacent to crossover.
13) Completion of surface finishes and landscaping.

C. Incorporate in the Plan(s) areas associated work, including, but not limited to:
1) Equipment and material storage.
2) Staging.
3) Stockpiles.
4) Site entrance and exit.
5) Truck loading areas.
6) Access and haul roads.

C. Prepare and submit the Plan to the Washington State Department of Ecology to obtain Sound Transit-and-Contractor joint Individual NPDES. Also prepare and submit the Plan to the City of Seattle Department of Planning and Development (DPD) as specified in Section 01 41 26, Permits. Conditions for an Individual NPDES Permit are geared towards a specific project and may be more stringent than those in a General NPDES Permit. Execute the joint permit as specified in Section 01 57 24, Temporary Site Water Discharge. The Contractor shall be responsible for the NPDES permit during the execution of U250 only.

1. The Plan(s) will contain the following information:
   a. Best Management Practices (BMPs)
      1) To control erosion and sedimentation from the Contractor's activities, and treat stormwater discharge to meet applicable city, state and federal permits and requirements.
      2) Implement such practices as perimeter BMPs, installation of surface water controls, stabilization of exposed soils, flagging of
clearing/construction limits, maintaining existing vegetation where possible, and the collection and treatment of runoff to minimize impacts on wetlands, wildlife, fish, and endangered species.

3) During the construction period, upgrade and modify the BMPs as needed to meet discharge requirements for changing construction activities, storm events, and changing site conditions.

b. Include a description of the inspection and monitoring of TESC BMPs over the life of the Project. At a minimum, inspect all TESC BMPs:

1) Weekly and after any significant rain event (0.5 inch or greater) between April 1 and September 30.

2) Daily and after any measurable rain event between October 1 and March 31.

c. Provide narrative on how they will educate the personnel including subcontractors on environmental protection. At a minimum, the Contractor shall train staff through regularly scheduled meetings to discuss environmental protection subjects as related to this project. This training may be added to existing weekly meetings (such as safety meetings). The trainings shall emphasize issues such as sensitive receptors, spill prevention, chemical handling, and storage, emergency response, stormwater control facilities inspections, proper dewatering techniques, and concrete handling.

d. Include the name, telephone number, fax number, cell phone number(s), email address, and business address of the designated CSEMS and all Contractor personnel responsible for erosion and sediment control. It is the responsibility of the Contractor to update this information as required.

2. Schedule BMP implementation correlated to wet and dry season activities. This may include activities such as temporary seeding and permanent seeding activities which change with seasons.

3. Temporary Erosion/Sedimentation Control Drawings. Indicate at a minimum, the following specific information:


b. Required BMP’s to be installed at the start of construction.

c. Locations and construction details of all ditches, berms, culvert pipes, filters, and basin outfalls.

d. Locations, types and quantities of all seeding, slope coverings, and ditch liners

e. Proposed reroutes of existing surface water and underground drainage within site to erosion control facilities prior to release to the offsite storm drain or sanitary sewer system. Refer to Section 01 57 24, Temporary Site Water Discharge.

f. Location of all facilities that are designed to treat sediment-laden runoff prior to the runoff being discharged to the existing drainage system. In lieu of providing onsite treatment of the runoff the runoff may be collected and hauled off site for treatment using an approved method.
g. Location of outlets of subsurface drainage system

4. Design wheel/truck washes to remove particulate matter that would otherwise be deposited on area roadways.
   a. Design to meet Ecology BMP C106 in Chapter 4, Volume II, SMMWW, or equivalent.
   b. Use a closed-loop recirculating design.
   c. Do not discharge wash water to storm drain system.
   d. Include BMPs for the wheel wash discharge water to meet applicable city, state and federal permits and requirements for containment, treatment and disposal as explained in Section 01 57 24, Temporary Site Water Discharge.
   e. All drawings: drawn to scale.
   f. Include Backup Design criteria for approval.

5. Collect, treat, and dispose of water used for sawcutting and slurry cuttings produced by the sawcutting operation in accordance with applicable permits and requirements. Refer to Section 01 57 24, Temporary Site Water Discharge, for handling of process water.

6. BMP installation, maintenance, removal, and inspection.

7. Construction stormwater runoff conveyance, storage, treatment, and discharge.

8. Hazardous materials storage and handling, including fueling of vehicles and power equipment.

9. Plans for the transport and offsite disposal of all construction spoils, solid wastes, including wastewater and excavated soils.

10. Any floating debris that enters the water during construction shall be collected once per day. This material shall be contained on site, secured, and then disposed of at the appropriate upland facility. If heavy debris or deleterious material enters the water and sinks, the location of the material shall be recorded in a log that is kept through the duration of the project. When construction is completed, this material/debris shall be removed by a diver and disposed of at the appropriate upland facility.

11. Prevent solid and liquid waste from entering the water.

12. Provide mitigation measures to prevent disturbances of aquatic habitat and environments.

13. Conform to the following surface water drainage requirements as applicable to the specific sites:
   a. SMMWW.
   b. City of Seattle Critical Areas Ordinance.
   d. FDI.
14. The Resident Engineer will have Seattle Public Utilities (SPU) review and comment on the plan.

15. Resident Engineer’s review of the Plan does not constitute approval of permanent drainage design. Approval of permanent drainage design is by reviewing agency(ies), i.e. City of Seattle and/or University of Washington.

PART 2 - PRODUCTS

2.01 SUMMARY

A. The materials, BMPs, and methods listed below are some of the materials, BMPs, and methods that the Contractor may choose to use in meeting the requirements of this Section. Those listed are commonly used on construction sites in the area. Unless otherwise noted, the materials, BMPs, and methods listed are not required and the list of materials, BMPs, and methods is not intended to be all-inclusive. The Contractor may choose other materials, BMPs, and methods provided they meet the applicable city, state and federal permits, and requirements.

2.02 MATERIALS

A. Wattles: Cylinders of biodegradable plant material such as straw, coir, or wood shavings encased within biodegradable or photodegradable netting.

1. Rolls shall be at least six inches in diameter, unless otherwise specified.

B. Quarry Spalls: Meet the requirements of City of Seattle Standard Specifications, Section 9-13.7, Quarry Spalls, 4-inch to 8-inch.

C. Reinforced Plastic Fabric:

1. Construed, copolymer laminate.

2. Reinforcing: Non-woven grid of high strength nylon cord submerged in a permanently flexible adhesive medium.

3. Equal tear resistance in all directions.


5. Ultraviolet light stabilized.

6. Material to be from a single manufacturer.

7. Physical strength requirements:

   a. Tear strength: 130 pounds in accordance with ASTM D1004.

   b. Elongation: 620 percent in accordance with ASTM D882.

   c. Minimum life expectancy: 2-1/2 years of normal outdoor exposure.

D. Fabrics/Mats/Blankets:

1. Geotextile fabric:

   a. Temporary silt fence geotextile fabric shall meet the following:
<table>
<thead>
<tr>
<th>Geotextile Property</th>
<th>Test Method</th>
<th>Posts with Wire or Polymeric Mesh</th>
</tr>
</thead>
<tbody>
<tr>
<td>AOS sieve</td>
<td>ASTM D4751</td>
<td>0.60 millimeters maximum for woven film (30 US Std. Sieve)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.30 millimeter maximum for all other geotextile types (50 US Std. Sieve) and 0.15 millimeter</td>
</tr>
<tr>
<td></td>
<td></td>
<td>minimum (100 US Std. Sieve)</td>
</tr>
<tr>
<td>Water permittivity</td>
<td>ASTM D4491</td>
<td>0.02 sec(^{-1}) minimum</td>
</tr>
<tr>
<td>Grab Tensile Strength, min. in machine and</td>
<td>ASTM D4632</td>
<td>100 pounds minimum</td>
</tr>
<tr>
<td>x-machine direction</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ultraviolet (UV) Radiation Stability</td>
<td>ASTM D4355</td>
<td>70 percent strength retained minimum, after 500 hrs. in weather meter</td>
</tr>
</tbody>
</table>

2. Permanent revegetation mat:
   a. Highly flexible polymeric mat with a three dimensional web-like weave.
   b. Color: Green.
   c. Biologically inert.
   d. Acid and alkaline resistant.
   e. Ultraviolet degradation resistant.
   f. Physical properties:
      1) Porosity: 85 percent to 95 percent.
      2) Flexibility: 2000 milligrams per centimeter (mg/cm) ASTM D1388.
      3) Weight: 18 ounces per square yard (oz/sy) ASTM D3776.
      4) Thickness: 0.12-inch ASTM D1777.
      5) Tensile strength: Length 15 pounds, width five pounds.
      6) Elongation: Length 150 percent, width 100 percent.

3. Erosion control blankets:
   a. Biodegradable wood materials.
   b. No chemical additives.
   c. Photodegradable extruded plastic netting top and bottom.
   d. Smolder resistant.
   e. Physical properties of blanket for slope protection:
      1) Weight: 0.98 pound per square yard (lbs/sy).
      2) Netting: 1-inch by 2-inch.
f. Physical properties of blanket for channel protection:
   1) Weight: 1.0 lb/sy.

E. Triangular Silt Dikes:
   1. Made of urethane foam sewn into a woven geotextile fabric.
   2. Dike is 10 inches high with a 20-inch base and seven feet long.
   3. A two-foot apron extends beyond both sides of the triangle.
   5. A sleeve shall be provided at one end to allow attachment of additional sections as needed.

F. Wire Fabric:
   1. 2-inch by 4-inch mesh, 14 gage.

G. Hold Downs:
   1. Sandbags.
      a. Secure with 1/4-inch polypropylene rope at ten feet on center maximum each way.
      b. Anchor rope with 2-inch by 4-inch fir, standard or better.
      c. Sand bags shall be filled with clean, poorly-graded, round pea gravel.

H. Perforated Pipe: Polyethylene drainage tubing, ASTM F405 and AASHTO M252.


J. Grass Seed: Composed of the following seed mixture and rate of application indicated unless otherwise specified:

<table>
<thead>
<tr>
<th>Kind &amp; Variety of Seed in Mixture</th>
<th>Percent By Weight</th>
<th>Minimum Percent Purity</th>
<th>Minimum Percent Germination</th>
</tr>
</thead>
<tbody>
<tr>
<td>Turf-type Perennial Rye (three approved types)</td>
<td>50</td>
<td>98</td>
<td>90</td>
</tr>
<tr>
<td>Creeping Red Fescue</td>
<td>20</td>
<td>98</td>
<td>90</td>
</tr>
<tr>
<td>Chewings Fescue</td>
<td>20</td>
<td>98</td>
<td>90</td>
</tr>
<tr>
<td>Hard Fescue</td>
<td>10</td>
<td>98</td>
<td>90</td>
</tr>
</tbody>
</table>

The rate of application is five pounds per 1000 square feet.

K. Fertilizer: Conform to City of Seattle Standard Specification, Section 9-14.3.
L. Polyacrylamides (PAM) for soil erosion protection: Consistent with BMP C126 in Chapter 4, Volume II SMMWW. Notify the Resident Engineer 14 Days prior to the start of construction if planning to use a chemical other than PAM to meet the water quality standard.


N. Asphalt Berm: As detailed in the Reference Drawings and supplemented with City of Seattle Standard Specifications Section 8-06. Asphalt: As specified in Section 32 12 16, Asphalt Paving.

O. Stabilized Construction Entrance: Meeting the requirements as stated in the City of Seattle Construction Stormwater Control Technical Requirements Manual, BMP E2.10.

P. Wheel /Truck Wash Facility (Required): As specified herein.

Q. Inlet Protection: Specifically designed for catch basins and inlets, made of a filter fabric insert with 48 inches by 36 inches adapter skirt, retrieval strap, overflow bypass, and sediment accumulator. Inlet protection by Silt Sack, Streamguard or approved equal.

R. Mechanical Street Sweeper: (Required): Provide a combination of mechanical brushes, water spray, and vacuum system capable of trapping and preventing fugitive dust emissions and removal of sediment present on the roadway as a result of contractor activities.

S. Temporary Storage Tanks: Provide a minimum storage tank size of 4,000 gallons. Use a portable tank to allow tank movement around the construction site as the work progresses. Use tanks with a minimum of two 3-inch valves and a 22-inch entrance to allow for easy cleaning and/or vacuuming of removed sediments.

T. Washed Gravel: 3/4-inch to 1-1/2 inch minimum diameter washed gravel.

PART 3 - EXECUTION

3.01 PREPARATION

A. Clearly flag the boundaries of the clearing/construction limits as indicated on the Plan or as designated by the Resident Engineer by a continuous length of fencing or screening wall prior to construction.

1. During the construction period at each Site, no disturbance beyond the clearing/construction limits is permitted.

2. Maintain the clearing/construction limits for the duration of construction.

B. Temporary spoil piles:

1. Piles shall be covered after two days of inactivity during the wet period and seven days of inactivity during the dry period.

2. Place all excavated material not hauled directly from the construction site in a temporary spoil pile surrounded by ecology blocks or equivalent.

3. Control water seepage and runoff and direct to water treatment system. Treatment of seepage and runoff from piles is required prior to discharge from site.
4. Control dust by covering or other reasonable means. Refer to Section 01 57 19, Temporary Environmental Controls.

C. Unless otherwise indicated, clean all catch basins and pipes prior to paving and upon completion of construction, in accordance with the City of Seattle, Standard Specification Section 7-07.3. Coordinate and obtain approval from SPU prior to flush of storm sewer and drains. If using water from the Seattle water system, obtain and pay for a fire hydrant use permit as needed. A backflow prevention device will be required and will be inspected by Seattle Public Utilities (SPU) at time of permit purchase. Do not flush sediment-laden water into the downstream system from the cleaning operation.

D. Stockpile on-site sufficient BMP materials and supplies to protect the entire site.

E. Protect catch basin inlets to the permanent storm drainage system from sediment influx by use of filter fabric, catch basin insert, or similar filtering materials and methods.

3.02 INSTALLATION

A. Wattles: Installed in accordance with the SMMWW.

B. Quarry Spalls:
   1. Install at locations required by the Plan and in accordance with the SMMWW.

C. Plastic sheeting:
   1. Install in accordance with City of Seattle Standard Specifications on all excavation faces and stockpiles.
   2. Completely cover stockpiles including slope faces.
   3. For short term installations (two months or less) overlap joints with minimum two feet lap and tape seam. For longer-term installation (two months or more) overlap joints with a minimum of three feet.
   4. Anchor plastic sheeting in 2-foot-by-2-foot trench around the entire perimeter of stockpile or exposed slopes.
   5. Install hold-downs at all excavation faces and at stockpiles.
   6. Secure hold-downs with polypropylene rope at ten feet on center, maximum each way, across the entire surface of plastic sheeting.
   7. Anchor the polypropylene rope by driving 2-inch by 4-inch stake at the top of excavations or bottom of stockpiles and tying rope to stake.

D. Silt Fence:
   2. Excavate a trench, roughly eight inches wide and 12 inches deep, upslope and along the line of the posts to allow the filter fabric to be buried.
   3. Bury wire and filter fabric into and above the ground in accordance with the City of Seattle Standard Specification 8-01.3(10)A. Do not staple filter fabric to existing trees or install within the “Critical Root Zone”, and obtain approval from Resident Engineer before installation within the outer drip line of existing trees designated to remain. Refer to Seattle Standard Specification Section 1-07.16(2).
4. When Extra-Strength filter fabric and closer post spacing are used, the wire mesh support fence may be eliminated. In such a case, take extra care to staple or wire the filter fence fabric directly to the posts with all other provisions of the standard notes still applying. Extra care shall be used when joining or overlapping these stiffer fabrics.

5. The trench shall be backfilled with 3/4-inch to 1-1/2-inch minimum diameter washed gravel or native soil.

6. Remove filter fabric fences when the upslope area has been permanently stabilized or just prior to paving. Remove retained sediment and properly dispose of or rake smooth, mulch, and seed sediment left in place.

7. Repairs:
   a. Rips, tears, holes, and other defects in the geotextile fabric or the backing or both shall be promptly repaired by placing new material(s) over the damaged materials the full width and height of fence including buried or covered fabric and backing, and shall overlap existing fence material(s) a minimum of five feet each side of the defect. The repaired fence supported by and securely tied to five evenly spaced posts.

   b. Broken posts shall be replaced with two posts spaced one foot on each side of the broken post driven 30 inches into the soil, or braced to upslope anchors. The fabric and backing shall be securely tied to each new post.

   c. Posts that lean greater than 1H:4V shall be replumbed and shall be supported at the top with bracing or guying to an adequately installed upslope anchor.

   d. Water or sediment escaping beneath the silt fence shall be repaired by installing new fabric and backing over the existing material extending three feet upslope with a minimum 3-foot overlap on both sides. Large aggregate ballast shall be placed over the surface repair with a minimum 6-inch depth. A new post or posts shall be installed along the leak with spacing not exceeding two feet. Any other conditions that reduce the effectiveness of the silt fence shall require immediate repair and replacement.

E. Triangular silt dike:
   1. Install with ends curved up to prevent water from flowing around the ends.
   2. Attach the fabric flaps and check dam units to the ground with wire staples. Wire staples: No. 11 gauge wire and 8 inches to 12 inches in length.
   3. When multiple units are installed, overlap the sleeve of fabric at the end of the abutting unit and staple.
   4. Locate and install check dams as soon as construction allows.
   5. Place check dams perpendicular to the flow of water.
   6. When used as check dams, secure the leading edge with rocks, sandbags, or a small key slot and staples.
   7. In the case of grass-lined ditches and swales, remove check dams and accumulated sediment when the grass has matured sufficiently to protect the
ditch or swale unless the slope of the swale is greater than four percent. Seed and mulch the area beneath the check dams immediately after dam removal.

F. Mulch:

1. Apply mulch in accordance with City of Seattle Standard Specifications, Section 8-01.3(6).
2. When indicated by the Plan to apply a separate mulch application for an area in addition to seeding, apply mulch immediately following the seeding.
3. Mulch by approved hand methods areas that are not accessible by mulching equipment.

G. Grass seeding:

1. Revisit all disturbed areas prior to the beginning of the wet season to identify which ones can be seeded in preparation for the wet season.
2. Install surface runoff control measures such as gradient terraces, interceptor dikes or swales, level spreaders and sediment traps/basins prior to seeding.
3. Cultivate all areas to be seeded to meet the City of Seattle and Ecology requirements.
   a. Cultivation may be accomplished by diskng, raking, harrowing, or other acceptable means. Perform all cultivating at right angles to the slope.
4. Hydroseed all disturbed areas following completion of construction or as otherwise indicated herein. Apply erosion control hydroseeding in accordance with City of Seattle Standard Specification 8-01. Comply with City of Seattle Standard Specification 9-14.2 for hydroseed mixes.
5. Seeding may be accomplished by approved hand methods when impracticable to do by hydroseeding.
6. Seed disturbed areas within one week of the beginning of the wet season.
7. Fertilize all areas which are seeded.

H. Inlet Protection:

1. Install in accordance with City of Seattle Standard Specification 8-01.3(12).

I. Gravel Filter Berm:

1. Install in accordance with City of Seattle Construction Stormwater Control Technical Requirements Manual, BMP E3.25.

J. Stabilized Construction Entrance:

1. Install in accordance with City of Seattle Construction Stormwater Control Technical Requirements Manual, BMP E2.10.

3.03 MAINTENANCE

A. If erosion is occurring, make modifications to the erosion control system to mitigate the erosion and its affects.
B. General maintenance activities:
   1. Repair or replace damaged or missing items immediately.

C. Maintain erosion and sediment control plans after excavation and grading. Maintain erosion and sediment control through Substantial Completion.

D. Provide necessary ditches, swales, and dikes to direct all potentially sediment-laden water towards and into sediment traps/basins or other approved treatment BMPs or devices.

E. Dust control:
   1. Use water sprinkling, temporary enclosures, and other methods to minimize dust and dirt migration in accordance with Section 01 57 19, Temporary Environmental Controls. Prevent runoff from all water used for dust control from entering into the storm sewer system. See 01 57 24, Temporary Site Water Discharge, for containment options and treatment measures. Do the water sprinkling so that water does not accumulate or run across grade.

F. Immediately stabilize with the approved BMP methods (such as seeding, mulching, and plastic covering) all areas of exposed soils that will not be disturbed for 24 hours during the wet season or seven days during the dry season.

G. Address all areas needing BMP measures that do not require immediate attention within 15 days of Contractor’s attention or notification from the Resident Engineer or CSEMS.

H. At a minimum, inspect all TESC BMPs weekly and after any significant rain event (0.5 inch or greater) between April 1 and September 30 and daily and after any measurable rain event between October 1 and March 31. Repair as necessary to meet requirements of the SMMWW and/or NPDES permit.

I. Maintain and repair all TESC practices as needed to ensure continued performance of their intended function. Conduct all maintenance and repair in accordance with the approved TESC Plan(s).

J. Inspect and maintain the TESC facilities on inactive sites once a week or 24 hours following a storm event.

K. Operate and maintain storm and surface water facilities as follows:
   1. Remove sediment from behind sediment fence when sediment reaches 1/3 the height of the fence to prevent overtopping.
   2. Prevent sediments from being flushed to the downstream system during cleaning.
   3. Remove sediment, trash, and debris from catch basin grate surfaces when blocking more than 20 percent of the grate surface.
   4. Remove sediment, trash, and debris from catch basin interiors when debris exceeds 1/3 of the depth from bottom to pipe invert.
   5. Perform inspection for systems using catch basin inserts. Clear or replace clogged fabric.
   6. Immediately remove all sediment accidentally introduced into a catch basin.
7. Clean interceptor ditches of sediment and vegetation when accumulation exceeds three inches in depth or when free movement of water through ditch is restricted.

8. If dead animals or other health hazards are present, contact local health department and/or animal control regarding removal and disposal.

L. Monitor triangular silt dikes for performance and sediment accumulations during and after each runoff producing rainfall. Remove sediment when it reaches one-half the height of the dike.

M. At a minimum of once per day or as directed by the Resident Engineer provide street sweeping services on streets and parking areas surrounding construction sites. Promptly clean up spills of transported material on public roads and parking lots by sweeping using an approved street sweeper machine. Coordinate with traffic control requirements, Section 01 55 26, Traffic Control.

N. Remove particulate matter deposited on paved public roads, sidewalks and bicycle and pedestrian paths to reduce mud and dust. Refer to Section 01 57 19, Temporary Environmental Controls.

O. Sawcutting: Collect, treat, and disposal of water used for and slurry and cuttings produced by the sawcutting operation:

1. Vacuum slurry and cuttings during cutting and surfacing operations continually with a wet-vac carried by laborer directly behind the cutting operation.

2. Do not leave slurry and cuttings on permanent concrete or asphalt pavement overnight.

3. Do not allow slurry and cuttings to drain to all natural or constructed conveyance system.

4. Dispose of collected slurry and cuttings in a manner that does not violate groundwater or surface water quality standards.

5. For disposal and treatment methods, Refer to Section 01 57 24, Temporary Site Water Discharge.

P. Continually monitor operations to determine whether slurry, cuttings, or process water could enter waters of the state. If inspections show that a violation of water quality standards could occur, stop operations and immediately implement preventive measures such as berms, barriers, secondary containment, and vacuum trucks.

Q. Handle and dispose of cleaning waste material and demolition debris in a manner that does not cause contamination of water. If the area is swept with a pick-up sweeper, the material must be hauled out of the area to an appropriate disposal site.

R. Remove all TESC measures within 30 days after final site stabilization is achieved or after the temporary BMPs are no longer needed. Remove and dispose of in an approved site or stabilize trapped sediment on site. Permanently stabilize disturbed soil areas resulting from removal.

3.04 COMPLETION OF CONSTRUCTION

A. See Section 01 12 19, Contract Interface.
3.05 SYSTEM COMPLIANCE

A. The Resident Engineer and regulatory agencies will determine the effectiveness of the erosion control system. Damaged and/or inadequate or ineffective TESC BMPs shall be corrected immediately.

B. If the erosion control system is determined to be ineffective by the Resident Engineer or regulatory agencies, upgrade and modify erosion control system until effective, as determined by the Resident Engineer and regulatory agencies.

C. Refusal to modify and upgrade the erosion control system as required within five Days of notice from the Resident Engineer, may result in the work being completed by a third party and the cost of the work being withheld from the Application for Payment.

D. Continued non-compliance with the erosion control requirements and water quality requirements may result in stoppage of work and monetary fines.

E. In the event that the Washington State Department of Ecology issues a Notice of Violation, Notice of Non-Compliance, or other Enforcement Action, the Resident Engineer may stop all construction activities until it has been determined to the satisfaction of the Resident Engineer that the project is in compliance. The Resident Engineer may require the Contractor to send additional staff to successfully complete the Stormwater Construction Best Management Practices (BMPs) field training as provided by the Associated General Contractors (AGC) before construction activities can resume. The project schedule will not be changed to accommodate the time lost. All costs associated with work stoppages, mitigation of the triggering event(s), and/or training shall be paid by the Contractor.

3.06 CLEANING

A. Wheel / Truck Wash

1. Design, construct, and operate a wheel wash for all construction conditions at the University of Washington Station.

   a. Incorporate the following into requirements indicated on the Contract Drawings.

      1) Designed to clean tires and truck under carriage.
      2) Include water spray nozzles aimed at tires and undercarriage.
      3) Water pressure and rates sufficient to clean.
      4) Include other methods, such as laborers with hoses, when needed to meet requirements to prevent mud and debris being transported off-site.

B. Equipment Wash

1. Do not discharge thinners or solvents into the sanitary or storm sewer systems when cleaning large machine parts where discharge of water is required. Use alternative methods for cleaning larger equipment parts such as high pressure, high temperature water washes, or steam cleaning.

2. Equipment washing detergents can be used and wash water discharged into the sanitary sewer system if grit is removed from the solution first. Do not exceed the discharge limits set by the sewer authority with the water discharged into the sewer.
3. Small parts can be cleaned with degreasing solvents which are reused or recycled. Do not discharge solvents into storm sewer in accordance with the SMMWW, nor into sanitary or combined sewer system.

4. Do not discharge process water from equipment washing to the storm drainage system. Refer to Section 01 57 24, Temporary Site Water Discharge.

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SECTION 01 57 15
TEMPORARY CONSTRUCTION NOISE AND VIBRATION CONTROL

PART 1 - GENERAL

1.01 SUMMARY

A. This Section specifies requirements for complying with applicable noise regulations, and noise and vibration limits.

B. Related Sections: The work of the following Sections is related to the work of this Section. Other Sections, not referenced below, may also be related to the proper performance of this work.

1. Section 01 12 16, Work Sequence.
2. Section 01 41 26, Permits.
3. Section 31 09 00, Geotechnical Instrumentation and Monitoring of Earthwork.

C. The hours of construction are subjected to and limited by the City of Seattle requirements. Construction during all other times is prohibited unless a variance can be obtained. Refer to Section 01 12 16, Work Sequence, for hours of work.

1.02 REFERENCES

A. This Section incorporates by reference the latest revisions of the following documents.

1. American National Standards Institute (ANSI)
   a. ANSI S1.4 Specification for Sound Level Meters
   b. ANSI S2.4 Auxiliary Analog Equipment for Shock and Vibration Measurements

1.03 DEFINITIONS

A. Construction Site: For purpose of noise and vibration control requirements, the Construction Work Area limits. This includes Right-of-Way, property, and construction easements, used expressly for construction.

B. Noise Level Measurements: A-weighted and "slow" response readings from instruments complying with TYPE 1 or TYPE 2 requirements of the American National Standard Institute (ANSI) S1.4, Specification for Sound Level Meters.

C. A-Weighted Noise Levels: Decibels (referenced to 20 micro-Pascal) as measured with A-weighting network of standard sound level meter, abbreviated dBA.

D. Vibration Measurements: The use of a vibration transducer, amplifier, peak detector, and frequency band filters complying with ANSI S2.4.

E. Vibration: Velocity in microinches per second. Vibration levels are expressed as velocity levels in Decibels referenced to one microinch per second, abbreviated VdB.
F. Noise Sensitive Locations: Residential areas, institutions, hospitals, parks, and other locations so named herein.

G. Maximum Sound Level $L_{\text{max}}$: The maximum recorded root mean square (RMS) A-weighted sound level for a given time interval or event.

H. Equivalent Sound Level $L_{\text{eq}}$: The A-weighted level of a constant sound having the same energy content as the actual time-varying level during a specified interval. The $L_{\text{eq}}$ is used to characterize complex, fluctuating sound levels with a single number. Typical intervals for $L_{\text{eq}}$ are hourly, daily and annually.

I. Vibration Monitoring: Monitoring used to determine if the equipment and methods used to complete the work cause vibrations that equal or exceed threshold values. The data gathered provide onsite feedback of the effects of specific operations and procedures.

### 1.04 REGULATORY REQUIREMENTS

A. Washington Code of Regulations (WCR)

B. Washington Industrial Safety and Health Act (WISHA)

C. City of Seattle Noise Control Ordinances

D. Code of Federal Regulations (CFR)

E. Environmental Protection Agency (EPA), State and local authorities.

F. Federal Occupational Safety and Health Act (OSHA)

### 1.05 SUBMITTALS

A. Procedures: Section 01 33 00, Submittal Procedures.

B. Noise and Vibration Control Plan: Within 45 Days of NTP, as specified herein.

C. Qualifications of the Acoustic Specialist:
   1. Membership in a recognized acoustical organisation such as the National Council of Acoustical Consultants (NCAC), Institute if Noise Control Engineering (INCE), or Acoustical Society of America (ASA).
   2. Minimum 10 years experience performing similar work.

D. Noise and Vibration Monitoring Plan:
   1. Within 45 Days of NTP for initial Plan, as specified herein.
   2. Updates as required.
   4. Certificates of calibration for monitoring instruments, including updated certificates after repairs to instruments.

E. Weekly Noise and Vibration Measurement Reports: as specified herein.

F. Shop and Working Drawings, computations, material data and other criteria, for all noise abatement measures identified in the Noise and Vibration Control Plan. Have Contract Drawings and computations approved by an Acoustic Specialist.
1.06 RESPONSIBILITIES OF CONTRACTOR

A. Sound Transit has applied for a Technical Noise Variance for construction. This process is currently in application and final noise levels have not been defined.

B. Perform Work within the permissible noise and vibration levels, work schedule limitations, and procedures provided for in this Section, the Technical Noise Variance listed in Section 01 41 26, Permits, and applicable federal, state, county and City of Seattle codes, regulations, and standards.

C. Other than those provided herein, be responsible for obtaining, at own expense, permits, variances, equipment certifications and other documents required by this Section and by applicable federal, state, county, and municipal codes, regulations and standards.

D. Use equipment with effective noise-suppression devices and employ other noise control measures such as barriers and curtains necessary to protect the public.

E. Schedule and conduct operations in a manner minimizes, to the greatest extent feasible, the disturbance to the public in areas adjacent to the construction activities and to occupants of buildings in the vicinity of the construction activities.

F. Compliance with the requirements of this Section may require the use of equipment with special exhaust silencers or enclosures, and construction of temporary enclosures or noise barriers around activities. Use haul routes and staging areas as shown on the Contract Drawings, to minimize noise at residential and other sensitive receptor sites. Noise produced by elevated equipment, including crane pulleys and hoses, must be minimized.

1.07 NOISE AND VIBRATION CONTROL PLAN

A. Requirements

1. Prepare a Noise and Vibration Control Plan which includes the following for construction activities that may occur at the construction site:

a. Site Drawing - Prepare a scaled drawing of the construction site indicating the following:

1) Contract name and number

2) Contractor's name

3) Date and hours of work operation

4) Scale

5) Direction of North

6) Identify noise and vibration sensitive locations near the construction site

7) Construction equipment locations used, designated by the code letter used in Column (a) in Part A of the Noise Control Plan Form, Figure 1.

8) Locations of the noise levels calculated for the nearest residential, commercial, and industrial areas as specified herein.
9) Locations and types of noise abatement measures that may be required to meet codes and regulations as indicated by the calculations.

b. Equipment Inventory - Prepare an inventory of equipment used by providing the following information in the indicated columns of Noise Control Plan Form, Figure 1.

1) **Column (a)** - Code letter in sketch to indicate position of equipment on site

2) **Column (b)** – Category or type of equipment

3) **Column (c)** - Equipment manufacturer and model, if known at the time of the Plan's preparation

4) **Column (d)** - Unique identifier (ID), such as registration number, if known at the time of the Plan's preparation.

5) **Column (e)** - Equipment horsepower

6) **Column (f)** - Estimated noise level at 50 feet, obtained from either the manufacturer or from approved field noise measurements of same equipment

7) **Column (g)** - Estimated date of first use on site

8) **Column (h)** Estimated date of last use on site

9) Noise Calculations - Prepare calculations of $L_{max}$ noise levels expected at the nearest residential and commercial property lines and identified noise-sensitive locations near the construction site, based on the equipment noise levels given in Part A of the Noise Control Plan Form. Determine the nearest property lines from the noise-sensitive locations. Make the calculations for locations where noise emitted by applicable equipment causes the greatest noise level for each type of land use, if necessary. Provide the results on Part B of the Noise Control Plan Form, Figure 2, with calculations included below the results, and with the locations for the calculations indicated on the site sketch.

c. Summary of Required Noise Abatement Measures as necessary.

2. Do not operate noise generating construction equipment at the construction site prior to Acceptance of the Noise and Vibration Monitoring Plan. Update and re-submit the Noise and Vibration Control Plan upon all major change in work schedule, construction methods, or equipment operations not included in the most recent Plan.

3. Prepared and certified by the Acoustic Specialist.

B. Noise Abatement Measures - If the results of the noise calculations indicate that noise level limits are exceeded, identify proposed noise abatement measures, their anticipated effects (dBA reductions), and a schedule for their implementation. Recalculate the noise levels at the nearest sensitive receptor location property lines that include the anticipated noise reduction effects and submit the results on Part B of the Noise Control Plan Form. Include, as backup documentation to Part B of the Noise Control Plan, drawings, sketches, and suitable calculations that demonstrate anticipated noise reduction benefits.
and that proposed structures or facilities comply with applicable building code requirements.

C. Noise Reduction Methods - To the extent required to meet the noise limits specified, use reasonable efforts to include noise reduction measures listed below to minimize construction noise emission levels. Noise reduction measures include, but are not limited to the following:

D. Vibration Control – Provide measures that can be used to reduce vibrations in the event that level limits are exceeded. The measures include changes in construction techniques.

1.08 NOISE AND VIBRATION MONITORING PLAN

A. Requirements

1. Prepare a Noise and Vibration Monitoring Plan specifying the construction activities, monitoring locations, equipment, procedures, characterization of the noise produced with equipment usage, schedule of measurements and reporting methods to be used.

2. Furnish noise and vibration monitoring data to the Resident Engineer on a weekly basis. Include measurements taken during the previous week.

3. In the event that the measured noise levels exceed allowable limits, immediately notify the Resident Engineer and immediately implement additional Noise Abatement Measures as specified in the Noise and Vibration Control Plan. Where necessary terminate the construction activity responsible for the noise limits exceedance until the specified Abatement Measures can be implemented.

4. In the event that the measured vibration levels exceed allowable limits, immediately notify the Resident Engineer and immediately implement changes in construction techniques as specified in the Noise and Vibration Control Plan.

B. Measurement Locations

1. The vibration monitoring locations in the vicinity of the University of Washington are shown on the Contract Drawings. The measurement sites shown represent the closest points to vibration sensitive land uses to the construction equipment being operated. These locations may change during the Contract, and the Resident Engineer updates as required.

2. Noise measurement to be taken at construction site boundaries and at nearby residential and commercial property lines as defined above.

3. Prepare and submit a scaled plan indicating noise and vibration monitoring locations.
Vibration sensitive building plan
PART 2 - PRODUCTS

2.01 NOISE CONTROL MATERIALS

A. Noise control materials may be new or used. Used materials must be sound and free of damage and defects and are of a quality and condition to perform their designed function for the duration of construction of this Contract.

2.02 NOISE MEASUREMENT EQUIPMENT

A. Perform noise measurements using permanently installed sound monitoring stations equipped with the following measurement and documentation devices:

1. Sound level analyzer with the following capabilities:
   a. Capable of measuring on both the A-Weighted and C-Weighted scales required by regulatory criteria and Noise Level Limits.
   b. Complies with the criteria for a TYPE 1 (Precision) or TYPE 2 (General Purpose) Sound Level Meter as defined in the ANSI Standard S1.4.
   c. Continuous broadband logging on 1-second LAeq, LAmx and LAmn.
   d. Continuous spectral logging of 1-second LAeq, LAmx and LAmn.
   e. Sound recording and external equipment trigger capabilities in the event of a variance exceedance.
   f. Sufficient internal memory for 1 week of logged data and sound recordings.

2. Free-field microphone housed in an environmental shroud providing protection from rain and wind conditions. The environmental shroud is capable of outdoor measurements for at least one year without service or replacement.

B. Calibrate sound level analyzer, microphones, and calibrators for certified laboratory conformance at least once during the Contract. Submit a current certificate of conformance to the Resident Engineer before using the sound level meter and submit updated certificates following subsequent calibrations upon the completion of repairs to the instrument.

2.03 VIBRATION MONITORING EQUIPMENT

A. Provide portable seismographs for monitoring the velocities of ground vibrations resulting from construction activities. The seismograph has the following minimum features:

1. Seismic Velocity range: 0.005 to 10 inches per second with an accuracy of within 3 percent of the measured peak particle velocity or better at frequencies between 1 Hertz and 250 Hertz, and with a resolution of 0.005 inch per second or less.

2. Frequency response (within 3 dBA points): 1 to 250 Hertz.

3. Multi channel for vibration monitoring.

4. Two power sources: internal rechargeable battery and charger and 115 volts AC. Battery must be capable of supplying power to monitor vibration continuously for up to 30 days.
5. Capable of internal dynamic calibration.

6. Direct writing to printer and capability to transfer data from memory to a laptop computer or compact disc (CD). Instruments must be capable of producing strip chart recordings of readings on site within one hour of obtaining the readings. Provide computer software to perform analysis, produce reports of continuous monitoring, and to perform zero-crossing frequency analyses of waveform data. Ensure that all reports and analyses are capable of output to a laptop computer or CD.

7. Self-triggering waveform capture mode that provides the following information: plot of wave forms, peak particle velocities, frequencies of peaks.

8. Continuous monitoring mode must be capable of recording single-component peak particle velocities, and frequency of peaks with an interval of 1 minute or less.

B. Provide all recommended ancillary equipment as recommended by the manufacturer for a complete and functional system.

PART 3 - EXECUTION

A. Do not exceed the maximum permissible sound levels presented in Table 1 and Table 2 during the hours of construction.

B. Sound created by impact types of construction equipment, including but not limited to pavement breakers, jackhammers, sandblasting tools, or other types of equipment or devices that create impulse noise or impact noise or are used as impact equipment, as measured at the nearest property line or monitoring point, may exceed the maximum permissible sound levels presented in Table 1 in any one-hour period during hours of 8 am and 5 pm on weekdays and 9 am and 5 pm on weekends only, but in no event is to exceed the following maximum noise level limits:

1. 90 dBA continuously;
2. 93 dBA for 30 minutes;
3. 96 dBA for 15 minutes;
4. 99 dBA for 7 minutes;
5. In excess of 99 dBA are prohibited unless authorized by variance.

C. For operation of construction equipment that could exceed allowable noise limits during nighttime hours between the hours of 10 pm and 7 am weekdays and 10 pm and 9 am Saturdays, Sundays or legal holidays, the Contractor must obtain appropriate noise variance from the City of Seattle. Contractors are given noise performance criteria that they are required to meet during nighttime hours. This criteria gives the Contractor flexibility of either prohibiting certain noise generating activities during nighttime hours or providing additional noise control measures to meet these noise limits.

D. These limits are for equipment on construction sites, including but not limited to crawlers, tractors, dozers, rotary drills, loaders, power shovels, cranes, derricks, graders, off-highway trucks, ditchers, trenchers, compactors, compressors, and pneumatic-powered equipment.

E. The noise levels should be measured at the nearest monitoring points.
3.02 VIBRATION LEVEL LIMITS

A. Measures applied to limit noise levels may in some cases limit vibration levels also. Measures specified above for noise levels are applicable. Table 4 contains the threshold vibration limits for construction vibration monitoring.

B. For all areas, conduct construction activities so that vibration levels at the nearest affected building monitoring points do not exceed root-mean-square (rms.) unweighted vibration velocity levels in vertical direction over a frequency range of one to 100 Hertz as listed in Table 3.

C. Vibration levels at buildings affected by construction operations refer to vertical direction vibration on ground surface or building floor.

D. Installation of Vibration Monitors:

1. For monitoring in the vicinity of nearby structures or utilities, locate vibration sensors on the ground surface near the structures or utilities. Install geophones level and firmly mount on the surface slab of concrete or asphalt, or firmly anchor in undisturbed soil. Orient geophones towards the construction activity.

2. For monitoring on structures, install wall mount kit to attach geophones to structure face or columns. Mount geophones level and orient towards the construction activity.

3. See Contract Specifications Section 31 09 00, Geotechnical Instrumentation and Monitoring of Earthwork, for other installation, monitoring, and reporting requirements.

E. Conduct daily measurements of vibration during peak vibration generating construction activities. Any activities that may produce vibration levels above values shown in Table 3 whenever a structure is located nearby the construction activity are subject to vibration monitoring. Peak vibration generating construction activities are limited in the design.

F. The design and construction is performed using the current state of practice in soft ground tunneling to help minimize potential for settlement, vibration-induced damage to structures and other ground movement.

3.03 CONSTRUCTION METHODS – EQUIPMENT

A. Where possible, use concrete crushers or pavement saws rather than hoe rams for tasks such as concrete deck removal and retaining wall demolition.

B. Ensure that pneumatic impact tools and equipment used at the construction site have intake and exhaust mufflers recommended by the manufacturers thereof, to meet relevant noise ordinance limitations.

C. Equip noise producing equipment, including jackhammers and pavement breaker(s), with acoustically attenuating shields or shrouds recommended by the manufacturers thereof, to meet relevant noise ordinance limitations.

D. Line or cover storage bins and chutes with sound-deadening material.

E. Provide mufflers or shield paneling for other equipment, including internal combustion engines, recommended by manufacturers thereof.

F. Blasting, impact pile driving, vibratory sheet installation and vibratory rollers are prohibited from use.
G. As required to meet the noise limits specified in this Section, use alternative procedures of construction and selection of proper combination of techniques that generate least overall noise and vibration. Such alternative procedures include the following:

1. Use electric welders powered from utility main lines instead of internal combustion powered generators/welders.
2. Mix concrete off-site instead of on-site.
3. Employ prefabricated structures instead of assembling on-site.
4. Drilled pile installation methods.

H. Use construction equipment manufactured or modified to dampen noise and vibration emissions, such as:

1. Use electric instead of diesel-powered equipment.
2. Use hydraulic tools instead of pneumatic impact tools.
3. Use electric instead of air- or gasoline-driven saws.

3.04 CONSTRUCTION METHODS – OPERATIONS

A. Operate equipment and in particular slurry wall installation equipment and cranes so as to minimize banging, clattering, buzzing, and other annoying types of noises, especially near residential areas.

B. To the extent feasible, configure the construction site in a manner that keeps noisier equipment and activities as far as possible from noise sensitive locations and nearby buildings.

C. In no case are above restrictions limiting the responsibility for compliance with applicable federal, state and local safety ordinances and regulations and other Sections of these Contract Specifications.

D. Maximize physical separation, as far as practicable, between noise generators and noise receptors. Separation includes following measures:

1. Provide enclosures for stationary items of equipment and barriers around particularly noisy areas on site.
2. Locate stationary equipment to minimize noise and vibration impact on community, subject to verification by the Resident Engineer.

E. Minimize noise-intrusive impacts during most noise sensitive hours.

1. Plan noisier operations during times of highest ambient noise levels.
2. Keep noise levels relatively uniform; avoid excessive and impulse noises.
3. Turn off idling equipment.
4. Phase in start-up and shut-down of site equipment.
5. Avoid simultaneous activities that both generate high noise levels.

F. Use construction truck routes for muck disposal as shown on the Contract Drawings.
1. Conduct truck loading, unloading and hauling operations so noise and vibration are kept to a minimum.

2. Do not operate trucks on streets that pass by schools during school hours.

3. Limit the time that steel decking or plates for street decking or covering excavated areas are in use.

4. Grade surface irregularities on construction sites to minimize the generation of impact noise and ground vibrations by passing vehicles.

G. Use warning broadband backup alarms on all equipment in operation at the site, daytime and nighttime.

H. Limit the use of enunciators or public address systems, except for emergency notifications.

3.05 CONSTRUCTION METHODS – NOISE ABATEMENT MEASURES

A. Install noise abatement measures in locations specified in the Noise Control Plan adjacent to equipment as required to meet the noise limits specified.

3.06 NOISE AND VIBRATION MEASUREMENT PROCEDURES

A. Noise Measurement Procedure

1. Field calibrate the sound level analyzer using an acoustic calibrator, according to the manufacturer’s specifications, before each measurement.

2. Except as otherwise indicated, perform measurements using the A-weighting network and the SLOW response of the sound level meter.

3. Measure impulsive or impact noises using the C-Weighting network and the FAST response of the sound level meter.

4. Fit the measurement microphone with an appropriate windscreen at the location of the sensitive receptor at least four to six feet away from the nearest reflective surface.

5. Take noise measurements at the nearest property line and agreed noise sensitive locations at least once each week and after a change in construction activity or construction location. Measurement periods: a minimum of 20 minutes.

6. Ensure that construction noise measurements coincide with periods of maximum noise-generating construction activity, and take measurements during the construction phase or activity that has the greatest potential to create annoyance or to exceed applicable noise regulations and restrictions.

7. If, in the estimation of the person performing the measurements, outside noise sources contribute significantly to the measured noise level, repeat the measurements with the same outside source contributions when construction is inactive to determine the background noise level.

8. Submit noise data to the Resident Engineer on a weekly basis using the Noise Measurements Report Form provided in Figure 3. Note the type of measurement (for example, baseline, on-going construction) on the form.
9. Clearly identify monitoring locations and sketch on the back of the Noise Measurements Report Form, Figure 3, along with the locations of and distances from any agreed noise-sensitive location.

10. Identify construction equipment operating and characterize the sound being generated during the monitoring period and the locations sketched on the back of the Noise Measurements Report Form, along with the locations and distances to any agreed noise sensitive location.

B. Vibration Measurement Procedures

1. Field calibrate the vibration monitoring equipment, according to the manufacturer’s specifications, before each measurement.

2. Take vibration measurements at sensitive locations as indicated herein and on the Contract Drawings at least once each week and after a change in construction activity or construction location. Measurement periods: a minimum of 20 minutes.

3. Ensure that vibration measurements coincide with periods of maximum vibration-generating construction activity, and take measurements during the construction phase or activity that has the greatest potential to create annoyance or to exceed applicable vibration limits.

4. Submit vibration data to the Resident Engineer on a weekly basis using a Contractor-generated form. Note the type of measurement (for example baseline, on-going construction) on the form.

5. Clearly identify monitoring locations and sketch on the back of the vibration report form.

6. Identify construction equipment operating during the monitoring period and the locations sketched on the back of the vibration report form.

<table>
<thead>
<tr>
<th>TABLE 1 MAXIMUM DAYTIME PERMISSIBLE SOUND LEVELS</th>
</tr>
</thead>
<tbody>
<tr>
<td>District of Sound Source</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Residential</td>
</tr>
<tr>
<td>Commercial</td>
</tr>
</tbody>
</table>
### TABLE 2  MAXIMUM NIGHTTIME PERMISSIBLE SOUND LEVELS

<table>
<thead>
<tr>
<th>District of Sound Source</th>
<th>District of Receiving Property</th>
<th>Residential (dBA)</th>
<th>Commercial (dBA)</th>
<th>Industrial (dBA)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Commercial</td>
<td></td>
<td>45</td>
<td>60</td>
<td>65</td>
</tr>
</tbody>
</table>

Note: Permissible sound levels given are based on current code limits indicated in Table 2. These may change based on the Technical Noise Variance application.

### TABLE 3.  CONSTRUCTION VIBRATION LIMITS

<table>
<thead>
<tr>
<th>Vibration Type (Permissible Duration)</th>
<th>Vibration Limit (RMS VdB re 1 microinch/sec)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sustained (≥1 hr/day)</td>
<td>80</td>
</tr>
<tr>
<td>Transient (&lt;1 hr/day)</td>
<td>90</td>
</tr>
<tr>
<td>Transient (&lt;10 min/day)</td>
<td>100</td>
</tr>
</tbody>
</table>

### TABLE 4.  THRESHOLD VIBRATION LIMITS FOR CONSTRUCTION VIBRATION MONITORING

<table>
<thead>
<tr>
<th>Location</th>
<th>IES Standard</th>
<th>Peak Particle Velocity (in/sec)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surgery Pavilion</td>
<td>VC - C</td>
<td>0.008</td>
</tr>
<tr>
<td>Wilcox Hall</td>
<td>VC - D</td>
<td>0.002</td>
</tr>
</tbody>
</table>
QUARTERLY NOISE CONTROL PLAN - CONSTRUCTION ACTIVITIES
AT EACH CONSTRUCTION SITE (DUPLICATE AS NEEDED)

Contract No.: _______________  Contract Name: _______________  Contractor: _______________

Site: _______________________  Date: _______________  Resubmit every three months

(ATTACH SITE SKETCH)

PART A: EQUIPMENT INVENTORY

<table>
<thead>
<tr>
<th>Code (a)</th>
<th>Equipment</th>
<th>Noise Level At 50 Feet (f)</th>
<th>Date Begin (g)</th>
<th>Date End (h)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</table>

FIGURE 1. QUARTERLY NOISE CONTROL PLAN FORM - PART A
QUARTERLY NOISE CONTROL PLAN (DUPLICATE AS NEEDED)

Contract No.: ____________  Contract Name: 
Contractor: ____________  Site: 
Date: ________________  Land Use: 

Resubmit every three months.

PART B: CALCULATED CONSTRUCTION NOISE LEVELS AT NEAREST RESIDENTIAL AND COMMERCIAL RECEIVERS FOR EACH CONSTRUCTION ACTIVITY

<table>
<thead>
<tr>
<th>Nearest Noise Sensitive Receivers</th>
<th>Calculated Sound Pressure Level (dBA)*</th>
</tr>
</thead>
<tbody>
<tr>
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</tr>
</tbody>
</table>

* Equipment used for each construction activity is taken from Part A of the Noise Control Plan

NOISE ABATEMENT MEASURES

ANTICIPATED EFFECTS

CALCULATIONS - attach additional sheet(s) as needed.

FIGURE 2. QUARTERLY NOISE CONTROL PLAN FORM - PART B
**NOISE MEASUREMENTS REPORT FORM**

Measured By: __________________________ Of: ________________________________ (Company)

Monitoring Address: ________________________________________________________ (Provide Sketch on Back)

Location No: _______________ Wind Speed: ___________ Km/Hr  Direction: ________

(MPH x 1.6)

Location of Sound Level Meter: (No closer than 15 meters from equipment and 3 meters from building)

Monitoring was Conducted: __________ Meters from Equipment (____________________)

(Type(s): Leave Blank for Baseline)

Land Use:  ☐ Residential/Institutional ☐ Business/Recreational ☐ Industrial

Sound Level Meter: Make and Model: ______________  ☐ A - Weighted Sound Level (Slow)

Duration of Measurement: (20 minutes to 1 hour)

<table>
<thead>
<tr>
<th>CALIBRATION LEVEL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leq</td>
</tr>
<tr>
<td>L25</td>
</tr>
<tr>
<td>L08</td>
</tr>
<tr>
<td>L02</td>
</tr>
<tr>
<td>Lmax</td>
</tr>
<tr>
<td>Allowable Noise Limit</td>
</tr>
</tbody>
</table>

Field Notes;

Check one of the following:

☐ Ongoing Construction  ☐ Post-Construction: __________  ☐ Baseline Conditions (Contract)

(Complete all that apply below)

Active Contract(s): _______________________________________________________

(List all contracts that contribute to measured noise)

Complaint Response: ______________________________________________________

(Describe: Include Log-In Number)

Abatement Follow-Up: _____________________________________________________

(Describe)

**FIGURE 3: NOISE MEASUREMENTS REPORT FORM**

END OF SECTION
PART 1 - GENERAL

1.01 SUMMARY:

A. This Section specifies elimination or minimizing of air and water pollution generated by construction activities.

B. Related Sections: The work of the following Sections is related to the work of this Section. Other Sections not referenced below may also be related to the proper performance of this work.

1. Section 01 35 29, Health, Safety, and Emergency Response Procedures.

2. Section 01 41 26, Permits.

3. Section 01 57 13, Temporary Erosion and Sediment Control.

4. Section 01 57 15, Temporary Construction Noise and Vibration Control.

5. Section 01 57 24, Temporary Site Water Discharge.

6. Section 01 74 00, Cleaning and Waste Management.

1.02 REFERENCES

A. This Section incorporates by reference the latest revisions of the following documents:

1. Revised Code of Washington (RCW)
   a. Chapter 70.105 Hazardous Waste Management.
   c. Chapter 90.48 Water Pollution Control Act

2. Washington Administrative Code (WAC):
   a. WAC Chapter 173-240 Submission of Plans and Reports for Construction of Wastewater Facilities.
   b. WAC Chapter 173-303 Dangerous Waste Regulations.
   c. WAC Chapter 173-304 Minimum Functional Standards for Solid Waste Handling.
   d. WAC Chapter 173-340 Model Toxics Control Act - Cleanup.

3. Other Agency Requirements
   a. National Pollution Discharge Elimination System Permit (NPDES Permit).
b. (COS) City of Seattle Critical Area Ordinance.

c. University of Washington Project Manager’s Reference Document for Environmental Stewardship (PMRDES)

1.03 DEFINITIONS

A. Hazardous or Contaminated Waste – Material generated by the Contractor’s operations that is either Hazardous or Contaminated Substances.

B. Suspect Materials – Material that is discovered in the construction process and is suspected to be contaminated, but has not been examined and identified as being contaminated.

C. PM10 – Particulate Matter 10 microns in diameter or less.

1.04 SUBMITTALS:

A. Procedures: Section 01 33 00, Submittal Procedures.

B. Contractor-Generated Hazardous and Contaminated Waste Management Plan.

C. Stormwater Pollution Prevention Plan: As required under the Clean Water Act and related federal and state laws and regulations, within 21 Days of effective date of NTP. Coordinate plan with requirements of Section 01 41 26, Temporary Site Water Discharge.

D. Air Pollution Control Plan: Within 21 Days of effective date of NTP.

E. Contractor Erosion and Sediment Control Plan: Within 21 Days of effective date of NTP. Coordinate plan with requirements of Section 01 57 13, Temporary Erosion and Sediment Control.

F. Qualifications for Construction Site Environmental Management Supervisor or other qualified employee(s) approved by the Resident Engineer, to implement, manage, and enforce compliance with the requirements herein.

G. Spill Control Plan: As required under the Clean Water Act and related federal and state laws and regulations, within 21 Days of effective date of Notice to Proceed (NTP). Coordinate plan with requirements of Section 01 57 24, Temporary Site Water Discharge.

H. Noise Control Plan and Noise Monitoring: In accordance with Section 01 57 15, Temporary Construction and Vibration Control.

I. Citations issued in conjunction with this project.


K. Waste Management Plan: Refer to Section 01 74 00, Cleaning and Waste Management

L. Waste Management Report: Refer to Section 01 74 00, Cleaning and Waste Management

1.05 QUALITY ASSURANCE

A. Designate a Construction Site Environmental Management Supervisor and other qualified employee(s) approved by the Resident Engineer, to implement, manage, and enforce compliance with the following:

2. Site Water Discharge: Section 01 57 24, Temporary Site Water Discharge.

3. Air Pollution Control Plan.


5. Spill Control Plan.


B. Qualifications:

1. Construction Site Environmental Management Supervisor (CSEMS):
   a. Certified Erosion and Sediment Control Lead (CESCL) as defined by Washington State Department of Ecology currently certified as a Certified Professional in Erosion and Sediment Control (CPESC) as provided by CPESC, Inc. (www.cpesc.org).
   b. Have a minimum 5 years of experience being responsible for construction site erosion and sediment control regulatory requirements, BMPs, TESC Plan development, and stormwater monitoring.

2. More than one person may be submitted to provide services required of the supervisor; however, only one person will be responsible for all activities.

1.06 AIR POLLUTION CONTROL PLAN

A. Address use of best management practices to contain dust so that no visible emissions beyond the site boundaries occur.

B. Address approach to prevent odors that interfere with public, including limiting use of chemical products and keeping construction equipment in good mechanical condition to minimize exhaust emissions.

1.07 CONTRACTOR-GENERATED HAZARDOUS AND CONTAMINATED WASTE MANAGEMENT PLAN

A. Submit within 21 Days after effective date of Notice to Proceed (NTP) with required documents.

B. Plan to properly handle Contractor-generated Hazardous or Contaminated Wastes in accordance with applicable laws and regulations. Include:

1. Indemnifications: To the maximum extent permitted by law and to the extent such Claims are not covered by the OCIP, Contractor shall indemnify, release, defend, and hold harmless the Indemnified Parties, as defined in General Conditions or Special Condition, against any liability including any and all suits, claims, actions, losses, costs, penalties, response costs, and damages of whatsoever kind or nature (collectively “Claims”) to the extent arising out of, in connection with, or incident to the management, abatement, removal, remediation, clean-up, transport, reuse, recycling, storage and disposal of all Contractor-Generated Hazardous or Contaminated Waste.
2. Identify responsibility for the management, abatement, removal, remediation, clean up, transport, reuse, recycling, storage and disposal of Contractor-Generated Dangerous Waste in accordance with laws, rules, regulations and orders, including without limitation, WAC 173-303, the University of Washington PMRDES, and regulations of the waste disposal facility to be used.

1.08 ENVIRONMENTAL COMPLIANCE MANUALS

A. Prepare manual for the University of Washington Station Construction Site.

B. Include the following information in the manual:

1. Surface water discharge treatment system operation and maintenance manual.

2. Sanitary sewer discharge treatment system operation and maintenance manual.

3. Permits that should be included, but not limited to are:

   a. Grading
   b. Noise variance
   c. NPDES permits.
   d. Sewer Discharge Permit

4. TESC Submittals with status of either “No Exception Taken” or “Exceptions as Noted - Resubmission Not Required”.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 PROTECTION

A. Air Pollution Controls

1. Criteria for Fugitive Dust:

   a. Do not cause or allow emissions of fugitive dust from transport, handling, construction, or storage activities to remain visible in atmosphere beyond property line of the emission source.

   b. Take precautions to minimize fugitive dust emissions from operations involving demolition, excavation, grading, clearing of land, and disposal of solid waste.

   c. Do not cause or allow particulate matter to exceed 50 milligrams per cubic meter (mg/m³) when determined as difference between upwind and downwind samples collected on high volume particulate matter samplers at the property line for a five-hour period during the time of active operations.

   d. Take precautions to prevent visible particulate matter from being deposited upon public roadways, sidewalks, or adjacent buildings.
facades as a direct result of operations. Precautions include removal of particulate matter from equipment before movement to paved streets or prompt removal of material from paved streets onto which such material has been deposited.

2. The following procedures and techniques can be used to meet the objectives of this Section. The list is not intended to be all-inclusive and the Contractor may use other procedures and techniques to meet the objectives.

a. Load all trucks coming to the jobsite or leaving the jobsite with materials or loose debris in a manner that prevents dropping of materials or debris on streets. Cover loads of materials, debris, and soil transported from construction sites. Remove spillage resulting from hauling operations along or across public traveled ways immediately.

b. Cover loads of hot asphalt to minimize odors.

c. Wet materials in trucks or provide adequate freeboard to allow for cover of transported materials, as practical, to reduce PM10 and deposition of particulates during transportation.

d. At least once daily use a qualified street sweeper, in accordance with Section 01 57 13, Temporary Erosion and Sediment Control, to sweep adjacent streets and sidewalks that have heavy volumes of construction vehicles carrying debris and excavated materials. The Resident Engineer may require additional watering down and sweeping if in his/her opinion excessive debris and excavated materials are present on the adjacent streets and sidewalks.

e. Establish regular cycles and locations for cleaning trucks that haul soil from site.

f. Water down construction sites to reduce emissions of PM10 and deposition of particulate matter as required to suppress dust during handling of excavation soil or debris or during demolition of brick or concrete buildings. Do not sluice particulate matter into storm drains.

g. Promptly clean up spills of transported material on public streets and roads.

h. Prevent runoff of all water used for dust control from entering storm drains or waters of Washington State.

i. Use construction equipment designed and equipped to prevent or control air pollution in conformance with most restrictive regulations of federal, state, and local authorities. Maintain evidence of such design and equipment and make available for inspection by the Resident Engineer.

j. Establish and maintain records of routine maintenance program for internal combustion engine powered vehicles and equipment used for the Contract. Keep records available for inspection by the Resident Engineer.

k. Do not allow internal combustion engines to idle for more than 5 minutes.

l. Use electrically-powered equipment where needed to meet requirements.
m. Make equipment for fugitive dust control available at all times.

n. Wash windows and exterior walls of buildings within two blocks of the site at the direction of the Resident Engineer.

o. Provide dust control at all times, including holidays and weekends, as required to abate dust nuisance on and about the site, that is a result of construction activities.

p. Provide dust control for the Burke Gilman Trail from dust that is a result of construction activities.

q. Provide sufficient quantities and equipment for dust control to effectively prevent dust nuisance on and about the jobsite; and when weather conditions warrant, have sprinkler equipment on hand at all times for immediate use for dust control.

r. Report all complaints from the public to the Resident Engineer.

s. If portions of the site are temporarily inactive or abandoned for whatever reason, provide dust control and abatement continuously during periods of inactivity.

B. Water Pollution Controls

1. Control use of all chemicals, lubricating oils, hydraulic fluids, greases and other such products, and prevent migration from the Work Site. Promptly clean up and properly dispose of materials contaminated by spillage or leakage of products. Comply with storage and containment requirements of these materials in accordance with Washington Stormwater Permit Regulations.

2. Store all containers of hazardous substances, including petroleum products, in covered secondary containment.

3. Refer to Section 01 57 24, Temporary Site Water Discharge.

4. Conduct fueling only in designated controlled locations with appropriate BMPs installed to contain and absorb potential spills. Bulk fuels may not be stored on the construction site or staging areas.

C. Pollution Abatement

1. Conduct operations in a manner to minimize pollution of the environment surrounding the area of work by every means practicable. Apply specific controls as indicated and as follows:

   a. Soil Erosion and Control: Do not allow waste or eroded materials to enter natural or man-made waters or sewage removal systems. Refer to Section 01 57 13, Temporary Erosion and Sediment Control.

   b. Noise and Vibration Control: Refer to Section 01 57 15, Temporary Construction Noise and Vibration Control.

2. Maintaining Flow of Sewers and Drains:
a. Provide for and maintain, at Contractor's expense, the flow of all sewers, drains, building or inlet connections, and all watercourses that may be encountered during progress of the Work.

b. Do not allow the contents of sewer, drain, or inlet connection to flow into trenches.

c. Maintenance of sewers and drains may require, at the Contractor's expense, the use of temporary pump stations with backup generators.

D. Mud Control

1. Take proper measures to prevent tracking of mud onto public streets, drives, parking lots, and sidewalks. Measures include, but are not limited to, covering muddy areas on the site with clean, dry sand, gravel, and trap rock.

2. Maintain all egress from the site and immediately remove mud tracked onto streets, sidewalks, or drives, and clean the affected area. Sweep all areas on adjacent streets within one block of the construction site using the following schedule:

   a. Twice per day during demolition work.

   b. Twice per week for other work.

   c. The Resident Engineer may require additional sweeping if in his/her opinion excessive debris and excavated material are present.

3. Where trucks leave a muddy site and enter paved public streets, maintain a suitable truck wheel-washing facility in accordance with Section 01 57 13, Temporary Erosion and Sediment Control. Clean all trucks, or other vehicles leaving the site, of mud and dirt, including mud and dirt clinging to exterior body surfaces of vehicles.

E. Contractor-Generated Hazardous or Contaminated Waste Controls

1. In the event that the Contractor or the Resident Engineer reasonably suspects that the Contractor has generated, released, or discharged Contractor-Generated Hazardous or Contaminated Waste, the Contractor shall bear costs of sampling, monitoring tests, and other investigations to determine whether said waste is Solid Waste or Hazardous or Contaminated Waste. Perform the investigations in accordance with federal, state, and local requirements. Sound Transit, reserves the right (but not the obligation) to perform its own physical and chemical analyses and tests on suspected Contractor-Generated Hazardous or Contaminated Waste. Contractor shall furnish samples, at their own cost, as directed by the Resident Engineer.

2. Spill Control Plan

   a. Spill Prevention, Control, Containment, and Countermeasures Plan (SPCCC)

      1) Adopt a Spill Control Plan and identify persons responsible for implementing the plan if a spill of a dangerous or hazardous waste should occur,
2) Identify on a drawing for each Site: Staging, storage, maintenance and refueling locations and their relationship to drainage pathways, waterways, and other sensitive areas.

3) Identify spill prevention and containment methods to be used at each Site.

4) Identify site security measures, inspection procedures and personnel training procedures as they relate to spill prevention containment, response, management, and cleanup.

5) Address: Equipment maintenance, refueling, and cleaning activities and on site storage areas for hazardous materials.

6) Inspection of: Fuel hoses, lubrication equipment, hydraulically-operated equipment, oil drums, and other equipment and facilities regularly for drips, leaks, or signs of damage, and maintain and store properly to prevent spills. Note: Maintain proper security to discourage vandalism.

7) Consider use of less toxic vegetable-based biodiesel and hydraulic oils as alternatives to petroleum-based fuels and oils.

8) Chemical storage:
   a) Store solid chemicals, chemical solutions, paints, petroleum products, solvents, acids, caustic solutions, and waste materials including used batteries to prevent the inadvertent entry of these materials into all waters, including ground water. Storage shall be in a manner that prevents spills due to overfilling, tipping, or rupture.

   b) Store all liquid products on durable impervious surfaces and within bermed containment capable of containing 110 percent of the largest single container in the storage area.

   c) Identify and implement reasonable steps to prevent releases of liquid products from malicious tampering or vandalism.

   d) Store liquid products under cover, such as tarpaulins or roofed structures.

   e) Clearly designate all waste storage areas, whether for waste oil or hazardous waste, as such and keep segregated from new product storage.

   f) Segregate non-compatible chemicals and securely store in separate containment areas that prevent mixing of incompatible or reactive materials.

   g) All empty barrels that have not been cleaned shall be adequately stopped and stored in an upright position.
9) All pollutants that occur on-site during construction shall be handled and disposed of in a manner that does not cause contamination of storm water or ground water.

b. Spill Response Plan

1) Report all spills that occur regardless of the size or type of the spill to the Resident Engineer. Maintain a log of all spills.

2) If the spills of a hazardous substance could reach surface waters the following agencies must be notified (There are fines for failing to notify) National response centre 1-800-424-8802 or WWW.NRC.USG.MIL/INDEX.HTM and notify the regional Department of Ecology Office.

3) Some important components of a spill control plan are to stop the spill at the source and install protective covers over storm drain grates. If spill is flammable, call 911 and dispose of as directed by the local Fire Marshal.

3. In the event of release of Hazardous or Contaminated waste, immediately notify the Resident Engineer and take all appropriate measures, consistent with protecting the health and safety of site personnel, Sound Transit personnel, and the public, to stop the spread of all Hazardous and/or Contaminated Wastes.

4. Promptly clean-up and dispose of materials containing Hazardous or Contaminated Wastes resulting from the release to the satisfaction of the Resident Engineer and in accordance with the governing regulatory agencies and all applicable federal, state, and local laws, regulations, and permits, including the University of Washington’s PMRDES. Report all reportable releases to federal, state, and local regulatory and emergency response agencies. Bear the cost of clean up and disposal of Hazardous or Contaminated Wastes that are accidentally released during performance of the Work.

F. Suspect Materials

1. If suspect materials are encountered, control and contain the material until appropriate measures can be taken.

2. Stockpile material at location determined by the Resident Engineer and treat as if it is contaminated material until determined otherwise.

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SECTION 01 57 24
TEMPORARY SITE WATER DISCHARGE

PART 1 - GENERAL

1.01 SUMMARY

A. This Section specifies permit compliance requirements, controls, treatment, monitoring, reporting, and inspection required during construction related to water discharged from construction sites.

B. The Construction Site Environmental Management Supervisor (CSEMS) shall be responsible for all work specified herein. Refer to Section 01 57 19, Temporary Environmental Controls for The Construction Site Environmental Management Supervisor qualifications.

C. Related Sections: The work of the following sections is related to the work of this Section. Other Sections, not referenced below, may also be related to the proper performance of this work.

1. Section 01 41 26, Permits.
2. Section 01 57 13 Temporary Erosion and Sedimentation Control.
3. Section 01 57 19, Temporary Environmental Controls.
4. Section 01 78 23, Operation and Maintenance Data.
5. Section 31 23 19, Dewatering.

D. Site Water discharge flow according to Exhibit 1.

1.02 REFERENCES

A. Referenced Standards: This Section incorporates, by reference, the latest revisions of the following documents.


2. Washington Administrative Code (WAC):
   a. Chapter 173-50 WAC, Accreditation of Environmental Laboratories.
   c. Chapter 173-201A WAC, Water Quality Standards for Surface Waters of the State.
d. Chapter 173-204 WAC, Sediment Management Standards.

3. Federal Register
   a. Vol. 57, No. 246, National Toxics Rule.

4. City of Seattle (COS)
   b. COS Standard Specifications for Road, Bridge, and Municipal Construction.

5. King County Code (KCC) – Industrial Waste Rules and Regulations
   a. KCC 28.84.060

1.03 DEFINITIONS

A. Construction Site Environmental Management Supervisor: Section 01 57 19, Temporary Environmental Controls.

B. Dewatering Water: Groundwater extracted and pumped away from an active construction site by the dewatering system as defined in Section 31 23 19, Dewatering.

C. Dry Weather Discharge: No measurable precipitation in site rain gauge during previous 72-hours at time of discharge.


E. Groundwater: Water in a saturated zone or stratum beneath the land surface or a surface of water.

F. Initial Site Construction Activities:
   1. Mobilization of equipment and materials.
   2. Temporary security fence installation.
   3. BMP construction.
   4. Start-up of treatment systems.
   5. Major grading not allowed except as needed for BMP construction.

G. Process Water:
   1. Process Water discharges include, but are not limited to: Truck and wheel wash water, equipment wash water, petroleum products, chemical wastes, non-contact cooling water, and chlorinated water.
   2. All water which, during manufacturing or processing comes into direct contact with or results from the production or use of all raw material, intermediate product, finished product, byproduct, or waste product.
   3. Water used for sawcutting.
4. Decant water, originating as either groundwater or added potable water, from excavated spoils that contain additives, conditioners including bentonite, cementitious materials, or pollutants.

5. Water in bottom of tunnel and station box excavation.

6. Water entering the excavation from or through the slurry diaphragm walls or invert slab and including any working slab areas.

7. Water discharge from slurry mixing and treatment plant and jet grouting operation.

8. Site water in contact with and chemically affected by site conditions which cannot be treated on site to meet surface water discharge criteria.

H. Non-Compliance Event (or Events): Occurrence where surface water, groundwater, or sanitary sewer water discharge or discharge to groundwater exceeds allowable discharge limits.

I. Site Water:
   1. All water on the Site of work that requires discharge from the Site.
      a. Classified as either: Stormwater, Dewatering Water, sanitary sewage, or Process Water.

J. Stormwater: Water originating as precipitation that does not infiltrate into the ground or evaporate.

K. Surface Water:
   1. Waters of the State.
   2. Wetlands, streams, and drainage channels.
   3. City of Seattle stormwater system.

L. Wet Weather Discharge: Any measurable precipitation in Site rain gauge during previous 72 hours at time of discharge.

M. Leachate: Water that has become contaminated by contact with material within the soil profile.

N. KCDNRP: King County Department of Natural Resources and Parks

1.04 SYSTEM DESCRIPTION

A. Design Requirements
   1. Site Water Treatment
      a. Provide treatment for Site Water when necessary to meet discharge requirements.
      b. Provide provisions for maintenance of treatment systems.
c. Design of treatment system shall be stamped by a Professional Engineer who is licensed to practice in the State of Washington.

d. Design of treatment system shall be approved by King County Industrial Waste prior to construction.

2. Solid Waste

a. Handle and dispose of all solid waste material in such a manner as to prevent its entry into ground or surface waters of the State.

b. Collected screenings, grit, solids, sludges, filter backwash, or other pollutants removed in the course of treatment or control of wastewaters so it is not resuspended or reintroduced to the final effluent stream for discharge to state waters.

3. Concrete Truck Washout Disposal:

a. Washout concrete truck chutes, pumps and barrel only into Eco-pans or formed areas awaiting installation of concrete or asphalt.

b. Return unused concrete remaining in the truck and pump to the originating batch plant for recycling.

c. Wash off hand tools only into Eco-pans or formed areas awaiting installation of Concrete or Asphalt.

d. Do not drain runoff from paved areas into the natural or constructed storm water conveyance until the measured pH of the discharge water is within the discharge criteria parameters.

e. Contain wash water and waste concrete within a lined container, lined with 30 mils plastic liner or six inches of concrete or asphalt, when no formed areas or eco-pans are available. Contain concrete waste in a manner which does not violate water quality standards or solid waste regulations.

4. Leachate Treatment

a. Do not allow leachate from solid waste material to enter State waters without providing all known, available, and reasonable methods of treatment, nor allow such leachate to cause violations of Chapter 173-201A WAC or Chapter 173-200 WAC.

5. Quantity Limitations:

a. Allow no more Quantity of Storm Water to Discharge from the site by any actions taken during construction into the storm drain system during and after construction than that amount of discharge currently leaving the site.

6. Chemical Usage:

a. Use chemicals according to the manufacturer’s instructions.

b. Do not use chemical if its toxicity to aquatic organisms is not known.

c. Chemical usage for stormwater treatment requires prior approval from the Washington State Department of Ecology. Submit the request for chemical treatment usage 30 days prior to the anticipated usage date.
B. Performance Requirements

1. Surface Water Discharges

   a. Comply with the water quality standards and requirements of the following:

      1) Chapter 173-201A WAC.
      2) Chapter 173-204 WAC.
      4) Seattle Municipal Code Chapter 22.800-808.
      6) For facilities that discharge either directly or indirectly via a stormwater conveyance system to waters listed as impaired by the State under Section 303(d) of the Clean Water Act, comply with the State’s water quality standards of the named pollutants.
      7) Do not discharge Process Water or domestic wastewater to Surface Water or Groundwater.
      8) Comply with the Effluent Limitations in Table 1.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Maximum Daily</th>
</tr>
</thead>
<tbody>
<tr>
<td>Turbidity</td>
<td>Do not exceed 5 NTU turbidity in the receiving water over background turbidity when the background turbidity is 50 NTU or less, or have more than a 10 percent increase in turbidity when the background turbidity is more than 50 NTU.</td>
</tr>
<tr>
<td>Turbidity (non-chemical treatment)</td>
<td>50 NTU</td>
</tr>
<tr>
<td>Turbidity (chemical treatment)</td>
<td>Do not exceed 5 NTU for the maximum daily average.</td>
</tr>
<tr>
<td>Total Petroleum Hydrocarbons</td>
<td>5 mg/L</td>
</tr>
<tr>
<td>pH</td>
<td>In the range of 6.5 to 8.5 standard units with a human-caused variation within a range of less than 0.2 unit.</td>
</tr>
</tbody>
</table>

1 The maximum daily effluent limitation is defined as the highest allowable daily discharge. All charges shall not cause a visible change in turbidity or color or cause visible oil sheens in the discharges or receiving water body.

2 The method detection level (MDL) for turbidity is 1 NTU using a turbidimeter and Method Number 180.1 from 40 CFR Part 136 or Standard Methods for the Examination of Water and Wastewater.

3 The MDL for total petroleum hydrocarbons is 0.1 mg/L using Gas Chromatography and Flame Ionization Detector (FID) and Method Number WTPH-D Diesel (WTPH-D) from Washington State Department of Ecology Method WTPH-D. The quantitation level (QL) for TPH-D is 0.5 mg/L (5 x MDL).
2. Combined or Sanitary Sewer Discharge

a. Comply with the water quality standards and requirements of the following:

1) Major Discharge Authorization, King County Department of Natural Resources and Parks, Industrial Waste Program.
2) King County Code, Title 28.

b. Discharge Quality

1) Monitor discharge for odor of solvent, gasoline, or hydrogen sulfide (rotten egg odor), oil sheen, or unusual color in discharge water.
2) If waste discharge limits identified in Table 2 are exceeded, stop discharging, notify the Resident Engineer, and implement the Contingency Plan.
3) Discharge limits are listed in Table 2:

TABLE 2 – PERMIT DISCHARGE LIMITS FOR UNIVERSITY OF WASHINGTON STATION SITE TO COMBINED OR SANITARY SEWER

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Daily Average (milligrams per liter(mg/l))</th>
<th>Instantaneous Maximum (mg/l)</th>
<th>Maximum Loading (pounds/day)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arsenic</td>
<td>1.0</td>
<td>4.0</td>
<td>1.4</td>
</tr>
<tr>
<td>Cadmium</td>
<td>0.5</td>
<td>0.6</td>
<td>0.3</td>
</tr>
<tr>
<td>Chromium</td>
<td>2.75</td>
<td>5.0</td>
<td>2.4</td>
</tr>
<tr>
<td>Copper</td>
<td>3.0</td>
<td>8.0</td>
<td>5.0</td>
</tr>
<tr>
<td>Lead</td>
<td>2.0</td>
<td>4.0</td>
<td>3.34</td>
</tr>
<tr>
<td>Mercury</td>
<td>0.1</td>
<td>0.2</td>
<td>0.14</td>
</tr>
<tr>
<td>Nickel</td>
<td>2.5</td>
<td>5.0</td>
<td>2.70</td>
</tr>
<tr>
<td>Silver</td>
<td>1.0</td>
<td>3.0</td>
<td>1.67</td>
</tr>
<tr>
<td>Zinc</td>
<td>5.0</td>
<td>10.0</td>
<td>8.34</td>
</tr>
<tr>
<td>Cyanide Amenable</td>
<td>2.0</td>
<td>3.0</td>
<td>NA</td>
</tr>
<tr>
<td>Nonpolar FOG</td>
<td>100</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>pH</td>
<td>5.5</td>
<td>5.0</td>
<td>12.0</td>
</tr>
<tr>
<td>Settleable Solids (Imhoff Cone)</td>
<td>NA</td>
<td>NA</td>
<td>7 milliliters per liter</td>
</tr>
</tbody>
</table>
### Table

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Daily Average (milligrams per liter(mg/l))</th>
<th>Instantaneous Maximum (mg/l)</th>
<th>Maximum Loading (pounds/day)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lower Explosive Limit¹</td>
<td>NA</td>
<td>NA</td>
<td>5 percent</td>
</tr>
<tr>
<td>Closed Cup Flash Point</td>
<td>NA</td>
<td>NA</td>
<td>140 degrees F²</td>
</tr>
<tr>
<td>Temperature</td>
<td>NA</td>
<td>NA</td>
<td>150 degrees F³</td>
</tr>
</tbody>
</table>

1. At no time two successive readings on an explosive hazard meter at any location be more than five percent of the lower explosive limit. Ensure no single reading exceed ten percent of the lower explosive limit.


3. Ensure that Discharge do not cause the temperature of the sanitary sewer to exceed 104 degrees F. Maintain the temperature of the discharge within 150 degrees F.

### Instructions

- c. Do not discharge substances causing fire or explosion hazard, flow obstruction, excess oxygen demand or toxic vapors.

- d. Do not discharge organic pollutants that result in the presence of toxic gases, vapors, or fumes. Organic pollutants subject to this restriction include, but are not limited to, organic compound listed in 40 CFR 433.11 (e) Total Toxic Organics (TTO) definition, acetone, 2-butanone (MEK), 4-methyl-2-pentanone (MIBK), and xylenes.

- e. Implement good “housekeeping” in order to prevent a concentrated discharge of a pollutant.

- f. Use treatment of the water for pollutant removal to meet the water quality standards. Do not use potable water, groundwater, stormwater or other materials for the purpose of diluting a waste to achieve discharge limits.

- g. Provide and maintain separate process water discharge points to sewer. Each discharge point shall be independently regulated under the King County Industrial Waste Major Discharge Authorization.

- h. The discharge-receiving sewer shall be kept clear of blockages at all times. Coordinate any cleaning or access to SPU utilities with SPU.

### 1.05 SUBMITTALS

A. Procedures: Section 01 33 00, Submittal Procedures.

B. Storm Water Pollution Prevention Plan (SWPPP) See Section 01 41 26, Permits.

   1. Update the SWPPP with site-specific construction work plans as necessary to reflect construction work area limit changes, the construction activities accompanying these changes, and all changes to BMPs and/or stormwater handling and treatment systems necessary to maintain compliance with the NPDES permit.

C. Site Water Monitoring and Reporting:

   1. Procedures:

      a. Stormwater sewer.
b. Sanitary sewer.

2. Discharge Monitoring Results:
   a. Stormwater water.
   b. Sanitary sewer.


D. Surface Water Discharge: Related Documentation

1. Treatment Systems (If needed to comply with Surface Water Discharge Requirements):
   a. Separate submittals for the following activities and locations with details for the treatment system, if required.
      1) Site between Husky Stadium and Montlake Boulevard, area south of Husky Stadium and triangular area between NE Pacific Place and Montlake Boulevard NE. Submittals for more than one major activity may be combined if the proposed treatment system is appropriate for all of the activities shown.
         a) Excavation to bottom of roof slab and installation of roof slab.
         b) Excavation to upper mezzanine level.
         c) Backfilling and grading of site.
         d) Restoration of surface.
         e) Excavation to lower mezzanine level and installation of lower mezzanine concrete.
         f) Excavation to base slab invert and installation of invert slab concrete.
         g) Installation of station platform slab concrete.
         h) Installation of crossover platform slab concrete.
         i) Installation of crossover walls, slab, and roof.
         j) Backfilling of crossover to grade.
         k) Restoration of surface above and adjacent to crossover.
         l) Completion of surface finishes and landscaping.
   b. Modifications to the treatment system.

2. Quantity: Daily for each discharge location.


5. Contingency Plan.
6. Obtain Surface Water Discharge submittal approvals prior to start of Initial Construction Activities in conjunction with authority and approval of local jurisdictions.

E. Sanitary Sewer Discharge: Related Documentation

1. Treatment Systems during civil and structural work for the University of Washington Station.
   a. Separate submittals for each of the proposed treatment systems.
   b. Modifications to the Treatment Systems.

2. King County Major Discharge Authorization Application. See Section 01 41 26, Permits.

3. Quantity: Daily for each discharge location.


5. Trucking Plan.


7. Obtain Sanitary Sewer Discharge submittal approvals prior to start of Initial Construction Activities in conjunction with authority and approval of local jurisdictions.

F. Chemical Usage Documentation.

G. Qualifications of Accredited Independent Testing Laboratory and Construction Site Environmental Management Supervisor.

H. Permits obtained by the Contractor.

I. Operation and Maintenance Manuals: Submit operation and maintenance instructions and data for equipment provided herein, in accordance with the requirements of Section 01 78 23, Operation and Maintenance Data. Include recommended maintenance materials and spare parts list for installed equipment.

1.06 QUALITY ASSURANCE

A. Qualifications:

1. Accredited Independent Testing Laboratory for testing water samples for pH, turbidity, TPH, and parameters with discharge limits in accordance with permit requirements

2. Independent Testing Laboratory registered or accredited under the provisions of Chapter 173-50 WAC.

B. Fines

1. Be responsible for all fines from governing authorities incurred from non-compliance with regulations.

2. Any person who is found guilty of willfully violating the terms and conditions of NPDES Permits:
a. Can be deemed guilty of a crime.

b. Upon conviction thereof can be punished by a fine of up to $10,000 and costs of prosecution or by imprisonment in the discretion of the court.

c. Each day upon which a willful violation occurs may be deemed a separate and additional violation.

3. Persons who violates the terms and conditions of a NPDES Permit shall incur, in addition to any other penalty as provided by law, a civil penalty in the amount of up to $10,000 for every such violation. Each and every violation may be deemed a separate and distinct offense, and, in case of a continuing violation, every day’s continuance shall be deemed to be a separate and distinct violation.

4. The Clean Water Act provides penalties for tampering:

a. Person who falsifies, tampers with, or knowingly renders inaccurate any monitoring device or method required to be maintained for the NPDES Permits, can, upon conviction, be punished by a fine of not more than $10,000 per violation or by imprisonment for not more than 2 years per violation, or by both.

b. If a conviction of a person is for a violation committed after a first conviction of such person under this Condition, punishment shall be a fine of not more than $20,000 per Day of violation, or by imprisonment of not more than four years, or by both.

1.07 SEQUENCING AND COORDINATION

A. Within 10 Days of the effective date of the Notice to Proceed, hold a meeting with the Construction Site Environmental Management Supervisor and the Resident Engineer to review and discuss in detail all requirements of this Section, how to meet them, and prepare a draft schedule for submittals, in accordance with Section 01 33 00, Submittal Procedures

1.08 STORM WATER POLLUTION PREVENTION PLAN (SWPPP)

A. Prior to disturbing soil or demolition activities, The Contractor is responsible for updates, as required by the NPDES Permit, or as directed by the Department of Ecology.

1.09 SITE WATER DISCHARGE RELATED DOCUMENTATION

A. Provide engineered Stormwater Management Plan for treatment and disposal of discharges to Surface Water, and Wastewater Pre-Treatment Plan for treatment and disposal of discharges to the Public Combined or Sanitary Sewer system, and Trucking Plan for Site Water to be hauled offsite.

1. Discharges to surface water must meet all state water quality requirements in accordance with the site’s NPDES Construction Stormwater Permit described in the SWPPP.

2. Discharges to combined or sanitary sewer must be permissible in accordance with Seattle Municipal Code 21.16 and 22.800-22.808, and adhere to all requirements of the King County Code Title 28 and the King County Major Discharge Authorization.

B. Stormwater and Groundwater that is affected by site activities shall be collected, treated, and discharged to Surface Water in accordance with Seattle Municipal Code 22.800-
22.808 unless expressly allowed by SPU and King County through the King County Major Discharge Authorization.

1.10 SURFACE WATER DISCHARGE RELATED DOCUMENTATION

A. Provide Treatment Systems for the treatment of all discharges to surface water prior to discharge from the site:

1. Evaluate and design each proposed treatment system, including the following:
   a. The evaluation of potential pollutant loading from construction activities.
   b. Treatment process evaluation.
   c. Description of process used in treatment:
      1) Design criteria.
      2) Design flow rates.
         a) Expected water volumes to be discharged to surface water.
         b) Treatment plant capacity.
      3) Design loading, type of pollutant material and quantity.
      4) Chemical usage.
      5) Design parameters associated with each unit process.
      7) Description of emergency power generator to operate treatment plant during power failure.
   d. Pressure filter system required except as indicated herein.
   e. Capability of automatic flow and turbidity passed chemical addition.
   f. Use BMPs as a treatment system during Initial Site Construction.

2. Operational and maintenance requirements, in accordance with Section 01 78 23, Operation and Maintenance Data.

3. Obtain approval of Surface Water Discharge submittals prior to start of Initial Construction Activities in conjunction with authority and approval of local jurisdictions, including City of Seattle, King County, University of Washington, and Ecology.

4. Contingency plan:
   a. For site water management in case of treatment system failure, a spill of hazardous substances, or other incident which introduces excess volume or unanticipated contaminants into the system.
b. For treatment system improvements necessary to meet discharge requirements if existing treatment system fails to meet discharge requirements.

B. Monitoring and Reporting Results:
1. Submit and certify daily as specified herein.
2. Include any pollutant monitored more frequently than required herein.

C. Non-compliance Event Notification:
1. Immediate notification of the Resident Engineer of the Non-compliance or becoming aware of a Non-compliance Event.
2. Submit a written report of the violation describing the Non-compliance.
3. In the report, include the following:
   a. Exact dates and times of the Non-compliance Event.
   b. Steps taken or planned to prevent reoccurrence of the Non-compliance.
   c. Water quality data in accordance with the requirements of the NPDES Waste Discharge Permit, University Link Project.
4. Submit the report within two days after the initial Event occurrence or one day after receiving Independent Testing Laboratory results, whichever time is shorter.

D. Operations and Maintenance Manual:
1. Be in accordance with Section 01 78 23, Operation and Maintenance Data.
2. Design criteria including pertinent calculations used in designing, selecting, or verifying the suitability of the installed equipment.
3. Pump curves: Manufacturer’s catalog curve.
4. Installation and startup procedures: Manufacturer’s recommendations for installation, adjustment, calibration, and troubleshooting.
5. Operating procedures: Manufacturer’s recommended step-by-step procedures for starting, operating, and stopping the equipment under specified modes of operation.
6. Preventive maintenance procedures: Manufacturer’s recommended steps and schedules for maintaining the equipment.

E. Contingency plan for the following:
1. Non-compliance Event.
2. Discharge rates require reduction from the maximum.
3. Discontinued discharge.
4. Treatment system improvements necessary to meet discharge requirements if existing treatment system fails to meet discharge requirements.
5. Additional BMP’s to bring discharge into compliance.

1.11 SANITARY AND COMBINED SEWER DISCHARGE AND OFFSITE DISPOSAL DOCUMENTATION

A. Treatment and Disposal:

1. Submit a report outlining how process water discharges to the sanitary and combined sewer will be treated and/or disposed of:
   a. Report to be prepared by a licensed Professional Engineer registered in the State of Washington in accordance with Chapter 173-240 WAC.
   b. Include design criteria and calculations for all major equipment, including but not limited to pumps, tanks, dosing pumps, and mixers.
   c. Submit all modifications with the approval of the Professional Engineer when treatment system is modified.
   d. Method to convey or truck Site Water from the Site.
   e. Water discharge to sanitary sewer is acceptable under the conditions of the King County Major Discharge Authorization. See Section 01 41 26, Permits, and Article 1.10 herein.
   f. Discharge of Site sanitary sewage from Contractor sanitary facilities to the Sanitary Sewer System is acceptable.
   g. Trucking Plan:
      1) Required for all trucking of Process Water and Site Water not disposed of in the sanitary sewer.
      2) Provide name, address, and telephone number of firm responsible for trucking.
      3) Truck capacity or capacities.
      4) Training provided to truck operators in discharge procedures and spill response.
      5) In the event of a spill:
         a) Emergency contact person to handle the spill.
         b) Steps taken by truck operator.
   h. KCDNR approval of plan required prior to beginning work.

B. Non-compliance Event Notification:

1. Immediately notify the Resident Engineer upon becoming aware of a Non-compliance Event.

2. Submit a written report of the violation to the Resident Engineer describing the Non-compliance. Report shall include the following:
   a. Exact dates and times of the Non-compliance Event.
b. List of permits with parameters in non-compliance.
c. List of parameters not in compliance with permit conditions.
d. Steps taken or planned to prevent reoccurrence of the Non-compliance.
e. Water quality data in accordance with the requirements of the NPDES Discharge Permit, University Link Project.

3. Submit the report within two days after the initial event occurrence or one day after receiving Independent Testing Laboratory results, whichever time is shorter.

C. Contingency plan shall include provisions for the following:

1. Waste discharge limits exceeded.
3. Discharge maximum rates require reduction from the maximum.
4. Discontinue discharge immediately upon notification by Resident Engineer.
5. For treatment system improvements necessary to meet discharge requirements if existing treatment system fails to meet discharge requirements.

1.12 CHEMICAL USAGE DOCUMENTATION

A. Document and submit chemicals used to treat water discharged to Surface Water.

B. Document the following:

1. Identification of chemical used.
2. Commercial source.
3. Material Safety Data Sheet (MSDS).
4. Quantities used.
5. Quantities of water treated.
6. Dosage rate.

C. Provide Certification as described in Article 1.13 below.

D. Maintain a daily log for all use.

E. Submit daily logs monthly no later than the third day of each month.

1.13 CERTIFICATION

A. Monitoring reports, non-compliance notifications, and chemical usage documentation shall have the following certification:

1. “I certify under penalty of law, that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering
information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.”

1.14 PERMITS OBTAINED BY SOUND TRANSIT AND THE CONTRACTOR

A. NPDES Stormwater Discharge Permit (NPDES Permit):
   1. Refer to Section 01 41 26, Permits, for additional requirements of the Permit.
   2. Permit is an Individual Permit which has requirements that are more stringent than a General Permit that typically applies to construction work.
   3. Issued as a joint permit to Sound Transit and Contractor.
   4. Authorizes the discharge of stormwater and uncontaminated groundwater associated with construction activities to waters of Washington State in conjunction with authority and approval of local jurisdictions, including City of Seattle, King County, University of Washington, and Ecology.
   5. Does not authorize illicit discharges, including spills of oil or hazardous substances, nor does it relieve entities from obligations under State and Federal laws and regulations pertaining to those discharges.
   6. Does not include water rights to allow beneficial use of groundwater or surface water.
   7. Requires monitoring as specified herein.
   8. Limits quantity of discharge as specified herein.
   9. Maintain a copy of the Permit at each construction Site office.

B. Major Discharge Authorization (Waste Discharge Permit):
   1. Refer to Section 01 41 26, Permits, for additional requirements of the Permit.
   2. Obtained by Sound Transit for the University Link Project from King County at the request of the Contractor.
   3. Authorizes discharge into the sanitary sewer/combined sewer at identified locations as indicated on the Contract Drawings in conjunction with authority and approval of local jurisdictions.
   4. Requires monitoring as specified herein.
   5. Limits quantity of discharge.
   6. Maintain a copy of the Major Discharge Authorization at each construction Site office.

PART 2 - PRODUCTS

2.01 RAIN GAUGE

A. Minimum requirements:
1. Install and maintain a rain gauge until Notice of Substantial Completion is given.

2. Install with no obstructions in the area, described as a cone with a 45-degree vertical boundary.

3. For manual rain gauge: After reading the rain gauge, discard water from the previous day.

4. Accurate to 0.10 inch.

5. If a plastic gauge is used:
   a. Gradations: at a minimum every 0.05 inch.

2.02 MONITORING INSTRUMENT

A. Use field equipment in-situ:

1. Temperature, turbidity, pH, dissolved oxygen (DO).

2. Rugged, small, portable and waterproof.

3. Meet the requirements in Table 3.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Range</th>
<th>Accuracy</th>
<th>Resolution</th>
</tr>
</thead>
<tbody>
<tr>
<td>DO</td>
<td>0 to 20 milligrams per liter (mg/L)</td>
<td>Within 0.1 if DO is 8 mg/L or less Within 0.2 if DO is greater than 8 mg/L</td>
<td>0.01 mg/L</td>
</tr>
<tr>
<td>pH</td>
<td>0 to 14 units</td>
<td>Within 0.2 units</td>
<td>0.01 units</td>
</tr>
<tr>
<td>Temperature</td>
<td>Negative 5 to 50 degrees C</td>
<td>Within 0.10 degrees C</td>
<td>0.01 degree C</td>
</tr>
<tr>
<td>Turbidity</td>
<td>0 to 1,000 Nephelometric Turbidity Units (NTU), with range selection of 0 to 9.99, 0 to 99.9 and 0 to 1000 NTU</td>
<td>Within 2 percent of reading; within 3 percent if turbidity is 500 NTU or more</td>
<td>0.01 NTU on lowest range</td>
</tr>
</tbody>
</table>

4. Acceptable manufacturer:
   a. Hydrolab.
   b. YSI MS5.
   c. LaMotte 2020 can be used for turbidity.
   d. Approved equal.
PART 3 - EXECUTION

3.01 PREPARATION
A. Post sign at all Sites with name and phone number of the Construction Site Environmental Management Supervisor.

3.02 FIELD QUALITY CONTROL
A. Site Tests
1. NPDES Permit Monitoring:
   a. General:
      1) Collect water samples for all point of discharge locations and receiving water upstream and downstream monitoring locations at the minimum frequencies indicated.
      2) Increase monitoring frequency whenever indicated.
2. Collect water samples for all construction locations in accordance with Table 4.

   TABLE 4 - NPDES MONITORING REQUIREMENTS FOR SURFACE WATER

<table>
<thead>
<tr>
<th>Category</th>
<th>Parameter</th>
<th>Units</th>
<th>Sample Point</th>
<th>Minimum Sampling Frequency</th>
<th>Sample Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stormwater</td>
<td>Turbidity</td>
<td>NTU</td>
<td>Point of Discharge &amp; Receiving Water</td>
<td>Rain Event</td>
<td>Grab</td>
</tr>
<tr>
<td>Stormwater</td>
<td>pH</td>
<td>Std. Units</td>
<td>Point of Discharge &amp; Receiving Water</td>
<td>Rain Event</td>
<td>Grab</td>
</tr>
<tr>
<td>Stormwater</td>
<td>Total Petroleum Hydrocarbons</td>
<td>mg/L</td>
<td>Point of Discharge</td>
<td>When oil sheen is visible in receiving waters or work area</td>
<td>Grab</td>
</tr>
<tr>
<td>Dewatering Water</td>
<td>Turbidity</td>
<td>NTU</td>
<td>Point of Discharge &amp; Receiving Water</td>
<td>Daily</td>
<td>Grab</td>
</tr>
<tr>
<td>Dewatering Water</td>
<td>pH</td>
<td>Std. Units</td>
<td>Point of Discharge &amp; Receiving Water</td>
<td>Daily</td>
<td>Grab</td>
</tr>
</tbody>
</table>
3. Rain gauge:
   a. Read each Day (Monday through Sunday) at 9:00 am local time.

4. Frequency of monitoring is modified in Table 4 after a Non-compliance Event. See Article 3.02A.14.f herein for frequency of monitoring after a Non-compliance Event.

5. Samples and measurements represents the volume and nature of the monitoring parameters, including representative sampling of all unusual discharge or discharge condition, including bypasses, upsets, and maintenance-related conditions affecting effluent quality.


7. Sample collection: Start at the most downstream location and work upstream.

8. Wear new, clean vinyl gloves when sampling at each discharge location.

9. Record instrument calibration records in logbooks at each discharge site and have them available for inspection. Record in waterproof, indelible, blue or black ink.

10. NPDES permit parameters other than those listed above will be monitored by the Resident Engineer. Provide access to allow such sampling to occur.

11. The Resident Engineer will collect monitoring samples in addition to those listed in this Section and test for constituents both listed in this Section and additional constituents. If results from the sampling indicate a Non-compliance Event, the Resident Engineer will notify the Contractor.

12. Discharge Monitoring:
   a. Monitor nonpolar fats, oils, grease (FOG), pH, and settleable solids at each Site where there is a discharge in accordance with Table 5.

### TABLE 5 – MONITORING FREQUENCY

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Volume</th>
<th>Sampling Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nonpolar FOG</td>
<td>For any discharge</td>
<td>Once per month</td>
</tr>
<tr>
<td>pH and</td>
<td>1 to 20,000 gallons per day</td>
<td>Once per day</td>
</tr>
</tbody>
</table>

---

1. When stormwater and groundwater are combined, testing of both categories is required.

2. Within 24 hours of every 0.25-inch rainfall event, not to exceed three times per week.
<table>
<thead>
<tr>
<th>Settleable Solids</th>
<th>20,000 to 30,000 gallons per day</th>
<th>Twice per day</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>30,000 to 50,000 gallons per day</td>
<td>Three times per day</td>
</tr>
<tr>
<td></td>
<td>Over 50,000 gallons per day</td>
<td>Four times per day</td>
</tr>
</tbody>
</table>

b. Record nonpolar FOG as follows:

1) Collect three grab samples of equal volume collected at least five minutes apart and analyzed separately.
2) Report total nonpolar FOG as average of the three samples.
3) If the average value is greater than 100 milligrams per liter, report the three individual sample concentrations.

c. Monitor the pH by grab samples at even time intervals during the day. If a pH violation occurs, make all future pH monitoring with a continuous in-line meter.

d. Record the pH and settleable solids measurements as follows:

1) Date, exact place, and time of sampling.
2) Dates the analyses were performed.
3) Person who performed the analyses.
4) Analytical techniques or methods used.
5) Results of all analyses.

e. Measure settleable solids by Imhoff cone.

f. Monitor discharge volumes daily with in-line flow meter. Flow meter to be non-resettable.

13. Non-compliance Event:

a. When not in compliance with discharge limits specified herein, take immediate action to stop the violation and notify the Resident Engineer.

b. Collect a discharge sample and submit new data within one day of becoming aware of non-compliance.

c. When discharge pH is in non-compliance, take immediate steps to bring the discharge into compliance. If it is not possible to be in compliance, stop discharge.

d. In the event of a concentrated solution spill, notify the Resident Engineer immediately and stop the discharge.

e. Implement the Contingency Plan.

f. Conduct monitoring twice daily after a violation is documented until three consecutive daily samples show the discharge(s) is in compliance.

14. Quantity Limitations:
a. Implement the Contingency Plan if discharge maximum rates indicated above require reduction from the maximum or discontinue discharge immediately upon notification by Resident Engineer.

B. Inspection

1. Grant the Resident Engineer, City of Seattle, University of Washington, other jurisdictional agencies, and representatives from Ecology the rights of access to:

a. Enter the Site where a discharge is located or where all submittals and monitoring logs are kept.

b. View and copy submittals and monitoring logs.

c. Inspect all facilities, equipment (including monitoring and control equipment), practices, methods, or operations regulated or required.

d. Sample or monitor all substances or parameters at all locations to ensure Contract compliance.
EXHIBIT 1: U250 TEMPORARY SITE WATER DISCHARGE FLOW CHART
Able to be Treated to Meet NPDES Permit Requirements

Process Water Slurry, Wheel Wash, Washdown, Tunnel, Boxbase, Sawcut, Jet Grout Water

Meets IWD Permit Requirements

No

Implement Contingency Plan

Yes

To Sanitary Sewer

Dewatering

Able to be Treated to Meet NPDES Permit Requirements

Consult with Local Agencies for Sewer Discharge Permission

No

Implement Contingency Plan

Yes

To Sanitary Sewer

Able to be Treated to Meet NPDES Permit Requirements

Meets NPDES Discharge Requirements

No

To Sanitary Sewer

Yes

Treatment (1)

Meets NPDES Discharge Requirements

No

To Sanitary Sewer

Yes

Treatment (1)

State Waters Discharge Monitoring Location

Sanitary Sewer Discharge Monitoring Location

(1) Treatment Shall Be Separate

To Lake Washington

END OF SECTION
CONTRACT SPECIFICATIONS

SECTION 01 60 00
PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes specifications for:
   1. Product option requirements.
   2. Spare parts and maintenance materials.
   3. Substitution limitations and procedures.
   4. Obtaining approval of alternative and substitute products.
   6. Transportation and handling.
   7. Storage and protection.

1.02 SUBMITTALS

A. Procedures: See Section 01 33 00, Submittal Procedures.

B. Product Data Submittals: Submit manufacturer's standard published data. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.

   1. Provision of manufacturer's standard details and drawings does not constitute provision of shop drawings, or alleviate the contractor from the responsibility to prepare shop drawings specifically prepared for the unique features of this project.

C. Shop Drawings

   1. Shop drawings are drawings, diagrams, schedules, and other data specially prepared for this project, and the unique conditions associated with it. Shop drawings shall sufficiently illustrate the specified portion of the Work, and all substrate, and associated work. Shop drawings shall indicate how the specified work is to be fabricated and installed.

   2. Contractor shall provide shop drawings indicating the work of specified section, and its interface with work in other sections. Drawings and details provided in the Contract Documents are intended as general depictions of design intent, and are not intended as a substitute for Contractor-prepared shop drawings, which shall reflect the Contractor's understanding of the work specified in an individual section, and its relationship to work specified elsewhere.

D. Sample Submittals: Illustrate functional and aesthetic characteristics of the product, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.
1. For selection from standard finishes, submit samples of the full range of the manufacturer's standard colors, textures, and patterns.

E. Indicate utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.

PART 2 - PRODUCTS

2.01 EXISTING PRODUCTS

A. Do not use materials and equipment removed from existing premises unless specifically required or permitted by the Contract Documents.

B. Unforeseen historic items encountered remain the property of the Sound Transit; notify Sound Transit promptly upon discovery; protect, remove, handle, and store as directed by Sound Transit.

C. Existing materials and equipment indicated to be removed, but not to be re-used, relocated, reinstalled, delivered to the Sound Transit, or otherwise indicated as to remain the property of the Sound Transit, become the property of the Contractor; remove from site and dispose of lawfully.

D. Reused Products: Reused products include materials and equipment previously used in this or other construction, salvaged and refurbished as specified.

2.02 NEW PRODUCTS

A. Provide new products unless specifically required or permitted by the Contract Documents.

B. Do not use products having the following characteristics:

1. Made outside the United States, its territories, Canada, or Mexico.

2. Made using or containing CFCs or HCFCs.

3. Made of wood from newly cut old growth timber.

C. Where all other criteria are met, Contractor shall give preference to products that:

1. Are extracted, harvested, and/or manufactured closer to the location of the project.

2. Have longer documented life span under normal use.

3. Result in less construction waste.

2.03 PRODUCT OPTIONS

A. Products Specified by Reference Standards or by Description Only: Use only product meeting those standards or description.

B. Products Specified by Naming One or More Manufacturers: Use a product of one of the manufacturers named and meeting specifications, no options or substitutions allowed.

C. Products Specified by Naming One or More Manufacturers with a Provision for Substitutions: Submit a request for substitution for a manufacturer not named.
2.04 SPARE PARTS AND MAINTENANCE PRODUCTS

A. Provide spare parts, maintenance, and extra products of types and in quantities specified in individual specification sections.

B. Deliver to Project site; obtain receipt from Resident Engineer prior to final payment.

PART 3 - EXECUTION

3.01 SUBSTITUTION LIMITATIONS AND PROCEDURES

A. Instructions to Bidders specify time restrictions for submitting requests for substitutions during the bidding period. Comply with requirements specified in this section.

B. Resident Engineer will consider requests for substitutions after date of Agreement.

C. Substitutions may be considered when a product becomes unavailable through no fault of the Contractor.

D. Document each request with complete data substantiating compliance of proposed substitution with Contract Documents.

E. A request for substitution constitutes a representation that the submitter:

1. Has investigated proposed product and determined that it meets or exceeds the quality level of the specified product.

2. Will provide the same warranty for the substitution as for the specified product.

3. Will coordinate installation and make changes to other Work which may be required for the Work to be complete with no additional cost to Sound Transit.

4. Waives claims for additional costs or time extension which may subsequently become apparent.

5. Will reimburse Sound Transit and Resident Engineer for review or redesign services associated with re-approval by authorities.

F. Substitutions will not be considered when they are indicated or implied on shop drawing or product data submittals, without separate written request, or when acceptance will require revision to the Contract Documents.

G. Substitution Submittal Procedure:

1. Submit three copies of request for substitution for consideration. Limit each request to one proposed substitution.

2. Submit shop drawings, product data, and certified test results attesting to the proposed product equivalence. Burden of proof is on proposer.

3. The Resident Engineer will notify Contractor in writing of decision to accept or reject request.
3.02 OBTAINING APPROVAL OF ALTERNATIVE AND SUBSTITUTE MATERIALS AND PRODUCTS

A. General: If a Bidder or the Contractor desires approval of some material or product other than that specified, it may submit a written request for approval of the alternate or substitute item in accordance with the requirements of this Article.

1. All approvals are at the discretion of the Sound Transit.

2. No request for approval will be considered unless submitted in accordance with this Article.

B. Requests for Approval: Every request for approval of alternative or substitute materials or products shall be accompanied by its reference in the Contract Documents and complete catalog, technical and other information and, if applicable, samples showing comparison of physical and other pertinent characteristics as required to establish equivalence or acceptability for the proposed application.

1. Where specific test results are required by the Contract Documents, the comparison data for the proposed item shall be based upon the same test methods as those specified, or be correlated to clearly demonstrate comparability.

C. Requests During Bid Period: Submit written requests on the Substitution Request Form following this Section, for approval of alternative materials or products.

1. All requests must be received by Sound Transit not later than 10 Days prior to scheduled time for receipt of bids in order to receive consideration.

2. Bidders will be informed by addendum of additional materials and products approved for use.

3. No other form of approval will be given during the bid period and bidders shall not rely upon an approval not incorporated into the documents in this manner.

D. Requests After Receipt of Bid or Proposal: Requests for approval of substitute materials or products will not be considered except under one or more of the following conditions. With their request, the Contractor shall indicate which condition it believes applies:

1. Unavailability: A substitution is required because the specified item is not available due to factors beyond the control of the Contractor.

2. Unsuitability: Subsequent information or changes disclose inability of the specified item to perform as intended.

3. Regulatory requirements: Final interpretation of Code, regulatory requirements, safety requirements, or insurance requirements necessitates a change due to inability of the specified item to conform.

4. Warranty: Manufacturer or fabricator cannot certify or warrant performance of specified item as required.

5. Sound Transit's benefit: In the judgment of the Resident Engineer, acceptance of the proposed substitution is clearly in Sound Transit's best interest because of cost, quality, or other consideration. In requesting a substitution under this clause, the Contractor shall furnish substantiation of such reason.

E. Redesign and Coordination: In making request for approval of alternative or substitute materials, the Bidder/Contractor agrees to the following.
1. Bidder/Contractor will coordinate all trades including changes thereto as may be required.

2. Bidder/Contractor waives all claims for additional costs which subsequently become apparent as a consequence of the substitution.

3. Bidder/Contractor shall bear all costs related thereto, including costs of the Resident Engineer’s services for redesign if deemed necessary.

3.03 SOUND TRANSIT-SUPPLIED PRODUCTS

A. See Section 01 64 00, Owner-Furnished Materials and Equipment, for identification of Sound Transit-supplied products.

B. Sound Transit’s Responsibilities:
   1. Arrange for and deliver Sound Transit reviewed shop drawings, product data, and samples, to Contractor.
   2. Arrange and pay for product delivery to site.
   3. On delivery, inspect products jointly with Contractor.
   4. Submit claims for transportation damage and replace damaged, defective, or deficient items.
   5. Arrange for manufacturers' warranties, inspections, and service.

C. Contractor's Responsibilities:
   1. Review Sound Transit reviewed shop drawings, product data, and samples.
   2. Receive and unload products at site; inspect for completeness or damage jointly with Sound Transit.
   3. Handle, store, install and finish products.
   4. Repair or replace items damaged after receipt.

3.04 TRANSPORTATION AND HANDLING

A. Coordinate schedule of product delivery to designated prepared areas in order to minimize site storage time and potential damage to stored materials.

B. Transport and handle products in accordance with manufacturer's instructions.

C. Transport materials in covered trucks to prevent contamination of product and littering of surrounding areas.

D. Promptly inspect shipments to ensure that products comply with requirements, quantities are correct, and products are undamaged.

E. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage.

F. Arrange for the return of packing materials, such as wood pallets, where economically feasible.
G. Provide undamaged products, materials, and equipment. Pack and brace items while transporting to the site from the plant of manufacture to prevent damage. Protect all items from conditions, which might have a detrimental effect.

H. Delivery: Deliver proprietary materials in original containers or packages with manufacturer's name, brand label, and identifying quality marks thereon. Do not remove from containers or destroy labels until ready for installation unless approved by the Resident Engineer.

3.05 STORAGE AND PROTECTION

A. Designate receiving/storage areas for incoming products so that they are delivered according to installation schedule and placed convenient to work area in order to minimize waste due to excessive materials handling and misapplication.

B. Provide weatherproof, secure storage for materials and equipment. Protect stored material from damage and from sunlight. Identify for required location and installation in the Work; do not mark in a manner that will remain visible after installation or which will affect performance or appearance. Organize and arrange storage for accessibility for inspection and for efficient and timely installation.

C. Store with seals and labels intact and legible.

D. Store sensitive products in weather tight, climate controlled, enclosures in an environment favorable to product.

E. For exterior storage of fabricated products, place on sloped supports above ground.

F. Provide bonded off-site storage and protection when site does not permit on-site storage or protection.

G. Off-Site Storage:
   1. If requested by the Contractor and approved in writing by Sound Transit, Sound Transit may make payment to the Contractor for products stored off-site prior to their installation.
   2. Such payment will be approved by Sound Transit, only when Contractor has furnished evidence, satisfactory to Sound Transit, of compliance with conditions the General Conditions of the Contract and, in addition, documentation outlining type and location of storage facilities and a method of inventory suitable to account for all such materials and products until installed in the Work.
   3. Items stored off-site: Label with project name, project address, and Contractor name. Insure for full replacement value.

H. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.

I. Store loose granular materials on solid flat surfaces in a well-drained area. Prevent mixing with foreign matter.

J. Prevent contact with material that may cause corrosion, discoloration, or staining.

K. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.
L. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.

END OF SECTION
SECTION 01 64 00
OWNER-FURNISHED MATERIALS AND EQUIPMENT

PART 1 - GENERAL

1.01 SUMMARY
A. This Section includes specifications for the acceptance, unloading, handling, storage, protection, and utilization of materials and equipment furnished by Sound Transit for installation by the Contractor, including installation supervisors, pursuant to the General and Special Conditions.
B. Refer to Section 01 60 00, Product Requirements, for handling, storage, and other pertinent requirements.

1.02 ABBREVIATIONS:
A. Sound Transit-furnished materials and equipment may be referred to herein and in other Sections, where applicable, by the abbreviations OFM (Owner Furnished Materials) and OFE (Owner Furnished Equipment) respectively.

1.03 SOUND TRANSIT-FURNISHED MATERIALS AND EQUIPMENT:
A. The materials and equipment to be furnished by Sound Transit for installation by the Contractor are specified in the Special Conditions.

1.04 CONTRACTOR'S RESPONSIBILITIES
A. Requirements: The Contractor shall assume custody of, and provide protection for OFE and OFM from the time of delivery and acceptance by the Contractor until Substantial Completion of the Work and the return of excess materials and equipment.
B. Protection: Protect OFE and OFM while in custody from theft, vandalism, loss, damage, and deterioration due to moisture and temperature during unloading, storing, handling, distributing, and installing the materials and equipment. Lost or damaged materials and equipment, as documented by Sound Transit, shall be replaced by the Contractor at no additional cost to Sound Transit.
C. Delivery Schedule:
1. OFE and OFM shall be delivered by the respective suppliers to the delivery sites indicated, within the dates indicated in the Special Conditions. OFE and OFM will be delivered to the delivery sites between the hours of 10:00 a.m. and 3:00 p.m., Monday through Friday.
2. The method and rate of material delivery shall be determined by the respective suppliers, and this information will be reported by Sound Transit to the Contractor at least 1 month before the initial delivery of each type of material.
3. All Contractor requests for modification to the delivery method, location, rate, or date(s) shall be made through the Resident Engineer. Should an agreement be reached to modify a delivery parameter, all additional costs due to the modification shall be paid by the Contractor.
D. Unloading: The Contractor shall provide the labor, equipment, and materials necessary to unload, handle, stockpile, and store OFM and OFE. The Contractor shall unload and stockpile or store OFE and OFM within 4 hours of their arrival at the delivery site. Unloading and handling shall be in accordance with the respective supplier's requirements. A Sound Transit representative will verify the quantity and condition of materials delivered.

E. Storage Plan: Prepare a storage plan for each storage area where OFM and OFE are proposed to be stored or stockpiled. The plan shall be in sufficient detail to demonstrate that efficient handling environmental controls, and security provisions have been provided, that supporting soils will not be overloaded, and that materials will not be overstressed due to bending or shear. No material or equipment shall be placed directly on the ground. Provide cribbing. A current inventory of the materials on hand shall be provided and kept by the Contractor. The Contractor shall notify the Resident Engineer at least 30 days in advance of anticipated shortages.

F. OFM and OFE Acceptance: Inspect OFE and OFM at time of delivery by the respective suppliers to the delivery sites, and submit certification to the Resident Engineer showing the quantity of accepted materials and equipment. Set aside damaged materials and equipment, and immediately notify the Resident Engineer and the delivery carrier in writing of the damage and circumstances of discovery.

G. Inventory Records: Prepare and maintain perpetual inventory records of Sound Transit-furnished materials and equipment, and assign stock number, date of receipt from Sound Transit, and approximate date of construction placement. Checkout and returns of OFE and OFM or other transfer of materials and equipment between the Contractor and Sound Transit shall be accompanied by an inventory record form.

H. Excess Materials: Upon Substantial Completion of the Work, the Contractor shall transport, unload, and stockpile, excess OFE and OFM to a delivery location within a 25-mile radius of the jobsite, as determined by the Resident Engineer.

1.05 INSTALLATION

A. OFE and OFM shall be installed accurately and efficiently to avoid waste, such as that due to incorrect or inaccurate installations. Wasted materials and equipment, as documented by the Resident Engineer, shall be replaced by the Contractor at no additional cost to Sound Transit.

1.06 INSTALLATION INSTRUCTIONS, TRADESMEN, AND SUPERVISION

A. The Resident Engineer shall provide the Contractor with installation instructions and drawings from the manufacturers of OFE. In addition, the assembly, installation, and testing of the major and more complex items of mechanical equipment, electrical and electronic equipment, and communications and radio equipment shall be performed under the technical supervision of installation supervisors from the various manufacturers' organizations.

B. The Contractor shall be responsible for providing appropriate tradesmen experienced in the installation and operation of similar equipment.

C. Installation supervisors' services for OFE will be obtained by and at the expense of Sound Transit, and the installation supervisor will be made available, as specified.

D. The Contractor shall be responsible for coordinating the work and cooperating with the Resident Engineer in scheduling the time when each installation supervisor will be needed in order to best conform with the installation and testing schedules and still allow
sufficient advance notice to the manufacturer for scheduling the most suitable installation supervisor.

E. The Contractor shall be responsible for work performed in the absence of the installation supervisor, or work which does not conform to such supervisor's instructions. Errors in assembly or installation resulting there from shall be corrected by the Contractor without additional cost to Sound Transit.

F. The Contractor shall not be held responsible for faulty manufacture of the equipment or for errors in the manufacturers' assembly drawings.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION
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PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes specifications for general requirements for materials and equipment, including the packaging, handling, delivery, and storage thereof. Additional requirements for product listing, product selection, equivalent materials, product performance, and requests for substitutions are included in Article 5 of the General Conditions.

1.02 QUALITY CONTROL

A. Provide products, materials, and equipment of the same generic kind from a single source. Where products or materials, by nature, are available only from sources that do not individually comprise sufficient quantity for the total project requirement, select products and materials from those individual sources that are most nearly equal and uniform in the indicated qualities.

PART 2 - PRODUCTS

2.01 MANUFACTURERS' INSTRUCTIONS

A. When the Contract Documents require that installation of work comply with manufacturers' instructions, obtain and distribute copies of such instructions to parties involved in the installation and one reproducible copy to the Resident Engineer. Maintain one set at the site until installation is complete.

B. Handle, install, connect, clean, condition, and adjust products in strict compliance with the instructions and specified requirements. Should job conditions or specified requirements conflict with the manufacturers' instructions, notify the Resident Engineer. Handle all equipment in strict accordance with the manufacturer's written handling instructions.

C. Perform work in accordance with the manufacturer's instructions. Do not omit steps unless specifically modified or exempted by the Contract Documents.

2.02 HANDLING OF MATERIALS

A. Handle all materials and equipment to be incorporated in the Work in a manner that will prevent misalignment of parts or the occurrence of damage of any kind.

B. Protect all materials and equipment at all times from all environmental conditions that might cause damage in a secure and dry storage facility.

C. Verify with the manufacturer all information regarding scheduling, delivery, and preparations necessary for installation.

D. Mark each item in accordance with referenced codes and standards.
E. Ship each unit securely wrapped, crated or packaged, and labeled for safe handling in shipment and to avoid damage or distortion.

F. Supply all necessary supervision and coordination information to accommodate the installations of equipment.

G. Adhere to manufacturer’s handling requirements when off-loading equipment and materials at the jobsite.

2.03 STORAGE OF MATERIALS AND EQUIPMENT

A. All equipment and materials shall be stored in accordance with the manufacturer’s recommendations, or as specified in the Contract Documents to preserve their quality and fitness for the Work. Stored equipment and materials, although determined acceptable for the Work upon delivery or during storage, must again be inspected by the Contractor before their incorporation into the Work. Stored equipment and materials shall be located and arranged to facilitate inspection by the Resident Engineer.

B. Sound Transit-furnished materials or materials paid for before incorporation shall be stored in secure locations approved in writing by the Resident Engineer in a manner that will preserve their full value. Such materials shall be prominently labeled as property of Sound Transit and shall not be commingled with non-Sound Transit materials. If necessary, storage shall be in controlled environment buildings.

PART 3 - EXECUTION (NOT USED)

END OF SECTION
PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes requirements for surveying of the work and for field measurement of work quantities.

B. Related Sections: The work of the following Sections is related to the work of this Section. Other Sections, not referenced below, may also be related to the proper performance of this work.
   1. Section 01 78 39, Project Record Documents.
   2. Section 31 09 00, Geotechnical Instrumentation and Monitoring of Earthwork.

1.02 SUBMITTALS

A. Procedures: Section 01 33 00, Submittal Procedures.

B. Qualifications.

C. Calibration reports, upon request.

D. Survey field notes and all survey calculations.

E. Record Drawings (as-built drawings)
   2. In accordance with Section 01 78 39, Project Record Documents.
   3. In Adobe Acrobat 7.0 or later PDF format.

F. Settlement monitoring surveys in accordance with Section 31 09 00, Geotechnical Instrumentation and Monitoring of Earthwork.

1.03 QUALITY ASSURANCE

A. Qualifications:
   2. Chief Tunnel Surveyor: Previous experience with tunnel boring machine guidance system and trained by the guidance system supplier.
1.04 PROJECT CONDITIONS

A. Only the Construction Control monuments and benchmarks generally referred to as Construction Control Points (CCPs) will be provided by Sound Transit. Use Sound Transit surveys to control establishment of the lines and grades required for completion of the work. CCPs for vertical and horizontal control are indicated on the Contract Drawings.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 CONSTRUCTION

A. General:

1. Perform all survey work by an approved Surveyor.
2. Verify and maintain CCPs as shown on the Contract Drawings.
3. Establish and maintain all secondary or additional survey control needed for the project.
4. Establish and maintain all alignment, slope, grade, clearing limit, and grading limit stakes, hubs, or marks.
5. Construct to dimensions, locations, lines, grades, and elevations as shown on the Contract Drawings or as specified.
6. Perform all survey work in conformance with survey requirements imposed by State of Washington, City of Seattle or University of Washington on the work through a permit, development condition, law, or regulation.
7. Develop and maintain detailed survey records that allow the survey work to be reproduced.

B. Lines And Grades

1. Using the CCPs, develop and make additional surveys as needed for construction, such as secondary control, control lines, slope stakes, settlement markers, batter boards, stakes for pipe locations, and other working points, lines and elevations. Re-establish all benchmarks and survey control points destroyed.
2. Maintain and preserve all monuments, stakes and markers outside the construction limits. In the event that monuments, stakes or markers are destroyed or damaged, replace them at no cost to Sound Transit. Provide new replacement monuments and boxes when removed or damaged during construction.
3. Be responsible for all other stakes or markers required to establish the lines and grades for the completion of the Work.

C. Surveys For Layout And Performance
1. Perform all surveys for layout and performance of the Work, reduce the field notes, and make all necessary calculations and drawings to carry out such work. Check the relative positions of all monuments and benchmarks each time monuments or benchmarks are used.

2. Use instruments and other survey equipment that are accurate, suitable for the surveys required in accordance with recognized professional standards, and in proper condition and adjustment at all times. Carry out instrument calibrations prior to the start of survey work and every 12 months thereafter. Furnish calibration reports upon request.

3. Record all surveys in field notebooks. Furnish a certified copy of the original pages of records to the Resident Engineer upon request. Furnish each field notebook to the Resident Engineer when filled or completed.

4. The Contractor’s surveys are a part of the Work and may be checked by the Resident Engineer at any time. Be responsible for lines, grades, or measurements that do not comply with specified or proper tolerances, or which are otherwise defective, and for the resultant defects in the Work. Conduct resurveys or check surveys to correct errors indicated by review of the field notebooks.

5. The Resident Engineer may require that work be suspended at any time when location and limit marks established by the Contractor are not reasonably adequate to permit inspection of the work.

6. In advance of any restoration paving, produce survey information to check the line and grade used for paving elevations and slopes.

7. Comply with the survey requirements for all monitoring as specified in Section 31 09 00, Geotechnical Instrumentation and Monitoring of Earthwork.

D. Surveys For Tunnels, Shafts And Underground Stations

1. Maintain control for line and grade within the tunneled sections.

2. Complete an optical survey and immediately provide survey results for the actual tunnel alignment, grade, and ring roundness on a weekly basis or at 300-foot intervals in the tunnel progress, whichever comes first or as required by the Resident Engineer. Immediately verify apparent changes in location and notify the Resident Engineer.

3. Adjust the published coordinates (horizontal and vertical) of these survey points as necessary and provide the revised coordinates to the Resident Engineer as soon as possible after verification of the location information.

E. Surveys For Measurement For Payment

1. Perform surveys for all Schedule of Value items measured by surveying methods.

2. Perform all surveys, in the presence of the Resident Engineer who will witness the surveying operation by signing the field notes or keeping duplicate field notes. Reduce the field notes and calculate quantities for payment purposes. Provide a duplicate copy of the note reductions and calculations when requested by the Resident Engineer.

F. Surveys For Record Drawings (As-built Drawings)
1. Be responsible for performance of surveys as are required to accurately indicate the record (as-built) information for all major components of the Work or as required elsewhere in these Contract Documents.

G. Surveying Accuracy And Tolerances In Setting Survey Stakes

1. Perform all control traverse field surveys and computations, including surveys of main control lines to determine alignment of major structure components, to a precision of at least 1:20,000 after azimuth closure and adjustment.

2. Set survey stakes to the tolerances in Table 01 71 23 A, herein, unless otherwise specified to stricter tolerances elsewhere in the Contract Documents. Table 01 71 23 A does not otherwise relieve the Contractor of responsibility for measurements in compliance therewith.

3. Do not exceed the following tolerances in setting survey stakes:

<table>
<thead>
<tr>
<th>TABLE 01 71 23 A - SURVEYING ACCURACY AND TOLERANCES</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Tolerance on Error in Line</strong></td>
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<tr>
<td><strong>Horizontal Survey Stake or Markers</strong></td>
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<tr>
<td>Horizontal markers on hubs and monuments on centerlines and offset centerlines</td>
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<tr>
<td>Intermediate stakes or markers on centerlines and offset centerlines for:</td>
</tr>
<tr>
<td>Rough excavation and embankment for roads and other work not otherwise provided</td>
</tr>
<tr>
<td>Trimming of excavation and embankment, unless otherwise provided</td>
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<tr>
<td>Structures, building construction</td>
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<tr>
<td>Equipment installation</td>
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<tr>
<td>Trimming or preparation of earth subgrade for roadways, trackway, concrete pipe, and other concrete structures</td>
</tr>
<tr>
<td>Trackway subballast, roadway subbase and base, steel pipe and other work not otherwise provided for</td>
</tr>
<tr>
<td>Roadway surfacing, steel reinforcement, concrete pipe and other formed concrete</td>
</tr>
<tr>
<td><strong>Vertical Grade Stakes or Markers for:</strong></td>
</tr>
<tr>
<td>Rough excavation and embankment for trackway, roads and other work not otherwise provided for</td>
</tr>
<tr>
<td>Trimming of excavation and embankment, unless otherwise provided for</td>
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<tr>
<td>Trimming or preparation of earth subgrade for trackway, roadways, concrete pipe, and other concrete structures</td>
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<td>Description</td>
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<tr>
<td>Trackway subballast, roadway subbase and base, steel pipe, and other work not otherwise provided for</td>
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<tr>
<td>Equipment installation</td>
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PART 1 - GENERAL

1.01 SUMMARY

A. This Section specifies protection and maintenance of underground and aboveground utilities, structures, fences, parking strips, sidewalks, driveways, streets, and other improvements which may be affected by the work, and specifies requirements for Contractor disposition of third party claims in a timely manner.

B. Related Sections: The work of the following Sections is related to the work of this Section. Other Sections, not referenced below, may also be related to the proper performance of this work.

1. Section 01 56 39, Tree and Plant Protection.

2. Section 31 50 00, Excavation Support and Protection.

1.02 REFERENCES

A. This Section incorporates by reference the latest revisions of the following documents.

1. Revised Code of Washington (RCW)

2. Washington Administrative Code (WAC)
   a. WAC 296-155 Part N Excavation, Trenching, and Shoring.
   b. WAC 296-24-960 Working on or Near Exposed Energy Parts.

1.03 SUBMITTALS

A. Procedures: Section 01 33 00, Submittal Procedures.

B. Listing and schedule of all potholing.

C. Listing of all utilities/facilities to be physically protected and relocated.

D. Shoring for all affected structures and utilities.

E. Qualifications for independent third party pre-construction inspectors for utilities and buildings.

F. Copies of all pre-construction inspections and surveys of utilities and buildings.

1.04 DEFINITIONS

A. Conflict: An existing major underground utility is considered to be in Conflict if:

1. It crosses or projects into the specified excavation at an elevation between the top and bottom of the proposed Facility.
2. When parallel to a proposed Facility within the zone-of-influence (1:1).

3. If the proposed Facility does not meet the above listed requirements, then no Conflict exists.

B. Facility: A real property entity consisting of one or more of the following: an underground or aboveground utility system or structure, pavement, or other improvement.

C. Major underground utility: A transmission, collection, or distribution line where it would be customary to expect that drawings would exist for the line and the utility owner would be aware of the line.

D. Minor underground utility: Services from a collection or distribution line such as irrigation lines less than four inches, water service lines, building drainage pipes, and direct burial cable.

E. Utility Quality Level: An opinion of the quality and reliability of existing subsurface utility information. Each of the existing utility data quality levels is established by different methods of data collection and interpretation.

F. Utility Quality Level B: Information obtained through the application of appropriate surface geophysical methods to determine the existence and approximate horizontal position of existing subsurface utilities. This information was surveyed to applicable tolerances, reduced, and indicated on the Contract Drawings.

G. Utility Quality Level C: Information obtained by surveying and plotting visible above-ground utility features and by correlating this information to Quality Level D information. This information was reduced and indicated on the Contract Drawings.

H. Utility Quality Level D: Information derived from existing records or oral recollections. This information was interpreted and indicated on the Contract Drawings.

1.05 LOCATION OF EXISTING FACILITIES

A. General:

1. Data for underground utilities have been obtained, reduced/interpreted and indicated on the Contract Drawings.

2. The locations of existing major utilities, whether aboveground or underground, are indicated on the Contract Drawings.

3. Sound Transit does not guarantee the accuracy or completeness of the information indicated on the Contract Drawings.

4. It is to be understood that other aboveground or underground facilities not indicated on the Contract Drawings may be encountered during the course of the work.

B. Abide by all the applicable requirements of Chapter 19.122 RCW.

C. Utility Underground Notification Center:

1. Call One-Call Utilities Locate Center (800-424-5555) for location of underground utilities in accordance to Chapter 19.122 RCW in advance of all excavation work.

2. Be responsible for damages to utilities resulting from failure to contact the One-Call Utilities Locate Center within the specified time period of Chapter 19.122 RCW prior to all excavation work.
3. Those utility owners who do not locate their facilities in accordance with Chapter 19.122 RCW are liable for costs incurred by the Contractor for affects of the utility on the Contractor’s work. Promptly notify the Resident Engineer prior to all work in the area of a utility where a utility owner fails to meet its obligations under Chapter 19.122 RCW.

4. If the Contractor discovers underground facilities which are not indicated on the Contract Drawings, immediately notify the Underground Notification Center, and the Resident Engineer. Provide an as-built survey after notification and put discovered underground facilities on as-built drawings.

D. Coordinate efforts to locate existing underground utilities. A minimum of 30 days prior to work in the location of a utility, review with the Resident Engineer the locations of existing utilities in relation to the work and evaluate areas of Conflict and potential Conflict.

E. Be responsible to excavate (pothole) and expose all major and minor existing utilities prior to the work to determine utility elevations in relation to the new Facilities.

F. Unless otherwise indicated, protect, modify, and relocate all existing utilities required to complete the work.

G. Unless otherwise indicated, be responsible for all relocations that may be affected as a result of the Contractor’s means and methods prior to commencing work in the area. This is in addition to the underground utilities which are indicated on the Contract Drawings to be relocated.

H. Specific means and methods to be utilized by the Contractor are not known to Sound Transit. Be responsible for protection, modification, or relocation of existing utilities and facilities required to accommodate means and methods.

I. Sound Transit will not be liable for utility protection, modification, and relocation not indicated on the Contract Drawings and required by the Contractor due to its means and methods. It is the Contractor’s responsibility to determine the requirements of the work required by the Contract Documents and make provision for protection, modification, and relocation required to perform the work.

J. Coordinate all protection, modification, and relocation work with the affected utility owner through the Resident Engineer. Perform work to the utility owners’ requirements and standards.

K. Major underground utilities:
   1. Be responsible for all protection, affects, and damages for utility not in conflict with a new facility.
   2. When not indicated on the Contract Drawings and in conflict with a new facility, meet and agree with the Resident Engineer on how to proceed. Reimbursement for additional work will be in accordance with the General Conditions.
   3. When not indicated on the Contract Drawings and no conflict with a new facility exists, no additional payment will be considered.

L. Minor underground utilities:
   1. Be responsible for all protection, affects, and damages on minor utilities.
   2. Sound Transit is not responsible for costs resulting from conflicts with minor underground utilities.
M. Abandoned pipelines shall be removed, plugged, or filled per the City of Seattle or University of Washington requirements, whichever is applicable.

N. Temporary Support Systems: Submit detail drawings of proposed methods to support, protect, and buttress utilities affected by the work. Methods proposed are required to be reviewed and accepted by the affected utility prior to submittal in accordance with Section 01 33 00, Submittal Procedures.

O. Storm and sanitary sewers:
   1. Existing live sewers shall remain in service, unless otherwise indicated.
   2. If interruption of sewers is required, provision shall be made for disposal of existing sewage flow.
   3. Immediately repair construction damage to the existing sewer system and manholes to a condition equal to or better than that existing prior to the damage.
   4. Repair all damage which results from the disturbance of the existing sewer.
   5. Remove water accumulating during the work from the new sewers and prevent it from entering existing lines until Substantial Completion.
   6. With SPU prior approval, flush existing pipes which were affected by the work to the point of the next upstream connection and clean and repair all pipelines or manholes affected by gravel, rocks, or other debris that has entered the existing system during construction.
   7. Connection to an existing manhole or sewer line shall not be made until approved by the Resident Engineer.

P. Aboveground electrical, cable, and communication facilities:
   1. Attention is called to all overhead items including, but not limited to, power and telephone lines, King County Metro transit power lines, traffic signals, traffic signal mast arms, overhead sign bridges, sign support span wires, signs, and street lights.
   2. Observe the location of these overhead facilities and plan and conduct work operations accordingly.
   3. Working with the utility owner, take precautions to protect and avoid damage to all overhead facilities.
   4. Relocate Facilities as required to meet the means and methods to be utilized.
   5. Observe and investigate the presence of Facilities that may be affected by the work.
   6. Consult with and rely on the information given by utility owners and operators to determine the extent of all hazards and measures required.
   7. Determine the extent of all hazard created by the work in all areas and follow approved safety procedures during the work.
   8. Support poles at risk of being undermined by the work.
   9. Follow the requirements of WAC 296-24-960 for all energized primary conductors:
a. For 50 kv lines and less, at no time shall personnel or equipment approach closer than 10 feet to all energized primary conductors.

b. For greater than 50 kv, meet the requirements of WAC 296-24-960.

Q. Underground electrical, cable, communication, and fiber optic Facilities:

1. Determine the protection necessary to proceed safely to protect these underground Facilities.

2. Fiber optics:
   a. When not indicated on the Contract Drawings and in conflict with the new facility, meet and agree with the Resident Engineer on how to proceed.
   b. When not indicated on the Contract Drawings and no conflict with the new facility exists, no additional payment will be considered.

R. Gas:

1. As required by the appropriate utility owner, protect, maintain, support in place, or relocate all gas mains crossing pipeline trenches and other elements of the work.

2. Provide a minimum of 12 inches of clearance, measured from edge to edge, between gas mains or gas service lines and new facilities.

3. If relocating either utility is not practical, provide a protective wrap for the entire distance where less than 12 inches of vertical clearance and less than 6 inches of horizontal clearance is provided.

4. Wrapping material: either a split polyvinyl chloride (PVC) pipe or PVC wrapping of at least 0.04 inch in thickness, applied to either one of the pipes.

5. Protect and maintain all temporary gas service slack lines during pipeline installation.

6. Notify Puget Sound Energy through the Resident Engineer at least 4 days in advance of excavation in the vicinity of the high pressure gas main.

S. Water:

1. As indicated in the Contract Documents, protect, maintain, support in place, or relocate water pipelines affected by the work.

2. Maintain water service along the alignment of work at all times.

3. Existing thrust blocks are not indicated on the Contract Drawings. Assume that thrust blocks are present at all water line deflections of 11.25 degrees or greater.

4. Notify the Resident Engineer immediately of all damage. Begin repairs immediately, and work continuously until water service is restored. Coordinate repair options and all repairs with the utility owner through the Resident Engineer.

T. Roadways:
1. Take adequate precautions to protect existing sidewalks, curbs, pavements, utilities, adjoining property, and structures, and to avoid damage thereto.

2. Protected and replace traffic signage, paint striping, and channelization if damaged by the Contractor’s operation.

3. Unless otherwise indicated, maintain the existing illumination pattern for signs and roads at all times.

4. Install temporary roadway lighting as necessary.

U. Traffic loops:

1. Be responsible for coordinating with Sound Transit and providing alternative means to regulate traffic flow during the time that the traffic loop is affected by the work.

1.06 SHORING AND BRACING

A. Shore up, brace, under-pin, and protect as necessary, the foundations and other parts of existing structures adjoining the site of the work that may be affected by the work.

B. For all loss and damage because of settlements or the loss of lateral or subjacent support of adjoining property and from all loss and damage to adjoining and adjacent structures and their premises that may occur in the prosecution of the work:

1. Follow the procedures required by the Sound Transit Controlled Insurance Policy (OCIP)

2. Be responsible for:
   a. All deductibles for OCIP-insured claims.
   b. All costs resulting from claims not insured by the OCIP.

C. Comply with the requirements of WAC 296-155-657, as applicable, and Section 315000, Excavation Support and Protection.

1.07 PRE- AND POST-CONSTRUCTION BUILDING SURVEYS

A. Contractor shall have an independent third party perform pre- and post- construction survey inspections of Husky Stadium. Such third party independent subcontractor’s qualifications shall be submitted to the RE for review, prior to authorization of work.

B. The portion of concern at Husky Stadium is the west stands of the stadium, closest to the station excavation. The portion that needs to be inspected is the outside façade and adjoining structure between SSP-700 and SSP-707, as shown on Contract Drawing N21-KM115.

C. The third party inspection firm shall have a minimum of five years performing work of similar nature.

D. Pre-construction surveys shall document interior and exterior inspections of conditions prior to construction activities, including but not limited to the following:

1. Hand-written notes.

2. Audio notes on tape.
3. Color photographs and/or videos.

4. Inspection forms.

E. Document all visible cracks, defects or unusual conditions. Document and record all comments made by property owners during inspections.

F. Coordinate all pre-construction surveys with the Resident Engineer. Do not perform pre-construction surveys unless accompanied by the Resident Engineer.

G. Submit one copy of all inspection reports to the Resident Engineer. Have the third party maintain the original inspection reports until Final Acceptance.

1.08 EMERGENCIES

A. Whenever work endangers the safety of life or property, including adjoining property or property in the immediate proximity of the work, take all reasonable and prudent actions to prevent threatened loss or injury.

1.09 PROTECTION OF TREES AND VEGETATION

A. In accordance with Section 01 56 39, Temporary Tree and Plant Protection.

1.10 DISPOSITION OF THIRD PARTY CLAIMS

A. Follow procedures required by the Owner Controlled Insurance Policy (OCIP).

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 GENERAL

A. Contact Utility Underground Notification Service prior to an excavation in accordance with Article 1.05C, herein.

B. Adjust work when location of utility is different than indicated on the Contract Drawings and materially impacts construction.

C. If damage to a utility occurs, repair damage to the requirements of the utility owner prior to backfilling said utility.

END OF SECTION
SECTION 01 74 00
CLEANING AND WASTE MANAGEMENT

PART 1 - GENERAL

1.01 SUMMARY:

A. This Section specifies requirements for cleanup during construction and final cleaning of the site prior to Acceptance and administrative and procedural requirements for construction waste management activities, including muck disposal.

B. Related Sections: The work of the following Sections is related to the work of this Section. Other Sections not referenced below may also be related to the proper performance of this work.

1. Section 01 57 19, Temporary Environmental Controls.
2. Section 01 57 24, Temporary Site Water Discharge.
3. Section 02 41 00, Demolition.

1.02 SUBMITTALS

A. Waste Management Plan: Within 21 Days of effective date of NTP.

1. Include proposed methods for construction, demolition and land clearing (CDL) waste salvage, reuse, recycling, and disposal during demolition including, but not limited to, one or more of the following:

   a. Contracting with a deconstruction specialist to salvage materials generated.
   b. Selective salvage as part of demolition Contractor’s work.
   c. Reuse of materials onsite or sale or donation to a third party.

2. Include proposed methods for CDL waste salvage, reuse, recycling, and disposal during construction including, but not limited to, one or more of the following:

   a. Requiring Subcontractors to take their CDL waste to a recycling facility.
   b. Contracting with a recycling hauler to haul recyclable CDL waste to an approved recycling or material recovery facility.
   c. Processing and reusing materials onsite.
   d. Self-hauling to a recycling or material recovery facility.

3. Include the name(s) of all proposed recycling, material recovery, treatment, and disposal facilities receiving the CDL wastes, including facilities designated to receive “clean fill” material, jet grout spoils return, muck, and all other excavated soils.
a. Include copies of all permits the receiving facility is required to maintain in order to accept the material anticipated to be treated, handled, or disposed of at the facility.

b. Demonstrate that the facility has been provided documentation regarding the nature (physical and chemical characteristics) of the material to be accepted.

c. Provide a contact name, address, email information, and phone number for receiving facility manager.

d. Indicate days and hours of operation for each facility proposed.

4. Handling Procedures:
   a. Include methods that will be employed to ensure proper separation of recyclable wastes including sizes of containers, container labeling, and designated location(s) on Project site where materials separation will be located.
   
   b. Provide details on proposed transportation methods for all waste streams, including but not limited to types of vehicles to be employed, all specialty permits required, trucking routes and anticipated vehicle miles per load.

5. Contact Information: The Plan shall include the name and contact information of the person designated as responsible for implementing the Waste Management Plan.

B. Waste Management Report: Submit report concurrent with the final application for payment.

1. Submit a cumulative Waste Management Report in a form acceptable to the Resident Engineer with the final Application for Payment with the following information:
   a. A record of the type and quantity, by weight, of each material salvaged, reused, recycled, or disposed.
   
   b. Total quantity of waste recycled as a percentage of total waste.
   
   c. Copy of all receipts issued by a disposal facility for all CDL waste that is disposed in a landfill.
   
   d. Copy of receipts issued by approved recycling facilities for co-mingled materials. Include weight tickets from the recycling hauler or material recovery facility and verification of the recycling rate for co-mingled loads at the facility.

2. Types and quantities, by weight, for materials salvaged for reuse on site, sold or donated to a third party.

C. Summary of Waste Generated: Submit with each application for progress payment.
PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 CLEANUP DURING CONSTRUCTION

A. Keep the entire site in a neat and orderly condition at all times during construction.
   1. Conduct a general cleanup of the site daily as a part of the work.
   2. Provide general daily clean-up and disposal service for removal of waste and rubbish from the jobsite.
   3. Clean material as necessary prior to incorporating into the work.

B. Dispose or recycle waste, trash, and debris in a safe, acceptable manner, in accordance with applicable laws and ordinances.
   1. Bury no waste material and debris on the site.
   2. Burning of trash and debris on the site is prohibited.

C. Remove materials and equipment from the site when no longer necessary.

D. Dust Control: Refer to Section 01 57 19, Temporary Environmental Controls.

E. Provide daily litter pickup and general cleanup within 500 feet of the limits of work area in all directions. Clean up both construction and non-construction material, including such things as drug paraphernalia and human waste. Provide trash receptacles for worker’s lunches, cigarette butts, and other miscellaneous garbage. Assume no less than 1 hour per day for this activity.

F. Remove graffiti from walls, trailers, and equipment within 24 hours. Assume no less than two hours per week for this activity.

G. Maintain planted landscape areas adjacent to the construction site. Mow and weed areas as needed.

3.02 FINAL SITE CLEANUP

A. Prior to final inspection, clean the entire site. Remove from the entire site all construction equipment and facilities, construction waste and unused materials, loose rock and stones, excess earth, and debris of all description resulting from the work.

B. Wash, scrub clean and use a street sweeper where necessary for all pavement and paved walks. Prevent run-off from entering into local storm water conveyance systems unless treated to acceptable limits as specified in Section 01 57 24, Temporary Site Water Discharge.

C. Remove mortar droppings from concrete work and pavement where they occur. Wash and scrub clean all exposed vertical surfaces of concrete. Clean all manholes. Prevent run-off from entering into local storm water conveyance systems unless treated to acceptable limits as specified in Section 01 57 24, Temporary Site Water Discharge.

D. Clear and clean drainage systems.
3.03 WASTE MANAGEMENT PLAN

A. Develop plan including analysis of proposed jobsite waste to be generated, identification of all waste types, estimation of quantity by weight and volume, methods of disposal, materials handling procedures, treatment options, and transportation methods and procedures. Include, at a minimum, separate sections for demolition, soil stabilization, construction, tunneling, dewatering and excavation wastes. Establish measurable goals for the recycling, salvage or reuse of materials.

3.04 IMPLEMENTATION AND DOCUMENTATION OF WASTE MANAGEMENT PLAN

A. Designate one or more on-site parties as responsible for instructing workers and overseeing and documenting results of the Waste Management Plan for the Project.

B. Distribute copies of the Waste Management Plan to the Job Site Foremen, all Subcontractors and Subconsultants. Provide on-site instruction of appropriate separation, handling, and recycling, salvage, reuse and return methods to be used by all parties at the appropriate stages of the Project. Post a summary of the Plan at appropriate locations on the jobsite.

C. Designate and label specific areas at the jobsite to facilitate separation of materials for potential recycling, salvage, reuse, and return. Recycling and waste bin areas are to be kept neat and clean:

1. Provide containers for CDL waste that is to be recycled clearly labeled as such with a list of acceptable and unacceptable materials.

2. The collection containers for recyclable CDL waste must contain no more than 10 percent non-recyclable material by volume.

3. Provide containers for CDL waste that is disposed in a landfill clearly labeled as such.

4. Include in material purchasing agreements a waste reduction provision requesting that materials and equipment be delivered in packaging made of recyclable materials, that vendors reduce the amount of packaging, that packaging be taken back for reuse or recycling, and to take back all unused product. Insure that Subcontractors require the same provisions in their purchase agreements.

5. Conduct regular visual inspections of dumpsters and recycling bins to remove contaminants. Document inspections in an inspection log to be kept at the jobsite.

D. Submit with each Application for Progress Payment a Summary of Waste Generated by the project. The Summary shall be submitted on a form acceptable to the resident Engineer and shall contain the following information:

1. Disposal Information:
   a. Amount (in tons) of material disposed from the Project (separate by receiving facility).
   b. Identity of the receiving facilities.
   c. Total amount of tipping fees paid.
   d. Total disposal cost (including transportation and container rental).
e. Weight tickets, manifests, receipts, scale and truck tickets and invoices.

f. Certification from receiving facility that their permit conditions are met for materials being disposed.

2. Recycling Information:
   a. Amount (in tons).
   b. Receiving party.
   c. Transportation cost.
   d. Amount paid or received for the recycled material.
   e. Net total cost or savings of recycling each material.
   f. Manifests, weight tickets, receipts, scale and truck tickets and invoices.
   g. Measurement of progress in regard to goals established in the Waste Management plan.

3. Reuse and Salvage Information:
   a. List of items salvaged for reuse on project.
   b. Amount (in tons, yards, or other appropriate measure).
   c. Receiving party.
   d. Net savings (avoided tip fee or cost difference of item purchased new).
   e. Measurement of progress in regard to goals established in the Waste Management plan.

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CONTRACT SPECIFICATIONS

SECTION 01 75 50
SYSTEM START-UP AND TESTING

PART 1 - GENERAL

1.01 SUMMARY

A. Contractor shall be responsible for testing the equipment installed in the U250 Contract to demonstrate that the equipment will operate as planned and can be monitored or controlled remotely by Sound Transit’s Control System as shown on the Contract Drawings and specified herein.

B. In addition to requirements stated in Section 01 45 00, Quality Control, Contractor shall coordinate and perform testing of the mechanical and electrical equipment and devices it installs or procures. The testing shall be performed in conjunction with the multiple systems contractors to ensure the equipment and devices are properly connected to the power, communications, control equipment, and wiring to provide for remote monitoring and control of the equipment.

1.02 DEFINITIONS

A. Acceptance Test: Functional tests performed on completed components or assemblies submitted for Acceptance as described in General Conditions. Acceptance Tests of Work shall serve as the functional and performance Inspections, as defined in the General Conditions, of the completed components or assemblies submitted for Acceptance. Acceptance Tests shall not have a detrimental effect on the operational life of the article, but shall ensure that each production article is the equal of that which successfully passes the qualification tests.

B. Certified Test Report: A written and signed document approved by a qualified party that contains sufficient data and information to verify the actual properties of items and the actual results of required tests.

C. Factory Tests: Tests performed at the point of manufacture before shipping. These functions/tests shall verify that items to be shipped comply with the Test Plan and manufacturer’s test procedures approved by the Resident Engineer.

D. Installation Verification Tests: Tests that verify inspection of materials and equipment have been satisfactorily installed. Physical inspection, circuit continuity, insulation resistance, and power-on tests shall be included as required.

E. Systems Integrated Tests: Tests that are performed after completion of installation tests to demonstrate that Systems elements perform satisfactorily when connected to interfacing Systems elements or subsystems.

F. System-wide Integrated Tests: Tests that are performed to ensure that Link contract elements function properly together. These tests involve interfaces such as vehicle/station tunnel clearances, track, wayside equipment, automatic train control, passenger station electrical and mechanical systems, communications systems, and control systems. System-wide Integrated Testing must be complete before Pre-Revenue Testing can commence.
G. Pre-Revenue Tests: Tests that are conducted to simulate revenue service operations during normal and abnormal conditions, including emergencies, and to verify proper training of operations staff. These tests involve elements of the Link system and are conducted by the Link Startup and Testing team with support from Contractor, Construction Management, and Systems Integration Team.

H. Material Tests: Tests performed to verify the basic strength of materials and/or fabrication and construction techniques, and includes tests of static, non-operating facilities.

I. Quality Records: Permanent quality records, which have significant value such as:

1. Construction compliance to Contract Documents;
2. Demonstrating capability for proper function and safe operation of critical item;
3. Maintaining, reworking, repairing, replacing, or modifying the item;
4. Determining the malfunction of an item;
5. Providing required baseline data;
6. Documenting the results of inspection and tests; and
7. Audit and Surveillance Reports.

J. Test: The activity to determine the capability of an item to meet specified requirements by subjecting the item to physical or chemical analysis or environmental and/or operational conditions.

K. Testing: The determination or verification of the capability of an item to meet specified requirements by subjecting the item to a set of physical, chemical, environmental, or operating conditions.

L. Verification: The act of reviewing, testing, inspecting, checking, auditing, or otherwise determining and documenting to ensure that items, processes, services, and documents conform to these Specifications.

1.03 SUBMITTALS

A. Contractor Testing Plan – Draft: The CWP shall include the Contractor Testing Plan as required by Section 01 45 00, Quality Control. Within 360 Days after NTP, Contractor shall submit for approval a draft plan that includes:

1. A list of equipment and systems requiring testing.
2. CPM based schedule identifying tasks associated with testing.
3. Procedures outlining the steps necessary to complete each test including the type of work, type of craft people required, supervision required, and resulting Certified Test Report.
4. Sample templates of forms and Certified Test Reports for each type of test. Typical forms would include Interface Testing Diagrams and Data Interface Tables.
5. Safety and notification procedures to ensure the protection of persons in the vicinity of the testing. This shall include electrical power lockout procedures to energize and de-energize equipment as necessary during testing.

B. Contractor Testing Plan – Final: No later than 60 days prior to the first test, Contractor shall submit for approval the final version of the Contractor Test Plan. This final plan shall address comments from the Resident Engineer. Sample templates shall be replaced with detailed forms and procedures for required tests.

C. Final Test Report: Test procedures and Certified Test Reports for tests performed in the Contractor Testing Plan shall be compiled and submitted to the Resident Engineer no later than 30 days after completion of testing.

PART 2 - PRODUCTS (NOT USED)

PART 3 - PART 3 - EXECUTION

3.01 SYSTEM START-UP AND TESTING

A. Installation Verification Test: This testing program shall be designed and implemented by the U250 Contractor to ensure that mechanical and electrical equipment operates and can be controlled locally, as designed. For each piece of equipment or system, Installation Verification Testing must be complete before Systems Integrated Testing can commence.

1. Testing shall include electrical and mechanical equipment, devices, and fixtures as described in the Contract Documents according to the approved Test Plans and procedures.

2. Contractor’s testing and startup procedures shall include detailed descriptions of pre-operational electrical, mechanical, and instrumentation testing work.

3. Each control device, item of mechanical and electrical equipment and local control circuits shall be considered in the testing procedure, which shall be designed, in a stepwise, logical sequence to ensure that equipment has been properly serviced, aligned, connected, calibrated and adjusted prior to operation.

4. Contractor is advised that failure to observe these precautions may place acceptability of the subject equipment in question, and Contractor may either be required to demonstrate that the equipment has not been damaged, or replace it as determined by the Resident Engineer.

5. Testing procedures shall be designed to duplicate as nearly as possible conditions of operation, and shall be carefully selected to ensure that the equipment is not damaged.

6. Once the testing procedures have been accepted by the Resident Engineer, Contractor shall produce checkout, alignment, and calibration signoff forms for each item of equipment, which shall be used in the field by Contractor and the Resident Engineer jointly to ensure that each item of electrical and mechanical equipment has been properly installed and tested.

7. Before startup Contractor shall properly service equipment and other items that normally require service in accordance with the maintenance instructions.
Contractor shall be responsible for lubrication of equipment throughout the entire “break-in” period.

8. If an item of equipment or a system does not operate properly, Contractor shall immediately replace or repair components until it operates properly.

9. Contractor shall be responsible for a 30-day start-up period, during which time electrical and mechanical equipment, fixtures, and associated devices shall be energized and operated under local controls. Contractor shall be present during the start-up period with adequate labor and support personnel to adjust equipment and troubleshoot system failures that might arise. The 30-day start-up period will commence at the time of Contract completion and before final payment.

B. Systems Integrated Test: This testing program shall be designed and implemented by the U250 Contractor to ensure the correct exchange of signals between the Control System (supplied by the Communications Systems contract C830) and monitored/controlled equipment.

1. In cases where equipment is interfaced to the Control System through a Contract Interface Terminal Strip, Contractor shall proceed with testing as follows:

   a. Contract Interface Terminal Strip is defined as a contiguous arrangement of terminal blocks dedicated to providing a wiring connection point between two or more contracts. These terminal strips will be arranged vertically with the left side of the terminal block for field connections. The right side of the block will be used for connection to the system-wide Control System by the Communications Systems, contract C830.

   b. Contractor shall provide an Interface Testing Diagram of each Interface Terminal Strip showing the physical arrangement of terminal blocks in the strip fully documenting connections. The sample diagram below shows the required layout and descriptive fields required on diagrams.
TERMINAL STRIP: 1
LOCATION:

c. Required descriptive fields are defined as follows:

1) Reference Drawing references the Contract Drawing(s) showing the other end termination of the field side wiring. As shown on the diagram, groups of wires may be referenced together.

2) Discrete/Analog identifies the type of signal on a pair of wires as discrete or analog. The arrow points to the right if the signal is from the field to the Control System (such as an input to the Control System). The arrow points to the left if the signal is from the Control System to the field (such as an output from the Control System).

3) Cable/Wire ID identifies the cable and individual wire. Whatever identification label is attached on the actual cable and wire, it shall be identical to the cable/wire ID on the diagram. If the individual wires in a cable are not labeled, the wire shall be identified by the color of the insulation.

4) Terminal Block ID identifies the individual terminal block label. On the sample diagram the terminal blocks are numbered 1, 2, 3. The label inside the terminal block rectangle on the diagram shall be identical to the actual terminal block label.

5) Name shall be a short description of the signal such as “Start Fan” or “Damper Closed”.
6) **Equipment** shall be the official ID name of the field equipment being interfaced. The Resident Engineer will define equipment names according to the standard Sound Transit naming convention.

7) **Function** describes the behavior of the signal in relation to the behavior of the field equipment. The description shall be specific, clear, and sufficient for testing the correct operation of the signal. For example, an acceptable description in the Function field for the “Start Fan” signal would be “Fan starts upon momentary contact closure.”

8) **Tested** shall be used as a signature field for Contractor to certify that the signal has been tested successfully on the field side of the terminal strip.

9) **Terminal Strip** identifies the number or name of the actual terminal strip in the panel or cabinet where it is located.

10) **Location** identifies the official ID name of the cabinet or panel containing the terminal strip. The Resident Engineer will define equipment names for cabinets or panels according to the standard Sound Transit naming convention.

   d. Contractor shall submit for approval sample Interface Testing Diagrams in the Contractor Testing Plan - Draft.

   e. Contractor shall submit for approval a single diagram for each individual Contract Interface Terminal Strip approval in the Contractor Testing Plan - Final.

   f. Contractor shall use the diagrams as Certified Test Reports in the Systems Integrated Test to validate the functionality of signals to and from the field equipment. Each signal shall be initialed and dated by Contractor when the signal performs as stated in the Function field. After signals have been successfully tested, the completed diagram shall be submitted to Resident Engineer in the Final Test Report.

2. In cases where equipment communicates with the Control System through a serial or network interface to the (C830-supplied) Control System, Contractor shall proceed as follows:

   a. Supply a Data Interface Table spreadsheet. Equipment with this kind of interface includes HVAC control panels, fire alarm control panels and uninterruptible power supplies.

   b. Contractor shall provide a Data Interface Table for each individual piece of interfaced equipment with fields completed as described below. The sample below shows the required layout and data fields required on Data Interface Tables.
The required fields are defined as follows:

1) **Equipment ID** shall be the official ID name of the interfaced equipment (such as the equipment with the serial/network communication interface port.) Resident Engineer will define equipment names according to the standard Sound Transit naming convention.

2) **Location** identifies the station or building and the room number or name where the interfaced equipment is located.

3) **Communication** completely describes details of the communication interface including: cable connection point, baud rate, data bits, stop bits, parity, and protocol. For example, “TB2, 9600 baud, 8 data bits, 1 stop bits, parity - none, AFP200 protocol”. Simply specifying the communication as “RS-232” will be unacceptable.

4) **Point Name** shall be a short description of the signal such as “Smoke 01”. Each point name shall be unique.

5) **Field Device** shall be the equipment ID of the field device such as a smoke detector, pull box, or air compressor. This ID shall be identical to the label of the device as shown on the Contract Drawings and/or detailed design drawings produced by Contractor. Resident Engineer will define equipment names according to the standard Sound Transit naming convention.

6) **Function** describes the state of this signal in relation to the field device. The description shall be specific, clear, and sufficient for testing the correct operation of the signal. For example, an acceptable description in the Function field for the “Smoke Alm 01” signal would be “ON when smoke activates detector”.

7) **Tested** shall be used as a signature field for Contractor to certify that the signal has been tested successfully such that the signal updates correctly as described in the Function field.

8) **Type** identifies the type of signal (e.g., “bit” or “word”. The arrow points to the right if the data is sent from the Interfaced Equipment to the Control System (such as an input to the
Control System). The arrow points to the left if the signal is from the Control System to the field (such as an output from the Control System).

9) **Address** defines the location of the signal as it is read or written by the Control System using the communication protocol.

d. Contractor shall submit for approval a sample Data Interface Table in the Contractor Testing Plan - Draft

e. Contractor shall submit for approval a single Data Interface Table for each individual serial or network interface in the Contractor Testing Plan – Final.

f. Contractor shall use the approved Data Interface Tables as Certified Test Reports to test the functionality of signals to and from the interfaced equipment. Each signal shall be initialed and dated by Contractor when the signal performs as stated in the Function field. After signals have been successfully tested, the completed tables shall be submitted to the Resident Engineer in the Final Test Report.

3.02 COORDINATION WITH C830 COMMUNICATIONS CONTRACTOR

A. Contractor shall provide copies of Interface Testing Diagrams and Data Interface Tables to the C830 communications contractor as soon these are approved in the Contractor Testing Plan - Final. These are necessary for the C830 communications contractor to design the Control System.

B. Continuity Testing: The C830 communications contractor will verify the continuity of signals between the Control System and the monitored / controlled equipment. Contractor shall provide signed-off Interface Testing Diagrams and Data Interface Tables to the C830 Communications contractor. To expedite Continuity Testing, Contractor shall supply individual Interface Testing Diagrams and Data Interface Tables within two days after points have been successfully tested and signed-off.

C. Control System Testing: Following the Continuity Testing, the C830 Communications contractor will verify the functionality of Control System software. The Control System Testing period will last 30 days. This period begins when Systems Integration Testing has been completed.

D. During the Continuity Testing and Control System Testing periods, Contractor shall:

1. Jointly field test points in the Interface Terminal Strips with the C830 contractor and verify the operation and monitoring of equipment as shown on the Contract Drawings, wiring diagrams, or Data Interface Tables.

2. Contractor shall be present during this testing period with adequate labor and support personnel to adjust equipment and troubleshoot system failures that might arise. When a piece of mechanical or electrical equipment is found to be in conflict with specific criteria, an adjustment shall be made to the item by an experienced representative of the manufacturer. If adjustments fail to correct the operation of a piece of equipment or fixture, remove the equipment or fixture from the Contract site and replace it with a workable replacement that will meet the specification requirements.
3.03 SYSTEM-WIDE INTEGRATED TEST SUPPORT

A. The Link Systems Integration Team conducts these tests with the assistance from Contractor, Construction Management, Operations, and the final design consultant. Systems will be tested together during System-wide Integrated Testing to ensure proper functionality, inter-operability, and reliability of systems necessary for operation.

B. Coordination with Sound Transit’s Start-up Manager: The System-wide Integrated Testing period shall occur before Pre-revenue Testing. During the testing period, Contractor shall provide adequate supervisory mechanical and electrical support personnel to adjust equipment and troubleshoot system failures that might arise.

3.04 PRE-REVENUE TEST SUPPORT

A. The Link Systems Integration Team conducts these tests with the assistance from Contractor, Construction Management, Operations, and the final design consultant. Tests will be conducted for this Segment.

B. Coordination with Sound Transit’s Start-up Manager: The System-wide Integrated Testing period shall be completed before operation. During the testing period, Contractor shall provide adequate supervisory mechanical and electrical support personnel to adjust equipment and troubleshoot system failures that might arise.

3.05 OPERATOR TRAINING

A. Prior to startup of new equipment, Contractor shall demonstrate to Sound Transit personnel the proper manner of operating the equipment, making adjustments, responding to alarms and emergency signals, and maintaining the systems. Training shall be provided for equipment and systems. Operator schools shall be conducted in accordance with the requirements of Section 01 73 5X, Training of Operations and Maintenance Personnel. Work performed by the manufacturer’s representative required for testing will not be considered as operator training even if the operators are present and witnessing the adjustments. Equipment testing shall be completed before the on-the-job operator training begins.

END OF SECTION
SECTION 01 77 00
CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.01 DESCRIPTION

A. This Section specifies requirements for performing all operations necessary for and incidental to closing out a Contract and assisting in the final inspection.

B. Related Sections: The work of the following Sections is related to the work of this Section. Other Sections, not referenced below, may also be related to the proper performance of this work.

1. Section 01 12 19, Contract Interface.
2. Section 01 74 00, Cleaning and Waste Management.
3. Section 01 78 39, Project Record Documents.

1.02 QUALITY CONTROL

A. Facilities: Maintain facilities until Acceptance of the Work. The following apply to interim facilities:

1. Inspect street and access roadway lighting and traffic signals: repair defects, and demonstrate operation to Sound Transit.
2. Inspect traffic signs and traffic control devices. Align and repair defects.
3. Clean and inspect paving, curbs and gutters, repair potholes and restore striping as required.
4. Inspect catch basins, lift station and valve chambers and demonstrate operation to Sound Transit.
5. Inspect all landscaping and make repairs or modification as required.

1.03 CLOSEOUT SCHEDULE AND PROCEDURE

A. Requirements Preparatory to Final Inspection:

1. Notify the Resident Engineer that the Work is ready for a preliminary final inspection for determining the state of completion. The Resident Engineer will advise when the inspection will be conducted. From the information gathered from this inspection, the Resident Engineer will prepare a Punch List of work to be performed, corrected or completed before the Work will be accepted. Complete all work on the Punch List prior to final inspection.
2. In accordance with the Shoreline Permit, provide a Site Restoration Plan per standards set forth in SMC 23.42.040.F.4 to DPD for review and approval within
180 days of cessation of use of the site for construction activities. Plan to include: removal of all structures, equipment, refuse, fencing, and lighting.

3. Remove or prepare temporary facilities per Section 01 12 19, Contract Interface.

4. Clean the site and all applicable appurtenances and improvements as specified in Section 01 74 00, Cleaning and Waste Management.

5. Properly mount operating instructions for equipment and post as specified or required.

6. Complete record drawings, specifications, and as-built surveys, and submit to the Resident Engineer as specified in Section 01 78 39, Project Record Documents. Also include the required closeout documents in the O&M Manuals described in Section 01 78 23, Operation and Maintenance Data.

7. Prepare and submit a report which provides detail on all waste and spoil generated in the course of the Project and which documents the ultimate destination of those wastes and spoils.

B. Final Inspection:

1. After all requirements preparatory to the final inspection have been completed, request that the Resident Engineer perform the final inspection.
   a. Give notice at least 7 Days in advance of the time the Work will be available for final inspection.
   b. The Resident Engineer will advise when the inspection will be conducted.
   c. If the work is acceptable at the final inspection, the requested date will be the Acceptance date.

2. Contractor’s Project Manager shall accompany the Resident Engineer on the final inspection tour, as well as all principal Subcontractors that the Resident Engineer may request to be present.

3. If the work has been completed in accordance with the Contract Documents, and no further corrective measures are required, the Resident Engineer will issue a Notice of Acceptance.

4. If the work has been substantially completed in accordance with the Contract Documents, and the work can be used for its intended purpose with only minor corrective measures required, the Resident Engineer will issue a Notice of Substantial Completion along with a Punch List of Corrective Actions or other work to be completed. These items will be completed after Final Inspection contingent upon the Contractor's assurance that corrective measures will be completed within the shortest practicable time period. Submit a fixed schedule for corrective measures to the Resident Engineer for approval.

5. If the work has not been substantially completed in accordance with the Contract Documents, and corrective measures are still required, the Resident Engineer will not issue a Notice of Substantial Completion. Instead, a Punch List will be prepared based on the information gathered from the inspection, and the Contractor shall be required to complete this work and then call for another final inspection, following the procedure outlined above.
6. Should the Resident Engineer perform re-inspections due to failure of the work to comply with the claims of status of completion made by the Contractor:
   a. Contractor shall compensate Sound Transit for such additional services at the rate of $150.00 (one-hundred and fifty dollars) per labor-hour.
   b. Sound Transit will deduct the amount of such compensation from the final payment to the Contractor.

7. Final Acceptance of the work by Sound Transit will be issued in accordance with the General Conditions.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION
PART 1 - GENERAL

1.01 DESCRIPTION

A. This Section specifies requirements for providing the following:

1. Posted operating and maintenance instructions of all installed equipment and systems.

2. Preparation and submission of an Operation and Maintenance (O&M) Manual of all installed equipment and systems.

3. Instruction of operation and maintenance personnel in the operation and maintenance of all installed equipment and systems.

1.02 SUBMITTALS

A. Procedures: Section 01 33 00, Submittal Procedures.

B. Posted Operating and Maintenance Instructions.

C. Operation and Maintenance (O&M) Manuals.

1.03 POSTED OPERATING AND MAINTENANCE INSTRUCTIONS

A. Provide and install, where directed, a printed sheet under framed clear acrylic plastic, giving brief, concise operating and maintenance instructions for items of mechanical and electrical equipment, as necessary.

1.04 OPERATION AND MAINTENANCE MANUALS

A. Before the work will be considered for Substantial Completion, prepare one complete bound set and one electronic version of an operation and maintenance manuals to be posted on The selected software of instructions of each equipment plant and its component parts, including:

1. Manufacturers’ certificates,

2. Warranty slips,

3. Parts lists,

4. Descriptive brochures,

5. Maintenance and operating instructions for all equipment and systems installed.

B. If subsequent modifications to the equipment require revised operation and maintenance procedures:

1. Revise the O&M Manual to show the equipment as installed.

3. Submit the revisions to the O&M Manual not later than 30 days following revision of the equipment.

C. Format:

1. Include a title page, contents page, frontispiece, and information covering description, installation, operation, preventive maintenance, corrective maintenance, overhaul, parts list, and list of recommended spare parts, and an appendix.

2. Include on the title page, the name and function of the equipment, manufacturer's identification number, and the Contract Specifications number and title.

3. List the contents of all sections and subsection titles of the Manual with reference to the page on which each starts and a list of included drawings.

4. Frontispiece shall be a recognizable illustration of the equipment described in the Manual.

5. Pages: 8-1/2 inches by 11 inches in size or folded to that size, and placed in a three-ring binder not filled more than 2/3 of its capacity.

D. Contents:

1. Descriptive information including drawings and diagrams, and a physical and functional description of the equipment, and major assemblies and subassemblies.

2. Cover the installation information and pre-installation inspection, installation, calibration, and preparation for operation, both for initial installation and for installation after overhaul.

3. Include the operation information, step-by-step procedures for starting, restarting, operating, shutdown, and emergency requirements. Include the information on performance specifications and operating limitations.

4. Include the maintenance information step-by-step procedures for inspection, operation checks, cleaning, lubrication, adjustments, repair, overhaul, disassembly, and reassembly of the equipment for proper operation of the equipment. Include a list of special tools that are required for maintenance with the maintenance information.

5. Provide the complete parts list and a list of recommended spare parts with all necessary information, including part numbers and catalog item numbers if applicable, for identifying parts. Identify parts or assemblies obtained from another manufacturer by the name of that manufacturer and its identifying part number. Supply the size, capacity, or other characteristics of the part if required for identification.

6. Include in the appendix safety precautions, a glossary, and, if available at time of submittal, copies of test reports and other relevant material not specified to be submitted.

7. Delete all information on material or equipment not used in the work from the O&M Manual.
PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 SPECIAL SUBMITTED PROCEDURES:
   A. Work with Sound Transit to review O&M manuals together in meeting environment.
   B. Revise manuals in accordance with directions and comments from both meeting inputs and formal mark-ups (by reviewers).
   C. Resubmit as required in accordance with Section 01 33 00, Submittal Procedures.

3.02 SOUND TRANSIT RESPONSIBILITY
   A. Upon receipt of Contractor’s Notice of Substantial Completion, Sound Transit will designate operating and maintenance personnel who will be responsible for operation, adjustment, and maintenance of all equipment and systems.
   B. Sound Transit and O&M personnel will set a meeting, to introduce and to review their complete understanding, all procedures necessary to operate and maintain all equipment and systems on a continuing basis.
   C. Sound Transit and O&M personnel will review the contents of the O&M manuals with Contractor’s personnel in full detail as it relates to the operation and maintenance of all equipment and systems.

END OF SECTION
PART 1 - GENERAL

1.01 DESCRIPTION

A. This Section specifies requirements for Project Record Documents including as-built drawings.

B. Related Sections: The work of the following Sections is related to the work of this Section. Other Sections, not referenced below, may also be related to the proper performance of this work.

  1. Section 01 31 23.10, Internet-Based Document Management System

1.02 MAINTENANCE OF PROJECT RECORD DOCUMENTS

A. Maintain at the jobsite one copy of the following Contract Documents for record purposes:

  1. As-built drawings (Full Size) based upon conformed Contract Drawings and subsequent Change Orders.
  2. Shop Drawings: Submitted in accordance with Section 01 33 00, Submittal Procedures.
  3. Record Contract Specifications.
  4. Inspection Reports.
  5. Laboratory Test Records.
  6. Field Test Records.
  7. Surveys. Including as-built surveys.

B. Store documents used for record purposes in the field job office or other location approved by Sound Transit.

C. Provide files and racks for storage of documents.

D. Maintain documents in clean, dry, legible condition.

E. Do not use record documents for construction purposes.

F. Make documents available for periodic review by the Resident Engineer.

G. Make Documents available for incremental review.

H. Store documents electronically on the selected software, in accordance with Section 01 31 23.10, Internet-Based Document Management System.
I. Retain Project Record Documents in accordance with the General Conditions.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 PROJECT RECORD DOCUMENTS

A. Contract Drawings:
   1. The Resident Engineer will furnish Contract Drawings for the purpose of as-built or record drawings. Immediately upon receipt, stamp drawings “As-Built.”
   2. Maintain as-built drawings of all Work continuously as the job progresses. Keep a complete set of prints, for this purpose only, at the jobsite at all times.
   3. During the course of construction, update the as-built set and make it available to the Resident Engineer for monthly review.
   4. As identified by the Resident Engineer, make selected drawings available incrementally for reproduction. Incremental updates shall not exceed more than three requests for the duration of the Contract.
   5. Incorporate all as-built conditions into the as-built drawing set in red ink or red pencil.
   6. During the course of construction, identify actual locations to scale in red ink or red pencil on the as-built drawings. Show deviations from Contract Drawings in detail. Where the Contract Drawings are not of sufficient size, scale, or detail, furnish the Contractor’s own shop drawings for incorporation of details and dimensions. Provide annotations on the as-built drawing set referencing applicable shop drawings. Note responses to RFIs or other similar documents on the as-built set.
   7. Do not permanently conceal any work until the required as-built information has been documented by the Contractor.

B. Change Orders:
   1. Incorporate Change Orders to Contract Drawings into the as-built drawings. Annotate the as-built changes into the revised Contract Drawing.
   2. Do not incorporate drawings deleted in their entirety by Change Orders as part of the record set. Mark these drawings “Deleted” or “Superseded,” and keep with as-built drawings to reflect status.

C. Shop Drawings:
   1. Submit one complete set of approved shop drawings, including manufacturers’ printed catalog cuts and data, and maintain for record purposes.
   2. File shop drawings in nine inch by 12-inch file folders to the greatest extent possible and index in accordance with the Contract Specifications.
3.02 RECORD CONTRACT SPECIFICATIONS

A. Contract Specifications:
   1. File the Contract Specifications for record purposes in a large, three-ring binder or binders.
   2. Record Specification information, changes, and notes in red ink or red pencil in blank areas, such as page margins or the backs of opposite pages, or on separate sheets inserted in the binder.
   3. Ensure the Record Specifications are complete and include all applicable Contract Documents other than Contract Drawings.

B. Change Orders:
   1. Incorporate Change Orders into the front of the record Contract Specifications in reverse numerical order. Use appropriate page dividers to identify Change Orders and to separate Change Orders from the Contract Specifications.
   2. In addition, if changes are made to the Contract Specifications by Change Order, make appropriate annotations on the affected page or pages of the Contract Specifications or adjacent thereto.

C. Incorporate RFIs into as-built drawings.

3.03 INCREMENTAL SUBMISSION OF DOCUMENTS

A. Upon request from the Resident Engineer, make available selected as-built drawings for reproduction. Accomplish reproduction by maintaining the original blackline copy with all red annotations (ink or pencil) reproduced in red on the reproduction print.

B. Incremental as-built drawings requested by the Resident Engineer shall be stamped “As-Built”, signed, and dated by Contractor.

C. Include a transmittal letter containing the following information:
   1. Date of submission.
   2. Project title and number.
   3. List of items covered in the incremental as-built submission.
   4. Contractor’s name and address.
   5. Certification that each document as submitted is complete and accurate.
   6. Signature of Contractor or its authorized representative.

3.04 SUBMISSION OF FINAL DOCUMENTS

A. At completion of the Work, and before requesting Final Acceptance of the Work, deliver record documents to the Resident Engineer.

B. For as-built drawings, submit the blackline print (full size) with revisions incorporated on the prints in red ink or red pencil.

C. Stamp final as-built drawings “As-Built,” sign, and date.
D. Ensure record documents are delivered neatly and efficiently filed and packaged in appropriate file storage cabinets or boxes, 12 inches by 15 inches in size. Roll as-built drawings and wrap with the transmittal letter affixed identifying contents.

E. Ensure boxes have covers and cutout handles, and the contents are accurately identified.

F. Submit record documents with a transmittal letter containing the following information:
   1. Date of submission.
   2. Project title and number.
   3. Contractor’s name and address.
   4. Title and number of each record document. (Shop drawings may be grouped in basic categories or divisions of work and by box identification.)
   5. Certification that each document as submitted is complete and accurate.
   6. Signature of Contractor or its authorized representative.

   END OF SECTION
SECTION 02 41 00

DEMOLITION

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes specifications for demolition, removal, and disposal or salvage of pavements, base course, curbs, sidewalks, utilities, walls, and site furniture and related ancillary components.

B. Related Sections: The work of the following Sections is related to the work of this Section. Other Sections, not referenced below, may also be related to the proper performance of this work.

1. Section 01 35 29, Health, Safety, and Emergency Response Procedures.
2. Section 01 35 93, Archaeological Finds.
3. Section 01 45 00, Quality Control
4. Section 01 50 00, Temporary Facilities and Controls.
5. Section 01 55 00, Vehicular Access and Parking.
6. Section 01 56 39, Temporary Tree and Plant Protection.
7. Section 01 57 13, Temporary Erosion and Sediment Control.
8. Section 01 57 19, Temporary Environmental Controls.
9. Section 01 57 24, Temporary Site Water Discharge.
10. Section 01 71 23, Field Engineering.
11. Section 01 74 00, Cleaning and Waste Management.
12. Section 31 09 00, Geotechnical Instrumentation and Monitoring of Earthwork
13. Section 31 11 00, Clearing and Grubbing
14. Section 31 20 00, Earth Moving
15. Section 31 23 33, Trenching and Backfilling
16. Section 33 01 00, Operation and Maintenance of Utilities

1.02 REFERENCES

A. This Section incorporates by reference the latest revisions of the following documents:

1. American National Standards Institute (ANSI):
   a. ANSI A10.6 Safety Requirements for Demolition Operations
2. City of Seattle (COS)
   a. Standard Plans for Municipal Construction
   b. Standard Specifications for Road, Bridge and Municipal Construction
3. Seattle Department of Transportation (SDOT):
   a. SDOT Director’s Rule 2004-02: Street and Sidewalk Pavement Opening and Restoration.

1.03 DEFINITIONS
A. Structure: Walls, slabs, beams, foundations, footings, piles, and foundation systems.
B. Asphalt Concrete Pavements: Streets, driveways, alleyways, or other surfaces constructed from bituminous mix, or combination of bituminous mixes or surfaces treatments.
C. Portland Cement Concrete Pavements: Streets, driveways, alleyways, or other slabs greater than four inches in thickness, constructed from portland cement concrete with or without asphaltic overlay.
D. Portland Cement Concrete Sidewalks: Portland cement concrete slabs that average 4 inches or less in thickness.

1.04 SUBMITTALS
A. Procedures: Section 01 33 00, Submittal Procedures.
B. Demolition Construction Work Plan: See Article 1.06 herein for details.
C. Permits: Submit copies of Hauling, and Debris Disposal permits.
D. Private Property Owner’s Release: If material demolished and removed from the site will be deposited on private property, submit two copies of written releases not less than 15 Days before the start of work. Ensure releases absolve Sound Transit from responsibility concerning the depositing of material on private property, and are signed by the owners of property on which the material will be deposited.
E. As-built drawing(s) of locations and depths of abandoned utilities and locations for utility caps.
F. Letter verifying re-establishment of survey markers and monuments.

1.05 SITE CONDITIONS
A. Existing Utilities:
   1. The Contract Drawings may not represent all surface and subsurface conditions at the site and adjoining areas. Verify on site the location and depth (elevation) of all existing utilities and services before commencing work. Refer to Section 33 01 00, Operation and Maintenance of Utilities, for additional requirements.

1.06 DEMOLITION CONSTRUCTION WORK PLAN
A. Prepare a Demolition Construction Work Plan in accordance with Section 01 45 00, Quality Control.

C. Attend a Readiness Review Meeting with representatives from Sound Transit and the University of Washington to determine roles, responsibilities, timing, permits, salvage items and other items pertaining to the Demolition Construction Work Plan.

D. Include the following items in the Demolition Construction Work Plan:

1. Demolition schedule including timing for utility disconnects and durations of parking lot or roadway impacts.
2. Description of the proposed sequence.
3. Description of demolition methods.
4. Description of equipment to be used in the demolition process.
5. Salvageable items.
6. Description of proposed disposal of materials including provisions for maximizing recycling and reuse of materials.
7. Description of haul routes: As specified in Section 01 55 00, Vehicular Access and Parking.
8. Description of clean up methods.

PART 2 - PRODUCTS

2.01 MATERIALS AND EQUIPMENT

A. Furnish all materials, tools, equipment, devices, appurtenances, facilities, and services as required for performing the demolition and removal work.

B. Backfill: Section 31 20 00, Earth Moving.

C. Products for patching, extending and matching: of the same type used in existing facility. Determine the type of products by inspection and, if necessary, by testing. Perform restoration in accordance with the Contract Documents.

PART 3 - EXECUTION

3.01 PROTECTION

A. Protection of Survey Markers: Section 01 71 23, Field Engineering.

B. Protection of Persons and Property:

1. Install temporary chain link fencing around the area of work as specified in Section 01 50 00, Temporary Facilities and Controls, to provide barriers and temporary shielding.

2. Erect and maintain temporary bracing, shoring, lights, barricades, signs, and other measures as necessary to protect the public, workers, and adjoining
property from damage from demolition work, all in accordance with applicable
codes and regulations.

3. Barricade and post with warning lights open depressions and excavations
occurring as part of this work when accessible through adjacent property or
through public access. Operate warning lights during the hours from dusk to
dawn each calendar day and as otherwise required.

4. Protect utilities, pavements, and facilities from damage caused by settlement,
lateral movement, undermining, washout, and other hazards created by the
demolition operations.

5. Protect trees and shrubs as specified in Section 01 56 39, Temporary Tree and
Plant Protection

C. Protection of Utilities:

1. Comply with Section 33 01 00, Operation and Maintenance of Utilities.

2. Protect active sewer, drainage, water, irrigation, gas, electric, and other utilities;
indicated or when not indicated, found or otherwise made known to the
Contractor before or during demolition work. If utility is damaged, immediately
notify the Resident Engineer and the utility owner for corrective action.

3.02 PREPARATION

A. Prior to the demolition of a building, make arrangements for the disconnection and
termination of all water, sewer, gas, electric, telephone, cable television, and other
facilities that are connected to the building.

3.03 DEMOLITION

A. Perform demolition in accordance with the following related Contract Specification
Sections:

1. Dust control: as specified in Section 01 57 19, Temporary Environmental
Controls.

2. Erosion control: Section 01 57 13, Temporary Erosion and Sediment Control.


4. Monitoring Well removal: Section 31 09 00, Geotechnical Instrumentation and
Monitoring of Earthwork.

5. Pollution Control: Section 01 35 29, Health, Safety, and Emergency Response
Procedures.

6. Backfilling of depressions cause by excavations, demolition, and removal:
Section 31 20 00, Earth Moving.

7. Archaeological finds: Section 01 35 93, Archaeological finds.

B. Perform demolition in accordance with the accepted Demolition Construction Work Plan,
permit requirements, ANSI A10.6, and the following:

1. Remove poles, signs and fences indicated.
a. Remove overhead wires and lights before removal of poles.

b. Remove poles, signs, and fences completely including foundations and footings.

c. Restore damaged pavement after demolition unless it is also indicated for removal.

d. Removed fencing materials may be reused for construction fencing, subject to approval by the Resident Engineer.

2. Structures

a. Prior to relocation of the gatehouses, make arrangements with the University of Washington through the Resident Engineer for the disconnection and termination of power and communications lines and other facilities that are connected to the building.

3. Pavements

a. Sawcut existing pavements prior to removal as indicated on the Contract Drawings or as referenced in a COS Standard Plan. Protect adjacent improvements indicated to remain from damage. Sawcutting is not required where removal limits extend to existing joints or cracks. Do not sawcut precast concrete unit pavers for removal.

1) Sawcutting and Line Drilling: COS Standard Specification Section 2-02.3(6).

b. Remove existing street pavement within the City of Seattle streets in accordance with COS Standard Specification Section 2-02.3(3).

c. Pavement removal and restoration limits for utility cuts and other pavement openings in City of Seattle’s right-of-way shall comply with SDOT Director’s Rule 2004-02: Street and Sidewalk Pavement Opening and Restoration found at:
http://www.seattle.gov/transportation/stuse_pavementopen.htm

d. When removing an asphalt overlay from a rigid base pavement, use methods and equipment that does not structurally damage the existing rigid base. Sawcut asphalt overlay edges unless the asphalt overlay is removed by planing or removal limits extend to joints or cracks.

e. Break up and completely remove asphalt and concrete pavement and bases, curbs, walks, steps, retaining walls, slabs, and aprons.

f. Remove precast concrete unit pavers with care and salvage for reinstallation or to the Resident Engineer as indicated.

g. Use extra care when removing pavements within critical root zones (CRZ) of trees to remain to avoid root damage. Perform pavement removal in CRZ under the supervision of the Resident Engineer and Project Arborist. See Specification Section 01 56 39, Tree and Plant Protection for additional requirements on the use of heavy equipment within the CRZ.

4. Utilities
a. Abandon Pipe – Cut, cap or plug utilities as indicated. Plug pipe ends completely with Cement Concrete, Class 5 (3/4) (COS Standard Specifications Section 5-05.3(2)) for a minimum length of 12 inches with no voids.

b. Where abandoned utilities are designated to be “abandoned and filled,” completely fill with pumpable, flowable cement slurry in accordance with COS Standard Specification Section 9-05.15.

c. Where utilities are indicated to be removed, cut and cap all portions of the utility indicated to remain. Completely remove and dispose of utilities indicated for removal. If remaining portion is indicated for abandonment plug pipe ends as described above for “Abandon Pipe.”

C. Salvaging: Remove, relocate, and deliver salvageable items to the location indicated by the Resident Engineer.

1. Salvage copper cable from University owned ductbanks to the Resident Engineer for delivery to the University of Washington.

2. Salvage intact, good quality precast concrete unit pavers that are not reinstalled to the Resident Engineer for delivery to the University of Washington.

3. Salvage the existing gatehouse adjacent to the west entrance to Husky Stadium to the Resident Engineer for delivery to the University of Washington.

3.04 DISPOSAL OF DEBRIS

A. There is a minimum goal of diverting 75 percent of the material generated from the Work in this section, by weight, from landfill disposal. Materials diverted from a landfill means that they are salvaged, reused, recycled and not sent to a transfer station or landfill. Develop a Waste Management Plan in accordance with Section 01 74 00, Cleaning and Waste Management, to describe methods used to meet the landfill diversion goal.

B. Contain on site all drainage through concrete rubble and crushed concrete and treat for high ph before entering the drainage system as specified in Section 01 57 24, Temporary Site Water Discharge.

C. Dispose of removed materials, waste, trash, and debris safely in accordance with applicable laws and ordinances and as prescribed by Washington State Department of Ecology.

1. Dangerous waste manifests must be signed by a representative of the University of Washington’s Environmental Programs Office (EPO). Provide no less than 48 hours advance notice to the EPO (206-616-0595) and the Resident Engineer in order to have an EPO representative present to sign manifests.

D. Do not bury trash or debris on the site.

E. Remove trash and debris from the site at frequent intervals.

F. Removed materials, trash, and debris shall become the property of the Contractor and shall be removed from the work site and disposed of in a legal manner. Dispose of waste and excess materials at a legally licensed landfill or disposal facility outside the jobsite. Determine location of disposal site and length of haul.

G. Perform waste management in accordance with Section 01 74 00, Cleaning and Waste Management.
3.05 RE-INSTALLATION OF REFERENCE MARKERS

A. Record the locations and designation of survey markers and monuments prior to their removal. Provide three reference points for each survey marker and monument removed, established by a land surveyor licensed in the State of Washington.

B. Store removed markers and monuments during demolition work, and replace them upon completion of the work. Re-establish survey markers and monuments in conformance with the recorded reference points.

C. Prepare a letter verifying re-establishment of survey markers and monuments, signed by a land surveyor licensed in the State of Washington.

3.06 RESTORATION AND CLEANUP

A. Restore site as indicated on the Contract Drawings and Contract Specifications.

B. Backfill depressions caused by excavations, demolition, and removal activities with materials placed and compacted in accordance with Section 31 20 00, Earth Moving.

C. Backfill and level to grades as specified in the grading plans.

D. Grade ground surface to eliminate water pockets.

E. Maintain a clean and orderly site. Perform cleaning as specified in Section 01 74 00, Cleaning and Waste Management.

END OF SECTION
PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes specifications for materials used in and for proportioning, measuring, batching, mixing and delivering portland cement concrete.

B. Related Sections: The work of the following Sections is related to the work of this Section. Other Sections, not referenced below, may also be related to the proper performance of this work.

1. Section 03 30 00, Cast-In-Place Concrete.

1.02 REFERENCES

A. This Section incorporates by reference the latest revisions of the following documents.

1. American Concrete Institute (ACI)
   a. ACI 116R Cement and Concrete Terminology
   b. ACI 121R Quality Management System for Concrete Construction
   c. ACI 211.1 Standard Practice for Selecting Proportions for Normal, Heavyweight and Mass Concrete
   d. ACI 301 Standard Specifications for Structural Concrete
   e. ACI 304R Guide for Measuring, Mixing, Transporting and Placing Concrete
   f. ACI 304.2R Placing Concrete by Pumping Methods
   g. ACI 305R Hot Weather Concreting
   h. ACI 306.1 Standard Specification for Cold Weather Concreting

   a. ASTM C33 Standard Specification for Concrete Aggregates
   b. ASTM C40 Standard Test Method for Organic Impurities in Fine Aggregates for Concrete
   c. ASTM C88 Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
   d. ASTM C94 Standard Specification for Ready-Mixed Concrete
   e. ASTM C127 Standard Test Method for Density, Relative Density (Specific Gravity) and Absorption of Coarse Aggregate
f. ASTM C128 Standard Test Method for Density, Relative Density (Specific Gravity) and Absorption of Fine Aggregate

g. ASTM C131 Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine

h. ASTM C136 Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates

i. ASTM C150 Standard Specification for Portland Cement


k. ASTM C260 Standard Specification for Air-Entraining Admixtures for Concrete

l. ASTM C289 Standard Test Method for Potential Alkali-Silica Reactivity of Aggregates (Chemical Method)

m. ASTM C494 Standard Specification for Chemical Admixtures for Concrete


o. ASTM C618 Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete

p. ASTM C989 Standard Specification for Ground Granulated Blast-Furnace Slag for Use in Concrete and Mortars

q. ASTM C1017 Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete

r. ASTM E329 Standard Specification for Agencies Engaged in Construction Inspection and/or Testing

3. City of Seattle (COS)
   a. Standard Specifications for Road, Bridge and Municipal Construction

4. Washington State Department of Transportation (WSDOT)
   a. Standard Specifications for Road, Bridge and Municipal Construction

1.03 DEFINITIONS

A. Concrete Class: Concrete Classes are defined in Table 03 05 15-A. Each class has one or more uses. Each Concrete Class is a concrete mix, and requires a separate concrete mix design.

B. Controlled Density Fill (CDF): Conform to Section 9-01.5 of the City of Seattle Standard Specification.
C. Supplementary Cementitious Materials: Cementitious materials other than portland cement.

D. Except for the above definitions, the words and terms used in this Section conform to ACI 116R.

1.04 SUBMITTALS

A. Procedures: Section 01 33 00, Submittal Procedures

B. Concrete Mix Designs: For each Concrete Class submit a concrete mix design including:

1. Supplier, mix design number and supply plant location.

2. Mix use and location in the structure.

3. Mix constituents, including:
   a. Cement: Type, class, manufacturer and plant location
   b. Supplementary Cementitious Materials: Type, class, manufacturer and plant location
   c. Coarse Aggregates: Type, pit or quarry location, manufacturer, grading and specific gravity
   d. Fine Aggregates: Type, pit or quarry location, manufacturer, grading and specific gravity
   e. Admixtures: Type, brand name and manufacturer
   f. Water: Source of supply

4. Mix constituent proportions per cubic yard including weight or dose and absolute volume.

5. Mix constituent ratios including water/total cementitious material ratio and supplemental cementitious material/total cementitious material ratio

6. Mix characteristics, including 28-day compressive strength, density, percent entrained air and slump.

7. Documentation of Required Average Compressive Strength
   a. Determine the required average compressive strength in conformance with ACI 301.
   b. If field test data are used, data must be supported by an Independent Testing Laboratory compressive strength test reports. Furnish these reports at the Resident Engineer’s request

8. Documentation of Average Compressive Strength
   a. Determine the average compressive strength in conformance with ACI 301.
   b. If field test data are used, all data must be supported by an Independent Testing Laboratory compressive strength test reports. Furnish these reports at the Resident Engineer’s request
c. If trial batch data are used, furnish compressive strength test reports and curve showing the relationship between water/total cementitious materials ratio and compressive strength.

C. Material Data

1. Material Samples for Testing

a. Submit samples of cementitious materials, coarse aggregate and fine aggregate in the amounts directed by the Resident Engineer to the Independent Testing Laboratory for testing and analysis.

b. Submit samples to the Independent Testing Laboratory at least 30 days prior to use on the project.

c. Submit the sample test reports to the Resident Engineer at least 21 days prior to use on the project.

2. Certification of Conformance: In lieu of material samples for testing, submit manufacturer’s certification that the materials conform to the requirements of this Section.

D. Admixtures: For each admixture, submit the following:

1. Manufacturer’s Product Data.

2. Manufacturer’s written instructions for storage, handling and use.

3. Manufacturer’s certification that admixture is compatible with all other admixtures specified in the mix design.

E. Qualifications: Submit qualifications for the following:

1. Concrete supplier

2. Independent Testing Laboratory

F. Quality Program Plan: Section 01 45 00, Quality Control

1.05 QUALITY ASSURANCE

A. Concrete Supplier: Select a concrete supplier holding a current Certificate of Conformance for Concrete Production Facilities from the National Ready Mix Concrete Association.

B. Independent Inspection and Testing Laboratory: Select an Independent Testing Laboratory in conformance with ASTM E329 and in conformance with Section 01 45 00, Quality Control.

C. Quality Program Plan: Develop a Quality Program Plan as defined in Section 01 45 00, Quality Control, in conformance with the recommendations of ACI 121R.

1.06 STORAGE AND HANDLING

A. Cementitious Materials: Store in dry, weather tight buildings, bins, or silos that exclude contaminants.
B. Coarse and Fine Aggregates: Store and handle to avoid segregation and prevent contamination with other materials or other sizes or types of aggregate. Store to drain freely. Do not use aggregates containing frozen lumps.

C. Admixtures: Store and handle admixtures in conformance with manufacturer’s written directions.

D. Water: Protect mixing water from contamination.

PART 2 - PRODUCTS

2.01 MATERIALS

A. General: For each material:
   1. Use only one source in each mix design.
   2. If source changes, submit a new mix design using the cementitious material from the new source.
   3. Do not change source for an approved mix design.

B. Cementitious Materials
   2. Supplementary Cementitious Materials

C. Coarse Aggregate
   1. Hard, strong, durable gravel or crushed stone conforming to ASTM C33.
   2. Unless otherwise specified, conform to City of Seattle Standard Specification Section 9-03.1(3) D, Grading No. 6.
   3. Meet the following requirements when tested in conformance with the specified test methods:
      a. Resistance to Abrasion (ASTM C131): For the loss for aggregate size range 3/4-inch to 3/16-inch after 100 revolutions and 500 revolutions do not exceed 10 percent and 35 percent, respectively. Include within the test sample seven parts of Grading B and three parts of Grading C.
      b. Resistance to Abrasion (ASTM C535): For the loss for aggregate size range 1-1/2 inches to 3/4 inch (Grading 3) after 200 revolutions and 1,000 revolutions do not exceed 10 percent and 35 percent, respectively.
      c. Soundness (ASTM C88): Weighted average loss after 5 cycles not to exceed 10 percent when tested with sodium sulfate.
      d. Bulk Specific Gravity (ASTM C127): On the basis of saturated surface-dry aggregate not less than 2.60.
      e. Absorption (ASTM C127): Not to exceed 3 percent.


D. Fine Aggregate

1. Hard, strong, durable stone or rock fragments conforming to ASTM C33, except as modified herein.

2. Unless otherwise specified, conform to City of Seattle Standard Specification Section 9-03.1(2) C, Grading Class 2.

3. Meet the following requirements when tested in conformance with the specified test methods:

   a. Soundness (ASTM C88): Weighted average loss after 5 cycles not to exceed 10 percent when tested with sodium sulfate.

   b. Bulk Specific Gravity (ASTM C128): On the basis of saturated surface-dry aggregate not less than 2.60.

   c. Organic Impurities (ASTM C40): Supernatant liquid lighter in color than the reference standard color solution

   d. Fineness Modulus (ASTM C33): In the range of 2.80 to 3.50; for the fine aggregate not to vary more than plus or minus 0.20 from the fineness modulus of the fine aggregates used in the concrete mix design.

   e. Absorption (ASTM C128): Not to exceed three percent.


E. Admixtures

1. Admixtures may be included in the concrete mix designs to improve the workability of the concrete, provided the specified strengths and other characteristics of the concrete are achieved and maintained.


2. Do not use admixtures containing chlorides, sulfides, or nitrides.

F. Water: Clean and potable, free of impurities detrimental to concrete.

2.02 MIX DESIGNS

A. Obtain concrete mix designs from a qualified Independent Inspection Laboratory or concrete supplier properly equipped to design concrete mixes.
B. Select mix proportions in conformance with ACI 211.1.

C. Design concrete mixes intended for pumping in conformance with the recommendations of ACI 304R and ACI 304.2R.

D. If trial batch data are used, sample and test concrete in conformance with Section 03 30 00 Cast-In-Place Concrete

E. Provide concrete mixes with at least the minimum weight of cementitious materials per cubic yard specified in Table 03 05 15-A, regardless of the fact that the strengths specified may be obtained with lesser amounts of cement. Exception will be made only for mass concrete as part of the means to control heat of hydration, as specified in Section 03 30 00, Cast-In-Place Concrete, as long as minimum specified strengths are obtained.

2.03 SOURCE QUALITY CONTROL

A. Sample Tests and Analyses: Test cement, coarse aggregate and fine aggregate to demonstrate conformance with the following requirements:

1. Portland cement: ASTM C150

2. Aggregates:
   a. Grading and quality:
      1) ASTM C33
      2) City of Seattle Specification, Section 9-03.1
   b. Sieve analysis: ASTM C136

PART 3 - EXECUTION

3.01 MEASURING, BATCHING AND MIXING

A. Measure, batch and mix portland cement concrete in conformance with ASTM C94.

1. Use central-mixed concrete transported to the jobsite in truck mixers.

2. Use truck mixers equipped with:
   a. Automatic device for recording number of revolutions of drum prior to completion of mixing operation.
   b. Either accurately calibrated water tanks or water meters.

3.02 DELIVERY

A. Transport and deliver concrete in conformance with ASTM C94.

B. Mix concrete continuously in truck mixer until discharged.

C. Mix ready-mixed concrete for a period of not less than 10 minutes. Mix for at least 3 minutes immediately prior to discharging at the site.
D. Do not place concrete more than 90 minutes or 300 drum revolutions after the introduction of mixing water, whichever is less.

3.03 SLUMP ADJUSTMENT

A. If concrete arrives at the site with a slump less than specified in the mix design, the slump may be adjusted by adding water at the site with the following restrictions:

1. Water added at the site was withheld from the batch water at the plant.

2. The total water added at the plant and the site does not exceed the mix design water amount.

3. Water is added at the site in conformance with ASTM C94.

B. Do not add water to the concrete after water reducing admixtures are added at the site.

C. Retest slump, temperature and air content after slump adjustment in conformance with Section 03 30 00, Cast-In-Place Concrete.

3.04 WEATHER RELATED PLACEMENT

A. For batching, mixing and delivering concrete in hot weather, conform to the recommendations of ACI 305R.

B. For batching, mixing and delivering concrete in cold weather, conform to ACI 306.1.
<table>
<thead>
<tr>
<th>Class</th>
<th>Use</th>
<th>28-Day Compressive Strength f'c (psi)</th>
<th>Maximum Aggregate Size (in)</th>
<th>Minimum Total Cementitious Content (lb/cy)</th>
<th>Maximum Water/Total Cementitious Materials Ratio (W/C)</th>
<th>Allowable Range of Fly-Ash (% total cementitious materials)</th>
<th>Allowable Range of GGBF Slag (% total cementitious materials)</th>
<th>Air Content</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>CDF A</td>
<td>Pipe bedding</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td>COS Standard Specification 9-01.5</td>
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<td>CDF B</td>
<td>Trench backfill</td>
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<td></td>
<td></td>
<td>COS Standard Specification 9-01.5</td>
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<td>CDF C</td>
<td>Soldier pile shaft fill for “dry” excavations only</td>
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<td></td>
<td></td>
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<td></td>
<td></td>
<td>WSDOT Standard Specification 2-09.3(1) E.</td>
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<tr>
<td>Lean Mix A</td>
<td>Soldier pile shaft fill for “wet” excavations’</td>
<td>NA</td>
<td>NA</td>
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<td>NA</td>
<td>NA</td>
<td>NA</td>
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<td>(4)</td>
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<td>4000 A</td>
<td>Concrete not noted otherwise</td>
<td>4,000</td>
<td>3/4”</td>
<td>564</td>
<td>0.40</td>
<td>15% to 40%</td>
<td>15% to 40%</td>
<td>4.5% ±1 1/2%</td>
<td>WSDOT Standard Specification 6-02.3(2), Mix Design 4000D</td>
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<td>4000 B</td>
<td>Station invert slab, station roof</td>
<td>4,000</td>
<td>3/4”</td>
<td>564</td>
<td>0.40</td>
<td>15% to 40%</td>
<td>15% to 40%</td>
<td>4.5% ±1 1/2%</td>
<td>WSDOT Standard Specification 6-02.3(2), Mix Design 4000D</td>
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<td>4000 C</td>
<td>Station topping slab</td>
<td>4,000</td>
<td>3/4”</td>
<td>564</td>
<td>0.35</td>
<td>15% to 40%</td>
<td>15% to 40%</td>
<td>4.5% ±1 1/2%</td>
<td>WSDOT Standard Specification 6-02.3(2), Mix Design 4000D</td>
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<tr>
<td>4000 D</td>
<td>Pedestrian bridge deck</td>
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<td>WSDOT Standard Specification 6-02.3(2), Mix Design 4000D</td>
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<tr>
<td>4000 E</td>
<td>All pedestrian bridge concrete except deck and drilled shafts</td>
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<td>WSDOT Standard Specification 6-02.3(2), Mix Design 4000D</td>
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<tr>
<td>4000 P</td>
<td>Pedestrian bridge drilled shafts</td>
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### TABLE 03 05-A – CONCRETE CLASSES

<table>
<thead>
<tr>
<th>Class</th>
<th>Use</th>
<th>28-Day Compressive Strength f’c (psi)</th>
<th>Maximum Aggregate Size (in)</th>
<th>Minimum Total Cementitious Content (lb/cy)</th>
<th>Maximum Water/Total Cementitious Materials Ratio (W/C)</th>
<th>Allowable Range of Fly-Ash (% total cementitious materials)</th>
<th>Allowable Range of GGBF Slag (% total cementitious materials)</th>
<th>Air Content</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>6000 A</td>
<td>Station elevated slabs (excluding roof)</td>
<td>6,000</td>
<td>3/4”</td>
<td>670</td>
<td>0.40</td>
<td>15% to 40%</td>
<td>15% to 40%</td>
<td>4.5% ±1 1/2%</td>
<td></td>
</tr>
<tr>
<td>6000 B</td>
<td>Headhouse columns and beams</td>
<td>6,000</td>
<td>3/4”</td>
<td>670</td>
<td>0.40</td>
<td>15% to 40%</td>
<td>15% to 40%</td>
<td>4.5% ±1 1/2%</td>
<td></td>
</tr>
<tr>
<td>8000 A</td>
<td>Station elevated slabs where indicated</td>
<td>8,000</td>
<td>3/4”</td>
<td>670</td>
<td>0.40</td>
<td>15% to 40%</td>
<td>15% to 40%</td>
<td>4.5% ±1 1/2%</td>
<td></td>
</tr>
</tbody>
</table>

**Notes:**
1. Mix designs may include either fly ash or GGBF, but are not required to.
2. Mix designs may include either fly ash or GGBF, but not both.
3. If a mix design includes either fly ash or GGBF, the percent total cementitious material must be within the range noted.
4. Foaming agents not allowed below bottom of mass excavation.

END OF SECTION
SECTION 03 11 00
CONCRETE FORMING

PART 1 - GENERAL

1.01 SUMMARY
A. This Section includes specifications for the design, construction, and treatment of formwork for cast-in-place concrete construction.

1.02 REFERENCES
A. This Section incorporates by reference the latest revisions of the following documents.

1. American Concrete Institute (ACI)
   a. ACI 116R Cement and Concrete Terminology
   b. ACI 117 Standard Specification for Tolerances for Concrete Construction and Materials
   c. ACI 347 Guide to Formwork for Concrete

2. American Plywood Association (APA)
   a. PS 1 U.S. Product Standard for Construction and Industrial Plywood

3. American Society for Testing and Materials International (ASTM)
   a. ASTM D994 Standard Specification for Preformed Expansion Joint Filler for Concrete (Bituminous Type)
   b. ASTM D1751 Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
   c. ASTM D4397 Standard Specification for Polyethylene Sheeting for Construction, Industrial, and Agricultural Applications

4. Federal Specifications (FED)
   a. FED TT-S-1543B Sealing Compound: Silicone Rubber Base (For Caulking, Sealing, and Glazing in Buildings and Other Structures)

1.03 DEFINITIONS
A. Roughened: Concrete intentionally roughened to a full amplitude of approximately 1/4 inch.
B. With the above exception, the words and terms used in this Section conform to the definitions given in ACI 116R.

1.04 SUBMITTALS
A. Procedures: Section 01 33 00, Submittal Procedures.
B. Samples
   1. Formwork facing materials: One sample for each type used, 12 inches by 12 inches or larger in size.

C. Manufactured Products: For each manufactured product submit:
   1. Manufacturer’s Product Data demonstrating conformance.
   2. Manufacturer’s written instructions for storage, handling, and installation.

D. Shop Drawings: Submit Shop Drawings showing:
   1. Overall geometry of formwork, shoring, and reshoring.
   2. Locations and details of:
      a. Construction joints.
      b. Formed concrete items such as keys, blockouts, and openings.
      c. Embedded items such as metal fabrications, waterstops, and conduit
   3. Procedures for:
      a. Erecting formwork and shoring.
      b. Monitoring formwork movement during concrete placement.
      c. Determining strength of concrete for removal of formwork if other than field-cured cylinders.
      d. Removing formwork, reshoring, and backshoring.

E. Working drawings describing formwork, shoring, and deshoring geometry, details, and procedures, sealed by a professional engineer.

F. Calculations supporting the Working Drawings, sealed by a professional engineer.

G. Qualifications for professional engineer.

1.05 QUALITY ASSURANCE
   A. Professional Engineer: Select a licensed professional engineer currently registered in the State of Washington experienced in this type of design.

1.06 DELIVERY, STORAGE AND HANDLING
   A. Store and handle form facing materials to prevent distortion, damage, and contamination that could adversely affect the concrete finish.
   B. Store and handle manufactured products in conformance with manufacturer’s written instructions.

1.07 PROJECT CONDITIONS
   A. Allow sufficient time between erection of formwork and placing of concrete for other trades to properly install concrete reinforcement and embedded items.
PART 2 - PRODUCTS

2.01 FORM FACING MATERIALS

A. Rough Form Finish

1. Boards: Use dressed side of lumber for surface in contact with the concrete and use dressed or tongue-and-groove edges.

2. Framing Lumber: Structural grade, dressed or rough.

B. Smooth Form Finish

1. Types

2. Thickness: As required to maintain surface smoothness without deflection, but not thinner than 5/8 inch.

2.02 MANUFACTURED PRODUCTS

A. Formwork Accessories

1. Form Ties: Rod type with end fasteners which can be removed without spalling the concrete. Provide cones with setbacks equal to the required concrete cover.

2. Form Tie Hole Plugs: Preformed mortar plugs to match the color of the concrete, recessed 1/4 inch. Adhere with a manufacturer approved epoxy adhesive.

3. Chamfer Strips: Fillet milled from clear, straight-grain pine, surfaced each side; or extruded vinyl type with or without nailing flange.

4. Polyethylene Sheeting: Single ply 6-mil polyethylene sheeting conforming to ASTM D4397. Provide a compatible tape with equal or better water vapor control characteristics than sheeting.

B. Form Release Agent

1. Commercial formulation, silicone-free, designed for use on all form facing materials used, which will not:

   a. Bond with, stain, or adversely affect concrete surfaces
   b. Impair subsequent treatment of concrete surfaces requiring bond or adhesion
   c. Impede wetting of surfaces which will be cured with water, steam, or curing compounds.

C. Joint and Seam Sealer: Capable of producing flush, watertight, and nonabsorbent surfaces and joints and compatible with forming material and concrete ingredients.
1. Caulking Compound: Silicone or polyurethane construction sealant conforming to Federal Specification TT-S-1543B.

2. Form Film Tape: Polypropylene plastic treated with waterproof adhesive for joint conditions not exposed to public view.

2.03 CONSTRUCTION JOINTS

A. Provide construction joints as indicated on the Contract Documents.

B. Locate construction joints not indicated on the Contract Documents as follows:
   1. In beams, girders, and slabs: within the middle third of the span.
   2. In walls and columns: at the underside of floors, slabs, beams, or girders, and at the top of footings or floor slabs.
   3. Locate construction joints perpendicular to the primary reinforcement. Continue reinforcement through joint.

C. Provide a roughened joint at all construction joints unless noted otherwise.

2.04 DESIGN REQUIREMENTS

A. Design formwork, shores, reshores, and backshores in conformance with the recommendations of ACI 347.

B. Design formwork and shores to resist pressure resulting from and maintain tolerances during placement and vibration of concrete.

C. Design formwork to be removed without damage to adjacent concrete surfaces or materials.

D. Carry loads for formwork of elevated slabs down to the invert slab. Do not use intermediate slabs or interior walls to carry formwork loads.

E. Do not use earth cuts as forms for vertical or sloping surfaces unless indicated on the Contract Documents.

F. Tolerances: Design and construct formwork to produce finished concrete surfaces within the following tolerances:
   1. Deflection of Facing Material
      a. Surfaces not exposed to public view: L/240.
      b. Surfaces exposed to public view: L/400.
   2. Vertical Alignment
      a. Lines, surfaces, and arrises: 1 inch
      b. Outside corner of exposed corner columns and control joint grooves in concrete exposed to view: 1/2 inch
   3. Lateral Alignment
      a. Members: 1 inch
      b. In slabs, centerline location of openings 12 inches or smaller and edge locations of larger openings: 1/2 inch
c. Sawcuts, joints, and weakened plane embedments in slabs: 3/4 inch

4. Level Alignment
a. Tops of slabs
   1) Elevation of slabs on grade: 3/4" inch
   2) Elevation of top surfaces of formed slabs before removal of supporting shores: 3/4 inch
b. Elevation of formed surfaces before removal of shores: 3/4 inch
c. Lintels, sills, parapets, horizontal grooves, and other lines exposed to view: 1/2 inch

5. Cross-sectional Dimensions
a. Members, such as columns, beams, piers, walls (thickness only), and slabs (thickness only)
   1) Dimension 12 inch or less: +3/8 inch, -1/4 inch
   2) Dimension more than 12 inch but less than 3 feet: +1/2 inch, -3/8 inch
   3) Dimension over 3 feet: +1 inch, -3/4 inch

6. Relative Alignment
a. Stairs
   1) Difference in height between adjacent risers: ±1/8 inch
   2) Difference in width between adjacent treads: ±1/4 inch
b. Grooves
   1) Specified width 2 inches or less: ±1/8 inch
   2) Specified more than 2 inches but less than 12 inches: ±1/4 inch
c. Formed surfaces may slope with respect to the specified plane at a rate not to exceed 3/8" per 10 feet.

7. The offset between adjacent pieces of formwork facing material shall not exceed:
   a. Surfaces exposed to public view: ACI 117 Class A surface, 1/8 inch
   b. Other surfaces: ACI 117 Class C surface, 1/2 inch

8. Floor finish tolerances as measured by placing a freestanding (unleveled) 10 foot straightedge anywhere on the slab and allowing it to rest upon two high spots within 72 hours after slab concrete placement. The gap at any point between the straightedge and the floor between the high spots shall not exceed the following:
   a. Bullfloated: 1/2 inch
   b. Straightedged: 5/16 inch
c. Flat: 3/16 inch

PART 3 - EXECUTION

3.01 CONSTRUCTION

A. General

1. Construct formwork in conformance with the approved Shop Drawings to produce finished concrete surfaces as indicated and within specified tolerances.

2. Anchor formwork to shores, supporting surfaces, or members to prevent upward or lateral movement of the formwork system during concrete placement.

3. Provide runways for moving equipment. Support runways directly on formwork or structure, without resting on reinforcing steel.

4. Provide positive means of adjustment of formwork. Adjust and secure before concrete placement. Do not adjust formwork after concrete has achieved initial set.

B. Form Facing Materials

1. Provide smooth form finish materials for surfaces exposed to public view.

2. Provide rough form finish materials for surfaces not exposed to public view.

C. Form Panels

1. Maintain form panels clean, smooth, and free from imperfections and distortion.

2. Arrange form panels in symmetrical patterns conforming to general lines of the structure. Unless otherwise indicated, orient panels on vertical surfaces with long dimension horizontal and make horizontal joints level and continuous. Use largest stock size practicable.

3. Make panel joints and seams mortar-tight. Install joint and seam sealers in accordance with the manufacturer's written instructions.

4. Align form panels on each side of a panel joint with fasteners common to both panels to provide a continuous concrete plane surface.

D. Construction Joints

1. At construction joints exposed to view, lap contact surface of form sheathing for flush surfaces over the hardened concrete in the previous placement by not more than 1 inch.

2. Ensure formwork is held firmly against hardened concrete to prevent offsets or loss of mortar at construction joints and to maintain a true surface.

E. Edge Forms And Bulkheads

1. Set edge forms, bulkheads, and intermediate screeds for slabs to obtain required elevations and contours in the finished slab surface. Ensure that edge forms and screed strips are sufficient to support the screeds to be used.

2. When formwork is cambered, set screeds to like camber to maintain required concrete thickness.
3. Brace bulkheads to prevent warpage or displacement. Set tightly against forms to prevent loss of concrete mortar.

4. Seal edge forms with joint and seam sealers such that neither a fin nor groove is made in the face of the cast concrete.

F. Corners: Provide 3/4” chamfer on all outside corners unless noted otherwise. Miter chamfer at intersections. Reentrant corners need not have fillets.

G. Embedded Items: Provide embedded items in conformance with the approved Shop Drawings. Secure to reinforcement or formwork to prevent movement during concrete placement. Fill voids with readily removable material to prevent entry of concrete.

H. Formed Items

1. Use polyethylene sheeting as a bond breaker between blockouts and invert slab concrete. Securely wrap concrete blockouts with sheeting forming a smooth, tight-fitting surface. Overlap sheeting material at seams a minimum of six inches and tape both sides of sheeting.

2. Provide temporary openings at the base of column and wall formwork and other locations where necessary to facilitate cleaning and inspection. Clean and inspect immediately before concrete is placed.

3. Provide air escape holes in bottom members of blockouts in vertical forms

I. Form Release Agent

1. Apply form release agent in conformance with manufacturer's written instructions.

2. Coat form contact surfaces with form release agent before reinforcement is placed.

3. Do not allow excess form release agent material to accumulate in the forms.

4. Do not allow excess form release agent to come into contact with surfaces to be bonded to fresh concrete such as concrete reinforcement, embedded items, and hardened concrete.

3.02 REMOVAL OF FORMWORK

A. Maintain formwork supporting concrete weight in place until the concrete has attained the minimum percentage of specified design compressive strength specified Table 03 11 00-A.

<table>
<thead>
<tr>
<th>Structural Member or Condition</th>
<th>Minimum Compressive Strength (Percent of Design Compressive Strength)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Elevated slabs or beams spanning more than 20 feet between supports</td>
<td>90 percent</td>
</tr>
<tr>
<td>Elevated floor slabs</td>
<td>70 percent</td>
</tr>
<tr>
<td>Free standing walls over four feet tall</td>
<td>70 percent</td>
</tr>
<tr>
<td>Sides of beams, columns, walls, and footings, and other vertical surfaces not carrying concrete weight</td>
<td>30 percent</td>
</tr>
</tbody>
</table>

B. Remove forms without injuring concrete surfaces, overstressing concrete members, or distorting formwork. Do not pry against concrete.
C. Cut nails off flush. Leave surfaces clean and unblemished.

3.03 RESHORING
A. Provide reshoring in conformance with the approved Shop Drawings.
B. Plan reshoring so areas of new construction do not support their own weight.
C. Place reshores in sequence with stripping operations.
D. Prevent construction loads on new construction during reshoring.

3.04 CLEANING AND RE-USING FORMS
A. Clean and repair surfaces of forms to be reused.
B. Apply form release agent as specified for new formwork.
C. Patch holes and defects in forms with materials and methods that will not be reflected in the concrete.
D. Do not reuse forms with raised grain, torn surfaces, worn edges, patches, dents, or other defects that will impair the texture of the concrete surface.

3.05 FIELD QUALITY CONTROL
A. Before placing concrete, verify the following:
   1. Lines and levels of erected formwork are correct.
   2. Formed and embedded items are located correctly and secured against movement.
   3. Embedded piping and conduit are free from obstructions.
   4. Loose tie-wire and other debris have been removed from the forms.
   5. Surfaces of formwork and embedded items are free of mortar, grout, and other foreign matter.
B. While placing concrete, verify the following:
   1. Formwork geometry is maintained within specified tolerances.
   2. Cement paste is not lost through joints.
C. Monitor movement during concrete placement. Adjust formwork as necessary to maintain tolerances.

END OF SECTION
PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes specifications for furnishing and installing joint fillers and sealing compounds for joints in concrete.

B. Related Sections: The work of the following Sections is related to the work of this Section. Other Sections, not referenced below, may also be related to the proper performance of this work.
   1. Section 03 11 00, Concrete Forming.

1.02 REFERENCES

A. This Section incorporates by reference the latest revisions of the following documents.

   1. American Concrete Institute (ACI):
      a. ACI 504R Guide to Joint Sealants for Concrete Structures
      a. ASTM D994 Preformed Expansion Joint Filler for Concrete (Bituminous Type)
      b. ASTM D1190 Concrete Joint Sealer, Hot Poured Type
      c. ASTM D1751 Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
      d. ASTM D2628 Preformed Polychloroprene Elastomeric Joint Seals for Concrete Pavements
      e. ASTM D3405 Joint Sealants, Hot Applied, for Concrete, and Asphalt Pavements
      f. ASTM D6690 Concrete Joint Sealer, Hot-Applied Elastic Type

1.03 SUBMITTALS

A. Procedures: Section 01 33 00, Submittal Procedures.

B. Shop Drawings: Include single-line diagram showing locations of all joints to be filled and sealed.

C. Manufacturers' product data for products used.

D. Samples: 12-inch long sample of joint filler and 1 pint or quart can of sealing compound for review when requested by the Resident Engineer.
PART 2 - PRODUCTS

2.01 MATERIALS

A. Joint Filler: Premolded, of sizes and thicknesses indicated, conforming to ASTM D994 or ASTM D1751. For structural joints and joints subject to movement, provide joint filler conforming to ASTM D1751.

B. Joint Sealant: ASTM D2628, for sealing of joints in slabs and at junctions of slabs and vertical surfaces. Use color selected by the Resident Engineer from the manufacturer's standards.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that concrete conditions comply with the requirements of the manufacturer’s written directions before installation.

B. Verify that weather conditions comply with the requirements of the manufacturer’s written directions before installation.

3.02 PREPARATION

A. Prior to sealing joints, clean the surfaces of the seams and joints so they are dry, and free of all loose aggregate, paint, corrosion, form oil and concrete curing compound.

B. Remove all loose concrete, dirt and foreign matter by sandblasting or by the use of wire brush. Remove projections of concrete into the seams. Blow the joints and surfaces adjacent to the seams free from all loose dust by means of oil-free compressed air immediately prior to priming.

C. Clean alkaline seepage and form oil by etching of the concrete surface with hydrochloric acid, thorough rinsing, neutralizing, and drying.

D. Prime joint surfaces, where required, as recommended by the manufacturer of the joint sealing compound.

E. Mix multi-component sealing compound as recommended by the manufacturer.

3.03 INSTALLATION

A. General: Install and protect joint sealant in conformance with manufacturer’s written instructions.

B. Expansion and Isolation Joints:

1. Provide premolded joint filler to full depth of slabs, less 1/2 inch. Install joint filler with top edge 1/2 inch below the surface. Use steel pins to hold material in place during placing and floating of concrete. Tool adjacent concrete edges to a 3/8-inch radius.

2. Fill expansion joints with joint sealant to 1/8 inch below surface of slabs.
C. Contraction Joints: Fill with joint sealant in areas and locations indicated. Fill joints flush to within 1/16 inch of the slab surface.

END OF SECTION
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SECTION 03 15 13
WATERSTOPS

PART 1 - GENERAL

1.01 SUMMARY
A. This Section includes specifications for waterstops in concrete.

1.02 SUBMITTALS
A. Procedures: Section 01 33 00, Submittal Procedures.
B. Shop Drawings: Submit the following:
      a. For Type A, C, and D waterstops, include locations for shop-fabricated changes in direction, intersections, and transitions, and field-fabricated butt or lap splices.
      b. For Type B waterstops, include extent of the reinjectable hose and the lengths of the solid vent ends. Show the locations of the junction boxes to be installed.
   2. Detail drawings:
      a. For Type A, C, and D waterstops, include details of shop fabricated changes in direction, intersections, and transitions, and field fabricated butt or lap splices.
      b. For Type B waterstops, include details of vent ends to be installed in junction boxes and method of protecting vent ends not to be installed in junction boxes.
C. Manufactured Products: For each type of waterstop, submit the following:
   1. Manufacturer’s Product Data.
   2. Manufacturer’s written instructions for storage, handling, and installation.
D. Product Samples: For each type of waterstop, submit the following:
   1. 12-inch long sample, including accessories necessary for installation.
   2. Sample of each shop-fabricated change in direction, intersection, and transition to be used in the Work.
   3. Sample of field-fabricated butt splice and lap splice.
E. Construction Work Plan (CWP): Section 01 45 00, Quality Control, for installing grouting, and cleaning of Type B waterstops. Include grout mix requirements per manufacturer’s recommendations and procedures for preventing damage to the system during installation.
F. Certifications: Manufacturer’s certification for grouting subcontractor.

1.03 QUALITY ASSURANCE
A. Grouting Contractor: Manufacturer certified.

1.04 DELIVERY, STORAGE, AND HANDLING
A. Store and handle manufactured products in conformance with manufacturer’s written instructions.

PART 2 - PRODUCTS

2.01 MATERIALS
A. Type A
   1. 14 inch Type A: Ribbed 14 inch PVC with center bulb, Catalog Item 905, manufactured by Greenstreak, or approved equal.
   2. 6 inch Type A: Ribbed 6 inch PVC with center bulb, Catalog Item 704, manufactured by Greenstreak, or approved equal.
B. Type B
   1. Reinjectable Hose: Fuko Type 2 Injection Hose, manufactured by Greenstreak, or approved equal.
   2. Single component suspension-based microfine cement: Tricodure SI, manufactured by Greenstreak, or approved equal.
   3. Solvent-free hydrophilic acrylate resin: Duroseal Inject, manufactured by Greenstreak, or approved equal.
C. Type C: Swellstop 3/4-inch by 1-inch, Style Number 594, manufactured by Greenstreak, or approved equal.
D. Type D: Retrofit, Catalog Item 667, manufactured by Greenstreak, or approved equal.

PART 3 - EXECUTION

3.01 INSTALLATION
A. Provide waterstops as indicated on the approved Shop Drawings.
B. Install waterstops in conformance with the manufacturer’s written instructions.
C. Locate accurately and secure against movement during concrete placement.
D. Install waterstops in the longest practicable length.
E. Place and consolidate concrete to ensure a complete bond between the concrete and waterstop. Cement-sand grout slurry may be used where necessary to ensure contact and bond of waterstop and concrete without voids.
3.02 SPlicing
A. Splice waterstops in conformance with the manufacturer's written instructions.
B. Provide only factory-made waterstop fabrications for all changes of direction, intersections, and transitions.
C. Provide only straight butt joint splices in the field.

3.03 GROUTING
A. After invert slab has reached its 28-day compressive strength, grout all Type B waterstops as follows.

1. Inject all Type B waterstops with the microfine cement grout. Clean the waterstops immediately to permit reinjection.

2. After the cure time specified by the manufacturer, inspect the invert slab for leaks. For the purposes of this activity, a leak is defined as a damp spot, dripping water, or running water.

3. If leaks appear, inject the Type B waterstops in these joints with the hydrophilic acrylate resin grout. Clean the waterstops immediately to permit reinjection.

3.04 FIELD QUALITY CONTROL
A. Joints constructed with waterstops will be subject to inspection by the Resident Engineer for material and installation defects that could reduce the effectiveness of the waterstop.
B. Replace defective waterstops and unacceptable waterstop installations.
C. Grouting shall be done by a manufacturer-certified Subcontractor and observed by a manufacturer's representative.

END OF SECTION
PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes specifications for anchoring structural steel and metal fabrications to concrete.

B. Related Sections: The work of the following Sections is related to the work of this Section. Other Sections, not referenced below, may also be related to the proper performance of this work.

1. Section 03 11 00, Concrete Forming
2. Section 03 20 00, Concrete Reinforcing

1.02 REFERENCES

A. This Section incorporates by reference the latest revisions of the following documents.

1. American Iron and Steel Institute (AISI)
   a. AISI 304/316

   a. ASTM A36 Standard Specification for Carbon Structural Steel
   b. ASTM A108 Standard Specification for Steel Bars, Carbon, Cold-Finished, Standard Quality
   c. ASTM A153 Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
   d. ASTM A496 Standard Specification for Steel Wire, Deformed, for Concrete Reinforcement
   e. ASTM A563 Standard Specification for Carbons and Alloy Steel Nuts
   f. ASTM A706 Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement
   g. ASTM F436 Standard Specification for Austenitic Gray Iron Castings
   h. ASTM F1554 Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength

   a. ANSI/AWS D1.1 Structural Welding Code – Steel
   b. ANSI/AWS D1.4 Structural Welding Code – Reinforcing Steel
1.03 SUBMITTALS

A. Procedures: Section 01 33 00, Submittal Procedures

B. Cast-In Concrete Anchors
   1. Mill certificates demonstrating conformance.

C. Post-Installed Concrete Anchors: For each post-installed concrete anchor submit:
   1. Manufacturer’s Product Data demonstrating conformance.
   2. Manufacturer’s written instructions for storage, handling, and installation.

D. Evaluation Service Reports
   1. If substitute products for post-installed anchors are proposed, submit Evaluation Service Reports from the ICC Evaluation Service, Inc., demonstrating conformance to the requirements of this Section.
   2. Substitute post-installed concrete anchor products, if submitted, shall have current International Code Council approval for use in cracked concrete.

E. Welder Certification

F. Weld Procedure Specification

G. Source Quality Control inspection and test reports

H. Field Quality Control inspection and test reports

1.04 QUALITY ASSURANCE

A. Welder Certification: Current AWS certification for each process, method, position, and size of weld executed.

B. Weld Procedure Specification: ANSI/AWS D1.4

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver cast-in concrete anchor materials to the fabricator tied and identified with plastic tags indicating the mill, melt or heat number, and the grade and size of bar.

B. Store and handle post-installed concrete anchors in conformance with manufacturer’s written instructions.

PART 2 - PRODUCTS

2.01 CAST-IN CONCRETE ANCHORS

A. Reinforcing Bars Noted A706: ASTM A706

B. Anchor Rods
   1. Rod and Nuts
      a. Unless noted otherwise: ASTM F1554 Grade 36 with ASTM A563A hex nuts
b. Noted Gr 105: ASTM F1554 Grade 105 with ASTM A563DH heavy hex nuts

2. Washers: ASTM F436

3. Finish: Section 05 05 13, Shop Applied Coatings for Metal

C. Welded Headed Studs: ASTM A108, grades 1015 through 1020, headed stud type, cold finished carbon steel, AWS D1.1, Type B; with fluxed end conforming to ANSI/AWS D1.1.

D. Deformed Bar Anchors: ASTM A496 with fluxed end conforming to ANSI/AWS D1.1.

2.02 POST-INSTALLED CONCRETE ANCHORS

A. Expansion Anchors
   1. Hilti Kwik Bolt TZ Anchors or approved equal. Provide galvanized carbon steel anchors unless noted otherwise.

B. Adhesive Anchors
   1. Adhesive: Hilti HIT–RE 500-SD or approved equal.
   2. Threaded rod: Stainless steel: AISI 304/316

2.03 WELDING ELECTRODE

A. Match filler metal requirements in conformance with ANSI/AWS D1.4

2.04 FABRICATION

A. Reinforcing Bars Noted A706
   1. Fabrication: Section 03 20 00, Concrete Reinforcing
   2. Welding: ANSI/AWS D1.4

B. Welded Headed Studs: Weld to structural steel and metal fabrications in conformance with ANSI/AWS D1.1 and manufacturer’s written instructions.

C. Deformed Bar Anchors: Weld to structural steel and metal fabrications in conformance with ANSI/AWS D1.1 and manufacturer’s written instructions.

2.05 SOURCE QUALITY CONTROL

A. Visually inspect all shop welds.

B. Welded Headed Studs: In addition to visual inspection, inspect and test welded headed stud connectors in conformance with ANSI/AWS D1.1 for stud welding as follows:
   1. Perform bend tests when visual inspection reveals either less than a continuous 360-degree flash or any case requiring weld repairs to any welded headed stud.
   2. Perform tests on additional welded headed studs when weld fracture occurs on studs already tested in conformance with ANSI/AWS D1.1.
PART 3 - EXECUTION

3.01 INSTALLATION

A. Cast-In Concrete Anchors
   1. Anchor Rods: Provide and use templates to ensure spacing and alignment. Secure to formwork or reinforcement to prevent movement during concrete placement. Protect threads until structural steel or metal fabrication is installed.
   2. Other Cast-In Concrete Anchors: Install cast-in concrete anchors with fabricated metal assembly in conformance with Section 03 11 00, Concrete Forming

B. Post-Installed Concrete Anchors
   1. Furnish anchors as noted on Contract Drawings. Install anchors in conformance with manufacturer’s written instructions.

3.02 FIELD QUALITY CONTROL

A. Post-Installed Concrete Anchors
   1. Provide special inspection of concrete anchor placement.
   2. Observe and record product description, including product name, adhesive expiration date, anchor or rebar diameter and steel grade, required size of the drill bit, required hole diameter and location, required cleanliness of the hole and required adhesive application.
   3. Observe anchor installation for conformance to the approved plans.

END OF SECTION
PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes specifications for materials for and fabrication and placement of concrete reinforcing and concrete reinforcing accessories.

1. Welding for reinforcing steel is covered in Section 03 15 25, Anchorage to Concrete.

B. Related Sections: The work of the following Sections is related to the work of this Section. Other Sections, not referenced below, may also be related to the proper performance of this work.

1. Section 03 15 25, Anchorage to Concrete.

1.02 REFERENCES

A. This Section incorporates by reference the latest revisions of the following documents:

1. American Concrete Institute (ACI)
   a. ACI 116R Cement and Concrete Terminology
   b. ACI 117 Standard Specifications for Tolerances for Concrete Construction and Materials
   c. ACI 315 Details and Detailing of Concrete Reinforcement

   a. ASTM A82 Steel Wire, Plain, for Concrete Reinforcement
   b. ASTM A185 Methods and Definitions for Mechanical Testing of Steel Products
   c. ASTM A497 Steel Welded Wire Fabric, Deformed, for Concrete Reinforcement
   d. ASTM A615 Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
   e. ASTM A706 Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement
   f. ASTM A1035 Standard Specification for Deformed and Plain, Low-Carbon, Chromium, Steel Bars for Concrete Reinforcement
   g. ASTM E329 Standard Specification for Agencies Engaged in Construction Inspection and/or Testing

3. Concrete Reinforcing Steel Institute (CRSI)
1.03 DEFINITIONS
A. Placing Drawings: Working drawings showing the grade, quantity, size, length, and location of the reinforcing steel necessary for the fabrication and placement of the material, including bending schedules, bending details, and material lists (bills of material)
B. With the above exception, the words and terms used in this Section conform to the definitions given in ACI 116R.

1.04 SUBMITTALS
A. Procedures: Section 01 33 00, Submittal Procedures.
B. Placing Drawings
   1. Detail reinforcing steel in conformance with ACI 315.
   2. Furnish bar lists, bending diagrams and schedules.
   3. Indicate locations for placement of reinforcing and reinforcing support.
   4. Indicate locations of lap splices, mechanical splices, and mechanical anchors.
   5. Indicate individual weight of each bar, total weight of each bar size, and total weight of all bars on the list.
C. Mill Certificates: For each lot or load of reinforcing steel delivered to the jobsite, submit mill certificates demonstrating conformance to the requirements of this Section.
D. Evaluation Service Reports: Submit Evaluation Service Reports from the ICC Evaluation Service, Inc., demonstrating conformance to the requirements of this Section for:
   1. Mechanical splices
   2. Mechanical anchorages
E. Manufactured Products: For each manufactured product submit:
   1. Manufacturer’s Product Data.
   2. Manufacturer’s written instructions for storage, handling, and installation.

1.05 QUALITY ASSURANCE
A. Independent Inspection and Testing Laboratory: ASTM E329

1.06 DELIVERY, STORAGE, AND HANDLING
A. Deliver reinforcing steel to the fabricator in bundles, limited to one size and length of bar, securely tied and identified with plastic tags in an exposed position indicating the mill, the melt or heat number, and the grade and size of bars.
B. Deliver reinforcing steel to the jobsite properly tagged and identified. Block up and protect in a manner that will prevent damage. Protect from moisture, dirt, grease, oil, and other foreign
materials that might impair bond with concrete. Maintain identification of reinforcing steel after bundles are broken.

C. Store and handle manufactured items in conformance with manufacturer’s written instructions.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Deformed Bars
   1. Unless otherwise indicated: ASTM A615, Grade 60
   2. Bars indicated A706: ASTM A706
   3. Bars indicated Gr 100: ASTM A1035, Grade 100

B. Welded Wire Fabric
   1. Plain Wire: ASTM A185
   2. Deformed Wire: ASTM A497

C. Smooth Dowel Bars: ASTM A615 Grade 60

D. Wire and Plain Bars: ASTM A82

E. Tie Wire: ASTM A82, No. 16 gauge or heavier, black or galvanized, soft or commercial grade steel tie wire.

2.02 MANUFACTURED ITEMS

A. Accessories:
   1. Provide reinforcement accessories as required for spacing, assembling, and supporting reinforcement in place.
   3. Provide metal chairs with Class 1 or Class 2 protection.
   4. Provide concrete blocks with a surface area greater than or equal to 4 square inches, and of compressive strength equal to or greater than the concrete being placed.

B. Mechanical Splices
   1. Capable of being installed in clear space indicated.
   2. Capable of developing 125 percent of the yield strength of spliced reinforcing bars.

C. Mechanical Anchorages
   1. Capable of being installed in clear space indicated.
   2. Capable of developing 125 percent of the yield strength of anchored reinforcing bar.
2.03 FABRICATION
A. Conform approved placing drawings.
B. Cutting and Bending
   1. Perform cutting and bending at a central location, equipped and suitable for the purpose.
   2. Bend bars cold.
   3. Do not use straightened bars.
   4. Label all bars in conformance with approved placing drawings. Secure like pieces in bundles when appropriate.

2.04 SOURCE QUALITY CONTROL
   1. Fabrication Tolerances: ACI 117.
B. Identification
   1. Bundle and tag reinforcing steel with grades and sizes, heat numbers, and suitable identification marks for checking, sorting, and placing.
   2. Mark tags with sizes and numbers correspond to approved placing drawings and schedules.
   3. Use waterproof tags and markings.

PART 3 - EXECUTION

3.01 PREPARATION
A. Prior to placing reinforcing:
   1. Verify surfaces over or against which reinforcing is to be placed are clean and in proper condition for placing reinforcement.
   2. Verify items to be embedded in concrete are secured in place.

3.02 PLACEMENT
A. General
   1. Install concrete reinforcing in conformance with approved placing drawings.
   2. Install reinforcement accurately and secure against movement from concrete placement.
   3. Do not cut, bend, or straighten bars in the field unless directed by Resident Engineer.
B. Reinforcing Supports: Support reinforcing above ground or mat on precast concrete reinforcing supports. Support reinforcing above formwork on precast concrete, metal, or plastic reinforcement supports.
C. Placing and Tying: Install reinforcing steel in place securely to prevent displacement. Bend ends of wire ties away from forms. Do not secure bars to the sides or bottom of the forms using tie wire.

D. Lap Splices: Where possible, stagger splices of alternate bars a minimum clear offset of 4 feet between splices.

E. Mechanical Splices: Install in conformance with the manufacturer’s written instructions. Where mechanical splices are connected to reinforcement on only one end and embedded in concrete, provide a metal cap on the open end to protect the interior of the splice and prevent intrusion of concrete.

F. Mechanical Anchorages: Install in conformance with the manufacturer’s written instructions.

G. Dowels: Provide additional bars for proper support of dowels where required. Furnish and use templates for placement of column dowels.


I. Concrete Cover: Provide a minimum concrete cover over steel reinforcement as shown on Contract Drawings.

J. Protection of Waterproofing Membrane: Where reinforcement is to be installed over a waterproofing membrane, protect the membrane during installation of the reinforcement to avoid punctures, tears, and abrasion. Notify the Resident Engineer immediately if the membrane is damaged.

3.03 CLEANING

A. Clean reinforcement free of foreign materials that might impair bond with concrete.

3.04 FIELD QUALITY CONTROL

A. Placing Tolerances: ACI 117.

B. Adjustment: Bars may be moved as necessary to avoid interference with other reinforcing steel or embedded items. Do not increase the maximum spacing or reduce the total number of bars. Replace and secure all bars moved to permit access for cleanup operations before the start of concrete placement.

C. Perform the following tests with the Resident Engineer present during reinforcing placement:

1. Mechanical Splices
   a. Provide continuous inspection of 100 percent of installed splices.
   b. Remove and replace incorrectly installed splices

2. Mechanical Anchorages and Anchorages for Future Extension
   a. Provide continuous inspection of 100 percent of installed anchorages.
   b. Remove and replace incorrectly installed anchorages.
D. Perform the following inspections with the Resident Engineer present prior to placing concrete:

1. Placement: Visually inspect reinforcing placement for conformance with the placing drawings. Verify the following:
   a. Bar grade
   b. Bar size, length, and bends
   c. Bar location, quantity, spacing, and cover
   d. Lap splice types, lengths, and locations
   e. Sufficient ties, supports, and side form spacers
   f. Bars are free from foreign materials that might impair bond with concrete.

2. Waterproofing Membrane: Verify integrity of waterproofing membrane.

END OF SECTION
PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes specifications for conveying placing, finishing, repairing, curing, protecting, and testing cast-in-place concrete.

B. Related Sections: The work of the following Sections is related to the work of this Section. Other Sections, not referenced below, may also be related to the proper performance of this work.

1. Section 03 05 15, Portland Cement Concrete
2. Section 03 11 00, Concrete Forming
3. Section 03 15 13, Waterstops
4. Section 03 20 00, Concrete Reinforcing
5. Section 03 35 00, Concrete Finishing
6. Section 03 62 00, Non-Shrink Grouting
7. Section 31 66 17, Slurry Diaphragm Wall Cleaning and Repairing

1.02 REFERENCES

A. This Section incorporates by reference the latest revisions of the following documents.

1. American Concrete Institute (ACI)
   a. ACI 116R Cement And Concrete Terminology
   b. ACI 301 Specifications For Structural Concrete
   c. ACI 304R Guide For Measuring, Mixing, Transporting, And Placing Concrete
   d. ACI 304.2R Placing Concrete by Pumping Methods
   e. ACI 305R Hot Weather Concreting
   f. ACI 306.1 Standard Specifications For Cold Weather Concreting
   g. ACI 309R Guide For Consolidation Of Concrete
   h. ACI 503.4 Standard Specification For Repairing Concrete With Epoxy Mortars

a. ASTM C31 Standard Practice For Making And Curing Concrete Test Specimens In The Field
b. ASTM C33 Specification For Concrete Aggregates
c. ASTM C39 Test Method For Compressive Strength Of Cylindrical Concrete Specimens
d. ASTM C42 Test Method For Obtaining And Testing Drilled Cores And Sawed Beams Of Concrete
e. ASTM C94 Standard Specification For Ready-Mixed Concrete
f. ASTM C143 Test Method For Slump Of Hydraulic-Cement Concrete
g. ASTM C150 Specification For Portland Cement
h. ASTM C171 Specification For Sheet Materials For Curing Concrete
i. ASTM C172 Practice For Sampling Freshly Mixed Concrete
k. ASTM C231 Test Method For Air Content Of Freshly Mixed Concrete By The Pressure Method
l. ASTM C309 Specification For Liquid Membrane-Forming Compounds For Curing Concrete
m. ASTM C881 Specification For Epoxy-Resin-Base Bonding Systems For Concrete
n. ASTM C928 Specification For Packaged, Dry, Rapid-Hardening Cementitious Materials For Concrete Repairs
o. ASTM C1059 Specification For Latex Agents For Bonding Fresh To Hardened Concrete
q. ASTM E329 Standard Specification for Agencies Engaged In Construction Inspection and/or Testing

3. American Association of State Highway and Traffic Officials (AASHTO)
   a. AASHTO M182 Specification For Burlap Cloth Made From Jute Or Kenaf

4. Washington State Department of Transportation (WSDOT)
   a. Standard Specifications for Road, Bridge, and Municipal Construction

1.03 DEFINITIONS
   A. Mass Concrete: Any volume of concrete with dimensions large enough to require that measures be taken to cope with generation of heat from hydration of the cement and attendant volume change, to minimize cracking.
1.04 SUBMITTALS

A. Procedures: Section 01 33 00, Submittal Procedures.

B. Product Data: For each manufactured product submit:
   1. Manufacturer’s Product Data.
   2. Manufacturer’s written instructions for storage, handling, and installation.

C. Qualifications: Independent Testing Laboratory.

D. Quality Program Plan

E. Construction Work Plan

F. Placement Records: Report the location in the finished work of each concrete class, and the start and completion times of placement of each batch of concrete placed.

G. Field Quality Control inspection and test reports and documents
   1. Concrete slump, air content, and temperature results.
   2. Concrete compressive strength test results.
   3. Concrete truck batch tickets in conformance with ASTM C94. Include all modifications to water or admixture volumes from the original mix design.

1.05 QUALITY ASSURANCE


B. Construction Work Plan: Prepare a Construction Work Plan in conformance with Section 01 45 00, Quality Control. Include descriptions of methods, materials, labor, and equipment used to:
   1. Convey, place, finish, repair, cure, protect, and test cast-in-place concrete.
   2. Conduct work in hot weather, cold weather, and wet weather.
   3. Mitigate heat of hydration and monitor concrete temperatures in mass concrete placements.

C. Quality Program Plan: Section 01 45 00, Quality Control.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Ready Mix Concrete: Section 03 05 15, Portland Cement Concrete.

B. Store and handle manufactured products in conformance with manufacturer’s written instructions.
PART 2 - PRODUCTS

2.01 MATERIALS

A. Portland Cement For Site-Mixed Repair Materials
   1. ASTM C150, Type II, low alkali, brand to match cement used in concrete to be repaired.
   2. Provide white portland cement where required to match surrounding concrete.

B. Fine Aggregate for Site-Mixed Repair Materials
   1. For Bonding Grout: ASTM C33 washed clean sand passing a Number 30 sieve.
   2. For Patching Mortar: ASTM C33 washed clean, graded fine aggregate of suitable size for areas to be repaired. Aggregate up to Size Number 8 may be used for repair of larger defects.


2.02 MANUFACTURED PRODUCTS

A. Patching Mortar: ACI 503.4 for Epoxy Mortar.

B. Epoxy Adhesive: ASTM C881
   1. Type II for non-load-bearing concrete, Type V for load-bearing concrete.
   2. Select grade and class by project conditions and requirements.

C. Damp Curing Materials
   1. Waterproof Sheet Materials: ASTM C171 waterproof paper with white paper face, polyethylene film pigmented white or white burlap-polyethylene sheeting.
   2. Burlap: AASHTO M182, class or weight suitable for the use and location.

   1. Type 1 for concrete not exposed to sunlight, Type 1-D with white fugitive dye for concrete exposed to sunlight.
   2. Class A or B as appropriate for use and location.

E. Patching Materials Other Than Portland Cement
   1. Portland cement mortar modified with a latex bonding agent conforming to ASTM C1059 Type II.
   2. Epoxy mortars and epoxy compounds that are moisture-insensitive during application and after curing, that embody an epoxy binder conforming to ASTM C881, Type III. Select type, grade, and class appropriate for the application.
   3. Non-shrink grout: Section 03 62 00, Non-Shrink Grouting.
2.03 MIX DESIGNS
   A. Mix Designs: Section 03 05 15, Portland Cement Concrete.

PART 3 - EXECUTION

3.01 PREPARATION
   A. Notification: Prior to each concrete placement:
      1. Notify the Resident Engineer at least 24 hours prior to actual placement, and not later than 3 pm on the day prior to placement.
      2. Notify the Resident Engineer at least 48 hours prior to actual placement when schedules require concrete placement at times other than normal working hours.
      3. Notify the Resident Engineer of the location of the placement and the concrete mix to be placed.
   B. Verification prior to placement:
      1. Formwork installation conforms to Section 03 11 00, Concrete Forming.
      2. Reinforcing placement conforms to Section 03 20 00, Concrete Reinforcing.
      3. Embedded items are located correctly and secured against movement.
      4. For slabs on grade, also verify the subgrade is well drained; free of debris, free of frost and ice; and moist with no muddy spots, soft spots, or ruts.
   C. Construction Joints
      1. Remove unsound or loose material.
      2. Verify construction joints are clean and properly roughened.
      3. Apply epoxy bonding compound in conformance with manufacturer’s written instructions.
   D. Waterproofing Membrane: Where concrete is to be placed over a waterproofing membrane, obtain acceptance of the membrane integrity from the Resident engineer prior to concrete placement.
   E. Weather Considerations
      1. Wet Weather: Provide protection for concrete during placement, finishing, and curing while rain, sleet, or snow is falling.
      2. Hot Weather: Conform to the recommendations of ACI 305R.
      3. Cold Weather: Conform to the requirements of ACI 306.1.
   F. Obtain acceptance of preparation from the Resident Engineer prior to placement.

3.02 PLACEMENT
   A. Conveying
1. General
   a. Convey concrete rapidly from mixer to the place of final deposit using methods that prevent segregation and loss of ingredients, and will ensure the required quality of concrete.
   b. Do not use aluminum pipes or chutes.
   c. Conform to the recommendations of ACI 304R

2. Pumping
   a. Conform to the recommendations of ACI 304.2R.
   b. Use pumping equipment that permits placement rates that avoid cold joints and prevent segregation in discharge of pumped concrete.
   c. Support pump hoses so that reinforcement is not moved from its original position.

B. Depositing
   1. Place concrete continuously in one horizontal layer or in several horizontal layers with fresh concrete deposited over previous placements that are still plastic.
   2. Do not place concrete that has surface-dried, partially hardened, or contains foreign material.
   3. Do not drop concrete freely through reinforcing which may cause segregation.
   4. Do not drop concrete freely more than 5 feet. When placing vertical sections of greater heights, use openings in the form, elephant trunks, tremies, or other approved devices to reduce the free drop.
   5. Placement Using Tremie Methods: Place concrete in or under water in conformance to the recommendations of ACI 304R.
   6. If truck is being sampled, place no more than 1/2 cubic yard until tests demonstrate concrete conforms to temperature, air content, and slump requirements.

C. Consolidating
   1. Consolidate concrete by mechanical vibration in conformance with the recommendations of ACI 309R.
   2. Thoroughly work concrete around reinforcement and embedded items and into corners of forms to eliminate air and rock pockets. Insert and withdraw the vibrator vertically at uniform spacing over the entire area of the placement. Space the distance between insertions such that the influence zones of each insertion overlap. Do not drag vibrators to move concrete horizontally.
   3. Use internal vibrators of the largest size and power that can properly be used in the Work. Maintain vibrators and provide sufficient back-up units on site.
   4. Conduct vibration using competent, skilled, and experienced workers,

3.03 FINISHING

A. Finish surfaces in conformance with Section 03 35 00, Concrete Finishing
3.04 CURING AND PROTECTION:

A. Curing Unformed Concrete Surfaces
   1. After placing and finishing, cure concrete by application of mats or fabric kept continuously wet for not less than 14 days.
   2. Do not cure with earth, sand, sawdust, straw, or hay.
   3. Do not use burlap where exposed to direct sunlight.

B. Curing Formed Concrete Surfaces
   1. Keep absorbent wood forms wet until they are removed.
   2. After formwork is removed, apply a curing compound.

C. Protection
   1. Immediately after placing, protect concrete from premature drying, excessively hot or cold temperatures, mechanical injury, and staining.
   2. Protect concrete during the curing period from mechanical and physical stresses that may be caused by heavy equipment movement, subjecting the concrete to load stress, load shock, or excessive vibration.

3.05 REPAIR OF SURFACE DEFECTS

A. General
   1. Repair tie holes and surface defects immediately after removing formwork and before curing.
   2. Where the surface is to be textured, repair tie holes and surface defects before texturing.
   3. Manufactured repair materials may be used in lieu of site-mixed repair materials. Apply manufactured repair materials in conformance with manufacturer’s printed directions.
   4. Repair concrete damage caused by construction activities, such as accidental equipment impact, temporary anchor bolts and construction equipment connections.

B. Site-Mixed Repair Materials
   1. Bonding grout: Mix one part cement to one part fine sand to the consistency of thick cream.
   2. Patching mortar
      a. Use same materials as the concrete to be patched with no coarse aggregate. Do not use more than one part cement to 2-1/2 parts sand.
      b. For repairs in exposed concrete, substitute white portland cement for a portion of the gray portland cement to produce a mix matching the surrounding concrete color when dry. Determine the proportion of white portland cement by trial mixes and test areas, prior to repair of actual defective areas.
C. Repair of Tie Holes
1. Plug all tie holes.
2. If portland cement patching mortar is used for plugging, clean and dampen tie holes before application.

D. Repair of Surface Defects Other Than Tie Holes
1. Outline defect with 1/2 inch to 3/4 inch deep saw cut. Remove all concrete within the sawcut to sound concrete. If chipping is required, leave chipped edges perpendicular to the surface or slightly undercut. Do not feather edges.
2. Dampen area to be patched plus a 6-inch band around the perimeter. Brush bonding grout thoroughly into the surface.
3. When bond coat begins to lose water sheen, apply patching mortar and thoroughly consolidate into place. Strike off mortar, leaving slightly higher than surrounding surface to permit shrinkage.
4. Finish the patch after 1 hour. Keep patch damp for 7 days.

E. Removal of surface stains and deposits
1. Remove stains, rust, efflorescence, and surface deposits considered objectionable by the Resident Engineer.

3.06 MASS CONCRETE
A. Use measures to mitigate heat of hydration in mass concrete placement by adjusting the concrete mix design, precooling concrete constituents or the concrete mix, postcooling or insulating the in-place concrete mass, or modifying construction methods.

B. Limit concrete temperatures to the following during curing
1. Maximum internal concrete temperature: 160 degrees F.
2. Maximum differential temperature between internal concrete and ambient: 35 degrees F.

C. Demonstrate that concrete temperatures do not exceed the specified limits.
1. Test concrete temperatures in conformance with ASTM C186.
2. Record internal and ambient temperatures hourly until internal concrete temperature has dropped to less than 90 percent of the maximum recorded.

3.07 FIELD QUALITY CONTROL
A. Independent Testing Laboratory: Use an Independent Testing Laboratory to perform the following:
1. Observe concrete batching and mixing operations.
2. Record all concrete batched.
3. Record all concrete delivered to the project.
4. Collect and check concrete truck batch tickets.
5. Visually inspect concrete placement.

6. Sample and test concrete.

7. Obtain drilled cores of concrete, if required by the Resident Engineer.

8. Install and read temperature measurement devices in mass concrete placements.

9. Prepare reports on all inspection and test results.

B. Provide additional labor, materials, or equipment required to assist the Independent Testing Laboratory in obtaining and handling samples at the site.

C. Provide and maintain for the sole use of the Independent Testing Laboratory adequate facilities for safe storage and proper curing of concrete test specimens on site for initial curing.

D. Concrete Sampling

1. Obtain at least one composite sample for each 100 cubic yards, or fraction thereof, of each concrete mixture placed in any one day.

2. Obtain composite samples in conformance with ASTM C172. Select the trucks or batches of concrete to be tested on a random basis. Samples may be obtained at the truck.

3. Perform the following tests on each sample:
   a. Slump: ASTM C143.
   b. Air content: ASTM C231.

4. Mold and cure three compressive strength specimens from each sample in conformance with ASTM C31. Record all deviations from the requirements of this Section in the test report.

E. Concrete Testing

1. Conduct compressive strength tests of each sample in conformance with ASTM C39.

2. Test one specimen at 7 days for information and two specimens at 28 days for acceptance, unless otherwise specified.

F. Evaluation and Acceptance of Tests

1. Acceptance of Concrete
   a. The compressive strength tests results for acceptance of each sample shall be the average of the compressive strengths from the two specimens tested at 28 days.
   
   b. If one specimen in a sample shows evidence of improper sampling, molding, or testing, discard the specimen and considered the strength of the remaining cylinder to be the test result.
c. If both specimens in a sample show defects, both specimens shall be discarded.

d. Compressive strength tests will be considered acceptable if the average compressive strength of all 28-day specimens of three consecutive sample tests are equal to or exceed the specified 28-day compressive strength, and if no individual specimen compressive strength is more than 300 pounds per square inch below the specified 28-day compressive strength.

2. Test Cores: If concrete strength is not considered acceptable, or if there is a likelihood of low strength concrete, a significant reduction in load-carrying capacity or an absence of desired durability in the concrete, the Resident Engineer may require tests of cores drilled for determination of in-place strength.

a. Obtain and test specimens in conformance with ASTM C42. Take three cores from each area as directed by the Resident Engineer.

b. Test cores will be considered acceptable if the average of the three cores is equal to at least 85 percent of the specified 28-day compressive strength and no single core is less than 75 percent of the 28-day compressive strength. Locations represented by erratic core strengths may be retested at the direction of the Resident Engineer.

c. Fill core holes in conformance with the requirements of this Section for repair of surface defects.

d. If, as a result of these tests, it is determined that the specified concrete properties are not being obtained, the Contractor may order such changes in proportions or materials, or both, as may be necessary to secure the specified properties.

3. Repair or replace low-strength concrete as directed by the Resident Engineer. Concrete is defined as low-strength if concrete compressive strength tests and test cores do not meet the requirements for acceptable tests as described herein.

END OF SECTION
SECTION 03 34 00
CELLULAR CONCRETE FILL

PART 1 - GENERAL

1.01 SUMMARY
   A. This Section includes specifications for batching, mixing, and placing cellular concrete fill.

1.02 REFERENCES
   A. This Section incorporates by reference the latest revisions of the following documents.
      1. American Society for Testing and Materials International (ASTM)
         a. ASTM C666 Standard Test Method for Resistance of Concrete to Rapid Freezing and Thawing
         b. ASTM C796 Standard Test Method for Foaming Agents for Use in Producing Cellular Concrete Using Preformed Foam
         c. ASTM D2434 Standard Test Method for Permeability of Granular Soils (Constant Head)
         d. ASTM D4015 Standard Test Methods for Modulus and Damping of Soils by Resonant-Column Method

1.03 DEFINITIONS
   A. Cellular Concrete: A lightweight product consisting of portland cement, cement-silica, cement-pozzolan, lime-pozzolan, lime-silica pastes, or pastes containing blends of these ingredients and having a homogeneous void or cell structure, attained with gas-forming chemicals or foaming agents.

1.04 SUBMITTALS
   A. Procedures: 01 33 00, Submittal Procedures
   B. Manufacturer’s Product Data: Submit manufacturer’s written product data including:
      1. Technical data, physical properties and specifications for cellular concrete.
      2. Instructions for batching, mixing, and placing.
      3. Description of equipment used.
      4. Instructions for storage and handling of materials.
   C. Applicator Qualifications
      1. Manufacturer’s certification.
      2. Examples of recent projects comparable in scope to the Work.
   D. Field Quality Control Test Reports
1.05 QUALITY ASSURANCE
   A. Applicator: Certified by the manufacturer. Use skilled workmen, experienced and familiar with the requirement and methods for proper performance.

1.06 DELIVERY STORAGE AND HANDLING
   A. Store and handle materials in conformance with manufacturer’s written directions.

PART 2 - PRODUCTS

2.01 MANUFACTURERS
   A. Foaming Agent
      1. The Mearl Corporation
      2. Elastizell Corporation of America
      3. BASF Construction Chemicals
      4. MixOnSite, LLC

2.02 MATERIALS
   A. Materials
      1. Concentrate: As recommended by the manufacturer.
      2. Portland Cement: ASTM A150, Type I or III.
      3. Supplementary Cementitious Materials: As recommended by the manufacturer.
      4. Admixtures: As recommended by the manufacturer.
      5. Water: Potable, free of materials that would adversely affect the setting or strength of the cellular concrete fill.

2.03 EQUIPMENT
   A. As recommended by the manufacturer.

2.04 MIXES
   A. Provide cellular concrete with the following properties:
### Property Value Remarks

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<thead>
<tr>
<th>Property</th>
<th>Value</th>
<th>Remarks</th>
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<td>Maximum Cast Density,pcf</td>
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</tr>
<tr>
<td>Minimum Compressive Strength, psi</td>
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<td>Shear Modulus, G, psi</td>
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<td>per ASTM D4015 at confining stress of 3 psi</td>
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<td>Young’s Modulus, E, psi</td>
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<td>based on Poisson’s Ratio (u=0.22) and (E=2G(1+u))</td>
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<td>Water Absorption, percent</td>
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<td>After 120 days, maximum</td>
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<td>Confining stress, 2.5 psi</td>
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<tr>
<td>Confining stress, 18 psi</td>
<td>5.4 (\times 10^5)</td>
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</tr>
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### PART 3 - EXECUTION

#### 3.01 SUBGRADE CONDITIONS

A. Examine the areas and conditions under which the Work will be performed. Correct conditions detrimental to timely and proper completion.

B. Remove standing water prior to placement of cellular concrete fill.

C. Set and secure any items to be encased in the cellular concrete fill prior to installation.

#### 3.02 WEATHER CONDITIONS

A. Avoid freezing before initial set of cellular concrete fill.

B. Do not place at temperatures lower than 40 degrees Fahrenheit or when freezing conditions are expected within 24 hours.

#### 3.03 MIXING AND CONVEYING

A. Mix the materials according to the approved mix design.

B. Convey promptly to the location of final placement. Avoid excessive handling.

C. Place cellular concrete fill in lifts not greater than 3 feet in depth.

D. Finish surface to within ± 0.1 foot of plan elevation.

E. Do not backfill or otherwise load cellular concrete fill until it has attained a compressive strength of at least 20 psi.

#### 3.04 FIELD QUALITY CONTROL

A. Sampling
1. During placement of the initial batches, test the density and adjust the mix as required to obtain the specified cast density at the point of placement.

2. At hourly intervals during placing, test the density and adjust as necessary to maintain the specified cast density.

3. Take four test specimens for each 300 cubic yards of cellular concrete placed for testing in conformance with ASTM C796.

B. Testing

1. Test specimens in conformance with ASTM C796.

END OF SECTION
SECTION 03 35 00
CONCRETE FINISHING

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes specifications for the finishing and curing of formed and unformed concrete surfaces, including the repair of surface defects. (CIP-1, CIP-2, CIP-3)

1. Tolerance requirements and measurement for floor surfaces indicated VERY FLAT FLOOR (SOV FF 50, MLV FF 35) on the drawings.

B. Related Sections: The work of the following Sections is related to the work of this Section. Other Sections, not referenced below, may also be related to the proper performance of this work.

1. Section 03 11 00, Concrete Forming
2. Section 03 30 00 Cast-in-Place Concrete
3. Section 33 13 13, Concrete Paving
4. Section 09 90 00, Painting and Coating

1.02 REFERENCES

A. This Section incorporates by reference the latest revisions of the following documents.

1. American Association of State Highway and Transportation Officials (AASHTO):
   a. AASHTO M182 Burlap Cloth Made from Jute or Kenaf

2. American Concrete Institute (ACI):
   a. ACI 117 Standard Tolerances for Concrete Construction and Materials
   b. ACI 301 Specifications for Structural Concrete for Buildings
   c. ACI 305R Hot Weather Concreting
   d. ACI 306 Cold Weather Concreting
   e. ACI 308 Standard Practice for Curing Concrete
   f. ACI 503.4 Standard Specification for Repairing Concrete with Epoxy Mortars

   a. ASTM C33 Specification for Concrete Aggregates
   b. ASTM C150 Specification for Portland Cement
   c. ASTM C171 Specifications for Sheet Materials for Curing Concrete
d. ASTM C309 Specification for Liquid Membrane-Forming Compounds for Curing Concrete

e. ASTM C881 Specification for Epoxy-Resin-Base Bonding Systems for Concrete

f. ASTM E 1155 Test Method for Determining Ff Floor Flatness and Ff Floor Levelness Numbers.

1.03 SUBMITTALS

A. Procedures: Section 01 33 00, Submittal Procedures.

B. Product Data: Submit manufacturers' product data for manufactured products specified and indicated.

C. Shop Drawings: Submit drawings, or diagrams to scale, that indicate the location in plan and elevation of all concrete finishes.

D. Samples: Submit 1/2-pint sample container of aluminum oxide and silicon carbide abrasive grit for review and acceptance where non-slip finish is indicated or specified.

1.04 QUALITY ASSURANCE

A. Site Mock-Ups: Provide site mock-ups, at least 3 feet by 4 feet in size, of finishes of formed surfaces in exposed locations and of exposed slab finishes.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Repair and Finishing

1. Portland Cement: ASTM C150, Type II, of same brand as used in the work. Furnish white portland cement where required to produce color matching color of surrounding concrete.

2. Aggregate:

a. For Bonding Grout: ASTM C 33, washed clean sand passing a Number 30 sieve.

b. For Patching Mortar: ASTM C 33, washed clean, graded fine aggregate of suitable size for areas to be repaired. Clean coarse aggregate up to Size Number 8 may be added for repair of larger pockets and voids.

3. Commercial Patching Mortar: Latex-modified portland cement mortar may be furnished if appropriate for the use.

4. Skim Coat: Commercial polymer modified, Portland cement mortar for thin trowel application, recommended by manufacturer for smoothing and patching walls on projects where an ultra smooth surface is desired.

   a. Basis of design product: Raeco Skimwall.
B. Curing

1. Damp Curing Materials:
   a. Waterproof Sheet Materials: ASTM C171, waterproof paper with white paper face, polyethylene film pigmented white, or white burlap-polyethylene sheeting.
   b. Burlap: AASHTO M182, of class or weight suitable for the use and location. Do not use burlap where concrete is exposed to direct sunlight.

2. Curing Compound: ASTM C309, liquid membrane-forming curing compound, Type 1 for concrete not exposed to sunlight, and Type 1-D with white fugitive dye for concrete exposed to sunlight, Class A or B as appropriate for the use or location.

PART 3 - EXECUTION

3.01 CONSTRUCTION

A. CIP-1: Formed Finish for Exposed to Public View Structural Elements.
   1. Formwork: As specified in Section 03 11 00, Concrete Forming, for exposed to view surfaces.
   2. Finishing Operations:
      a. Repair as specified in Section 03 30 00, Cast-In-Place Concrete.
      b. Apply skim coat.
      c. Sponge finish.

B. CIP-2: Unformed Finish for Bridge Walking Surface:
   1. Finish: Trowel and fine broom.
   2. Joints: Tooled with sidewalk jointer.

C. CIP-3: Formed Finish for Bridge Soffit: Glass-like, to receive semi-gloss paint finish.
   1. Formwork: Steel, fiberglass, smooth formliner, or polyethylene-faced plywood.
   2. Finishing operations:
      a. Repair as specified in Section 03 30 00, Cast-In-Place Concrete.
      b. Grind and polish fins, ridges, and protrusions flush with surface and smooth to the touch.

D. Other Formed Surface Finishes: After removing forms, finish each formed surface as noted below.
   1. Specified Finishes: For the surfaces specified below, provide the following surface finishes in conformance with ACI 301.
      a. Sump walls: Smooth form finish
2. Unspecified Finishes: For surfaces not specified above, provide the following surface finishes in conformance with ACI 301.
   a. Concrete surfaces not exposed to public view: Rough-form finish.

E. Finishing Unformed Surfaces

1. Placement:
   a. Place concrete at a rate that allows spreading, straightedging, and darbying or bullfloating before bleed water appears.
   b. Strike smooth the top of walls, buttresses, horizontal offsets, and other similar unformed surfaces and float them to a texture consistent with the finish of adjacent formed surface.

2. Specified Finishes: For the surfaces specified below, provide the following surface finishes in conformance with ACI 301.
   a. Invert Slab: Scratched finish.
   b. Topping Slab: Troweled finish;

3. Unspecified Finishes: for surfaces not specified above, provide the following surface finishes in conformance with ACI 301.
   a. Surfaces to receive bonded cementitious materials and tile: Trowel and fine broom finish.
   b. Walks; drives; steps; ramps; and surfaces intended to receive waterproofing, roofing, insulation, or sand-bed terrazzo: Floated finish.
   c. Interior slabs and flatwork to be exposed in the completed structure and for slabs to receive resilient floor coverings: Troweled finish.

4. Surface Tolerances: Conform to ACI 301 as follows:
   a. Class A Tolerance: Slabs and flatwork with troweled finish including trowel and fine broom finish to receive tile.
      1) Exception: Floors indicated “VERY FLAT FLOOR (SOV FF 50, MLV FF 35)” shall meet flatness tolerance defined by ASTM E 1155.
   b. Class C Tolerance: Slabs and flatwork with scratched finish, with floated finish, and with coarse broom finish.

3.02 FIELD QUALITY CONTROL

A. Finishes:
   1. Conform to applicable requirements of ACI 301.

B. Tolerances:
   1. Formed Surfaces: Conform to the applicable requirements of ACI 301. For parts of the structures not covered by ACI 301, conform to the applicable requirements of ACI 117.
2. Floors designated "VERY FLAT FLOOR (SOV FF 50, MLV FF 35)": Measure floor flatness in accordance with ASTM E 1155. Floor levelness measurements are not required.

3.03 CORRECTIVE MEASURES

A. Remedy for out-of tolerance work:

1. Designated Floor Sections measuring at or above both of the specified Minimum Local F-Numbers (MLV) shall be accepted for tolerance compliance as constructed.

2. Floor Sections measuring below the specified MVL Ff-Number shall be ground and/or re-topped as directed by the Resident Engineer.

   a. For the purposes of this paragraph, a Floor Section shall be any rectangular area of approximately 1500 square feet.

3.04 PROTECTION

A. Protect exposed concrete surfaces as required preventing damage from impact or strains.

END OF SECTION
SECTION 03 37 13
SHOTCRETE

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes specifications for shotcrete as a placing option for concrete in the vent structures.

B. Related Sections: The work of the following Sections is related to the work of this Section. Other Sections not referenced below may also be related to the proper performance of this work.

1. Section 03 05 15, Portland Cement Concrete.
2. Section 01 45 00, Quality Control
3. Section 03 20 00, Concrete Reinforcing

1.02 REFERENCES

A. This Section incorporates by reference the latest revisions of the following documents.

1. American Concrete Institute (ACI)
   a. ACI 214 Recommended Practice for Evaluation of Compression Test Results of Field Concrete.
   b. ACI 506R Guide to Shotcrete
   c. ACI 506.2 Specification for Materials, Proportioning, and Application of Shotcrete
   d. ACI 506.4R Evaluation of In-Place Shotcrete
   e. ACI CP-60 Certification of Shotcrete Nozzle Operator

   a. ASTM C39 Test Method for Compressive Strength of Cylindrical Concrete Specimens
   b. ASTM C42 Test Methods for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete
   c. ASTM C94 Specification for Ready-Mixed Concrete
   d. ASTM C1074 Standard Practice for Estimating Concrete Strength by the Maturity Method
   e. ASTM C1141 Standard Specification for Admixtures for Shotcrete
f. ASTM E329 Standard Specifications for Agencies Engaged in Construction Inspection and/or Testing

1.03 DEFINITIONS

A. The words and terms used in this Section conform to ACI 116 R.

1.04 SUBMITTALS

A. Procedures: Section 01 33 00, Submittal Procedures.

B. Concrete Mix Designs: Section 03 05 15, Portland Cement Concrete.

C. Material Data: Section 03 05 15, Portland Cement Concrete

D. Admixtures: Section 03 05 15, Portland Cement Concrete

E. Construction Work Plan

F. Project References: Include project name, owner’s name, and description of at least three comparable projects within the last year.

G. Sample Panel: Submit sample shotcrete panel 1 foot wide by 1 foot wide by 1 inch thick representing the formed and unformed finishes to be achieved in the field.

H. Qualifications: Submit qualifications for the following:
   1. Independent Testing Laboratory
   2. Concrete supplier
   3. Shotcrete application crew

I. Source Quality Control test reports

J. Field Quality Control test reports

1.05 QUALITY ASSURANCE

A. Construction Work Plan: Prepare a Construction Work Plan in conformance with Section 01 45 00, Quality Control. Describe methods, materials, labor, and equipment used to:
   1. Batch, mix, and convey shotcrete materials
   2. Place shotcrete
   3. Control and verify unformed face alignment and location
   4. Control and verify shotcrete layer thickness
   5. Control and verify shotcrete soundness
   6. Cure and protect shotcrete
   7. Conduct Work in hot and cold weather
   8. Test concrete strength during construction
9. Control and dispose of waste materials, including excess shotcrete, rebound and overspray

B. Concrete Supplier: Section 03 05 15, Portland Cement Concrete

C. Shotcrete Application Crew
   1. Supervisor: Not less than two years experience as a nozzle operator and certified in conformance with ACI A506.3R.
   2. Nozzle Operator: Not less than one year experience as a nozzle operator and certified in conformance with ACI A506.3R.

D. Independent Testing Laboratory: Section 03 30 00, Cast-In-Place Concrete

1.06 STORAGE, AND HANDLING
   A. Cementitious Materials: Section 03 05 15, Portland Cement Concrete
   B. Aggregates: Section 03 05 15, Portland Cement Concrete
   C. Admixtures: Section 03 05 15, Portland Cement Concrete
   D. Water: Section 03 05 15, Portland Cement Concrete

PART 2 - PRODUCTS

2.01 MATERIALS
   A. Portland Cement: Section 03 05 15, Portland Cement Concrete.
   B. Aggregates: Section 03 05 15, Portland Cement Concrete. The gradation and maximum size of aggregate may be varied subject to the Resident Engineer’s approval and the requirements of the approved design.
   C. Water: Section 03 05 15, Portland Cement Concrete
   D. Admixtures: Section 03 05 15, Portland Cement Concrete, and ASTM C1141. Do not use hydration control admixtures that can decrease shotcrete strength with age.
   E. Reinforcement: Section 03 05 15, Portland Cement Concrete

2.02 MIX DESIGNS
   A. Furnish shotcrete mix designs in conformance with Section 03 05 15, Portland Cement Concrete

2.03 DELIVERY EQUIPMENT
   A. Conform to the recommendations of ACI 506R

2.04 SOURCE QUALITY CONTROL
   A. Preconstruction Testing
      1. Prepare test panels for examination by the Resident Engineer prior to execution.
2. Produce test panels for each proposed mix design, each anticipated shooting orientation, and each proposed nozzle operator. In half of the test panels, provide reinforcement of the same size and spacing required for the Work. Obtain six specimens from each panel; three nonreinforced specimens and three reinforced specimens.

3. Test the nonreinforced specimens for compliance with compressive strength requirements in accordance with ASTM C42.

4. Visually grade the reinforced specimens for compliance with specified core grade requirements in conformance with ACI 506.2.

5. Test admixtures for compatibility with cement in conformance with ASTM C1141.

6. Only nozzle operators with a test panel mean core grade less than or equal to 2.5 will be allowed to place shotcrete in the Work. If a prequalification test panel is rejected, a second panel may be placed. If a nozzle operator’s second mean core grade is greater than 2.5, the nozzle operator will not be allowed to place shotcrete in the Work.

PART 3 - EXECUTION

3.01 MEASURING, BATCHING, AND MIXING
   A. Batch materials by weight.
   B. Machine-mix materials and deliver to the site pre-mixed. For wet-mix shotcrete, conform to ASTM C94.
   C. Batching and mixing
      1. Mix weight batching in compliance with the accuracy specified in ASTM C94.
      2. Shoot dry-mix shotcrete material within 45 minutes after batching or pre-dampening.
      3. Shoot wet-mix shotcrete material within 90 minutes after batching.
      4. Dosing of admixture by hand is not permitted.

3.02 PREPARATION
   A. Notification of Resident Engineer: Section 03 30 00, Cast-In-Place Concrete
   B. Verification of Preparation: Section 03 30 00, Cast-In-Place Concrete
   C. Weather Considerations:
      1. Hot Weather: Section 03 30 00, Cast-In-Place Concrete.
      2. Cold Weather: Section 03 30 00, Cast-In-Place Concrete, except do not place shotcrete during cold weather.
      3. Do not place shotcrete during rain or windy weather.
   D. Obtain acceptance of preparation from the Resident Engineer prior to placement.
3.03 PREPARATION
A. General: Clean surfaces to receive shotcrete of soil, grease, loose materials, mud and other foreign matter by using a combination of water and high velocity air jet, or other approved methods. Dampen surface immediately prior to shooting.
B. Concrete and Shotcrete: Remove all deteriorated and unsound material that may inhibit bonding.
C. Water Control: Securely fix drainage pipes, panning, channels or similar prior and during temporary shotcreting, as required.
D. Arrange placing equipment so that the nozzle operator may use air and water in all combinations to prepare surfaces for shotcreting or to clean the completed work.
E. Provide a separate air hose and blow pipe, capable of simultaneous operation with shotcreting operation, for removal of rebound and dust

3.04 PLACEMENT
A. Conform to the recommendations of ACI 506R.
B. Place shotcrete to completely encase reinforcing steel. Encase reinforcement by shooting with sufficient velocity and plasticity so material flows around and behind the reinforcement.
C. Use pins, wire, score holes, or other means to confirm shotcrete thickness required is achieved.
D. Add accelerators either at the nozzle or in the mix. Dispense admixtures by calibrated means at dosage rates not exceeding those in the approved design mix.
E. Monitor air ring at nozzle for signs of blockage of individual air holes. Stop application and clean air ring if non-uniform discharge of shotcrete becomes apparent.
F. Do not reuse rebound shotcrete or incorporate into the work.
G. Do not apply shotcrete on surfaces with standing water or running water.
H. Remove hardened overspray and rebound from adjacent surfaces, including exposed reinforcement.
I. Clean shotcrete delivery equipment thoroughly at the end of each shift. Regularly inspect and clean air ring and nozzle; replace if required.

3.05 FINISHING
A. Finish shotcrete in conformance with Section 03 30 00, Cast-In-Place Concrete.

3.06 CURING AND PROTECTING
A. Cure and protect shotcrete in conformance with Section 03 30 00, Cast-In-Place Concrete.

3.07 REPAIR OF SURFACE DEFECTS
A. Repair surface defects in shotcrete in conformance with Section 03 30 00, Cast-In-Place Concrete.
3.08 FIELD QUALITY CONTROL

A. Visual Inspection
   1. Visually inspect each shotcrete layer during and after application.

B. Sounding
   1. Inspect set shotcrete after set by sounding with a hammer. The Resident
      Engineer may consider hollow-sounding concrete defective and require further
      examination.

C. Construction Testing
   1. Obtain construction test specimens from site-placed test panels in conformance
      with ASTM C1140.
   2. For each mix design and each nozzle operator, prepare separate test panels for
      each work day or every 50 cubic yards placed, whichever is less.
   3. Obtain at least five test specimens from each test panel.
   4. Test two specimens at seven days and 28 days after application. Save the
      remaining specimen for testing at 56 days should additional testing be
      necessary.
   5. Test specimens in conformance with ASTM C42.

D. If concrete strength is not considered acceptable, the Resident Engineer may require
   tests of cores drilled for determination of in-place strength in conformance with Section
   03 30 00 Cast-In-Place Concrete.

E. Repair or replace low-strength concrete as directed by the Resident Engineer.

END OF SECTION
SECTION 03 45 00
PRECAST ARCHITECTURAL CONCRETE

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Delegated engineering design of precast architectural concrete work.
   2. Architectural precast concrete wall panels (PC-1).
   3. Precast concrete stair treads for Stair 1, Stair 2, Stair 3 and Stair 6 (PC-2).
      a. Two-piece metal nosing with abrasive inserts in each tread and at top landing.
   4. Supports, anchors, attachments, and other items cast into precast concrete units.
   5. Grouting under and between units.

B. Related Sections: The work of the following Sections is related to the work of this Section. Other Sections, not referenced below, may also be related to the proper performance of this work.
   1. Section 03 20 00, Concrete Reinforcing.
   2. Section 07 92 00, Joint Sealants.
   3. Section 09 90 00, Painting and Coating: Concrete stain.
   4. Section 09 96 23, Graffiti- and Water-Resistant Coatings: Sealer for stair treads.

1.02 REFERENCES

A. This Section incorporates by reference the latest revisions of the following documents.

B. American Concrete Institute (ACI)
   1. ACI 301 - Specifications for Structural Concrete for Buildings; American Concrete Institute International
   2. ACI 318 - Building Code Requirements for Structural Concrete and Commentary; American Concrete Institute International.

C. American Society for Testing and Materials International (ASTM)


D. American Welding Society (AWS)

1. AWS D1.1/D1.1M - Structural Welding Code - Steel.

2. AWS D1.4/D1.4M - Structural Welding Code - Reinforcing Steel.

E. Precast/Prestressed Concrete Institute (PCI)

1. PCI MNL-117 - Manual for Quality Control for Plants and Production of Architectural Precast Concrete Products.

2. PCI MNL-120 - PCI Design Handbook - Precast and Prestressed Concrete

3. PCI MNL-122 - Architectural Precast Concrete.

4. PCI MNL-123 - Design and Typical Details of Connections for Precast and Prestressed Concrete.

5. PCI MNL-135 - Tolerance Manual for Precast and Prestressed Concrete Construction.

1.03 DESIGN REQUIREMENTS

A. Design units to withstand design loads and erection forces. Calculate structural properties of units in accordance with ACI 318.

B. Design units to withstand static loads and anticipated dynamic loading, including positive and negative wind loads and thermal movement loads.

C. Design and size components to withstand seismic loads and sway displacement as calculated in accordance with code.

D. Design units to accommodate construction tolerances, deflection of building structural members, and clearances of intended openings.

1.04 SUBMITTALS

A. See Section 01 33 00, Submittal Procedures, for submittal procedures.

B. Product Data: Manufacturer’s information on accessory products, including pigments, admixtures, inserts and plates.
C. Shop Drawings: Indicate layout, dimensions, and cross sections, unit locations, configuration, unit identification marks, reinforcement, connection details, support items, location of lifting devices, dimensions, openings, and relationship to adjacent materials. Provide erection drawings.

1. Include details of mix designs.
2. Include structural design calculations.
3. Include sequencing of erection, procedures, tolerances, and other items necessary for fabrication.
4. Show welded connections using AWS standard symbols.

D. Provide details of all connections, joints, accessories, cast inserts, and openings.

E. Provide complete design calculations, including loads imposed on structure, prepared by a qualified professional engineer.

F. Samples:
1. Submit two concrete cast samples, 12 by 12 inches in size, illustrating surface finish and texture.
2. Submit 6-inch long samples of each type and finish of abrasive metal nosing.

G. Fabricator qualifications.

H. Maintenance Data: Indicate surface cleaning instructions.

1.05 QUALITY ASSURANCE

A. Perform the work of this Section in accordance with PCI MNL-117, PCI MNL-120, PCI MNL-122, PCI MNL-123, PCI MNL-135, ACI 318, and CRSI Manual of Standard Practice. Perform welding in accordance with AWS D1.1.

1. Maintain one copy of each document on site.

B. Fabricator Qualifications:
1. Firm having at least two years of documented experience in production of precast concrete of the type required.
2. Plant certified under Precast/Prestressed Concrete Institute Plant Certification Program; product group and category A1 - Architectural Precast Concrete.


D. Welder: Certified within previous 12 months in accordance with AWS D1.1 and AWS D1.4.

1.06 MOCK-UP

A. Provide full size mock-up of each type of unit specified in this Section, with lifting device, and attachment points, and finish in accordance with approved sample.
B. Mock-up may remain as part of the Work, if approved.

1.07 PRE-INSTALLATION MEETING
A. Convene one week prior to commencing work of this Section.

1.08 PROJECT CONDITIONS
A. Field Measurements: Check actual locations of walls, slabs, framing, and other construction to which work of this Section must fit, by accurate field measurements before fabrication; show recorded measurements on final shop drawings. Coordinate fabrication, delivery and installation schedule with construction progress to avoid delay of work.

1. Where field measurements cannot be made without delaying the Work, guarantee dimensions and proceed with fabrication of products without field measurements. Coordinate construction with work of other trades to ensure that actual dimensions correspond to guaranteed dimensions. Allow for fitting and trimming.

1.09 DELIVERY, STORAGE, AND PROTECTION
A. Deliver precast units to project site in such quantities and at such times to ensure continuity of installation.
B. Handling: Lift and support precast units only from designated support points.
C. Blocking and Lateral Support During Transport and Storage: Use materials that are clean, non-staining, and non-harmful to exposed surfaces. Provide temporary lateral support to prevent bowing and warping, and cracking.
D. Protect units to prevent staining, chipping, or spalling of concrete.
E. Mark units with date of production in location that will be concealed after installation.

PART 2 - PRODUCTS

2.01 MANUFACTURERS
A. Architectural Precast Concrete:

1. Any manufacturer holding a PCI Group A Plant Certification for the types of products specified; see www pci org.

2. Substitutions: See Section 01 60 00, Product Requirements.

B. Metal Nosings:

1. American Safety Tread Co., Inc.
3. Balco, Inc.
2.02 FORMWORK
A. Provide forms and, where required, form-facing materials of metal, plastic, wood, or other acceptable material that is nonreactive with concrete and will produce required finish surfaces.
B. Unless forms for plant-manufactured prestressed concrete units are stripped prior to detensioning, design forms so that stresses are not induced in precast units due to deformation of concrete under prestress or to movement during detensioning.

2.03 REINFORCEMENT
A. Comply with requirements of Section 03 20 00, Concrete Reinforcing.

2.04 PRESTRESSING TENDONS
A. Uncoated, 7-wire stress-relieved strand complying with ASTM A 416. Use Grade 250 unless noted otherwise.

2.05 CONCRETE MATERIALS
A. Cement: ASTM C 150, Type II, Low-Alkali or Type III High Early Strength. Portland type.
C. Surface Finish Aggregate: Clean, washed natural gravel; size as approved, color as approved, from single source throughout conforming to ASTM C 33.
D. Water: Clean and not detrimental to concrete.
E. Admixtures: Air entrainment as specified in Section 03 30 00, Cast-in-Place Concrete.
F. Water reducing, retarding, or accelerating agents: ASTM C 494, type as selected by fabricator, not containing more than 0.1 percent chloride ions.
G. Grout:
   1. Non-shrink, non-metallic, non-corrosive, non-staining, minimum 10,000 psi, 28 day strength, when tested in accordance with CRD C-621, colored to match precast units.

2.06 FORM LINERS
A. Form Liners: Units of face design, texture, arrangement, and configuration indicated. Furnish with manufacturer's recommended liquid-release agent that will not bond with, stain, or adversely affect precast concrete surfaces and will not impair subsequent surface or joint treatments of precast concrete.
   1. Profile: Custom; fluted rib. Ribs 1-3/16 inches on centers, 1/4 inch wide at peak and 1/2 inch wide at base.

2.07 SUPPORT DEVICES
A. Connecting and Support Devices: ASTM A 36/A 36M steel; hot-dip galvanized in accordance with ASTM A153/A 153M or Stainless Steel AISI Type 302/304.
B. Bolts, Nuts, and Washers: ASTM A 325 (A 325M) heavy hex structural bolts, Type 1, plain, with matching ASTM A 563 (A 563M) nuts, and washers as follows:

2. Compressible Direct Tension Indicators: ASTM F 959, Type 325.

C. Primer: Zinc rich type.

2.08 ACCESSORIES

A. Bearing Pads: One of the following types, as recommended by precast fabricator for application:

1. Elastomeric Pads: AASHTO M 251, plain, vulcanized, 100 percent polychloroprene (neoprene) elastomer, molded to size or cut from a molded sheet, Type A durometer hardness of 50 to 70, ASTM D 2240, minimum tensile strength 2250 psi, ASTM D 412.

2. Random-Oriented, Fiber-Reinforced Elastomeric Pads: Preformed, randomly oriented synthetic fibers set in elastomer. Type A durometer hardness of 70 to 90, ASTM D 2240; capable of supporting a compressive stress of 3000 psi with no cracking, splitting, or delaminating in the internal portions of pad. Test one specimen for every 200 pads used in Project.

3. Cotton-Duck-Fabric-Reinforced Elastomeric Pads: Preformed, horizontally layered cotton-duck fabric bonded to an elastomer; Type A durometer hardness of 80 to 100, ASTM D 2240; complying with AASHTO’s “AASHTO Load and Resistance Factor Design (LRFD) Bridge Design Specifications, Division II, Section 18.10.2, or with MIL-C-882E.

4. Frictionless Pads: Tetrafluoroethylene (Teflon), glass-fiber reinforced, bonded to stainless or mild-steel plate, of type required for in-service stress.


B. Shims for Tread/Riser Units: High density plastic concrete grey color.

C. Sealant: Type specified in Section 07 92 00, Joint Sealers.

2.09 MIX

A. Prepare design mixtures for each type of precast concrete required.

B. Design mixtures may be prepared by a qualified Independent Testing Laboratory or by qualified precast plant personnel at architectural precast concrete fabricator’s option.

C. Limit water-soluble chloride ions to maximum percentage by weight of cement permitted by ACI 318 or PCI MNL 117 when tested according to ASTM C 1218/C 1218M.

D. Normal-Weight Concrete Mixtures: Proportion full-depth mixture by either laboratory trial batch or field test data methods according to ACI 211.1, with materials to be used on Project, to provide normal-weight concrete with the following properties:

1. Compressive Strength (28 days): 5000 psi minimum.

2. Maximum Water-Cementitious Materials Ratio: 0.45.

E. Water Absorption: 6 percent by weight or 14 percent by volume, tested according to PCI MNL 117.
F. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having an air content complying with PCI MNL 117.

G. When included in design mixtures, add other admixtures to concrete mixtures according to manufacturer's written instructions.

2.10 METAL NOSINGS

A. Extruded Units: Aluminum, with abrasive filler consisting of aluminum oxide, silicon carbide, or a combination of both, in an epoxy-resin binder. Fabricate units in lengths necessary to accurately fit openings or conditions.

1. Provide ribbed units, with abrasive filler strips projecting 1/16 inch (1.5 mm) above aluminum extrusion.

2. Nosings: Two-piece units, 3 inches wide, with subchannel for casting into concrete steps.

3. Aluminum finish: Mill.

4. Abrasive color: Black.

B. Provide anchors for embedding units in concrete, either integral or applied to units, as standard with manufacturer.

C. Apply clear lacquer to concealed surfaces of extruded units.

2.11 FABRICATION

A. Fabricate in conformance with PCI MNL-117 and PCI MNL-135.

B. Forms: Accurately construct forms mortar tight and of sufficient strength to withstand pressures due to concrete placing operations, temperature changes, and, when prestressed, pretensioning and detensioning operations. Maintain form work to provide completed precast concrete units of shapes, lines, and dimensions indicated, within specified fabrication tolerances.

C. Use rigid molds, constructed to maintain precast unit uniform in shape, size, and finish.

D. Use form liners in accordance with manufacturer's instructions.

E. Fabricate connecting devices, plates, angles, items fit to steel framing members, inserts, bolts, and accessories. Fabricate to permit initial placement and final attachment.

F. Embed reinforcing steel, anchors, inserts plates, angles, and other cast-in items required for securing units to supporting and adjacent members.

G. Embed receivers for nosings of stair tread units.

H. Locate hoisting devices to permit removal after erection.

I. Cure units to develop concrete quality, and to minimize appearance blemishes such as non-uniformity, staining, or surface cracking.

J. Fabricate units straight, smooth, and true to size and shape, with exposed edges and corners precise and square unless otherwise indicated.
K. Cast-in items:
   1. Provide reglets, slots, holes, and other accessories in units to receive windows,
      cramps, dowels, reglets, waterstops, flashings, and other similar work as
      indicated.

L. Minor patching in plant is acceptable, providing structural adequacy and appearance of
   units is not impaired.

2.12 FINISH - PRECAST UNITS

A. Panel faces shall be free of joint marks, grain, and other obvious defects. Corners,
   including false joints shall be uniform, straight, and sharp. Finish exposed-face surfaces
   of architectural precast concrete units to match approved sample panels and as follows:
   
   1. As-Cast Surface Finish: Provide surfaces free of pockets, sand streaks, and
      honeycombs. Use light abrasive blast to remove surface sheen without exposing
      course aggregate.

B. Precast Stair Units: Finish tread surface with trowel and medium broom finish. Finish
   exposed riser with smooth form finish or trowel finish.

C. Finish other exposed surfaces of architectural precast concrete units by smooth, steel-
   trowel finish.

D. Finish unexposed surfaces of architectural precast concrete units by float finish.

2.13 FABRICATION TOLERANCES

A. Conform to PCI MNL-117 and PCI MNL-135, except as specifically amended below.
   
   1. 10 feet or less: plus or minus 1/8 inch.
   2. 10 to 20 feet: plus 1/8 inch, minus 3/16 inch.
   3. Angular deviation of plane of side mold: 1/32 inch per 3 inches depth, or
      1/16 inch total.
   4. Openings: plus or minus 1/8 inch.
   5. Out of square: 1/8 inch per 6 feet.
   6. Thickness: Minus 1/8 inch, Plus 1/4 inch.
   7. Other dimensions: 1/16 inch.
   9. Maximum Variation from Square or Designated Skew: Plus or minus 1/8 inch in
      10 feet.
   10. Maximum Variation from Thickness: Plus or minus 1/8 in.
   11. Maximum Misalignment of Anchors, Inserts, Openings: Plus or minus 1/8 inch.
   12. Maximum Bowing of Members: Plus or minus length/360.
2.14 SOURCE QUALITY CONTROL AND TESTS

A. Concrete Sampling and Testing:

1. Sampling Method: Take representative samples in compliance with ATSM C172. Collect samples from different batches of concrete on a random basis. Place no more than 1/2 cubic yard before slump, temperature, and air content tests demonstrate concrete is within acceptable limits.

2. Sampling Frequency:
   a. Obtain at least one composite sample for each 100 cubic yards, or fraction thereof, of each concrete mixture placed in any one day.

3. Tests Per Sample: Perform the following tests on each sample:
   a. Slump: ASTM C143.
   b. Air content: ASTM C231.
   d. Compressive Strength:
      1) Make a minimum of three specimens from each sample. When additional sets of specimens are required beyond the normal seven and 28-day tests, include a minimum of two specimens in each set.
      2) Make and cure specimens in compliance with ASTM C31. Record all deviations from the ASTM requirements in the test report.
      3) Test specimens in compliance with ASTM C39. From each set of specimens cast, test one specimen at 7 days for information and two specimens at 28 days for acceptance, unless otherwise specified.

B. Evaluation and Acceptance of Tests:

1. Acceptance of Concrete:
   a. Compressive strength tests will be considered acceptable if the averages of all specimens of three consecutive strength test results are equal to or exceed the specified 28-day compressive strength, and no individual strength test result is more than 300 pounds per square inch below the specified 28-day compressive strength.
   b. If one specimen in a sample shows evidence of improper sampling, molding, or testing, discard the specimen and consider the strength of the remaining cylinder to be the test result.
   c. If both specimens in a sample show evidence of improper sampling, molding, or testing discard both specimens. Determine acceptance of concrete using test cores. The Resident Engineer may waive this requirement for large pours.
PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that building structure, anchors, devices, and openings are ready to receive work of this Section.

3.02 PREPARATION

A. Provide for erection procedures and induced loads during erection. Maintain temporary bracing in place until final support is provided.

3.03 ERECTION

A. Deliver anchorage items to be embedded in other construction before start of such work. Provide setting diagrams.

B. Erect units without damage to shape or finish. Replace or repair damaged panels.

C. Erect units level, plumb, and in alignment within allowable tolerances specified below. Provide temporary supports and bracing as required to maintain position, stability, and alignment as members are being permanently connected.

D. Align and maintain uniform horizontal and vertical joints as erection progresses.

E. When units require adjustment beyond design or tolerance criteria, discontinue affected work; advise Resident Engineer.

F. Fasten units in place with mechanical connections, or weld, as indicated in shop drawings. At welded connections, chip of slag, and touch up with primer.

G. Set vertical units dry, without grout, attaining joint dimension with lead or plastic spacers. Pack grout between units, tool with standard masonry grout.


I. Exposed Joint Dimension: 1/2 inch.

J. Seal perimeter and intermediate joints in accordance with Section 07 92 00, Joint Sealants.

3.04 ERECTION TOLERANCES

A. Erect members level and plumb within allowable tolerances. Conform to PCI MNL-135, except as specifically amended below.

1. Bowing: not to exceed 1/360, with a maximum of 3/4 inch over 30 feet.

2. Warpage: not to exceed 1/16 inch per foot. 1/8 inch maximum.

3. Joint widths: plus or minus 3/16 inch total. 1/40 inch per foot taper,


5. Edge alignment: 1/8 inch.
6. Plumb: Plus or minus 1/4 inch in 40 feet.
7. Level: Plus or minus 1/4 inch in 40 feet.
10. Maximum Plumb Variation Over Height of Structure or 100 ft (whichever is less): Plus or minus 1/2 inch.

3.05 ADJUSTING
A. Adjust units so that joint dimensions are within tolerances.

3.06 REPAIRS
A. Repair architectural precast concrete units if permitted by Resident Engineer. The Resident Engineer reserves the right to reject repaired units that do not comply with requirements.
B. Mix patching materials and repair units so cured patches blend with color, texture, and uniformity of adjacent exposed surfaces and show no apparent line of demarcation between original and repaired work, when viewed in typical daylight illumination from a distance of 20 feet.
C. Wire brush, clean, and paint damaged prime-painted components with same type of shop primer.
D. Remove and replace damaged architectural precast concrete units when repairs do not comply with requirements.

3.07 CLEANING
A. Clean surfaces of precast concrete units exposed to view.
B. Clean mortar, plaster, fireproofing, weld slag, and other deleterious material from concrete surfaces and adjacent materials immediately.
C. Clean exposed surfaces of precast concrete units after erection and completion of joint treatment to remove weld marks, other markings, dirt, and stains.
   1. Perform cleaning procedures, if necessary, according to precast concrete fabricator’s recommendations. Clean soiled precast concrete surfaces with detergent and water, using stiff fiber brushes and sponges, and rinse with clean water. Protect other work from staining or damage due to cleaning operations.
   2. Do not use cleaning materials or processes that could change the appearance of exposed concrete finishes or damage adjacent materials.
3.08 PROTECTION OF FINISHED WORK

A. Provide non-combustible shields during welding operations.

END OF SECTION
PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes specifications for providing nonshrink grouts as follows:

1. Furnishing, mixing, and placing nonshrink, nonmetallic, noncorrosive cementitious grout for structural columns, base plates, and equipment bases as indicated.

2. Furnishing, mixing, and placing nonshrink, nonmetallic, noncorrosive epoxy grout for equipment bases subject to impact, vibration, or chemical attack.

B. Related Sections: The work of the following Sections is related to the work of this Section. Other Sections, not referenced below, may also be related to the proper performance of this work.

1. Section 03 05 15, Portland Cement Concrete.

2. Section 03 30 00, Cast-In-Place Concrete.

3. Section 03 35 00, Concrete Finishing.

1.02 REFERENCES

A. This Section incorporates by reference the latest revisions of the following documents.

1. American Concrete Institute (ACI):
   a. ACI 503.2 Specification for Bonding Plastic Concrete to Hardened Concrete with a Multi-Component Epoxy Adhesive

   b. ASTM C157 Test Method for Length Change of Hardened Hydraulic Cement Mortar and Concrete
   c. ASTM C579 Standard Test Method for Compressive Strength of Chemical-Resistant Mortars, Grouts, Monolithic Surfacings, and Polymer Concretes
   d. ASTM C827 Test Method for Change in Height at Early Ages of Cylindrical Specimens from Cementitious Mixtures
   e. ASTM C881 Specification for Epoxy-Resin-Base Bonding Systems for Concrete
   f. ASTM C1090 Test Method for Measuring Changes in Height of Cylindrical Specimens from Hydraulic-Cement Grout
g. ASTM C1107 Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrinkable)

3. United States Army Corps of Engineers:
   a. CRD-C620 Standard Method of Sampling Fresh Grout
   b. CRD-C621 Corps of Engineers Specification for Nonshrink Grout

1.03 DEFINITIONS:

A. Nonshrink grout: A mortar or grout that does not shrink in the plastic state, is dimensionally stable in the hardened state, and bonds permanently to a clean baseplate and concrete substrate.

1.04 SUBMITTALS

A. Procedures: Section 01 33 00, Submittal Procedures.

B. Product Data: Submit manufacturer's product data and installation instructions.

C. Certification: Submit certificates of compliance or laboratory test reports that indicate the following:

1. Materials used in the grout are free from metallic components and corrosion-producing elements.

2. Materials meet specified shrinkage and compressive strength requirements.

1.05 PROJECT CONDITIONS:

A. Handle grout the same as concrete with regard to temperature and curing, as specified in Section 03 30 00, Cast-In-Place Concrete, Section 03 05 15, Portland Cement Concrete, and Section 03 35 00, Concrete Finishing.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Cementitious Grout: Provide nonshrink, nonmetallic, noncorrosive cement-based grout conforming to the following requirements:


2. Manufactured specifically for use in supporting heavy loads (loads in excess of 300 pounds per square foot (psf) concentrated load or 100 psf uniform load). Grout: ASTM C1107, Grade A, B, or C, as appropriate for the condition or circumstance.

3. Shrinkage at 28 days: none (0.00 shrinkage when tested in accordance with ASTM C827).

4. Compressive strength, minimum:
   a. At 1 day: 1000 pounds per square inch (psi)
   b. At 3 days: 2500 psi
c. At 7 days: 3500 psi  
d. At 28 days: 5000 psi  

5. Initial setting time, after addition of water: approximately one hour at 70 degrees F.  
6. Provide nonsag trowelability or flowability as necessary for the particular application.  

B. Water: Clean and potable, free of impurities detrimental to grout.  

C. Epoxy Grout: Provide nonshrink, nonmetallic, noncorrosive epoxy grout conforming to the following requirements:  
1. Manufactured specifically for use in supporting heavy loads.  
2. Shrinkage at 28 days: None (0.00 shrinkage when tested in accordance with ASTM C827 modified procedure) with a minimum effective bearing area (EBA) of 95 percent.  
3. Compressive strength, minimum: 10,000 psi at seven days.  
4. Initial setting time: Approximately one hour at 70 degrees F.  
5. Provide flowable consistency as necessary for the particular application.  
6. Epoxy grouts, which are volatile and which give off noxious fumes, are not acceptable.  

D. Epoxy Adhesive: ASTM C881, Type V, epoxy-based bonding agent.  

2.02 SOURCE QUALITY CONTROL  

A. Inspections and Tests: Perform visual inspections, and shrinkage tests using an approved Independent Test Laboratory, and strength tests as necessary to verify performance requirements of grout. Sample and test grout in conformance with applicable ASTM or CRD requirements.  

B. Shrinkage Tests:  
1. Cementitious Grout: Meets the following performance requirements:  
   a. Expansion: 0.4 percent maximum at 3, 14, and 28 days. No displacement when tested in accordance with ASTM C157.  
   b. Shrinkage: None (0.00 shrinkage at 28 days when tested in accordance with ASTM C827 and ASTM C1090). No vertical volume shrinkage of grout in the plastic or hardened stage at any time.  
2. Epoxy Grout: Meet the following performance requirements for grout:  
   a. Expansion: No displacement when tested in accordance with ASTM C827 and ASTM C157, modified procedures.  
   b. Shrinkage: None (0.00 shrinkage when tested in accordance with ASTM C827, modified procedure; specific gravity of indicator ball will be changed to approximately 1.0).  
   c. Effective Bearing Area (EBA): 95 percent minimum coverage of the tested base plate.
PART 3 - EXECUTION

3.01 PREPARATION

A. Prepare concrete surfaces to receive grout by chipping, sandblasting, water blasting, or other accepted methods to remove defective concrete, laitance, dirt, oil, grease, and other foreign matter to achieve sound, clean, and roughened concrete surfaces.

B. Cover concrete areas with protective waterproof covering until ready to place grout.

C. Remove foreign matter from steel surfaces to be in contact with grout. Clean contact steel surfaces as necessary by wire brushing and wiping dust clean.

D. Align and level components to be grouted, and maintain in final position until grout placement is complete and accepted.

E. Install forms for grout about the columns and other spaces to be grouted.

F. Remove protective waterproof covering and clean contaminated surfaces immediately before grouting.

G. Provide air-relief holes in large baseplates and in baseplates where underneath obstructions may cause air entrapment.

H. Saturate concrete surfaces with clean water, and remove excess water immediately before grouting.

I. Where necessary or appropriate for better bond, epoxy adhesive may be applied to clean, dry substrate surfaces in accordance with applicable requirements of ACI 503.2.

3.02 CONSTRUCTION

A. Mixing

1. Mix grout ingredients in accordance with the respective manufacturer’s instructions and recommendations. Mix grout materials in proper mechanical mixers.

2. Mix grout as close to work area as possible.

B. Installation

1. Place grout in accordance with the manufacturer’s published instructions. Pour grout from one side only until grout rises at least 1 inch above the plate on opposite side of said plate. Strapping and plunging or other recommended method may be used to force grout to flow under the entire area.

2. Neatly trowel edges of grout base, tapered at an angle of 60 degrees when measured from the horizontal, or as indicated.

3. Do not remove leveling shims for at least 48 hours after grout has been placed.

4. After shims have been removed, if used, fill voids with grout, packing the material with a suitable tool.

5. Do not use grout that has begun to set or if more than one hour has elapsed after initial mixing.

C. CURING
1. Cure cementitious grout the same as specified for concrete in Section 03 35 00, Concrete Finishing.

2. Cure epoxy grout as recommended by the grout manufacturer.

END OF SECTION
SECTION 03 64 23
EPOXY INJECTION GROUTING

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes specifications for repair of cracks in the existing slurry diaphragm wall concrete by pressure injection of an epoxy resin adhesive. Identify cracks to be epoxy-injected in while the dewatering system is operational, but no less than 28 days after the concrete is cast and cured.

1.02 REFERENCES

A. This Section incorporates by reference the latest revisions of the following documents.

1. American Society for Testing and Materials International (ASTM)
   e. Brookfield Engineering

1.03 SUBMITTALS

A. Procedures: Section 01 33 00, Submittal Procedures.

B. Product Data: Submit manufacturer’s specifications and installation instructions for each item of proprietary material used to show compliance with these Specifications.

C. Data on proposed injection equipment.

1.04 QUALITY ASSURANCE

A. Applicator’s Qualifications: Ensure epoxy injection is performed by a manufacturer certified applicator. Submit applicator’s qualifications to the Resident Engineer at least 2 weeks before commencing of epoxy injection work.

B. Workers’ Qualifications: Ensure workers engaged in the epoxy injection process have satisfactorily completed a program of instruction in the methods of restoring concrete structures utilizing the specific epoxy injection process indicated or submit evidence of sufficient work experience in utilizing the process. Submit qualifications of workers to the Resident Engineer for review two weeks before starting work.
1.05 DELIVERY STORAGE AND HANDLING

A. Store and handle manufactured materials in conformance with manufacturer’s published directions.

B. Provide and maintain one set of current Material Safety Data Sheets (MSDS) for each material being used on-site. Comply with MSDS requirements.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Epoxy Adhesive: Two-component, low viscosity, moisture insensitive, structural epoxy adhesive capable of restoring the structural integrity of concrete by bonding the cracks. Provide hydrophilic resin formulations with variable viscosity to allow for full depth penetration in cracks having a width of 6 mils or greater.

B. Characteristic Test Method Min. Performance

<table>
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<tr>
<th>Characteristic</th>
<th>Test Method</th>
<th>Min. Performance</th>
</tr>
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<tbody>
<tr>
<td>Minimum Tensile Strength</td>
<td>ASTM D638</td>
<td>6,000 pounds per square inch (psi)</td>
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<td>Elongation at Break</td>
<td>ASTM D638</td>
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<tr>
<td>Compressive Strength</td>
<td>ASTM D695</td>
<td>12,000 psi</td>
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<tr>
<td>Minimum Flexural Strength</td>
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<td>5,200 psi</td>
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<tr>
<td>Heat Deflection Temperature</td>
<td>ASTM D648</td>
<td>120 degrees F</td>
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<tr>
<td>Maximum Viscosity at 77 degrees F</td>
<td>Brookfield</td>
<td>700 cps</td>
</tr>
</tbody>
</table>

C. Surface Seal:
1. Material used to confine the epoxy adhesive in the cracks during injection and cure.
2. Has adequate strength to hold injection fittings firmly in place and to resist injection pressures adequately to prevent leakage during injection.

2.02 EQUIPMENT

A. Equipment used to meter and mix the two injection adhesive components, and inject the mixed adhesive into the cracks:

1. Portable positive displacement-type pumps with interlock to provide positive ratio control of exact proportions of the two components at the nozzle.
2. Electric or air-powered,
3. Provide in-line metering and mixing.
4. Discharge Pressure:
   a. Automatic pressure control
   b. Capable of discharging the mixed adhesive at any preset pressure up to 200 psi
   c. Equipped with a manual pressure control override.
5. Ratio Tolerance:
   a. Capability to maintain the volume ratio for the injection adhesive prescribed by the manufacturer of the adhesive within a tolerance of 2.5 percent by volume at all discharge pressures up to 200 pounds per square inch (psi).

6. Automatic Shut-Off Control: Be equipped with sensors on both Component A and Component B reservoirs that automatically stop the machine when only one component is being pumped to the mixing head.

PART 3 - EXECUTION

3.01 EXAMINATION
   A. The Resident Engineer will identify cracks to be injected.
   B. Inject all cracks identified by the Resident Engineer with epoxy resin.

3.02 PREPARATION
   A. Approval: Prior to preparation for injection work, mark cracks to be injected in color. Mark all cracks that exceed 6 mils in width that are not identified by the Resident Engineer with a different color.
   B. Surfaces: Clean surfaces adjacent to and within cracks to remove all dirt, dust, grease, oil, efflorescence, or other foreign matter and sealing materials detrimental to bond for the epoxy surface seal and epoxy adhesive injection materials, respectively. Do not use acids or corrosives for cleaning.
   C. Entry Ports: Provide entry ports along the crack at an interval not-to-exceed the minimum dimension of the member receiving epoxy injection. Set the entry ports in accordance with epoxy injection material manufacturer's recommendation. Drill the holes for the entry ports shall be drilled with a hollow bit with an attached vacuum chuck to prevent concrete dust from becoming embedded in the crack.
   D. Surface Seal: Apply surface seal material to the surface of the crack, and adjacent areas of application between the entry ports, as needed. Allow sufficient time for the surface seal material to gain adequate strength and attain a seal capable of withstanding the injection pressures.

3.03 INSTALLATION
   A. Injection:
      1. Space pressure grout ports depending on size and overall thickness of area containing cracks to be filled. Begin injecting of epoxy adhesive at lower entry port and continue until there is an appearance of epoxy adhesive at the next entry port adjacent to the entry port being pumped.
      2. When epoxy adhesive travel is indicated by appearance at the next adjacent port, discontinued injection on the entry port being pumped, seal the port, transfer epoxy injection to next adjacent port where epoxy adhesive has appeared.
      3. Perform epoxy adhesive injection continuously until each crack is completely filled.
      4. If port-to-port travel of epoxy adhesive is not indicated, immediately stop the work and notify the Resident Engineer.
5. If the ambient temperature or temperature of the epoxy approaches 85 degrees F, take precautions to prevent premature setting of epoxy while the injection is in progress.

6. On wide cracks where resin travels between ports rapidly, two or more ports may be pumped simultaneously. On exceptionally large cracks, use a formulation of epoxy resins and fine sands as approved by the Resident Engineer.

B. Finishing:

1. When the cracks are completely filled, allow the epoxy adhesive to cure in conformance with the manufacturer’s instructions and to allow the removal of the surface seal without draining or runback of the epoxy material from voids or cracks.

2. Grind the face of the crack flush with the adjacent concrete, and finish surface to show no indentations or protrusions caused by the placements of entry ports.

3.04 FIELD QUALITY CONTROL

A. Inspection

1. Pressure Test:

   a. Equipment:

      1) Consist of two independent valved nozzles capable of controlling flow rate and pressure by opening or closing the valve

      2) Contains a pressure gauge capable of sensing the pressure buildup behind each valve

   b. Procedure:

      1) Disconnect the mixing head of the injection equipment and attach the two-adhesive component delivery lines to the pressure check device

      2) Close the valves on the pressure check device

      3) Operate equipment until the gauge pressure on each line reads 160 pounds per square inch (psi).

      4) Stop the pumps and verify the gauge pressure does not drop below 150 psi within 2 minutes.

   c. Frequency of Pressure Test: For each injection unit Run test at the beginning and every 4 hours of use for every shift that the unit is used in the work of crack repair.

B. Ratio Test

1. Equipment:

   a. Consist of two independent valved nozzles capable of controlling back pressure by opening or closing the valve.

   b. Contains a pressure gauge capable of sensing the back pressure behind each valve.
c. Supplied by the Contractor

2. Procedure:
   a. Disconnect the mixing head of the injection equipment pump the two-adhesive components simultaneously through the ratio check device
   b. Simultaneously discharged both adhesive components into separate calibrated containers.
   c. Adjust discharge pressure to 160 psi for both adhesive components
   d. Measure the amounts discharged into the calibrated containers simultaneously during the same period to determine that the volumes discharged conform to the manufacturer's recommended ratio for applicable material.

3. Frequency of Ratio Test: For each injection unit, run test at the beginning and every 4 hours of use for every shift that the unit is used in the work of crack repair.

C. Proof of Ratio and Pressure Test
   1. At all times during the course of the work, keep complete and accurate records available to the Resident Engineer of the pressure and ratio tests specified above.
   2. In addition, the Resident Engineer at any time without prior notification may request the Contractor to conduct the tests specified above in the presence of the Resident Engineer.

END OF SECTION
CONTRACT SPECIFICATIONS

SECTION 04 20 00
UNIT MASONRY

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes specification for:
   1. Standard Concrete Unit Masonry
   2. Mortar and Grout.
   3. Steel Reinforcement and Anchorage.
   4. Accessories.
   5. Masonry Installation.

B. Related Section: The work of the following Sections is related to the work of this Section. Other Sections, not referenced below, may also be related to the proper performance of this work.
   1. Section 03 20 00, Concrete Reinforcing.
   2. Section 07 92 00, Joint Sealants.

1.02 REFERENCES

A. This Section incorporates by reference the latest revisions of the following documents.

1. American Concrete Institute (ACI):
   a. ACI 530/ASCE 5/TMS 402 - Building Code Requirements for Masonry Structures; American Concrete Institute International.
   b. ACI 530.1/ASCE 6/TMS 602 - Specification for Masonry Structures; American Concrete Institute International.

   a. ASTM A615/A615M Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
   b. ASTM C90 Standard Specification for Load-bearing Concrete Masonry Units.
   c. ASTM C140 Standard Test Methods of Sampling and Testing Concrete Masonry Units and Related Units.

g. ASTM C404 Standard Specification for Aggregates for Masonry Grout.

h. ASTM C476 Standard Specification for Grout for Masonry.

3. Underwriters Laboratories Inc. (UL):

   a. UL Fire Resistance Directory (FRD).

1.03 SUBMITTALS

A. Procedures: Section 01 33 00, Submittal Procedures.

B. Product Data: Provide data for masonry units, fabricated wire reinforcement, mortar, and masonry accessories.

C. Shop Drawings: Indicate reinforcement fabrication, bending, and placement. Include bar schedules, stirrup spacing schedules, bending and arrangement diagrams for reinforcement. Indicate height of walls, including top and bottom of all raked walls. Indicate location and provisions required for attachment of work included in other sections.

D. Manufacturer’s Certificate: Certify that masonry units, grout and mortar mixes meet or exceed specified requirements. Include test results or ICBO reports for all specified items required to meet specific standards.

1.04 QUALITY ASSURANCE

A. Comply with provisions of ACI 530/ASCE 5/TMS 402 and ACI 530.1/ASCE 6/TMS 602, except where exceeded by requirements of the contract documents.

1. Maintain one copy of each document on project site.

B. Fire-Rated Assemblies: Conform to Seattle Building Code for fire-resistive requirements for fire-rated masonry construction.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver, handle, and store masonry units by means that will prevent mechanical damage and contamination by other materials.

1.06 PROJECT CONDITIONS

A. Environmental Requirements

1. Maintain materials and surrounding air temperature to minimum 40 degrees F prior to, during, and 48 hours after completion of masonry work.

2. Maintain materials and surrounding air temperature to maximum 90 degrees F prior to, during, and 48 hours after completion of masonry work.

PART 2 - PRODUCTS

2.01 MATERIALS

A. CONCRETE MASONRY UNITS (CMU)
1. Standard Concrete Block: Comply with referenced standards and as follows:
   a. Sizes: Provide standard hollow core units with nominal face dimensions of 16 inches by 8 inches and nominal depth as indicated on Contract Drawings.
   b. Special Shapes: Provide non-standard blocks configured for corners, bond beams, lintels, headers, control joint edges (sash blocks), and other detailed conditions.
   c. Load-Bearing Units (Typical): ASTM C90, Type 1, normal or medium weight with a minimum compressive strength as noted on Contract Drawings.

B. Mortar and Grout Materials

1. Portland Cement: ASTM C150, Type I or Type III.
2. Hydrated Lime: ASTM C207, Type S.
4. Mortar Aggregate: ASTM C 144; washed aggregate consisting of natural sand or crushed stone.
5. Water: Clean and not detrimental to mortar mixture.

C. Reinforcement and Anchorage

1. Reinforcing Steel: Type as specified in Section 03 20 00, Concrete Reinforcing; size: as indicated on Contract Drawings.
2. Flexible Anchors: 2-piece anchors that permit differential movement between masonry and building frame, sized to provide not more than 1 inch and not less than 1/2 inch of mortar coverage from masonry face.

D. Accessories

1. Preformed Control Joints: Rubber material. Provide with corner and tee accessories, fused joints.
   a. Manufacturers:
      4) Substitutions: Section 01 25 00, Substitution Procedures.

2. Joint Filler: Closed cell polyvinyl chloride; oversized 50 percent to joint width; self expanding; 6 inches wide by the maximum lengths available.
   a. Manufacturers:


4) Substitutions: Section 01 25 00, Substitution Procedures.

3. Cleaning Solution: Non-acidic, not harmful to masonry work or adjacent materials.

2.02 MIXES

A. Mortar and Grout Mixes

1. Mortar for Unit Masonry: ASTM C270, Type N using the Proportion Specification.

2. Grout: ASTM C476. Consistency required to fill completely volumes indicated for grouting; fine grout for spaces with smallest horizontal dimension of 2 inches or less; coarse grout for spaces with smallest horizontal dimension greater than 2 inches.

3. Mixing: Use mechanical batch mixer and comply with referenced standards.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive masonry.

B. Verify that related items provided under other sections are properly sized and located.

C. Verify that built-in items are in proper location, and ready for roughing into masonry work.

D. Do not proceed until unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Direct and coordinate placement of metal anchors supplied for installation under other Sections.

B. Provide temporary bracing during installation of masonry work. Maintain in place until building structure provides permanent bracing.

3.03 INSTALLATION

A. Comply with referenced standards.

B. Leave openings for equipment to be installed. Coordinate with other trades.

3.04 COURSING

A. Establish lines, levels, and coursing indicated. Protect from displacement.

B. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness.
C. Concrete Masonry Units:
   1. Bond: Running.
   2. Coursing: One unit and one mortar joint to equal 8 inches.
   3. Mortar Joints: Concave. Joints that will be concealed by other construction (such as furred gypsum board) may be struck flush.

3.05 PLACING AND BONDING

A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint widths and for accurate location of openings, joints, returns, and offsets. Avoid the use of less than half-size units at corners, jambs, and other locations.
B. Lay hollow masonry units with face shell bedding on head and bed joints.
C. Buttering corners of joints or excessive furrowing of mortar joints is not permitted.
D. Remove excess mortar and mortar smears as work progresses.
E. Interlock intersections and external corners.
F. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment must be made, remove mortar and replace.
G. Perform job site cutting of masonry units with proper tools to provide straight, clean, unchipped edges. Prevent broken masonry unit corners or edges.
H. During erection, cover tops of walls, projections, and sills with waterproof sheeting at the end of each day's work. Cover partially completed masonry when construction is not in progress. Extend cover a minimum of 24 inches down both sides and hold securely in place.
I. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Remove immediately all grout, mortar, and soil that comes into contact with such masonry.
   1. Protect base of walls from rain-splashed mud and mortar splatter by means of coverings spread on wall surface and on the ground.
   2. Protect sills, ledges, and projections from mortar droppings.
J. Stopping and Resuming work: In each course, rack back as required, clean exposed surfaces of set masonry, wet clay masonry units if required, and remove loose units prior to laying fresh masonry.
K. Isolate masonry partitions from vertical structural framing members with a control joint.
L. Isolate top joint of masonry partitions from horizontal structural framing members and floor slabs or decks with compressible joint filler or firestopping as required.

3.06 REINFORCEMENT AND ANCHORAGE - GENERAL

A. Fasten anchors to structural framing and embed in masonry joints as masonry is laid. Refer to reinforcement and anchorage requirements in Contract Drawings.
3.07 LINTELS
A. Provide reinforced concrete or reinforced concrete masonry lintels as detailed or scheduled on Contract Drawings.

3.08 GROUTED COMPONENTS
A. Splices: Lap 24 bar diameters minimum.
B. Support and secure reinforcing bars from displacement. Maintain position within 1/2 inch of dimensioned position.
C. Place and consolidate grout fill without displacing reinforcing.
D. Do not place grout until entire height of masonry to be grouted has attained sufficient strength to resist grout pressure.

3.09 CONTROL AND EXPANSION JOINTS
A. Form control joint using sash blocks on both sides of joint.
B. Install preformed control joint device in continuous lengths. Seal butt and corner joints in accordance with manufacturer’s instructions.
C. Size control joint to match typical mortar joint width.

3.10 BUILT-IN WORK
A. As work progresses, install built-in metal door frames and other items to be built into the work and furnished under other sections.
B. Install built-in items plumb, level, and true to line.
C. Bed anchors of metal door and glazed frames in adjacent mortar joints. Fill frame voids solid with grout.
   1. Fill adjacent masonry cores with grout minimum 12 inches from framed openings.
D. Do not build into masonry construction organic materials that are subject to deterioration.

3.11 TOLERANCES
A. Maximum Variation from Unit to Adjacent Unit: 1/16 inch.
B. Maximum Variation from Plane of Wall: 1/4 inch in 10 feet and 1/2 inch in 20 feet or more.
C. Maximum Variation from Plumb: 1/4 inch per story non-cumulative; 1/2 inch in two stories or more.
D. Maximum Variation from Level Coursing: 1/8 inch in 3 feet and 1/4 inch in 10 feet; 1/2 inch in 30 feet.
E. Maximum Variation of Joint Thickness: 1/8 inch in 3 feet.
F. Maximum Variation from Cross Sectional Thickness of Walls: 1/4 inch.
3.12 CUTTING AND FITTING
A. Cut and fit for chases, pipes, conduit, and structure. Coordinate with other sections of work to provide correct size, shape and location.
B. Obtain approval prior to cutting or fitting masonry work not indicated or where appearance or strength of masonry work may be impaired.

3.13 FIELD QUALITY CONTROL
A. Engage the services of an Independent Testing Laboratory meeting the requirements specified in Section 01 45 00, Quality Control, to perform field quality control tests.
B. Concrete Masonry Unit Tests: Test each variety of concrete unit masonry in accordance with ASTM C140 for conformance to requirements herein.

3.14 CLEANING
A. Remove excess mortar and mortar droppings.
B. Replace defective mortar. Match adjacent work.
C. Clean soiled surfaces with cleaning solution.
D. Use non-metallic tools in cleaning operations.

3.15 PROTECTION OF FINISHED WORK
A. Without damaging completed work, provide protective boards at exposed external corners, which are subject to damage by construction activities.

END OF SECTION
SECTION 05 05 13

SHOP-APPLIED COATINGS FOR METAL

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes specifications for:
   1. Galvanizing where indicated for steel items.
   2. Shop primer for steel items not receiving galvanized finish.

B. Related Sections:
   1. Section 05 12 00, Structural Steel Framing.
   2. Section 05 50 00, Metal Fabrications
   3. Section 05 51 00, Metal Stairs
   4. Section 05 52 00, Metal Railings
   5. Section 05 53 31, Steel Gratings
   6. Section 09 90 00, Painting and Coating
   7. Section 09 96 00, High-Performance Coatings

1.02 REFERENCES

A. This Section incorporates by reference the latest revisions of the following documents.
   1. American Hot-Dip Galvanizers Association, Inc. (AHDGA)
      a. AHDGA Inspection Manual for Hot-Dip Galvanized Products
   2. American Society for Testing and Material International (ASTM)
      a. ASTM A123/ A123M Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
      b. ASTM A143 Safeguarding against Embrittlement of Hot-Dip Galvanized Structural Steel Products and Procedure for Detecting Embrittlement
      c. ASTM A384 Safeguarding against Warpage and Distortion During Hot-Dip Galvanizing of Steel Assemblies
      d. ASTM A780 Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings
      e. ASTM B6 Standard Specification for Zinc
3. Society for Surface Protective Coatings (SSPC)
   a. PA 1, “Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel,”
   b. SP6 Commercial Blast Cleaning.
   c. SP8 Pickling.

1.03 DEFINITIONS:

A. Hot-dip galvanizing: Dipping steel members and assemblies into molten zinc for lasting, or long-term corrosion protection. Resultant zinc coating fuses permanently with base steel material.

1.04 SUBMITTALS

A. Procedures: Section 01 33 00, Submittal Procedures.

B. Product Data: Submit data for shop primer and finish coats specified in Section 09 90 00, Painting and Coating, and 09 96 00, High-Performance Coatings.
   1. Timing: Submit concurrent with or prior to submittal of shop drawings for structural steel and metal fabrications.

C. Certification: Furnish certification for the following, signed by the galvanizer:
   1. Membership in American Hot-Dip Galvanizers Association Inc.
   2. Materials used in galvanizing and repair.
   3. Methods used in galvanizing and repair.

D. Coordination Drawings: To safeguard against distortion, furnish to the galvanizer steel fabricator's shop drawings of non-standard fabrications, tubular fabrications, fabrications involving all dimension that exceed the size of the galvanizer's kettle and fabrications involving materials of different thicknesses.

E. Reports showing results of all inspections and tests.

1.05 QUALITY ASSURANCE

A. Engage a galvanizing firm with a current membership in the American Hot-Dip Galvanizers Association Inc. (AHDGA).

B. Inspect and test galvanized fabrications in compliance with ASTM 123 for the following:
   1. Visual examination of samples and finished products.
   2. Thickness of coating
   3. Adhesion

C. Mark all galvanized material with the galvanizer's stamp.

1.06 DELIVERY, STORAGE, AND HANDLING:

A. Deliver, store, and handle galvanized fabrications in a manner that prevents damage to the item and its galvanizing.
PART 2 - PRODUCTS

2.01 GALVANIZING MATERIALS
B. Galvanizing Repair Paint: A three-part system using an organic zinc-rich primer, an epoxy or urethane intermediate coat, and a urethane topcoat.

2.02 SHOP PAINTING MATERIALS
A. Primer Paint: Zinc-rich, micaceous iron oxide (MIO), moisture-cured urethane:
   1. AISC-certified for Class B slip-critical connections.
   2. Minimum 8000 hours salt-spray resistance when tested in accordance with ASTM B 117.
   3. Acceptable products:
      a. Tnemec Series 394 "PerimePrime".
      b. Wasser "MC MIO-Zinc".
      c. Or approved equal.

PART 3 - EXECUTION

3.01 PREPARATION FOR GALVANIZING
A. Complete fabrications to the greatest extent possible prior to galvanizing.
B. Mask areas that are to be field welded or that are to be shop welded to ungalvanized members to a distance of one inch from the weld line prior to galvanizing.
C. Clean all surfaces in compliance with SSPC SP6, Commercial Blast Cleaning.
D. Pickle all surfaces in compliance with SSPC SP8, Pickling.

3.02 APPLICATION OF GALVANIZING
A. Hot-dip galvanize in compliance with ASTM A123. Mix the galvanizing bath to contain 0.05 to 0.09 percent nickel by weight. Apply galvanizing in the weights and thicknesses specified.
B. Safeguard against steel embrittlement in compliance with ASTM A143
C. Safeguard against warpage or distortion in compliance with ASTM A384. Notify the Resident Engineer of potential warpage problems that require modification in design before proceeding with fabrications.

3.03 REPAIR OF GALVANIZING
A. Grind rough areas to produce a uniform surface.
B. Repair minor defects and coat masked areas in accordance with ASTM A780.
3.04 SHOP PAINTING

A. Surface Preparation For Non-Galvanized Fabrications: Remove loose rust, loose mill scale and spatter, slag or flux deposits. Clean steel in accordance with Steel Structures Painting Council (SSPC) as follows:

1. Solvent clean and blast clean steel surfaces using abrasive air blast method in accordance with SSPC-SP 6 “Commercial Blast Cleaning”. The height of profile or anchor pattern shall be 1.5 to 2.5 mils, unless otherwise required by the primer manufacturer.

B. Primer Application: Immediately after surface preparation, apply primer to provide dry film thickness of not less than 3 mils.

1. Shop Priming: Apply shop primer to uncoated surfaces of metal fabrications, including those to be embedded in concrete. Primer shall be held back 2 inches from edges to be field welded. Comply with SSPC-PA 1 for shop painting.

3.05 FIELD QUALITY CONTROL AND REPAIR

A. Galvanized Surfaces: Apply galvanizing repair paint or other methods described in ASTM A 780.

B. Touch-Up Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material as used for shop painting. Apply by brush to provide a minimum dry film thickness of 3.0 mils.

END OF SECTION
SECTION 05 05 14
FLUOROPOLYMER COATINGS FOR METAL

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes specifications for:
   1. Baked on fluoropolymer coating systems on surfaces specified in respective technical Sections herein. (FP-1, FP-2)
   2. Repair or refinishing of damaged finishes.

B. Related Sections: The work of the following Sections is related to the work of this Section. Other Sections, not referenced below, may also be related to the proper performance of this work.
   1. Section 05 52 00, Metal Railings: Custom aluminum guardrails.
   2. Section 07 42 10, Metal Wall Panels
   3. Section 08 44 10, Glazed Aluminum-Framed Storefronts and Curtain Walls.
   4. Section 08 91 00, Louvers.

1.02 REFERENCES

A. Architectural Aluminum Manufacturer's Association (AAMA):

B. American Society for Testing and Materials International (ASTM)
   1. ASTM B449 - Specification for Chromates on Aluminum
   2. ASTM D1730 - Practice for Preparation of Aluminum and Aluminum-Alloy Surfaces for Painting.
   3. ASTM D 2244 - Practice for Calculation of Color Differences and Color Tolerances from Instrumentally Measured Color Coordinates.

1.03 SUBMITTALS

A. Procedures: Section 01 33 00, Submittal Procedures.

B. Product Data: Submit manufacturer's literature and technical data for each coating system.
   1. Application instructions including mixing, surface preparation, compatible primers and topcoats, recommended wet and dry film thickness, recommended application methods.
   2. Manufacturer's recommendations for use; include limitations.
C. Qualification Data - Applicator: Submit certification from the manufacturer stating that the applicator is an approved applicator of the material for work of this Section.

D. Samples: Submit samples of each specified finish in selected colors on 12-inch-long sections of extrusions and 12-inch-square heavy gage sheet metal. Furnish additional samples as required until colors and finishes are approved. Label samples with color number, name, and date.

E. Coating Touch-Up Procedures: Submit coating manufacturer's recommended touch-up procedures and instructions.

F. Warranty:
   1. Draft: Submit draft of warranty with required inclusions for review. Submit draft warranty with product data.
   2. Submit signed warranty at time of Project Closeout; include warranty in "Warranties Manual".

1.04 QUALITY ASSURANCE

A. Fluoropolymer Coating Applicator Qualifications: Engage an experienced coating applicator that is approved by fluoropolymer coating manufacturer. If requested, coating applicator shall furnish test results of previously tested production specimens within the last six months showing conformance with AAMA 2605

   1. Coating system shall be factory applied and oven baked on pretreated and primed metal substrates. Coating on various portions of the work shall match in color and visual texture.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Wrap finished parts and package in such a way that exposed surfaces are protected.
   1. Do not handle freshly painted members until paint has cured in accordance with manufacturer's recommendations for "to handle" curing. Adjust time requirements for ambient and surface temperature and relative humidity.
   2. Packing and Shipping: Provide protective wrappings, cartons, dunnage between members, crating and the like as required to prevent damage to coating in shipping, delivery, and handling at the site.
   3. Lifting - Shop and site:

1.06 WARRANTY

A. Special Warranty: Submit written warranty for a period of 10 years from date of Substantial Completion, stating that coating will not blister, peel, crack, chalk, change color, or have other forms of degradation for the full warranty period.

   1. For the purpose of this warranty, color change is defined as not to exceed 5 CIELAB or Hunter units as determined in accordance with ASTM D 2244.
2. In the event that any of the above coating failures occurs within the warranty period, the Contractor shall replace said item showing such failure, and shall assume full cost of labor and materials for such replacement. Replacement item(s) shall be new and be finished with same type of fluoropolymer coating meeting the requirements of herein. Any replacement item shall match its adjacent member within tolerances as specified herein.

3. Resident Engineer may, at its discretion, permit field repairs in lieu of replacement, provided the coating failure is minor in scope and the field repair material and method employed match its adjacent member.

4. Warranty shall be signed by the coating manufacturer, coating applicator and Contractor. Warranty shall be in addition to, and not a limitation of, other rights Sound Transit may have against the Contractor under the Contract Documents.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Resin - Provide Coatings manufactured with polyvinylidene fluoride resin made by one of the following:
   1. Arkema: “Kynar 500”
   2. Solvay Solexis: “Hylar 5000”
   3. Approval equal

B. Acceptable Coating Producers (Tradenames) Include
   1. PPG (Duranar®)
   2. Valspar (Fluropor®)
   3. Akzo Nobel (Trinar®)
   4. BASF (Fluoroceram®)
   5. Approval equal

2.02 FLUOROPOLYMER COATINGS - "FP-#"

A. General: Factory applied, baked on fluoropolymer coating containing minimum 70 percent polyvinylidene fluoride (PVDF) by weight in resin system. Provide system consisting of primer and one or more topcoat(s) meeting or exceeding AAMA 2605.

B. Coil coatings: Dry film thicknesses specified below are spray coating thicknesses; manufacturer’s standard thickness which meet performance requirements of AAMA 2605 are acceptable.

C. Spray (extrusion) Coatings: Meet or exceed AAMA 2605. Dry film thicknesses specified are minimum.
   1. Powder coat systems containing 100 percent PVDF resin are acceptable in lieu of spray coatings, subject to color approval.

D. Standard (2-Coat) System:
1. Dry Film Thickness: 0.25 mil (plus or minus 0.05 mil) primer coat, 1.0 mil color coat.

2. Acceptable products include:
   a. PPG Industries "Duranar".
   b. Valspar: "Fluoropon".
   c. BASF "Fluoroceram".
   d. Approval equal

3. FP-2 Color: "Zinc Grey"

E. 2-Coat Mica-Flake System: 0.25 mil (plus or minus 0.05 mil) primer coat, 1.0 mil color coat. Metallic appearance achieved by use of mica flakes in topcoat; no clearcoat required.

1. Acceptable products include.
   a. PPG "Duranar Sunstorm".
   b. Valspar: "Fluoropon Classic II."
   c. BASF "Ultramet C".
   d. Approval equal

2. FP-1 Color: Match PPG UC70092F "Silversmith".

F. Touch-Up Material: Fluoropolymer air-dried system, which is recommended and approved by fluoropolymer finish coating manufacturer.

2.03 FABRICATION

A. Spray or Coil Applied Systems: Pretreatment and coating application shall be in accordance with coating manufacturer's recommendations.

B. Metal Preparation and Pre-Treatment: Remove organic and inorganic surface soil, grease, oils, and other foreign materials using a chemical cleaning and pre-treatment process as recommended by coating manufacturer.

1. Use a chemical conversion coating which conforms to ASTM D1730, Type B, Method 5 or Method 7.

2. Weight of chemical conversion coating shall conform to ASTM B449, Section 6, Class 1.

3. Processing shall conform to ASTM B449, Section 5.

C. Finishing: Apply coating by conventional air or electrostatic spray or by coil coating process over surfaces, which have been thoroughly cleaned, pretreated and primed according to specifications of the licensed formulator. Dipping and flowcoating are not permitted. Thermally cure (bake) coating immediately following application.

1. All coil coating shall be processed in one production lot to aid in eliminating color variations due to use of metallic coating.
2.04 SOURCE QUALITY CONTROL

A. General: Coating applicator shall maintain a Quality Assurance Log which reflects conditions under which production was made, including pretreatment cycles; coating conditions; cure temperature and time; random testing of dry film thickness, color and gloss; and selection of random production samples.

B. Surface Appearance: Cured coating must be visibly free from flowlines, streaks, blisters and other surface imperfections on exposed surfaces.
   1. Surfaces shall have no signs of mill finish aluminum or galvanized material showing.
   2. No “rack” or “gripper” marks caused by the finishing process on exposed aluminum surfaces will be permitted.

PART 3 - EXECUTION

3.01 REPAIR AND TOUCH-UP

A. Minor scratches and blemishes: Repair with coating manufacturer’s recommended products or system. Provide repairs that:
   1. Match original finish for color and gloss.
   2. Adhere to original finish when tested in accordance with AAMA 2605.
   3. Are not discernable when viewed at a distance of 5 feet.

3.02 PROTECTION

A. Protection:
   1. Shortly before final completion of the project, examine surfaces for damage to coatings and restore coatings to new, undamaged condition.
   2. Touch-up of minor damage will be acceptable where result is not visibly different from surrounding surfaces. Where result is different either in color, sheen, or texture, recoat entire surface or provide new building component.

END OF SECTION
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CONTRACT SPECIFICATIONS

SECTION 05 05 23
METAL FASTENINGS

PART 1 - GENERAL

1.01 SUMMARY
A. This Section includes specifications for welding and bolting of structural steel and metal fabrications, and welding of sheet steel, as indicated. This Section also includes qualification of welders and welding procedures, and inspections, and tests of welding and bolting.

1. Materials for and fabrication and installation of welded-headed studs, deformed bar anchors, and concrete reinforcing steel anchors are covered in Section 03 15 20 Anchorage to Concrete.

1.02 REFERENCES
A. This Section incorporates by reference the latest revisions of the following documents.

1. American Society for Nondestructive Testing (ASNT)
   a. Recommended Practice No. SNT-TC-1A

2. American Institute of Steel Construction (AISC)
   a. AISC 303 Code of Standard Practice for Steel Buildings and Bridges

3. American Society for Testing and Materials International (ASTM)
   a. ASTM A153 Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
   b. ASTM A307 Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength
   c. ASTM A325 Standard Specification for Structural Bolts, Steel, heat Treated, 120/105 ksi Minimum Tensile Strength
   d. ASTM A563 Standard Specification for Carbons and Alloy Steel Nuts
   e. ASTM E94 Guide for Radiographic Testing
   f. ASTM E164 Practice for Ultrasonic Contact Examination of Weldments
   g. ASTM E165 Standard Test Method for Liquid Penetrant Examination
   h. ASTM E709 Guide for Magnetic Particle Examination
   i. ASTM E1032 Method for Radiographic Examination of Weldments
   j. ASTM F436 Standard Specification for Hardened Steel Washers
   k. ASTM F844 Standard Specification for Washers, Steel, Plain (Flat), Unhardened for General Use
1. ASTM F959 Standard Specification for Compressible-Washer-Type Direct Tension Indicators for Use with Structural Fasteners

m. ASTM F1852 Standard Specification for “Twist Off” Type Tension Control Structural Bolt-Nut-Washer Assemblies, Steel, heat Treated, 120/105 ksi Minimum Tensile Strength

4. American Welding Society (AWS)
   a. ANSI/AWS A2.4 Standard Symbols for Welding, Brazing, and Nondestructive Examination
   b. ANSI/AWS A3.0 Standard Welding Terms and Definitions
   c. ANSI/AWS A5 Series Filler Metal Specifications
   d. ANSI/AWS B1.10 Guide for the Nondestructive Examination of Welds
   e. ANSI/AWS D1.1 Structural Welding Code - Steel
   f. ANSI/AWS D1.3 Structural Welding Code - Sheet Steel
   g. ANSI/AWS D1.8 Structural Welding Code – Seismic Supplement
   h. AWS QC1 Standard for AWS Certification of Welding Inspectors

5. Research Council on Structural Connections (RCSC)
   a. Specification for Structural Joints Using ASTM A325 or A490 Bolts

1.03 DEFINITIONS

A. Structural Steel: Elements of structural-steel frame, as classified by AISC 303, that support design loads.

B. Seismic Load Resisting System (SLRS): Assembly of Structural Steel elements that resists seismic loads. Members of SLRS are indicated in the Contract Drawings and include the braced frames for Elevators 1, 2, and 3, and the roof of the Station Entry.

C. Demand-Critical Welds: Welds in the SLRS including:
   1. Complete penetration welds in beam-to-column connections, including welds to flanges, webs, and flange reinforcement, stiffener, and doubler plates.
   2. Complete penetration welds of column splices and of columns to base plates.
   3. Fillet welds connecting braced frame gusset plates to braces, beams, and columns.
   4. Other welds indicated as “Seismic Demand Critical” on the Contract Drawings.

D. Lowest Anticipated Service Temperature: 0 degrees Fahrenheit, as required by ANSI/AWS D1.8.

1.04 SUBMITTALS

A. Procedures: Section 01 33 00, Submittal Procedures.

B. Manufactured Products
1. **Welding Electrode**: Manufacturer’s certification of conformance.

2. **High-Strength Bolts, Nuts, and Washers**: Manufacturer’s mill certificates demonstrating conformance.

3. **Mild Bolts, Nuts, and Washers**: Manufacturer’s mill certificates demonstrating conformance.

4. **Direct Tension Indicating Washers**: Manufacturer’s mill certificates demonstrating conformance, if proposed for use.

5. **Tension Control Structural Bolt-Nut-Washer Assemblies**: Manufacturer’s mill certificates demonstrating conformance, if proposed for use.

**C. Qualifications**: Current certification demonstrating qualifications for the following:

1. Welders, welding operators, and tack welders
2. Welding inspectors
3. Personnel performing nondestructive testing

**D. Welding Procedures**

   a. Submit a WPS for each welded joint proposed for use whether prequalified or qualified by testing. Include all welding that will be performed in both the shop and the field.
   b. For welds to the SLRS, specify the additional requirements of ANSI/AWS D1.8.

2. **Procedure Qualification Record (PQR)**: ANSI/AWS D1.1.
   a. Submit a PQR for tests of procedures other than those prequalified.
   b. For welds to the SLRS, including Demand Critical Welds, include Charpy V-Notch (CVN) testing in conformance with ANSI/AWS D1.8.

**E. Inspection and Test Reports**: Forward the following inspection and test results to the Resident Engineer immediately after results are available. Results must state whether Work is conforming or nonconforming.

1. **Source Quality Control**
2. **Field Quality Control**

**1.05 QUALITY ASSURANCE**

**A. Welders, Welding Operators, and Tack Welders**: Current AWS certification for all types, positions, and sizes of welds performed as follows:

1. **Structural Steel**: ANSI/AWS D1.1, and ANSI/AWS D1.8, as applicable to the Work.
2. **Metal Fabrications**: ANSI/AWS D1.1
3. **Sheet Steel**: ANSI/AWS D1.3
B. Welding Inspector: ANSI/AWS QC1 Certified Welding Inspector (CWI)

C. Personnel Performing Nondestructive Testing;
   1. ASNT Certified NDT
   2. Only personnel certified for NDT Level I and working under a certified NDT Level II person or persons may perform nondestructive testing.

D. Welding Procedures: Prequalified or qualified in conformance with ANSI/AWS D1.1.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle welding electrodes in conformance with ANSI/AWS D1.1.

B. Deliver, store, and handle bolts, nuts, and washers in conformance with RCSC Specification.

PART 2 - PRODUCTS

2.01 MANUFACTURED PRODUCTS

A. Welding Electrodes for Structural Shapes, Plates, and Bars:
   1. Conform to ANSI/AWS A5 Series Standards, with a minimum tensile strength of 70 ksi. Provide coated rods or wire of size and classification number as recommended by the manufacturer for the positions and other conditions of actual use. Match filler metal requirements in conformance with ANSI/AWS D1.1.

B. High-Strength Bolts:
   1. Bolts: ASTM A325, Type 1, heavy hex
   2. Nuts: ASTM A563 heavy hex
   3. Washers
      a. Plain: ASTM F436
      b. Direct Tension Indicating: ASTM F959, Type 325 compressible-washer type

C. Tension Control Structural Bolt-Nut-Washer Assemblies:
   1. Bolts: ASTM F1852, Type 1, heavy hex head splined ends
   2. Nuts: ASTM A563 heavy hex
   3. Washers: ASTM F436

D. Mild Bolts: Provide mild bolts where noted A307
   1. Bolts: ASTM A307, Type A
   2. Nuts: ASTM A563A hex
3. Washers: ASTM F884

2.02 FABRICATION

A. Shop Welding and Shop Welding Repairs

1. Perform shop welding as indicated in conformance with the following:
   a. Structural Steel: ANSI/AWS D1.1, and ANSI/AWS D1.8, as applicable to the Work.
   b. Metal Fabrications: ANSI/AWS D1.1
   c. Sheet Steel: ANSI/AWS D1.3

2. Weld joints in conformance with approved WPS. Make WPS available to welders and inspectors during fabrication.

3. Provide complete joint penetration welds for groove welds indicated on the Contract Drawings unless noted otherwise. Select groove preparation in conformance with ANSI/AWS D1.1 and approved WPS.

4. Remove backing bars for complete joint penetration welds where indicated in the Contract Drawings or required for testing and inspection.

5. Mark welder ID adjacent to completed weld using metal stamp, metal engraving, keel, paint stick, or other appropriate marking means.

6. Repairs: ANSI/AWS D1.1. Reinspect or retest repaired or corrected welds as specified for the original weld.

B. Shop Bolting

1. Perform shop bolting as specified for field bolting.

2.03 SOURCE QUALITY CONTROL

A. Shop Welding Procedures and Personnel: Verify the following prior to and during fabrication:

1. Welder qualifications and identifications.

2. WPS has been provided to and reviewed with each welder performing the Work.

3. Consumables meet WPS requirements.

4. Joint fit-up meets WPS requirements. Mark joint prior to welding.

5. Preheat and interpass temperatures and weld pass sequence meet WPS requirements.

B. Shop Welding Inspection and Testing

1. Visual Inspection: ANSI/AWS D1.1. Visually inspect 100 percent of welds, for both permanent and temporary Work.

2. Ultrasonic Testing: ANSI/AWS D1.1, and ASTM E164, as applicable. Ultrasonically test complete joint penetration groove welds as follows:
a. 10 percent with material thickness equal to or less than 3/4 inch.
b. 50 percent with material thickness greater than 3/4 inch and equal to or less than 1-1/2 inches.
c. 100 percent for material thickness greater than 1-1/2 inches.

3. Magnetic Particle Inspection: ASTM E709. Inspect complete and partial joint penetration groove welds and fillet welds as follows:
   a. 20 percent of complete joint penetration groove welds of tee and corner joints.
   b. 10 percent of partial joint penetration groove welds and fillet welds.

4. Liquid Penetrant Inspection: ASTM E165. Liquid penetrant inspection may be used for detecting discontinuities that are open to the surface.


C. Shop Bolting Inspection and Testing

1. Torque Wrench Calibration
   b. Test the calibrating device for setting calibrated torque wrenches for accuracy using qualified personnel not more than 30 days prior to first use on the Work, and at intervals not more than six months thereafter.
   c. If the Resident Engineer has reason to question the accuracy of the calibrating device, return it to the manufacturer for certification of accuracy.

2. Visually inspect 100 percent of shop bolted connections.

D. Shop Inspection and Testing by the Resident Engineer

1. Allow the Resident Engineer access to perform independent verification inspection and testing.

2. All welded and bolted connections are subject to inspection and testing by the Resident Engineer. The Resident Engineer will inspect and test connections at random.

3. The Resident Engineer will make inspection and test results available to the Contractor.

PART 3 - EXECUTION

3.01 ERECTION

A. Field Welding and Field Welding Repairs: Perform field welding and field welding repairs as specified for shop welding and shop welding repairs.

B. Field Bolting
1. Drive bolts accurately into holes without damaging the thread. Protect bolt heads from damage during driving. Place washers und all bolt heads and nuts. Rest bolt heads and nuts squarely against the washers.

2. High-Strength Bolting
   b. Pretension bolts unless noted otherwise.
   c. Prepare faying surfaces for joints indicated as Slip-Critical in conformance with Class C for galvanized items, and in conformance with Class A for non-galvanized items.
   d. Snug-tight connections may be used in beam-to-beam connections only if approved by the Resident Engineer.

3.02 FIELD QUALITY CONTROL

   A. Field Welding Procedures and Personnel: Verify field welding procedures and personnel prior to and during field welding as specified for shop welding procedures and personnel.

   B. Field Welding Inspection and Testing: Perform field welding inspection and testing as specified for shop welding inspection and testing.

   C. Field Bolting Inspection and Testing: Perform field bolting inspection and testing as specified for shop bolting inspection and testing.

   D. Verify all tests and inspections demonstrate conformance with the Contract Documents before loading structures, either temporary or permanent. Notify the Resident Engineer of the results.

   E. Field Inspection and Testing by the Resident Engineer

     1. Allow the Resident Engineer access to perform independent verification inspection and testing.

     2. All welded and bolted connections are subject to inspection and testing by the Resident Engineer. The Resident Engineer will inspect and test connections at random.

     3. The Resident Engineer will make inspection and test results available to the Contractor.

END OF SECTION
SECTION 05 12 00
STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes specifications for furnishing, fabricating, and erecting structural steel as indicated.

1. Structural steel for the pedestrian bridge is specified in Section 05 12 33, Structural Steel for Bridges.

B. Related Sections: The work of the following Sections is related to the work of this Section. Other Sections, not referenced below, may also be related to the proper performance of this work.

1. Section 03 62 00, Non-Shrink Grouting
2. Section 05 05 13 Shop Applied Metal Coatings
3. Section 05 05 23, Metal Fastenings
4. Section 09 96 00 High-Performance Coatings
5. Section 26 05 26 Grouting and Bonding for Electrical Systems
6. Section 26 42 50 Tunnel Corrosion Control at Stations

1.02 REFERENCES

A. This Section incorporates by reference the latest revisions of the following documents.

1. American Institute of Steel Construction (AISC):
   a. AISC 303 Code of Standard Practice for Steel Buildings and Bridges
   b. AISC 360 Specification for Structural Steel Buildings

   a. ASTM A6 Standard Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling
   b. ASTM A36 Standard Specification for Carbon Structural Steel
   c. ASTM A53 Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
   d. ASTM A252 Specification for Welded and Seamless Steel Pipe Piles
   e. ASTM A500 Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
f. ASTM A572 Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel  
g. ASTM A992 Specification for Structural Steel Shapes  

a. ANSI/AWS A2.4 Standard Symbols for Welding, Brazing, and Nondestructive Examination  
b. ANSI/AWS D1.1 Structural Welding Code-Steel  
c. ANSI/AWS D1.8 Structural Welding Code – Seismic Supplement  

4. American Petroleum Institute (API)  

5. Society for Protective Coatings (SSPC)  
a. SSPC-SP 6/NACE No. 3, Commercial Blast Cleaning  

1.03 DEFINITIONS  
A. Structural Steel: Elements of structural-steel frame, as classified by AISC 303, that support design loads.  

B. Seismic Load Resisting System (SLRS): Assembly of Structural Steel elements that resists seismic loads. Members of SLRS are indicated in the Contract Drawings and include the braced frames for Elevators 1, 2, and 3, and the roof of the Station Entry.  

C. Demand-Critical Welds: Welds in the SLRS including:  
1. Complete penetration welds in beam-to-column connections, including welds to flanges, webs, and flange reinforcement, stiffener, and doubler plates.  
2. Complete penetration welds of column splices and of columns to base plates.  
3. Fillet welds connecting braced frame gusset plates to braces, beams, and columns.  
4. Other welds indicated as “Seismic Demand Critical” on the Contract Drawings.  

D. Protected Zone: Surface of braced frame diagonal member, its gusset plates and cover plates in which restrictions apply to fabrication and attachments. Protected zones are noted on the Contract Drawings.  

1.04 SUBMITTALS  
A. Procedures: Section 01 33 00, Submittal Procedures.  

B. Shop Drawings:  
1. Submit detailed shop drawings of structural steel work, including erection plans and piece drawings, showing member sizes, details of fabrication and construction, methods of assembly, field welding, spacing and locations of members, hardware, anchors, openings, and accessories, and erection sequence and details. Include procedures for heavy lifts and rigging.
2. Include in shop drawings member identity, welding technique, cuts, copes, gussets, connections, holes, fasteners, camber, fabrication and erection tolerances, type of finish, paint system, weights of members, and critical clearances. Indicate locations of Protected Zones.

3. Indicate welds, both shop and field, using standard welding symbols of ANSI/AWS A2.4. Show the size, length, and type of each weld on drawings. Identify welds to the SLRS and Demand Critical Welds.

4. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical high-strength bolted connections.

5. Verify all dimensions and coordinate Work with adjoining Work.

C. Template Drawings and Placement Plans: As required for satisfactory placing of connections and anchorages.

D. Working Drawings and Method Statements:

1. Investigate stresses caused by the proposed erection procedure.

2. Submit the construction sequence for erection and disassembly of the shoring system. Indicate how sequence is coordinated with interim grading and drainage and the construction of the permanent structure.

3. Submit drawings sealed by a Professional Engineer. Show details of required temporary supports, staying, and bracing. Include descriptive data to illustrate the erection, transportation, and handling procedures, including sequence of erecting and transfer of loads if applicable.

4. Submit calculations sealed by a Professional Engineer supporting the drawings and other descriptive data.

5. Furnish setting diagrams, templates, and directions for the erection of structural framing, anchor bolts, bearing plates, and other embedded items.

E. Mill test reports of structural steel materials, showing:

1. Name, address and phone number of the steel manufacturer.

2. Statement identifying the type of steel referenced on the mill certification (for example: carbon plate, ASTM A36/ASME SA36).

3. Statement that the steel was melted and rolled in the USA.

4. Number of pieces represented by the mill certification (for example: 6 pieces, 12 feet by 12 feet by 6 inches).

5. Physical properties including; Heat Number, Yield Strength, Tensile Strength, Percentage of Elongation, Hardness (if applicable) and Bend Tests (if applicable).

6. Chemical Analysis as applicable for each type of steel and each heat number referenced on the mill certification including; Carbon, Manganese, Phosphorus, Sulfur, Silicon, Copper, Nickel, Vanadium, Columbium, Aluminum, Chromium, Molybdenum, and Cerium.

7. Signature of the person that prepared the mill certificate.
F. Records for steel pipe struts verifying fabrication, erection inspection, and nondestructive test conformance.

G. Qualifications
   1. Fabricator: AISC certification demonstrating conformance, and current work history.
   2. Erector: AISC certification demonstrating conformance, and current work history.
   3. Professional Engineer: License number, and current work history.

1.05 QUALITY ASSURANCE
A. Fabricator:
   1. Currently certified under the AISC Certification Program, Category STD.
   2. Minimum of five years experience with successfully completed structural steel work of similar complexity.

B. Erector
   1. Currently certified under the AISC Certification Program, Category CSE
   2. Minimum of five years experience with successfully completed structural steel work of similar complexity.

C. Professional Engineer: Licensed professional engineer currently registered in the State of Washington.

D. Welders: Section 05 05 23, Metal Fastenings
E. Welding Procedures: Section 05 05 23, Metal Fastenings

1.06 DELIVERY, STORAGE, AND HANDLING
A. Deliver, store, and handle structural steel materials in such a manner that the metal is kept clean and free from injury. Store materials above ground on platforms, skids, or other supports, and cover and protect from corrosion.

B. Mark weight and piece (mark) number, corresponding to shop erection sequence drawing, on all members. Match-mark all shop pre-fitted members.

C. Ship small parts, in boxes, crates, or barrels, plainly marked with an itemized description of the contents on the outside of each container.

D. Pack separately each length and diameter of bolt and each size of nut and washer.

PART 2 - PRODUCTS

2.01 STRUCTURAL STEEL SHAPES UNLESS NOTED OTHERWISE
A. Wide Flange Shapes: ASTM A992
B. Channels: ASTM A36
C. Angles: ASTM A36
D. Plate:
   1. Unless noted otherwise: ASTM A36
   2. Noted Grade 50: ASTM A572, Grade 50

E. Hollow Structural Sections
   1. Rectangular: ASTM A500, Grade B, Fy = 46 ksi.
   2. Round, diameter equal to or less than 20 inches: ASTM A500, Grade B, Fy = 42 ksi.

F. Pipe, diameter equal to or less than 12 inches: ASTM A53, Grade B, Fy = 35 ksi.

2.02 PIPE FOR TEMPORARY STRUTS

A. ASTM A252 Grade 3 with a minimum yield strength of 45 ksi as modified by the following:
   1. Use straight seam welded, seamless, or helical (spiral) welded steel pipe. Make all welds complete joint penetration welds.
   2. Manufacture steel pipe in conformance with the dimensional and fabrication tolerances indicated in API 5L, Chapter 7.
   3. Use pipe of carbon equivalency (CE), as defined in AWS D1.1 no greater than 0.45.
   4. Use steel pipe with steel sulfur content no greater than 0.05 percent.

B. Fabrication inspection requirements at the manufacturing plant are as follows:
   1. For 25 percent of the length of each continuous longitudinal and spiral weld on each pipe, use nondestructive testing by either radiographic, radioscopic, real time imaging systems, or ultrasonic methods that are in conformance with the requirements of AWS D1.1 or API Specification 5L, Section 9.7 for PSL-1 pipe.
   2. For 100 percent of the length of each circumferential butt splice weld joining lengths of pipe, use nondestructive testing by either radiographic, radioscopic, real time imaging systems, or ultrasonic methods that are in conformance with the requirements of AWS D1.1 or API Specification 5L, Section 9.7 for PSL-1 pipe.
   3. Conform the acceptance and repair criteria to the requirements of AWS D1.1, for tension, cyclically-loaded, non-tubular connections, or API 5L for PSL-1 pipe.
   4. If repairs are required in a portion of the weld, perform additional nondestructive testing on both sides of the repair for a length equal to 10 percent of the total length of the weld on the piece of pipe inspected. If additional weld defects are found, perform nondestructive testing on 100 percent of the length of the weld on the steel pipe in conformance with the procedures described above.
   5. Be responsible for performing all fabrication and erection inspection at the manufacturing plant. Costs associated with such performance are incidental to furnishing the steel pipe.
   6. Allow inspection to be witnessed by the Resident Engineer in conformance with the requirements of API Specification 5L, Appendix H as requested by the Resident Engineer.
   7. Submit records verifying that testing was accomplished and tested welds were in conformance with these specifications with the manufacturer’s mill certificates.
2.03 MANUFACTURED PRODUCTS

A. Bolts: Section 05 05 23, Metal Fastenings
B. Welding Electrodes: Section 05 05 23, Metal Fastenings
C. Grout: Section 03 62 00 Non-Shrink Grouting.

2.04 FABRICATION

A. Conform to the applicable requirements of AISC 303 and AISC 360.
B. Prefabricate and preassemble steel members and metal fabrications in the factory or shop as far as practicable. Mark and match-mark materials for field assembly.
C. Form and fabricate the work to meet installation conditions. Include accessories to adequately secure the work in place.
D. Seal joined members exposed to weather by continuous welds. Grind exposed welds smooth as indicated on the Contract Drawings.
E. Straighten rolled material, if necessary, before it is laid out for fabrication, in a manner conforming to the mill tolerances specified in ASTM A6, and by a process and in a manner which does injure the material. Sharp kinks and bends is cause material rejection. Do not use heat shrunk low-alloy structural steel.
F. Perform shearing, flame cutting, and chipping carefully and accurately so as not to induce residual stress in the metal being cut. Hold the radii of re-entrant gas-cut fillets not less than 3/4 inch and as much larger as practicable. Perform flame cutting in such manner that metal being cut is not carrying stress. For cut edges exposed in the finished work, machine cut, shear, or flame cut, and grind flush in conformance with AISC 360. Maintain all working points.
G. Fabricate bearing stiffeners and stiffeners intended as supports for concentrated loads as indicated. Mill or grind bearing surfaces of these stiffeners.
H. Bend load-carrying cold-rolled steel plates cold at right angles to the direction of rolling. Bend such that the radius of bend, measured to the concave face of the metal, is not less than indicated in the following table, in which T is the thickness of the plate.

<table>
<thead>
<tr>
<th>ANGLE THROUGH WHICH PLATE IS BENT</th>
<th>MINIMUM RADIUS</th>
</tr>
</thead>
<tbody>
<tr>
<td>61 to 120 degrees</td>
<td>1.0 T</td>
</tr>
<tr>
<td>121 to 150 degrees</td>
<td>2.0 T</td>
</tr>
</tbody>
</table>

1. If a shorter radius is indicated, bend the plate hot. Before bending, round plate edges where bending occurs to a radius of 1/16 inch.
I. Bolt or weld connections as indicated.
J. Drill or punch holes at right angles to the surface of the metal and do not make or enlarge by burning. Drill holes in base or bearing plates. Provide holes in members to permit connecting the work of other trades. Punch or drill holes at 1/16 inch larger than the diameter of the bolt.
K. For items bearing on concrete, provide steel bearing plates and anchors as indicated. Level base or bearing plates by means of adjustment nuts. Furnish templates, together with instructions for setting of anchors, anchor bolts, and bearing plates. Set anchors and related items properly in concrete during the progress of the work.

L. Fabricate metal bearing surfaces that contact preformed elastomeric bearing pads or grout flat to within 1/8-inch tolerance in 12 inches and to within 3/16 inch overall.

M. Include reinforcing angles, clip angles, plates, punched straps, brackets, and hangers as required to complete the work as indicated.

N. Provide drainage holes in structural components where water may accumulate without escape.

O. Where finishing is required, complete the assembly, including welding of units, before start of finishing operations. Finish surfaces of members exposed in the final structure shall be free of markings, burrs, and other defects.

P. Repair discontinuities within Protected Zones caused by fabrication operations such as tack welds, erection aids, air-arc gouging, and thermal cutting in conformance with AWS D1.8.

2.05 WELDING

A. Shop Welding and Shop Welding Repairs: Section 05 05 23, Metal Fastenings

2.06 BOLTING

A. Shop Bolting: Section 05 05 23, Metal Fastenings

2.07 SOURCE QUALITY CONTROL

A. Fabricator's Facility: Fabricator's shop or facility will be inspected before the start of fabrication work. Notify the Resident Engineer in writing at least ten days before the scheduled start of fabrication work.

B. Shop Welding Procedures and Personnel: Section 05 05 23, Metal Fastenings

C. Shop Welding and Weld Repair Testing and Inspection: Section 05 05 23, Metal Fastenings

D. Shop Bolting Testing and Inspection: Section 05 05 23, Metal Fastenings

PART 3 - EXECUTION

3.01 ERECTION


B. Prior to erection, verify elevations of concrete and masonry bearing surfaces and locations of anchor rods, bearing plates, and other embedments, with steel erector present, for compliance with requirements. Proceed with installation only after unsatisfactory conditions have been corrected.

C. Lines and Levels: Install structural steel accurately at established lines and levels. Install steel plumb and level before bolting is commenced. Install in accordance with accepted shop drawings and actual conditions, true and horizontal or perpendicular as the case may be, level and square, with angles and edges parallel with related lines of the building.
D. Temporary Bracing: Provide temporary bracing as required and keep in position until final completion. Brace and carefully handled shop fabricated items subject to damage to prevent distortions or other damage. Properly brace all items installed before concrete is placed to prevent distortion by pressure of concrete. Watch and maintain bracing during concreting operations.

E. Bases and Bearing Plates


2. Set base and bearing plates for structural members on wedges, shims, or setting nuts as required for correct leveling.

3. Weld plate washers to top of base plate.

4. Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of base or bearing plate.

5. Install high-strength, non-shrink grout in conformance with Section 03 62 00, Non-Shrink Grouting

F. Erection and Assembly: After erection and field assembly, align the various members forming parts of the completed structure and adjust accurately before fastening. Conform to tolerances of AISC 303.

G. Splice members only where indicated. Fasten splices of compression members after bringing abutting surfaces completely into contact.

H. Do not use thermal cutting during erection unless approved by the Resident Engineer. Finish thermally cut sections within smoothness limits in AWS D1.1. Cutting will be permitted only on secondary members which are not under stress, as acceptable to the Resident Engineer.

I. Drift Pins: Drift pins may be used only to bring together several parts or components. Do not use fit-up bolts and drift pins to bring out-of-tolerance fabricated members and components into alignment. Do not use drift pins with such force as to distort or damage the material.

J. Erection Connections

1. Place holes, plates, or other attachments required by the erector so as not to interfere with or cause any other detrimental affect to structural members or connections.

2. Remove erection bolts and attachments not shown on the Contract Drawings.

3. Fill holes not shown on the Contract Drawings with plug welds and grind smooth at exposed surfaces.

3.02 WELDING

A. Field Welding and Field Welding Repairs: Section 05 05 23, Metal Fastenings

3.03 BOLTING

A. Field Bolting: Section 05 05 23, Metal Fastenings
3.04 PROTECTION AND REPAIR

A. Corrective Measures

1. Report any errors in location or inaccuracies in setting anchor bolts, base plates, bearing plates, or other items of attachment or support for steel work to the Resident Engineer immediately. Correct as directed by the Resident Engineer.

2. Report any fit-up errors due to misfabrication to the Resident Engineer immediately, along with a proposed corrective measure. Do not proceed with corrective measures until approved by the Resident Engineer.

3. Correct bolted or welded connections, joints, or fastenings considered defective by the Resident Engineer as approved by the Resident Engineer.

B. Use fire-retardant blankets to completely contain arcs and spatter associated with welding.

C. Protected Zones:

1. Keep Protected Zones free of attachments such as welds, bolts, screwed or shot-in fasteners, limiting connection of perimeter edge angles, light gauge framing, partitions, duct work, piping, and other construction.

2. Repair Protected Zones in conformance with AWS D1.8.

3.05 FIELD QUALITY CONTROL

A. Field Welding Procedures and Personnel: Section 05 05 23, Metal Fastenings

B. Field Welding and Weld Repair Testing and Inspection: Section 05 05 23, Metal Fastenings

C. Field Bolting Testing and Inspection: Section 05 05 23, Metal Fastenings

END OF SECTION
PART 1 - GENERAL

1.01 SUMMARY

A. This section includes specifications for materials, fabrication and erection of structural steel for the pedestrian bridge.

B. Related Sections: The work of the following Sections is related to the work of this Section. Other Sections, not referenced below, may also be related to the proper performance of this work.

1. Section 01 45 00, Quality Control.
2. Section 05 05 23, Metal Fastenings
3. Section 09 96 00, High-Performance Coatings

1.02 REFERENCES

A. This Section incorporates by reference the latest revision of the following documents. It is a part of this Section as specified and modified. In case of a conflict between the requirements of this Section and those of a listed document, the requirement of this Section will prevail.

1. American Association of State Highway and Traffic Officials (AASHTO)
   a. AASHTO M 102 Standard Specification for Steel Forgings, Carbon, and Alloy, for General Industrial Use
   b. AASHTO M 103 Standard Specification for Steel Castings, Carbon, for General Application
   c. AASHTO M 105 Standard Specification for Gray Iron Castings
   d. AASHTO M 107 Standard Specification for Bronze Castings for Bridges and Turntables
   e. AASHTO M 138 Standard Specification for Copper Sheet, Strip, Plate, and Rolled Bar
   f. AASHTO M 164 Standard Specification for High-Strength Bolts for Structural Steel Joints
   g. AASHTO M 169 Standard Specification for Steel Bars, Carbon, and Alloy, Cold-Finished
   h. AASHTO M 232 Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
   i. AASHTO M 253 Standard Specification for Structural Bolts, Alloy Steel, Heat-Treated, 150 ksi Minimum Tensile Strength
j. AASHTO M 270 Standard Specification for Structural Steel for Bridges
k. AASHTO M 291 Standard Specification for Carbon and Alloy Steel Nuts
l. AASHTO M 292 Standard Specification for Carbon and Alloy Steel Nuts for Bolts for High-Pressure or High-Temperature Service, or Both
m. AASHTO M 293 Standard Specification for Hardened Steel Washers
n. AASHTO M 298 Standard Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel
o. AASHTO T 244 Standard Method of Test for Mechanical Testing of Steel Products

   a. AASHTO/AWS D1.5M/D1.5 Bridge Welding Code

3. American Institute of Steel Construction (AISC)
   a. AISC Certification – Fabricator
   b. ASIC Certification - Erector

   a. ANSI/AWS D1.1/D1.1M Structural Welding Code – Steel

5. American Society of Testing and Materials International (ASTM)
   b. ASTM A307 Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength
   c. ASTM A536 Standard Specification for Ductile Iron Castings
   d. ASTM A563 Standard Specification for Castings and Alloy Steel Nuts
   e. ASTM A1008 Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable
   f. ASTM A1011 Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability
   g. ASTM D312 Standard Specification for Asphalt Used in Roofing
   h. ASTM D4601 Standard Specification for Asphalt-Coated Glass Fiber Base Sheet Used in Roofing
   i. ASTM F436 Standard Specification for Hardened Steel Washers
   j. ASTM F606 Standard Test Methods for Determining the Mechanical Properties of Externally and Internally Threaded Fasteners, Washers, Direct Tension Indicators, and Rivets
k. ASTM F844 Standard Specification for Steel Plates, 9 percent Nickel Alloy, for Pressure Vessels, Produced by the Direct-Quenching Process

l. ASTM F959 Standard Specification for Compressible-Washer-Type Direct Tension Indicators for Use with Structural Fasteners

m. ASTM F1554 Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength

6. The Society For Protective Coatings (SSPC)
a. SSPC-SP6, Commercial Blast Clean

1.03 DEFINITIONS

A. Erection Drawings: Drawings showing the location and attachment of the individual structural steel shipping pieces, including all required field welding.

B. Normal Temperature: Contract Drawings state dimensions at a normal temperature of 64 degrees F. Unless otherwise noted, these dimensions are horizontal or vertical.

C. Shop Drawings: Drawings showing the individual structural steel shipping pieces that are to be produced in the fabrication shop.

D. Structural Steel

1. Structural steel is classified as
   a. Structural carbon steel (to be used when the Contract Drawings do not specify another)
   b. Structural low alloy steel
   c. Structural high strength steel

2. For the purposes of this Section, the following shall be classified as structural carbon steel: shims; ladders; stairways; anchor rods and sleeves; pipe, fittings and fastenings used in handrails; and other metal parts.

E. Working Drawings: Drawings showing the sequence of erection, requirements for temporary supports and anchorages, and the requirements for raising, field bolting, and field welding. These are in addition to the Erection Drawings and usually prepared by the erector.

1.04 SUBMITTALS

A. Shop Drawings and Erection Drawings

1. Submit shop drawings and erection drawings for all structural steel.

2. Furnish heat numbers for each piece on the as-built shop drawings for steel in main load-carrying tension members and in tension components of flexural members.

B. Working Drawings

1. Submit working drawings with supporting calculations. Working drawings and supporting calculations shall be prepared and sealed by a Professional Engineer.
C. Manufacturer’s Certificates of Conformance: Submit mill certificates demonstrating conformance, signed by the manufacturer’s representative, for each of the following materials and manufactured items:

1. Structural steel
2. Unfinished bolts, nuts, and washers
3. High strength bolts, nuts, and washers
4. Load indicating washers
5. Anchor rods, nuts, and washers
6. Welding electrode

D. Qualifications: Submit certificates demonstrating conformance for each of the following:

1. Fabricator: Copy of AISC certification
2. Erector: Copy of AISC certification
3. Welders: Copy of AWS certification for each welder
4. Inspectors: Copy of AWS CWI certificate
5. Professional Engineer: Professional Engineer license number and description of similar work in past 5 years.

E. Construction Work Plan: Submit a Construction Work Plan (CWP) in conformance with Section 01 45 00, Quality Control, including the following:

1. Welding Procedures
   a. For each weld procedure prequalified by AWS, specify the type of equipment to be used, electrode selection, preheat requirements, base materials, and joint details to be used.
   b. For each weld procedure not prequalified by AWS, submit a Welding Procedure Specification (WPS).
2. High Strength Bolt Drilling and Installation Procedures
3. Material Tracking System: Specify a system to visibly mark the material such that it can be tracked from the mill, through fabrication, and into the completed structure. These marks shall remain visible at least through the fit-up of the main load-carrying tension members. The marking method shall permit the Resident Engineer to verify 1) the material specification, 2) the heat number, and 3) all material test reports to meet all special requirements.
4. Heat Straightening Procedures: Specify heat-straightening the procedures for plates used by the mill or the fabricator if necessary.
5. Erection Plan:
   a. Provide complete details of the erection equipment and process including but not limited to:
1) Make and model, weight, geometry, lift, outrigger sizes, and reactions for each crane used

2) Locations of cranes, barges, trucks delivering girders, and the location of cranes and outriggers relative to other structures, including retaining walls and wing walls.

3) Temporary falsework support, bracing, guys, deadmen, and attachments to other structure components

4) Procedure and sequence of erection

5) Girder weights, lift points, and lifting devices

6) Girder stresses during progressive stages of erection

b. Include drawings, calculations, and catalog cuts as required to clearly show the details, assumptions, and dimensions. Include material properties, specifications, structural analysis, and all other data used.

c. Submit evidence that the fabricator has reviewed the erection plans and procedure. Submit the fabricator's review comments with the CWP.

d. Submit evidence that the erector has reviewed the erection plans and procedure. Submit the erector's review comments along with the CWP.

F. Mill Orders and Shipping Statements: Submit copies of mill orders and shipping statements.

G. Source Quality Control inspection and test reports

H. Field Quality Control inspection and test reports

1.05 QUALITY ASSURANCE

A. Fabricator

1. Certified under the AISC Certification Program, Major Steel Bridges Category.

2. When fracture critical members are specified in the Contract Documents, structural steel fabricators shall also have an endorsement F, Fracture Critical, under the AISC Quality Certification Program.

B. Erector: Certified under the AISC Certification Program, Advanced Certified Steel Erector

C. Welders: Conform to Section 05 05 23, Metal Fastenings

D. Welding Inspectors: Conform to Section 05 05 23, Metal Fastenings

E. Personnel Performing Nondestructive Testing: Conform to Section 05 05 23, Metal Fastenings

F. Weld Procedure Specifications: Conform to Section 05 05 23, Metal Fastenings

G. Professional Engineer: Licensed civil or structural engineer currently registered in the State of Washington.
1.06 DELIVERY STORAGE AND HANDLING

A. Apply markings at the mill to distinguish structural low alloy steel from structural carbon steel. Keep the two classes of steel carefully separated.

B. Mark and identify all fasteners.

C. Before fabrication, protect all material stored at the fabricating plant from rust, dirt, oil, and other foreign matter. Rust-pitted material will not be accepted.

D. After fabrication, protect all material awaiting shipment in the same manner as unfabricated material.

E. Deliver all structural steel to the job in good condition. As required by the Resident Engineer, thoroughly clean all damaged steel by high pressure water flushing, chemical cleaning, or sandblasting, and repainted with the specified shop coat.

F. All material shall be stored so as to prevent rust and loss of small parts. Support material off the ground and water on skids or platforms. Store in reverse order of installation.

G. Loading, transport, unload, and store structural steel such that the material and all coatings will be kept clean and free from damage from rough handling.

H. Use methods and equipment in field assembly not likely to twist, bend, deform, or otherwise damage the metal. Corrected all members slightly bent or twisted before it is placed. The Resident Engineer will reject member with serious damage.

I. Store and handle girder sections to prevent damage to the girders. If necessary, provide temporary stiffeners to prevent buckling during erection.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Structural Steel

1. Structural Carbon Steel: AASHTO M 270, Grade 36, except as otherwise noted.

2. Structural Low Alloy Steel: AASHTO M 270, Grade 50 or 50W.

3. Structural High Strength Steel: High yield strength, quenched and tempered structural steel conforming to AASHTO M 270, Grades 70W, 100, or 100W as specified in the Contract Drawings.

4. Charpy V-Notch Requirements

   a. All AASHTO M 270 material used in what the Contract Drawings show as main load-carrying tension members or as tension components of flexural members shall meet the Charpy V-notch requirements of AASHTO M 270 Temperature Zone 2.

   b. All AASHTO M 270 material used in what the Contract Drawings show as fracture critical members shall meet the Charpy V-notch requirements of AASHTO M 270, Fracture Critical Impact Test Requirements, Temperature Zone 2.
c. Charpy V-notch requirements for other steel materials shall be as specified in the Contract Drawings.

2.02 MANUFACTURED PRODUCTS

A. Unfinished Bolts (Ordinary Machine Bolts)
   1. Bolts: ASTM A307 Grade A
   2. Nuts: ASTM A563 Grade A
   3. Washers: ASTM F844

B. High Strength Bolts
   1. Bolts: AASHTO M 164 or M 253 Type 1, 2, or 3.
      a. Test bolts conforming to AASHTO M 164 that are galvanized in accordance with AASHTO M 232 embrittlement after galvanization in accordance with ASTM F606, Section 7. The Manufacturer’s Certificate of Compliance for the lot provided shall show the ultimate tensile strength test results.
      b. Bolts conforming to AASHTO M 253 shall not be galvanized. AASHTO M 253 Type 1 and 2 bolts shall be painted with two coats of zinc rich paint, formula A-9-73, consisting of a minimum dry film thickness of 2 mils per coat.
      c. Unpainted and nongalvanized bolts shall conform to AASHTO M 164 and M 253 Type 3.

2. Nuts
   a. AASHTO M 164 Bolts
      1) Black or galvanized Type 1: AASHTO M 291 Grade C, C3, DH, and DH3
   b. AASHTO M 292 Grade 2H
      1) Black weathering Type 3: AASHTO M 291 Grade C3 and DH3
      2) Galvanized Type 1: AASHTO M291 Grade DH, and AASHTO M 292 Grade 2H
   c. AASHTO M 253 Bolts
      1) Black Type 1 and 2: AASHTO M 291 Grade DH, DH3, and AASHTO M 292 Grade 2H
      2) Black weathering Type 3: AASHTO M 291 Grade DH3
   d. Nuts that are to be galvanized shall be tapped oversized the minimum required for proper assembly. The amount of overtap shall be such that the nut will assemble freely on the bolt in the coated condition and shall meet the mechanical requirements of AASHTO M 291 and the rotational capacity test specified in AASHTO M 164.
e. Galvanized nuts shall be lubricated in accordance with AASHTO M 291 including supplementary requirement S2. Documentation shall include the name, method of application, and dilution of the lubricant applied to the nuts.

3. Washers for AASHTO M 164 Type 1 and 3 bolts and AASHTO M 253 Type 1, 2, and 3 bolts: AASHTO M 293. The surface condition and weathering characteristics of the washers shall be the same as for the bolts being specified.

C. Direct Tension Indicating Washers

1. Conform to the requirements of ASTM F959 and may be used with either AASHTO M 164 or M 253 bolts.

2. Galvanize by mechanical deposition in accordance with AASHTO M 298 class 55. Do not hot dip galvanize direct tension indicating washers.

D. Anchor Rods

1. Rods: ASTM F1554, Grade 105 unless noted.

2. Nuts
   a. For ASTM F1554 Grade 105 black anchor rods: AASHTO M 291, Grade D or DH.
   b. For ASTM F1554 Grade 105 galvanized bolts: AASHTO M 291, Grade DH.
   c. For ASTM F1554 Grade 36 or 55 black or galvanized anchor rods: AASHTO M 291, Grade A


E. Welded Headed Studs

1. Material: Cold drawn bar stock conforming to the requirements of AASHTO M 169, Grades 1010 through 1020, inclusive, either semikilled or killed deoxidation

2. Conform to the following minimum mechanical properties determined in accordance with AASHTO T 244
   a. Tensile Strength: 60,000 psi min.
   b. Yield Strength: 50,000 psi min.
   c. Elongation: 20 percent min.
   d. Reduction of Area: 50 percent min.

3. Mechanical properties of the studs may be determined by testing either the steel after cold finishing or the full diameter finished studs.

2.03 CASTINGS

A. Steel Castings: AASHTO M 103, grade 70-36, unless otherwise designated in the Contract Drawings.

B. Gray Iron Castings: AASHTO M 105, the class of castings as designated in the Contract Drawings.
C. Malleable Iron Castings: ASTM A47.

D. Steel Forgings and Steel Shafting

1. Steel Forgings: AASHTO M 102, the classes of forgings as designated in the Contract Drawings.

2. Steel Shafting: AASHTO M 169, Grade Designation 1016 to 1030 inclusive, unless otherwise specified.


F. Copper Sheets For Seals: AASHTO M 138, UNS C12500, light cold rolled, and furnished in flat sheets each not less than 0.018 inch in thickness. Braze or solder all splices or joints to produce a continuous watertight seal for the full length of each unit.

G. Ductile Iron Castings: ASTM A536, Grade 80-55-06, unless otherwise specified in the Contract Drawings.

2.04 FABRICATION

A. General

1. Workmanship and finish shall be first-class, equaling the best practice in modern bridge fabrication shops. Welding, shearing, burning, chipping, and grinding shall be done neatly and accurately. All parts of the Work exposed to view shall be neatly finished.

2. Draining Pockets: Provide enough holes to drain all water from pockets in trusses, girders, and other members. Unless shown on approved shop plans, do not drill drain holes without the written approval of the Resident Engineer.

B. Machine Finished Surfaces

1. Provide a machined surface wherever the Contract Drawings show a surface finish symbol.

2. As soon as possible and before they leave the shop, cover machine-finished surfaces on abutting chord splices, column splices, and column bases with grease.

3. Prime all surfaces of iron and steel castings milled to smooth the surface.

4. While still in the shop, provide the full paint system on machine-finished surfaces and inaccessible surfaces of rocker or pin-type bearings.

5. Do not paint surfaces of pins and holes machine-finished to specific tolerances. As soon as possible and before they leave the shop, coat these surfaces with grease on the nuts. Provide sufficient thread on the pins to allow burring after the nuts are tightened.

C. Erection Marks: Paint erection marks on previously painted surfaces to permit identification of members in the field.

D. Edge Finishing

1. Finish all rolled, sheared, and thermal cut edges true to line and free of rough corners and projections. Break corners along exposed sheared or cut edges by light grinding or another method approved by the Resident Engineer to achieve an approximate 1/16-inch chamfer or rounding.
2. Plane, mill, grind, or thermal cut sheared edges on plates more than 5/8-inch thick to a depth of at least 1/8-inch.

3. Fillet re-entrant corners or cuts to a minimum radius of 3/4-inch.

4. Finish exposed edges of main load-carrying tension members or tension components of flexural members to a surface roughness no greater than 250-microinches as defined by the American National Standards Institute, ANSI B46.1, Surface Texture. Finish exposed edges of other members to a surface roughness no greater than 1,000-micro-inches.

5. The hardness of thermal-cut edges of structural low alloy or high-strength steel flanges for main load-carrying tension members or tension components of flexural members shall not exceed Rockwell Hardness C 30. Prevent excessive hardening of flange edges through preheating, post heating, or control of the burning process as recommended by the steel manufacturer and approved by the Resident Engineer.

6. Hardness testing shall consist of testing thermal-cut edges with an approved portable hardness tester. The hardness tester, and its operating test procedures, shall be submitted to the Resident Engineer for approval prior to use. The hardness tester shall be convertible to Rockwell C scale values.

7. At two locations, two tests shall be performed on each thermal-cut edge, one each within 1/4-inch of the top and bottom surfaces. The tests shall be located 1/4-the length of each thermal-cut edge from each end of the cut. If one or more readings are greater than RHC 30, the entire length of the edge shall be ground or machined to a depth sufficient to provide acceptable readings upon further retests. If thermal-cutting operations conform to procedures approved by the Resident Engineer, and hardness testing results are consistently within acceptable limits, the Resident Engineer may approve a reduction in the testing frequency.

E. Planing of Bearing Surfaces

1. Mill ends of columns that bear on base and cap plates to true surfaces and accurate bevels.

2. When assembled, caps and base plates of columns and the sole plates of girders and trusses shall have a fit tolerance within 1/32-inch for 75 percent of the contact area. If warped or deformed, heat-straighten the plates shall be heat straightened, planed, or corrected in some other way to produce accurate, even contact. If necessary for proper contact, bearing surfaces that will contact other metal surfaces shall be planed or milled. Rough finish surfaces of warped or deformed base and sole plates that will contact masonry.

3. On the surface of expansion bearings, orient the cut of the planer in the direction of expansion.

F. Abutting Joints

1. Face abutting ends of compression members accurately so that they bear evenly in the completed installation. On built-up members, face or mill the ends after fabrication.

2. Rough-finish ends of tension members at splices to produce neat, close joints. A contact fit is not required.

G. End Connection Angles
1. On floor beams and stringers, end connection angles shall be flush with each other and set accurately in relationship to the position and length of the member.

2. Unless required by the Contract Drawings, do not finish end connection angles. If, however, faulty assembly requires them to be milled, milling shall not reduce thickness by more than 1/16-inch.

H. Built-Up Members

1. The various pieces forming one built-up member shall be straight and close fitting, true to detailed dimensions, and free from twists, bends, open joints, or other defects.

2. Do not use localized heat or mechanical force when fabricating curved girders to bend the girder flanges about an axis parallel to girder webs.

I. Hand Holes: Fabricate hand holes, whether punched or cut with burning torches, true to sizes and shapes shown in the Contract Drawings. Fabricate edges true to line and grind smooth.

J. Plate Girders

1. Web Plates: If web plates are spliced, set gaps between plate ends at shop assembly to 1/4 inch. Do not exceed 3/8 inch.

2. Web Splices and Fillers: Fit web splice plates and fillers under stiffeners within 1/8 inch at each end. In lieu of the steel material specified in the Contract Drawings, the Contractor may substitute ASTM A1008 or ASTM A1011 steel for all filler plates less than 1/4 inch thickness, provided that the grade of filler plate steel meets or exceeds that of the splice plates.

K. Fabricating Tension Members: Plates for main load-carrying tension members or tension components of flexural members shall be:

1. Blast cleaned entirely or blast cleaned on all areas within 2 inches of welds to SSPC-SP6, Commercial Blast Cleaning, and

2. Fabricated from plate stock with the primary rolling direction of the stock parallel to the length of the member.

L. Annealing

1. Anneal all eyebars by heating uniformly to the proper temperature, then cooling slowly and evenly in the furnace. Control the temperature of the bars at all stages.

2. Slight bends on secondary steel members may be made without heat. Crimped web stiffeners need no annealing.

M. Straightening Bent Material

1. If the Resident Engineer permits in writing, plates, angles, other shapes, and built-up members may be straightened. Straightening methods shall not fracture or injure the metal. Distorted members shall be straightened mechanically. A limited amount of localized heat may be applied only if carefully planned and supervised, and only if the Resident Engineer has approved a heat-straightening procedure in writing.

2. Parts to be heat-straightened shall be nearly free from all stress and external forces except those that result from the mechanical pressure used with the heat.
3. After straightening, inspect the member for fractures using a method determined by
the Resident Engineer.

4. The Resident Engineer will reject metal showing sharp kinks and bends.

N. High Strength Bolt Holes

1. General

   a. Holes may be punched or subpunched and reamed, drilled or subdrilled and
      reamed, or formed by numerically controlled drilling.

   b. Provide holes 1/16 inch larger than the nominal diameter of the bolt.
      Subdrill or subpunch the holes then ream full size after assembly or drill
      holes full size from the solid with all thicknesses of material shop assembled
      in the proper position. If neither of these methods are used, then the
      following shall apply:

      1) Drill bolt holes in steel splice plates full size using steel
templates.

      2) Drill bolt holes in the main members of trusses, arches,
continuous beam spans, bents, towers, plate girders, box girders,
and rigid frames at all connections as follows:

         a) Make a minimum of 30 percent of the holes in one side of
the connection full size using steel templates.

         b) Make a minimum of 30 percent of the holes in the second
side full size assembled in the shop.

         c) Make all remaining holes full size in unassembled
members using steel templates.

      3) Drill bolt holes in crossframes, gussets, lateral braces, and other
secondary members full size using steel templates.

2. Punched Holes:

   a. Die diameter shall not exceed punch diameter by more than 1/16 inch.
   Ream all holes requiring enlargement to admit the bolts. Cut all holes clean
with no torn or ragged edges.

   b. Accuracy of Punched, Subpunched, and Subdrilled Holes: After shop
assembly and before reaming, all punched, subpunched, and subdrilled
holes shall meet the following standard of accuracy. The Resident Engineer
will reject all pieces that fail to meet these standards.

      1) At least 75 percent of the holes in each connection shall permit
the passage of a cylindrical pin 1/8 inch smaller in diameter than
nominal hole size. This pin shall pass through at right angles to
the face of the member without drifting.

      2) All holes shall permit passage of a pin 3/16 inch smaller in
diameter than nominal hole size.

3. Reamed and Drilled Holes
a. Use short taper reamers or twist drills to produce cylindrical holes perpendicular to the member. Direct reamers and drills mechanically, not manually. Assemble and hold securely connecting parts that require reamed or drilled holes as the holes are formed, then match-mark before disassembly. Provide the Resident Engineer a diagram showing these match-marks. The Resident Engineer will reject components having poorly matched holes.

b. Remove burrs on outside surfaces. If the Resident Engineer requires, disassemble parts to remove burrs.

c. If templates are used to ream or drill full-size connection holes, position and angle with extreme care and bolt firmly in place. Use duplicate templates for reaming or drilling matching members or the opposite faces of one member. Match-mark all components.

d. Accuracy of Reamed and Drilled Holes: After shop assembly and before reaming, all reamed and drilled holes shall meet the following standard of accuracy. The Resident Engineer will reject all pieces that fail to meet these standards.

1) At least 85 percent of all holes in a connection of reamed or drilled holes shall show no offset greater than 1/32 inch between adjacent thicknesses of metal. No hole shall have an offset greater than 1/16 inch.

2) Inscribe centerlines from the connection on the template and locate holes from these centerlines. Use centerlines also for accurately locating the template relative to the milled or scribed ends of the members.

3) Templates shall have a hardened steel bushing inserted into each hole. These bushings may be omitted, however, if the fabricator satisfies the Resident Engineer that 1) the template will be used no more than five times, and 2) use will produce no template wear.

4) Use templates at least 1/2 inch thick. If necessary, use thicker templates to prevent buckling and misalignment as holes are formed.

4. Numerically Controlled (N/C) Drilling

a. N/C holes may be drilled or punched to size through individual pieces, or may be drilled through any combination of tightly clamped pieces.

b. When the Resident Engineer requires, demonstrate that the N/C procedure consistently produces holes and connections meeting the requirements of these Specifications.

O. Fitting for Bolting

1. Assemble, pin and draw firmly together all parts of a member before drilling, reaming, and bolting begins. If necessary, take assembled pieces apart to remove all burrs or shavings produced as the holes are formed. The member shall be free from twists, bends, and other deformation.
2. Sandblast contacting metal surfaces clean before assembly in conformance with SSPC Specifications for Commercial Blast Cleaning (SSPC-SP 6).

3. Any drifting done during assembly shall be no more than enough to bring the parts into place. Drifting shall not enlarge the holes or distort the metal.

P. Pins and Rollers

1. General
   a. Fabricate pins and rollers of the class of forged steel as noted on the Contract Drawings. Turn accurately to detailed dimensions, smooth, straight, and flawless. Produce the final surface by a finishing cut.
   b. Pins and rollers 9 inches or less in diameter may either be forged and annealed or made of cold-finished carbon steel shafting.
   c. Pins more than 9 inches in diameter shall have holes at least 2 inches in diameter bored longitudinally through their centers. Pins with inner defects will be rejected.
   d. Provide pilot and driving nuts for each size of pin unless noted otherwise.

2. Boring Pin Holes
   a. Bore pin holes true to detailed dimensions, smooth and straight, and at right angles to the axis of the member. Holes shall be parallel with each other unless noted otherwise. A finishing cut shall always be made.
   b. The distance between holes shall not vary from detailed dimensions by more than 1/32 inch. In tension members, this distance shall be measured from outside to outside of holes; in compression members, inside to inside.

3. Pin Clearances
   a. Each pin shall be 1/50 inch smaller in diameter than its hole. All pins shall be numbered after being fitted into their holes in the assembled member.

Q. Shop Construction, Castings, Steel Forgings, and Miscellaneous Metals

1. This section’s requirements for structural steel (including painting requirements) shall also apply to castings, steel forgings, and miscellaneous metals.

2. Castings shall be:
   a. True to pattern in form and dimensions;
   b. Free from pouring faults, sponginess, cracks, blow holes, and other defects in places that would affect strength, appearance, or value;
   c. Clean and uniform in appearance;
   d. Filleted boldly at angles; and
   e. Formed with sharp and perfect arises.

3. Iron and steel castings and forgings shall be annealed before machining, unless the Contract Drawings state otherwise.
2.05 SHOP ASSEMBLY

A. Method of Shop Assembly: Choose one of the shop assembly methods described below that will best fit the proposed erection method. Obtain the Resident Engineer’s approval of both the shop assembly and the erection methods before beginning fabrication.

1. Full Truss or Girder Assembly: Each truss or girder is completely assembled over the full length of the superstructure.

2. Progressive Truss or Girder Assembly: Each truss or girder is assembled in stages longitudinally over the full length of the superstructure.
   a. For trusses: The first stage shall include at least three adjacent truss panels. Each truss panel shall include all of the truss members in the space bounded by the top and bottom chords and the horizontal distance between adjacent bottom chord joints.
   b. For girders: The first stage shall include at least three adjacent girder shop sections. Shop sections are measured from the end of the girder to the first field splice or from field splice to field splice.
   c. For trusses and girders: After the first stage has been completed, each subsequent stage shall be assembled to include: two truss panels or girder shop sections of the previous stage (or one truss panel or girder shop section, if approved by the Resident Engineer) and one or more truss panels or girder shop sections added at the advancing end. The previous stages shall be repositioned if necessary, and pinned to ensure accurate alignment.

   1) For straight sections of bridges without skews or tapers, girders in each subsequent stage may be assembled to include one girder shop section from the previous stage and one or more girder shop sections at the advancing end.

   2) If the bridge is longer than 150-feet, each longitudinal stage shall be at least 150-feet long, regardless of the length of individual continuous truss panels or girder shop sections.

   3) The Contractor may begin the assembly sequence at any point on the bridge and proceed in either or both directions from that point.

   4) No assembly shall have less than three truss panels or girder shop sections.

3. Full Chord Assembly: The full length of each chord for each truss is assembled with geometric angles at the joints. Chord connection bolt holes are drilled/reamed while members are assembled. The truss web member connections are drilled/reamed to steel templates set by relating geometric angles to the chord lines.
   a. At least one end of each web member shall be milled or scribed at right angles to its long axis. The templates at both ends of the member shall be positioned accurately from the milled end or scribed line.

4. Progressive Chord Assembly: Adjacent chord sections are assembled in the same way as specified for Full Chord Assembly, using the procedure specified for Progressive Truss or Girder Assembly.
5. Special Complete Structure Assembly: All structural steel members (Superstructure and Substructure, including all secondary members) are assembled at one time.

B. Check of Shop Assembly

1. Check each assembly for alignment, accuracy of holes, fit of milled joints, and other assembly techniques. Do not begin drilling or reaming until the Resident Engineer has given approval. If N/C drilling is used, this approval must be obtained before the assembly or stage is dismantled.

2.06 SHOP BOLTING

A. Bolted Connections

1. All bolted connections are slip critical.
   a. Provide Type 1 or Type 2 bolts for painted structures.
   b. Provide Type 3 bolts for unpainted structures.
   c. Do not galvanize AASHTO M 253 Type 1, 2, and 3 bolts or use in contact with galvanized material.

2. Provide hardened washers under turned elements for connections using AASHTO M 164 and AASHTO M 253 bolts and, as required in the following:
   a. Irrespective of the tightening method, provide hardened washers under both the head and the nut when AASHTO M 253 bolts are to be installed in structural carbon steel.
   b. Where the outer face of the bolted parts has a slope greater than 1:20 with respect to a plane normal to the bolt axis, provide a hardened beveled washer to compensate for the lack of parallelism.

3. Lubricate all galvanized nuts with a lubricant containing a visible dye so a visual check for the lubricant can be made at the time of field installation. Black bolts shall be “oily” to the touch when installed. Clean and relubricate weathered or rusted bolts and nuts prior to installation.

4. After assembly, bolted parts shall fit solidly together. Bolted parts shall not be separated by washers, gaskets, or other material. Assembled joint surfaces, including those next to bolt heads, nuts, and washers, shall be free of loose mill scale, burrs, dirt, and other foreign material that would prevent solid seating.

5. When all bolts in a joint are tight, each bolt shall carry at least the proof load shown in Table 05 12 33-A below:
Table 05 12 33-A – Bolt Proof Load

<table>
<thead>
<tr>
<th>Bolt Size (inches)</th>
<th>AASHTO M 164 (pounds)</th>
<th>AASHTO M 253 (pounds)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/2</td>
<td>12,050</td>
<td>14,900</td>
</tr>
<tr>
<td>5/8</td>
<td>19,200</td>
<td>23,700</td>
</tr>
<tr>
<td>3/4</td>
<td>28,400</td>
<td>35,100</td>
</tr>
<tr>
<td>7/8</td>
<td>39,250</td>
<td>48,500</td>
</tr>
<tr>
<td>1</td>
<td>51,500</td>
<td>63,600</td>
</tr>
<tr>
<td>1-1/2</td>
<td>56,450</td>
<td>80,100</td>
</tr>
<tr>
<td>1-1/4</td>
<td>71,700</td>
<td>101,800</td>
</tr>
<tr>
<td>1-3/8</td>
<td>85,450</td>
<td>121,300</td>
</tr>
<tr>
<td>1-1/2</td>
<td>104,000</td>
<td>147,500</td>
</tr>
</tbody>
</table>

B. Tightening may be done by either the turn-of-nut or the direct-tension indicator method. Preferably, the nut shall be turned tight while the bolt is prevented from rotating. However, if required because of operational clearances, tightening may be done by turning the bolt while the nut is prevented from rotating.

1. Turn-of-Nut Method
   a. Provide hardened steel washers under the turned element. After a bolt in a connection or joint splice plate has been tightened to snug-tight and all specified bolting conditions satisfied, tighten to the specified minimum tension by rotating the amount specified in Table 05 12 33-B.
   b. Before final tightening, match-mark with crayon or paint the outer face of each nut and the protruding part of the bolt. To ensure that this tightening method is followed, the Resident Engineer will (1) observe as the Contractor installs and tightens all bolts and (2) inspect each match-mark.

Table 05 12 33-B – Turn-of-Nut Tightening Method

<table>
<thead>
<tr>
<th>Bolt Length L</th>
<th>Disposition of Outer Faces of Bolted Parts</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Condition 1</td>
</tr>
<tr>
<td>L ≤ 4D</td>
<td>1/3 turn</td>
</tr>
<tr>
<td>4D &lt; L ≤ 8D</td>
<td>1/2 turn</td>
</tr>
<tr>
<td>8D &lt; L ≤ 12D</td>
<td>2/3 turn</td>
</tr>
</tbody>
</table>

Notes:
1. Bolt length measured from underside of head to top of nut.
2. D = nominal bolt diameter of bolt being tightened.
3. Condition 1 — both faces at right angles to bolt axis.
4. Condition 2 — one face at right angle to bolt axis, one face sloped no more than 1:20, without bevel washer.
5. Condition 3 — both faces sloped no more than 1:20 from right angle to bolt axis, without bevel washer.
6. Nut rotation is relative to the bolt regardless of which element (nut or bolt) is being turned. Tolerances permitted are as follows:

± 30-degrees (1/12-turn) for final turns of 1/2-turn or less

± 45-degrees (1/8-turn) for final turns of 2/3-turn or more.

7. When bolt length exceeds 12D, determine the rotation by actual tests in which a suitable tension device simulates actual conditions.

2. Direct-Tension-Indicator (DTI) Method.
   a. Do not use DTIs under the turned element. Place DTIs under the bolt head with the protrusions facing the bolt head when the nut is turned. Place DTIs under the nut with the protrusions facing the nut when the bolt is turned.
   b. Install DTIs using two or more person crews with one individual preventing the element at the DTI from turning and measuring the gap of the DTI to determine the proper tension of the bolt.
   c. Test three DTIs per lot with a WSDOT-approved bolt tension calibrator. Tension bolts 105 percent of the tension shown in Table 05 12 33-A. Do not tension the test bolts such that all of the DTI protrusions are completely crushed (all five openings with zero gap). Measure the DTI gap between all protrusions with a tapered feeler gage to the nearest 0.001 inch. Average all of the non-zero DTI gap measurements for the three test bolts. Use this average in the tightening of all the production bolts except as provided below.

1) Snug-tighten all bolts in a connection prior to bringing all DTIs in the connection to full load. The maximum gap of the production bolt DTIs shall not be greater than the average test gap established above or 0.005 inch, whichever is less. The minimum gap of the production bolt DTIs may be zero (all five openings with zero gap).

2) Tension all bolts and inspect all DTIs with a feeler gage in the presence of the Resident Engineer.

3) If a bolt that has had its DTI brought to full load loosens during the course of bolting the connection, install a new DTI and be retension.

C. Reuse of Bolts

1. Do not reuse AASHTO M 253 bolts or galvanized AASHTO M 164 bolts.

2. Ungalvanized AASHTO M 164 bolts may be reused if approved by the Resident Engineer.
   a. Inspect the threads of all bolts to be reused for distortion by reinstalling the used nut on the bolt and turning the nut for the full length of the bolt threads by hand.
   b. Relubricate all bolts to be reused.
   c. Used bolts shall be subject to a rotational capacity test.
d. Touching up or retightening previously tightened bolts which may have been loosened by the tightening of adjacent bolts will not be considered as reuse, provided the retightening continues from the initial position and does not require greater rotation, including the tolerance, than that required by Table 05 12 33-B.

2.07 SHOP WELDING AND SHOP WELDING REPAIR

A. Welding and repair welding of all bridge steel shall comply with the AASHTO/AWS D1.5M/D1.5 Bridge Welding Code.

B. Welding and repair welding for all other steel fabrication shall comply with the ANSI/AWS D1.1/D1.1M Structural Welding Code – Steel.

C. The following shall prevail whenever they differ from either of the above welding codes.

1. Weld structural steel only to the extent shown in the Contract Drawings.

2. Do not provide shop or field welds, including tack and temporary welds, unless the location of the welds is shown on the approved Shop Drawings and Erection Drawings, or approved by the Resident Engineer in writing.

3. Do not begin welding prior to receiving the Resident Engineer’s approval of Shop Drawings.

4. Any welded shear connector longer than 8 inches may be made of two shorter shear connectors joined with full-penetration welds.

5. In shielded metal-arc welding, use low-hydrogen electrodes.

6. In submerged-arc welding, oven-dry the flux at 550 degrees F for at least two hours, then store in ovens held at 250 degrees F or more. If not used within four hours after removal from a drying or storage oven, redry flux before use.

7. Preheat and interpass temperatures shall conform to the applicable welding code as specified in this section. When welding main members of steel bridges, the minimum preheat shall not be less than 100 degrees F.

8. If groove welds (web-to-web or flange-to-flange) have been rejected, they may be repaired no more than twice. If a third failure occurs:

a. Trim the members, if the Resident Engineer approves, at least 1/2 inch on each side of the weld; or

b. Replace the members.

9. By using extension bars and runoff plates, terminate groove welds in a way that ensures the soundness of each weld to its ends. Remove the bars and plates after the weld is finished and cooled. Grind the weld ends smooth and flush with the edges of abutting parts.

10. The following will not be allowed:

a. Welding with electrogas or electroslag methods,

b. Welding or flame cutting when the ambient temperature is below 20 degrees F.
c. Using coped holes in the web for welding butt splices in the flanges unless shown in the Contract Drawings

2.08 SHOP PAINTING
A. Shop Painting: Section 09 96 00, High-Performance Coatings.

2.09 SOURCE QUALITY CONTROL
A. Shop Welding Inspection and Testing
   1. General
      b. Steel Structures Other Than Bridges: AWS D1.1/D1.1M, Structural Welding Code – Steel.
      c. The requirements described in the remainder of this Section shall prevail whenever they differ from either of the above welding codes.
   2. Frequency
      a. Visual Inspection: Inspect 100 percent of welds. Perform inspection before, during, and after the completion of welding.
      b. Ultrasonic Testing: Test 100 percent of complete joint penetration welds on plates 5/16 inch or thicker.
      c. Magnetic Particle Inspection
         1) Inspect at least 30 percent of each size of fillet weld, excluding intermittent fillet welds.
         2) Inspect at least 30 percent of each size and type of partial joint penetration weld.
         3) Inspect a least 30 percent of each longitudinal butt joint weld in beam and girder webs.
         4) Inspect 100 percent of complete joint penetration welds on plates 5/16 inch or thinner. If backing plate is not used, test both sides of weld.
         5) Inspect 100 percent of complete joint penetration weld ends at plate edges.
      d. Radiographic Inspection: Inspect 100 percent of complete joint penetration welds in tension.
         1) Use edge blocks in conformance with AASHTO/AWS D1.5M/D1.5.
         2) For beam and girder webs, cover the greater of:
            a) 15 inches from the tension flange, or
            b) 1/3 of the web depth.
3. The testing procedure and acceptance criteria for tubular members shall conform to the requirements of the ANSI/AWS D1.1/D1.1M.

4. Maintain the radiographs and the radiographic inspection report in the shop until the last joint to be radiographed in that member is accepted.

B. Shop Bolting Inspection and Testing

C. Pre-Erection Testing

1. High strength bolt assemblies (bolt, nut, and washer), black and galvanized, shall be subjected to a rotational capacity test (AASHTO M 164, Section 8.5) prior to all erection activities. Each combination of bolt production lot, nut lot, and washer lot shall be tested as an assembly. All tests shall be performed by the Contractor in the presence of the Resident Engineer. Two specimens per lot shall be tested at the erection site immediately prior to installation, or whenever the Resident Engineer deems it necessary. The bolt assemblies shall meet the following requirements.

   a. Go through two times the required number of turns from snug-tight condition as indicated in Table 05 12 33-B without stripping, tensile, or shear failure. Rotation-capacity test shall be performed in a WSDOT-approved bolt tension calibrator.

   b. The maximum recorded tension shall be equal to or greater than 1.15 times the minimum bolt tension listed in Table 05 12 33-A.

   c. The measured torque to produce the minimum bolt tension shall not exceed the value obtained by the following equation.

   \[
   \text{Torque} = 0.25 \, P \, D
   \]

   Where: Torque = Calculated Torque (foot-pounds)

   \[
   P = \text{Measured Bolt Tension (pounds)}
   \]

   \[
   D = \text{Normal Bolt Diameter (feet)}
   \]

   d. Disassemble the torqued bolt and inspect for signs of failure. Failure is defined as any shear damage to the threads of the bolt or the nut or cracks in the body of the bolt. If either specimen fails, the lot of bolts will be rejected. Elongation of the bolt between the bolt head and the nut is not considered to be a failure.

D. The bolts shall be tested by the manufacturer in conformance with these Specifications. Anchor rods, nuts, and washers shall be inspected prior to shipping to the project site.

E. Bolts shall be sampled prior to incorporating into a structure. For the purposes of selecting samples, a lot of bolts shall be the quantity of bolts of the same nominal diameter and same nominal length in a consignment shipped to the project site. The minimum number of samples from each lot shall be as shown in Table 05 12 33-C:
### Table 05 12 33-C – Test Sample Size

<table>
<thead>
<tr>
<th>Lot Size</th>
<th>Sample Size (1, 2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 to 50</td>
<td>(Note 3)</td>
</tr>
<tr>
<td>51 to 150</td>
<td>4</td>
</tr>
<tr>
<td>151 to 1,200</td>
<td>6</td>
</tr>
<tr>
<td>1,201 to 10,000</td>
<td>10</td>
</tr>
<tr>
<td>10,001 to 35,000</td>
<td>16</td>
</tr>
<tr>
<td>35,001 and over</td>
<td>24</td>
</tr>
</tbody>
</table>

**Notes:**

1. If bolts are galvanized, increase the sample size by 1.5 times the table value for the number of bolts being sampled.

2. Nuts, washers, and load indicator devices shall be sampled at the same frequency as the bolts.

3. Manufacturer’s Certificate of Compliance only — samples not required.

1. All testing of bolts, nuts, washers, and load indicating devices shall be performed on specimens as they are to be installed.

2. All samples shall include a Manufacturer’s Certificate of Compliance for each lot of bolts provided.

**F.** Facilities for Inspection: Provide all facilities at the mill and fabrication shop required by the inspector to inspect material and workmanship. Allow Inspectors safe and free access to all areas in the mill and shop.

**G.** Inspector’s Authority

1. The Inspector may reject materials or workmanship that does not comply with these Specifications. In any dispute, the Contractor may appeal to the Resident Engineer whose decision shall be final.

2. By its inspection at the mill and shop, the Resident Engineer intends only to facilitate the Work and prevent errors. This inspection shall not relieve the Contractor of responsibility for identifying and replacing defective material or workmanship.

**H.** Weighing: Structural steel need not be weighed unless required. When a weight is required, it may either be calculated or obtained by scales. If scale weights are used, record separately the weights of all tools, erection material, and dunnage.

**I.** Shop Inspection and Testing by the Resident Engineer

1. Where 100 percent testing is not required, the Resident Engineer reserves the right to select the location(s) for testing. If rejectable flaws are found in a test length of weld, the full length of the weld or 5 feet on each side of the test length, whichever is less, shall be tested.

2. After the Contractor’s welding inspection is complete, the Contractor shall allow the Resident Engineer sufficient time to perform quality assurance ultrasonic welding inspection.
3. Rejections: Even if the Inspector accepts materials or finished members, the Resident Engineer may later reject them if defective. The Contractor shall promptly replace or make good all rejected materials or workmanship.

PART 3 - EXECUTION

3.01 INSTALLERS

A. Load Restrictions on Bridges Under Construction

1. Bridges under construction shall remain closed to all traffic, including construction equipment, until the Substructure and the Superstructure, through the roadway deck, are complete for the entire structure, except as provided herein. Completion includes release of all falsework, removal of all forms, and attainment of the minimum design concrete strength and specified age of the concrete in accordance with these Specifications.

2. If necessary and safe to do so, and if the Contractor requests it in writing, the Resident Engineer may approve traffic on a bridge prior to completion. The maximum distributed load at each construction equipment support shall not exceed the design load by more than 33 percent. The written request shall:
   a. Describe the extent of the structure completion at time of the proposed equipment loading;
   b. Describe the loading magnitude, arrangement, movement, and position of traffic (equipment) on the bridge, including but not limited to the following:
      1) Location of construction equipment, including outriggers, spreader beams and supports for each, relative to the bridge framing plan (bridge girder layout);
      2) Mechanism of all load transfer (load path) to the bridge;
   c. Provide stress calculations under the design criteria specified in the AASHTO Standard Specifications for Highway Bridges, current edition, prepared by a professional engineer, and carrying the professional engineer’s signature and seal, including but not limited to the following:
      1) Supporting calculations showing that the flexural and shear stresses in the main load carrying members due to the construction load are within the allowable stresses;
      2) Supporting calculations showing that the flexural and shear stresses in the bridge deck due to the construction load are within the allowable stresses;
   d. Provide supporting material properties, catalogue cuts, and other information describing the construction equipment and all associated outriggers, spreader beams, and supports; and,
   e. State that the Contractor assumes all risk for damage.

3.02 PREPARATION

A. Clearing the Site: Clear the entire site of the proposed structure to the limits staked by the Resident Engineer.
3.03 ERECTION

A. Setting Anchor rods: Set anchor rods in masonry as required in the Contract Documents. Grout anchor rods in after the shoes, masonry plates, and keeper plates have been set and the span or series of continuous spans are completely erected and adjusted to line and camber.

B. Setting and Grouting Masonry Plates

1. The following procedure applies to masonry plates for all steel spans, including shoes, keeper plates, and turning racks on movable bridges:
   a. Set masonry plates on the anchor rods;
   b. Place steel shims under the masonry plates to position pin centers or bearings to line and grade and in relationship to each other. Steel shims shall be no more than 2-1/2 inches square and placed under plate webs;
   c. Level the bases of all masonry plates;
   d. Draw anchor rod nuts down tight;
   e. Recheck pin centers or bearings for alignment; and
   f. Leave at least 3/4 inch of space under each masonry plate for grout.

2. After the masonry plates have been set and the span or series of continuous spans are completely erected and swung free, fill the space between the top of the masonry and the top of the concrete bearing seat grout. Set and grout main masonry plates for cantilever spans in before all steel work is erected.

3. Grout mixture and placement shall be as required in WSDOT Section 6-02.3(20).

C. Setting Steel Bridge Bearings: Set and adjust masonry plates, shoes, and keeper plates of expansion bearings to center at a normal temperature of 64 degrees F. Adjustment for an inaccuracy in fabricated length shall be made after dead-load camber is out.

D. Placing Superstructure: Place no Superstructure load on finished piers or abutments until the Resident Engineer allows. Normally, this concrete-hardening interval requires at least 12 days.

E. Alignment and Camber

1. General
   a. Before beginning field bolting:
      1) Adjust the structure to correct grade and alignment,
      2) Regulate elevations of panel points (ends of floorbeams), and
      3) Delay bolting at compression joints until adjusting the blocking to provide full and even bearing over the whole joint.
   b. On truss spans, a slight excess camber will be permitted as the bottom chords are bolted. But camber and relative elevations of panel points shall be correct before the top chord joints, top lateral system, and sway braces are bolted.
2. Measuring Camber
   a. Provide the Resident Engineer with a diagram for each truss that shows camber at each panel point. This diagram shall display actual measurements taken as the truss is being assembled.

3. Assembling and Bolting
   a. To begin bolting all field connections or splices, install and tighten to snug-tight enough bolts to bring all parts into full contact with each other prior to tightening these bolts to the specified minimum tension. “Snug-tight” means either the tightness reached by (1) a few blows from an impact wrench or (2) the full effort of a person using a spud wrench.
   b. As erection proceeds, securely drift pin and bolt all field connections and splices for each member with Items 1) or 2) below before releasing the weight of the member or the next member is added. Erection Drawings shall specify pinning and bolting requirements that meet or exceed the following minimums:

   1) Joints in Normal structures. Fill 50 percent of the holes in a single field connection and 50 percent of the holes on each side of a single joint in a splice plate with drift pins and bolts. Pin 30 percent of the filled holes. Bolt 70 percent of the filled holes and tighten to snug-tight. Once all these bolts are snug-tight, systematically tightened each bolt to the specified minimum tension. “Systematically tightened” means beginning with bolts in the most rigid part, which is usually the center of the joint, and working out to its free edges. Locate the fully tensioned bolts near the middle of a single field connection or a single splice plate.

   2) Joints in Cantilevered structures. Fill 75 percent of the holes in a single field connection and 75 percent of the holes on each side of a single joint in a splice plate with drift pins and bolts. Pin 50 percent of the filled holes. Bolt 50 percent of the filled holes and tighten to snug-tight. Once all these bolts are snug-tight, systematically tighten each bolt to the specified minimum tension. Locate the fully tensioned bolts near the middle of a single field connection or a single splice plate.

   c. Place drift pins throughout each field connection and each field joint with the greatest concentration in the outer edges of a splice plate or member being bolted. To complete a joint following the method listed above, fill all remaining holes of the field connection or splice plate with bolts and tighten to snug-tight.

   d. Once all of these bolts are snug-tight, systematically tighten each bolt to the specified minimum tension. After these bolts are tightened to the specified minimum tension, replace the drift pins with bolts tightened to the specified minimum tension.

   e. Complete a field bolted connection or splice in a continuous operation before releasing the mass of the member or adding the next member. Utilize drift pins to align the connection. Fill between 15 and 30 percent of the holes in a single field connection and between 15 and 30 percent of the holes on each side of a single joint in a splice plate with drift pins. Once the
alignment drift pins are in place, fill all remaining holes with bolts and tighten to snug-tight starting from near the middle and proceeding toward the outer gage lines. Once all of these bolts are snug-tight, systematically tighten all these bolts to the specified minimum tension. Replace the drift pins with bolts. Tighten each of these bolts shall be tightened to the specified minimum tension.

f. Place all bolts with heads toward the outside and underside of the bridge.

g. Install and tighten all high-strength bolts shall be before the falsework is removed.

h. Metal railings may be erected as bridge erection proceeds. Railings shall not be bolted or adjusted permanently until the falsework is released and the deck placed.

i. Do not begin painting until the Resident Engineer has inspected and accepted field bolting.

F. Adjusting Pin Nuts

1. Tighten all pin nuts thoroughly. Place the pins such that members bear fully and evenly

G. Swinging the Span

1. Do not place forms, steel reinforcing bars, or concrete roadway slabs on steel spans until the spans swing free on their supports and elevations recorded. No simple span or series of continuous spans will be considered as swinging free until all temporary supports have been released. Forms, reinforcing steel, or concrete roadway slabs shall not be placed on a simple or continuous span steel girder bridge until all its spans are adjusted and its masonry plates, shoes, and keeper plates grouted. For the purposes of this Section, the structure shall be considered as continuous across hinged joints.

2. After the falsework is released (spans swung free) the masonry plates, shoes, and keeper plates are grouted, and before all load is applied, measure elevations at the tenth points along the tops of girders and floorbeams.

3. The Resident Engineer will compare steel mass camber elevations with the elevations measured above, and will furnish the Contractor with new dead-load camber dimensions.

3.04 CONSTRUCTION

A. Surface Condition

1. As the structure is erected, the keep all steel surfaces clean and free from dirt, concrete, mortar, oil, paint, grease, and other stain-producing foreign matter.

2. Clean all surfaces that become stained as follows:

   a. Clean painted steel surfaces by methods required for the type of staining. Submit the method to the Resident Engineer for approval.

   b. Clean unpainted steel surfaces by sandblasting to remove stains on publicly visible surfaces shall be done to the extent that, in the Resident Engineers
opinion, the uniform weathering characteristics of the structure are preserved.

3.05 ADJUSTING
A. Appearance of Structures: To achieve a more pleasing appearance, the Resident Engineer may require the Contractor to adjust the height and alignment of bridge railings, traffic barrier, and structural curbs.

3.06 CLEANING
A. After erection, clean the steel and painted as specified.
B. Final Cleanup: When the structure is completed, leave it and the entire site in a clean and orderly condition. Sweep and wash decks. Remove temporary buildings, falsework, piling, lumber, equipment, and debris. Level and fine grade all excavated material not used for backfill, and fine grade all slopes and around all piers, bents, and abutments.

3.07 PROTECTION
A. Install no permanent plates or markers on a structure unless the Contract Drawings show it.
B. Floorbeam Protection: Coat each floorbeam that supports a concrete slab joint on its top and flange edges with a heavy mop of roofing grade asphalt, applied hot. This asphalt shall conform to ASTM D312 (not mineral stabilized). Place a protective covering of asphalt coated glass fiber sheet (ASTM D4601 Type 1 non-perforated) over the hot coat of asphalt. Apply this combination coating over the shop paint. It shall take the place of the two field coats of paint specified for other parts of the structural steel.

3.08 FIELD QUALITY CONTROL
A. Field Welding Inspection and Testing: Perform field welding inspection and testing as specified for shop welding inspection and testing.
B. Field Bolting Inspection and Testing: Perform field bolting inspection and testing as specified for shop bolting inspection and testing.

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SECTION 05 30 00
METAL DECKING

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes specifications for furnishing and installing metal roof deck, composite metal floor deck, and accessories as indicated.

B. Related Sections: The work of the following Sections is related to the work of this Section. Other Sections, not referenced below, may also be related to the proper performance of this work.

1. Section 03 15 25, Anchorage to Concrete
2. Section 05 05 23, Metal Fastenings.
3. Section 05 34 23 Acoustical Metal Roof Decking

1.02 REFERENCES

A. This Section incorporates by reference the latest revisions of the following documents.

   b. ASTM A780 Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings

2. Steel Deck Institute (SDI):
   a. SDI Publication No. 31, "Design Manual for Composite Decks, Form Decks, Roof Decks and Cellular Floor Deck with Electrical Distribution"

1.03 SUBMITTALS

A. Procedures: Section 01 33 00, Submittal Procedures.

B. Shop Drawings: Submit shop drawings showing:

1. Dimensioned deck layout noting deck type, profile, and gage.
2. Locations of and details for deck supports, laps, edges, and openings.
3. Locations of and details for deck attachments.
4. Locations of and details for deck accessories.

C. Manufacturer’s Product Data
1. Metal Deck
   a. Profiles, properties, load and shear capacities of each type, profile, and gage used.
   b. Accessories.
   c. Manufacturer’s written instructions for storage, handling, and application.

2. Galvanizing Repair Compound
   a. Manufacturer’s written instructions for storage, handling, and application.

D. Field Quality Control test and inspection reports.

1.04 QUALITY ASSURANCE:
   A. Qualifications of Welders and Welding Procedures: Section 05 05 23, Metal Fastenings.

1.05 DELIVERY, STORAGE, AND HANDLING
   A. Store and handle products in conformance with manufacturer’s written directions.

PART 2 - PRODUCTS

2.01 MANUFACTURERS
   A. Metal Roof and Composite Floor Deck
      1. ASC Steel Deck; Product; www.ascsd.com.

2.02 MATERIALS
   A. Metal Roof Deck
      1. Fabricate panels without top-flange stiffening grooves in conformance with SDI Publication 31 Specifications and Commentary for Steel Roof Deck.
      2. Galvanized Sheet Steel: ASTM A653/AS53M, Structural Steel, Grade 33, G90 zinc coating.
      3. Deck Type: profile, type, and gage as indicated.

   B. Composite Metal Floor Deck:
      1. Fabricate panels with integrally embossed or raised pattern ribs and interlocking side laps in conformance with SDI Publication 31 Specifications and Commentary for Steel Composite Steel Floor Deck.
      2. Galvanized Sheet Steel: ASTM A653/AS53M, Structural Steel, Grade 33, G90 zinc coating.
3. Deck Type: profile, type, and gage as indicated.

C. Accessories:

1. Provide closures and flashings as indicated or required for complete and finished installation and as required to prevent leakage of concrete.

2. Side-Lap Fasteners: Corrosion-resistant, hexagonal washer head; self-drilling, carbon steel screws, No. 10 minimum diameter.

3. Provide cover caps for covering abutting ends where required.

4. Provide accessories and flashings of the same material as the deck and no lighter than 22-gage. Use the deck manufacturer's standard type, galvanized accessories as follows:

   a. Adjusting plates or segments of deck units in locations too narrow to accommodate full-size units;

   b. End closures to close the open ends at openings through the roof, where units terminate at exterior walls, and other locations where required

   c. Sump pans at drains as indicated, fabricated from metal not lighter than 14 gage. For drains, cut holes in the field.

D. Welding Electrodes: Section 05 05 23, Metal Fastenings.

E. Welded Headed Studs: Section 03 15 25 Anchorage To Concrete.

F. Galvanizing Repair Compound: ASTM A780

2.03 FABRICATION

A. Metal Deck And Associated Metal Fabrications: SDI Publication No. 31.

B. Welding and Welded Connections: Section 05 05 23, Metal Fastenings.

C. Prefabricate and preassemble in the shop as far as practicable.

2.04 SOURCE QUALITY CONTROL

A. Testing and Inspection:

1. Materials, fabrications, and welding are subject to inspections in the shop. Perform testing using an approved independent testing laboratory.

2. Weld Inspection: Section 05 05 23, Metal Fastenings.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install deck panels and accessories according to applicable specifications and commentary in SDI Publication No. 31, manufacturer’s written instructions, and requirements in this Section.

B. Provide deck and accessories in conformance with the approved Shop Drawings.
C. Fasten deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated or arc seam welds with an equal perimeter that is not less than 1-1/2 inches long, and as follows:

1. Weld Diameter: 1/2 inch, effective.
2. Weld Pattern:
   a. Roof Deck: Weld lower flutes in a 24/2 (2 flutes welded per each 24 inch panel) or 36/4 pattern (4 flutes per each 36 inch panel). Space welds 18 inches apart, maximum.
   b. Floor Deck: Weld lower flutes in a 36/3 pattern (3 flutes per each 36 inch panel). Space welds an average of 12 inches apart, but not more than 18 inches apart.

D. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals not exceeding the lesser of 1/2 of the span or 18 inches, and as follows:

1. Mechanically fasten with self-drilling, No. 10 diameter or larger, carbon-steel screws.
2. Mechanically clinch or button punch.

E. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches, with end joints buttéd.

F. Position roof drain pans with flange bearing on top surface of deck. Fusion weld at each deck flute.

1. Install reinforcing channels or zees in ribs to span between supports and weld.

G. Floor-Deck Closures: Weld steel sheet column closures, and Z-closures to deck, according to SDI recommendations, to provide tight-fitting closures at open ends of ribs and sides of deck.

3.02 WELDING

A. Weld deck to supports in conformance with the approved Shop Drawings.

B. Procedures: Section 05 05 23, Metal Fastenings.

3.03 GALVANIZING REPAIR:

A. Repair galvanized surfaces damaged from welding, handling, or installation immediately after installation

B. Apply galvanizing repair compound in conformance with manufacturer’s written instructions.

C. Complete all galvanizing repair before concrete is placed.

3.04 FIELD QUALITY CONTROL

A. Inspect field welds and shear studs as specified in Section 05 05 23, Metal Fastenings.

END OF SECTION
PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes specifications for acoustical roof deck.

B. Related Sections: The work of the following Sections is related to the work of this Section. Other Sections, not referenced below, may also be related to the proper performance of this work.

1. Section 05 50 00 Metal Fabrications: Framing deck openings with miscellaneous steel shapes.

2. Section 07 54 23, Thermoplastic Olefin (TPO) Roofing: Installation of acoustic insulation in decking flutes.

3. Section 09 90 00, Painting and Coating.

1.02 REFERENCES

A. This Section incorporates by reference the latest revisions of the following documents.

1. American National Standards Institute (AISI) North American Specification for the Design of Cold-Formed Steel Structural Members; American Iron and Steel Institute

2. American Welding Society (AWS)
   a. AWS D1.3-98: Structural Welding Code - Sheet Steel

3. American Society for Testing and Materials International (ASTM)
   a. ASTM A 653/A 653M-02a: Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
   b. ASTM C 423-02: Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method

4. Steel Deck Institute (SDI)
   a. SDI Specifications and Commentary for Steel Roof Deck,” in SDI Publication No. 30

1.03 SUBMITTALS

A. Procedures: Section 01 33 00, Submittal Procedures.

B. Product Data: For each type of deck, accessory, and product indicated.
C. Shop Drawings: Show layout and types of deck panels, anchorage details, reinforcing channels, pans, cut deck openings, special jointing, accessories, and attachments to other construction.

1.04 QUALITY ASSURANCE
A. Welding: Qualify procedures and personnel according to AWS D1.3, "Structural Welding Code - Sheet Steel."
B. AISI Specifications: Comply with calculated structural characteristics of steel deck according to AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members."

1.05 DELIVERY, STORAGE, AND HANDLING
A. Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling.
B. Stack steel deck on platforms or pallets and slope to provide drainage. Protect with a waterproof covering and ventilate to avoid condensation.

1.06 COORDINATION
A. Coordinate installation of sound-absorbing insulation strips in topside ribs of acoustical deck with roofing installation specified in Section 07 54 23, Thermoplastic Olefin (TPO) Roofing to ensure protection of insulation strips against damage from effects of weather and other causes.

PART 2 - PRODUCTS

2.01 MANUFACTURERS
A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
B. Substitutions: No known equal of domestic manufacture.

2.02 ACOUSTICAL ROOF DECK
A. Acoustical Steel Roof Deck:
   2. Galvanized and Shop-Primed Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade 40, G60 zinc coating; cleaned, pretreated, primed, and finished with manufacturer’s standard baked-on, rust-inhibitive primer.
   3. Profile Depth: 2 inches.
   4. Design Uncoated-Steel Thickness: As indicated.
   5. Acoustical Perforations: Deck units with manufacturer’s standard perforated bottom flange.
6. Sound-Absorbing Insulation: Manufacturer's standard premolded roll or strip of glass or mineral fiber.

7. Acoustical Performance: NRC 0.95, tested according to ASTM C 423.

2.03 ACCESSORIES

A. General: Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.

B. Mechanical Fasteners: Corrosion-resistant, low-velocity, power-actuated or pneumatically driven carbon-steel fasteners; or self-drilling, self-threading screws.

C. Flexible Closure Strips: Vulcanized, closed-cell, synthetic rubber.

D. Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of 33,000 psi, not less than 0.0359-inch design uncoated thickness, of same material and finish as deck; of profile indicated or required for application.

E. Flat Sump Plate: Single-piece steel sheet, 0.0747 inch thick, of same material and finish as deck. For drains, cut holes in the field.

F. Repair Paint: Manufacturer's standard rust-inhibitive primer of same color as primer.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine supporting frame and field conditions for compliance with requirements for installation tolerances and other conditions affecting performance.

3.02 INSTALLATION, GENERAL

A. Install deck panels and accessories according to applicable specifications and commentary in SDI Publication No. 30, manufacturer's written instructions, and requirements in this Section.

B. Install temporary shoring before placing deck panels, if required to meet deflection limitations.

C. Locate deck bundles to prevent overloading of supporting members.

D. Place deck panels on supporting frame and adjust to final position with ends accurately aligned and bearing on supporting frame before being permanently fastened. Do not stretch or contract side-lap interlocks.

E. Place deck panels flat and square and fasten to supporting frame without warp or deflection.

F. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to deck.

G. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of deck, and support of other work.

H. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.
3.03 ROOF-DECK INSTALLATION

A. Fasten roof-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated or arc seam welds with an equal perimeter that is not less than 1-1/2 inches long, and as follows:
   1. Weld Diameter: 1/2 inch, effective.
   2. Weld Pattern: Weld lower deck flutes to supporting members in 24/4 pattern (four flutes welded per each 24-inch wide panel).

B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals not exceeding the lesser of 1/2 of the span or 36 inches, and as follows:
   1. Arc seam welds: 3/8 inch wide by 1 inch long.
   2. Arc spot (puddle) welds at perimeter edges: 1/2 inch effective diameter.
   3. Fillet welds at side lap edges: 2 inches long.

C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches, with end joints as follows:
   1. End Joints: Butted.

D. Roof Sump Pans and Sump Plates: Install over openings provided in roof deck and weld or mechanically fasten flanges to top of deck. Space welds or mechanical fasteners not more than 12 inches apart with at least one weld or fastener at each corner.
   1. Install reinforcing channels or zees in ribs to span between supports and weld.

E. Miscellaneous Roof-Deck Accessories: Install ridge and valley plates, finish strips, end closures, and reinforcing channels according to deck manufacturer's written instructions. Weld or mechanically fasten to substrate to provide a complete deck installation.
   1. Weld cover plates at changes in direction of roof-deck panels, unless otherwise indicated.

F. Flexible Closure Strips: Install flexible closure strips over partitions, walls, and where indicated. Install with adhesive according to manufacturer's written instructions to ensure complete closure.

G. Sound-Absorbing Insulation: Installation of sound-absorbing insulation into topside ribs of deck is specified in Section 07 54 23, Thermoplastic Olefin (TPO) Roofing.

3.04 FIELD QUALITY CONTROL

A. Inspect field welds.

B. Allow Resident Engineer access to perform independent verification testing and inspection.
3.05 REPAIRS AND PROTECTION

A. Repair Painting: Wire brush and clean rust spots, welds, and abraded areas on top surface of prime-painted deck immediately after installation, and apply repair paint.

B. Provide final protection and maintain conditions to ensure that steel deck is without damage or deterioration at time of Substantial Completion.

END OF SECTION
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PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes specifications for non-axial-load-bearing cold-formed steel wall framing and bridging (shown as "Structural Studs" on Contract Drawings).

B. Delegated structural design of cold-formed steel framing system components.

C. Related Sections: The work of the following Sections is related to the work of this Section. Other Sections, not referenced below, may also be related to the proper performance of this work.

1. Section 04 20 00, Unit Masonry: Veneer masonry supported by wall stud metal framing.

2. Section 05 12 00, Structural Steel Framing: Structural building framing.


4. Section 07 21 00, Thermal Insulation: Insulation within framing members.

5. Section 07 42 10 - Metal Wall Panels: Siding system supported by cold-formed metal framing.

6. Section 07 42 53 - Cementitious Wall Panels: Siding system supported by cold-formed metal framing.

7. Section 07 92 00, Joint Sealants.

8. Section 09 21 16, Gypsum Board Assemblies: Lightweight, non-load-bearing metal stud framing supporting gypsum board.

1.02 REFERENCES

A. This Section incorporates by reference the latest revisions of the following documents.

1. American Iron and Steel Institute (AISI)

   a. AISI SG02-1 - North American Specification for the Design of Cold-Formed Steel Structural Members

   b. AISI SG-971 - Specification for the Design of Cold-Formed Steel Structural Members; American Iron and Steel Institute


b. ASTM A 653/A 653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

c. ASTM A 780 - Standard Practice for Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.

d. ASTM C 955 - Standard Specification for Load-Bearing (Transverse and Axial) Steel Studs, Runners (Tracks), and Bracing or Bridging for Screw Application of Gypsum Panel Products and Metal Plaster Bases.

e. ASTM C 1007 - Standard Specification for Installation of Load Bearing (Transverse and Axial) Steel Studs and Related Accessories.

3. American Welding Society (AWS)

a. AWS D1.1 - Structural Welding Code - Steel.

b. AWS D1.3, Structural Welding Code--Sheet Steel

1.03 PERFORMANCE REQUIREMENTS

A. Cold-Formed Steel Framing, General: Design according to AISI's "Standard for Cold-Formed Steel Framing - General Provisions."

1. Design non-load-bearing wall framing to accommodate horizontal deflection without regard for contribution of sheathing materials.

B. Performance Requirements - Exterior Applications

1. Design and size components to withstand the load requirements indicated on the Contract Drawings (Structural General Notes) without damage or permanent set:

C. Performance Requirements - Interior Applications: Design panel system to safely withstand air pressure loading of specified below and environmental conditions within the station and tunnel.

1. Pressure loading requirements are shown on the partition schedule for walls and partitions with special loading criteria.

2. Other interior walls and partitions: Plus or minus 15 psf

D. Horizontal Deflection: Design to permit maximum deflection of 1/240 of span.

E. Vertical Deflection: Design non-axial load-bearing framing to accommodate not less than plus or minus 1/4 inch vertical deflection.

F. Design wall system to provide for movement of components without damage, failure of joint seals, undue stress on fasteners, or other detrimental effects when subject to seasonal or cyclic day/night temperature ranges.

G. Design system to accommodate construction tolerances, deflection of building structural members, and clearances of intended openings.

1.04 SUBMITTALS

A. Procedures: Section 01 33 00, Submittal Procedures.
B. Product Data:
1. Data on standard framing members; describe materials and finish, product criteria, limitations and span tables.
2. Manufacturer's data on factory-made framing connectors, showing compliance with requirements.

C. Shop Drawings: Indicate component details, framed openings, bearing, anchorage, loading, welds, and type and location of fasteners, and accessories or items required of related work.
1. Indicate framing layout.
2. Describe method for securing studs to tracks and for bolted framing connections.
3. Provide design engineer's stamp on shop drawings.

D. Certifications:
1. Welders and welding procedures: Submit certifications as specified in Section 05 05 23, Metal Fastenings.

E. Manufacturer's Installation Instructions: Indicate special procedures, conditions requiring special attention, and any other instructions.

1.05 QUALITY ASSURANCE

A. Designer Qualifications: Design framing system under direct supervision of a Professional Structural Engineer experienced in design of this Work and licensed in the State of Washington.

B. Calculate structural properties of framing members in accordance with requirements of AISI North American Specification for the Design of Cold-Formed Steel Structural Members.

C. Manufacturer: Company specializing in manufacturing the types of products specified in this section, and with minimum three years of documented experience.

D. Installer Qualifications: Company specializing in performing the work of this section with minimum five years of experience.

E. Design structural elements under direct supervision of a Professional Structural Engineer experienced in design of this Work and licensed in the State of Washington.

F. Welding: See Section 05 05 23, Metal Fastenings for requirements for welders, welding procedures, and inspections.

G. The work of this section is subject to testing and inspection as specified in Section 01 45 00, Quality Control.

H. Regulatory Requirements:
1. Framing system shall meet the requirements of the Seattle Building Code
2. Furnish all calculations, engineer's stamps, drawings, and other items required by the Seattle Department of Planning and Development to obtain approval of the installation.
1.06 PROJECT CONDITIONS
A. Verify that field measurements are as indicated on the Contract Drawings.

PART 2 - PRODUCTS

2.01 MATERIALS
A. Framing System
   1. Provide primary and secondary framing members, bridging, bracing, plates, gussets, clips, fittings, reinforcement, and fastenings as required to provide a complete framing system.

B. Framing Materials
   1. Studs and Track: ASTM C 955; studs formed to channel, "C", or "Sigma" shape with punched web; U-shaped track in matching nominal width and compatible height.
      a. Gage and depth: As required to meet specified performance levels.
      b. Galvanized in accordance with ASTM A 653/A 653M G90/Z275 coating.

   2. Headers: Job-fabricated or factory fabricated at Contractor's option.

C. Fasteners
   1. Self-Drilling, Self-Tapping Screws, Bolts, Nuts and Washers: Hot-dip galvanized in accordance with ASTM A 153/A 153M.


2.02 ACCESSORIES
A. Bracing, Furring, Bridging: Formed sheet steel, thickness determined for conditions encountered; finish to match framing components.

B. Plates, Gussets, Clips: Formed Sheet Steel, thickness determined for conditions encountered; finish to match framing components.

C. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, Type I - Inorganic, complying with VOC limitations of the US Environmental Protection Agency (EPA).

PART 3 - EXECUTION

3.01 EXAMINATION
A. Verify that substrate surfaces are ready to receive work.

3.02 INSTALLATION
A. Stud Framing
1. Install components in accordance with manufacturers' instructions and ASTM C 1007 requirements.

2. Place studs at 16 inches on center; not more than 2 inches from abutting walls and at each side of openings. Connect studs to tracks using clip and tie method.

3. Construct corners using minimum of three studs. Install double studs at wall openings and door and window jambs.

4. Install studs full length in one piece. Splicing of studs is not permitted.

5. Install load bearing studs, brace, and reinforce to develop full strength and achieve design requirements.


7. Install intermediate studs above and below openings to align with wall stud spacing.

8. Provide deflection allowance in stud track, directly below horizontal building framing at non-load bearing framing.

9. Attach cross studs to studs for attachment of fixtures anchored to walls.

10. Install framing between studs for attachment of mechanical and electrical items, and to prevent stud rotation.

11. Touch-up field welds and damaged galvanized surfaces with primer.

3.03 FIELD QUALITY CONTROL

A. Erection Tolerances

1. Maximum Variation from True Position: 1/4 inch.

2. Maximum Variation of all Members from Plumb: 1/8 inch in 10 feet.

3. Maximum Variation of all Members from Level: 1/8 inch in 10 feet.

END OF SECTION
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PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes specifications for final engineering (delegated design), furnishing and installing continuous slot, bolted metal framing channels and all associated fittings and hardware.

1. Support framing for miscellaneous items.
2. Trapeze type supports for cable tray, conduit, pipe and other similar systems.
3. Bolted metal framing as a surface metal raceway.

B. Related Sections: The work of the following Sections is related to the work of this Section. Other Sections, not referenced below, may also be related to the proper performance of this work.

1. 26 05 26 Grounding and Bonding.
   a. Electrical grounding required for metal strut framing located within 15-foot radius of centerline of track.

1.02 REFERENCES

A. This Section incorporates by reference the latest revision of the following documents.

1. American National Standard (ANSI)
   a. ANSI/NFPA 70– National Fire Protection Association (National Electrical Code)

2. American Iron and Steel Institute (AISI)
   a. AISI Specification for the Design of Cold-Formed Steel Structural Members;

3. American Society for Testing and Materials International (ASTM)
   a. ASTM A653, General Requirements for Steel Sheet, Zinc-Coated Galvanized by the Hot-Dip Process
   b. ASTM A1008, Specification for Steel, Sheet and Strip, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability
   c. ASTM F1136, Standard Specification for Chromium/Zinc Corrosion Protective Coatings for Fasteners
   d. ASTM A907 - Standard Specification for Steel, Sheet and Strip, Heavy-Thickness Coils, Carbon, Hot-Rolled, Structural Quality
e. ASTM B633 - Specification for Electrodeposited Coatings of Zinc on Iron and Steel

4. Metal Framing Manufacturers Association (MFMA)
   a. MFMA-4, "Metal Framing Standards Publication"
   b. MFMA-103, Guidelines for the Use of Metal Framing; Metal Framing Manufacturers Association

B. SSPC: The Society for Protective Coatings:
   1. SSPC-SP 6/NACE No. 3: Commercial Blast Cleaning

1.03 SUBMITTALS

A. Procedures: Section 01 33 00, Submittal Procedures.

B. Product Data: Submit on strut channels including, but not limited to, types, materials, finishes, gauge thickness, and hole patterns. For each different strut cross-section, submit cross sectional properties including Section Modulus ($S_x$) and Moment of Inertia ($I_x$).

C. Shop Drawings: Submit drawings of strut and accessories including clamps, brackets, hanger rods, and fittings.

D. Calculations: Submit calculations stamped by a licensed engineer for struts and accessories demonstrating adequacy to support imposed loads. At a minimum, include the following:
   1. Design Criteria
   2. Selection of framing members, fittings and accessories
   3. Stress and deflection analysis
   4. Reactions and imposed loads transmitted to primary structure.

1.04 QUALITY ASSURANCE

A. Manufacturers: Firms regularly engaged in the manufacture of bolted metal framing of the types required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. Engineer: Select a licensed structural engineer currently registered in the state of Washington.

C. MFMA Compliance: Comply with the latest revision of MFMA Standards Publication Number MFMA-4.

D. NEC Compliance: Comply with the latest revision NFPA 70 - Article 352 "Surface Metal Raceways and Surface Nonmetallic Raceways".

E. Bolted framing channels and fittings shall have the manufacturer’s name, part number, and material heat code identification number stamped in the part itself for identification. Material certification sheets and test reports must be made available by the manufacturer upon request.

F. Pre-Installation Conference: Comply with requirements specified in Section 01 31 19, "Project Meetings".
1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver strut systems and components carefully to avoid breakage, denting, and scoring finishes. Do not install damaged equipment.

B. Store strut systems and components in original cartons and in clean dry space; protect from weather and construction traffic.

1.06 METAL STRUT FRAMING SYSTEM DELEGATED DESIGN REQUIREMENTS

A. Meet the following criteria:

2. American Iron and Steel Institute (AISI) Specification for the Design of Cold-Formed Steel Structural Members, latest edition
3. Manufacturer’s published design criteria
4. For the strut system at the ceiling of the station platform, design the system to support the following loads:
   a. Gravity Loads: Strut system self-weight, plus the greater of the following:
      1) Uniform load of 10 pounds per square foot.
      2) Uniform load of 5 pounds per square foot, plus a concentrated load of 500 pounds located to produce the maximum stress in the element being designed.
      3) Actual weights of supported elements.
   b. Seismic loads generated by the masses of the specified gravity loads.

5. For Metal Strut Framing Systems used for locations other than at the station platform ceiling, as indicated on the drawings, design the systems to support the following loads:
   a. Gravity Loads: Strut system self-weight, plus the greater of the following:
      1) A concentrated load of 250 pounds located to produce the maximum stress in the element being designed.
      2) Actual weights of supported elements.
   b. Seismic loads generated by the mass of the system self-weight plus the actual weights of the supported elements.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Manufacturer: Subject to compliance with these specifications, strut systems to be installed shall be as manufactured by

1. Cooper B-Line, Inc.
2. Flex-Strut, Inc.
3. Powerstrut Corp.
4. Thomas & Betts Corp
5. Unistrut Division of Tyco, Inc.
6. Unitron Products, Inc.

2.02 STRUT CHANNELS AND COMPONENTS
A. Slotted Channel Framing: 1-5/8 inch wide cold-formed metal channels with continuous slot complying with MFMA-4.
B. Material: Steel complying with ASTM A 1008/A 1008M, commercial steel, Type B; 0.0677-inch minimum thickness.
C. Finish:
   1. For all channels and components other than concrete inserts, one of the following:
      a. Flat black polyester powder coat.
      b. Flat black epoxy coating.
   2. For concrete inserts: Pre-galvanized zinc complying with ASTM A653.

2.03 FASTENERS
A. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A; with hex nuts, ASTM A 563; and, where indicated, flat washers.
B. Expansion Anchors: Anchor bolt and sleeve assembly with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.

2.04 FINISH
A. Preparation:
   1. Prepare uncoated ferrous-metal surfaces to comply with SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
   2. Treat prepared metal with iron-phosphate pretreatment, rinse, and seal surfaces.
B. Finish all components except fasteners with flat black coating; manufacturer’s option of the following:
   1. Powder coat: Apply thermosetting polyester or acrylic urethane powder coating with cured-film thickness not less than 1.5 mils
   2. Epoxy: Apply epoxy primer and topcoats to surfaces. Apply at spreading rates recommended by coating manufacturer.
2.05 FABRICATION, GENERAL

A. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch, unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

B. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) screws or bolts, unless otherwise indicated. Locate joints where least conspicuous.

C. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

B. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag bolts, wood screws, and other connectors.

C. Install framing and supports to comply with requirements of items being supported, including manufacturers’ written instructions and requirements indicated on Shop Drawings.

D. Install strut in accordance with MFMA-103; in accordance with equipment manufacturer's recommendations, and with recognized industry practices

E. Tighten nuts and bolts to the following values:

<table>
<thead>
<tr>
<th>Bolt Size</th>
<th>Torque (ft-lbs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/4 - 20</td>
<td>6</td>
</tr>
<tr>
<td>5/16 - 18</td>
<td>11</td>
</tr>
<tr>
<td>3/8 - 16</td>
<td>19</td>
</tr>
<tr>
<td>1/2 - 13</td>
<td>50</td>
</tr>
</tbody>
</table>

3.02 FINISH REPAIR

A. Clean and touch up drilled holes, cuts, and minor abrasions in finishes with air dried coating that matches color and gloss of, and is compatible with the factory-applied finish coating.

END OF SECTION
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PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes specifications for, but is not limited to: all miscellaneous shop-fabricated ferrous metal and aluminum work indicated or otherwise required to complete the work, except as otherwise indicated.

B. Shop-fabricated steel, aluminum, and other miscellaneous metal items, including:
   1. Shop-fabricated ladders and safety cages as detailed or indicated on Drawings
   2. Loose bearing and leveling plates
   3. Framing and supports for:
      a. Overhead Grills
      b. Elevator sills, and guide rail supports
      c. Applications not specified in other Sections
   4. Miscellaneous steel trim.
   5. Pipe Bollards as indicated on Contract Drawings.
   6. Canopies.
   7. Handrails, railings and guardrail supports not provided under Section 05 52 00, Metal Railings.

C. Related Sections: The work of the following Sections is related to the work of this Section. Other Sections, not referenced below, may also be related to the proper performance of this work.
   1. Section 03 30 00, Cast-in-Place concrete.
   2. Section 03 45 00, Precast Architectural Concrete: Placement of metal fabrications in concrete.
   3. Section 03 62 00, Non-Shrink Grouting.
   4. Section 04 20 00, Unit Masonry: Placement of metal fabrications in masonry.
   5. Section 05 05 13, Shop Applied Coatings for Metal: Coatings for ferrous metal fabrications including galvanizing and shop primer.
   6. Section 05 05 14: Fluoropolymer Coatings: Coatings for aluminum fabrications.
   7. Section 05 05 23, Metal Fastenings.
8. Section 05 12 00, Structural Steel Steel Framing.
9. Section 05 51 00, Metal Stairs.
10. Section 05 52 00, Metal Railings.
11. Section 05 53 31, Steel Gratings.
12. Section 05 53 33, Aluminum Gratings.
13. Section 09 90 00, Painting and Coating: Paint finish.
14. Section 09 96 00, High-Performance Coatings.
15. Section 11 24 23, Roof Safety Anchors

1.02 REFERENCES
A. This Section incorporates by reference the latest revisions of the following documents.

1. American Architectural Manufacturers Association (AAMA)

   e. ASTM A 325M - Standard Specification for Structural Bolts, Steel, Heat Treated 830 MPa Tensile Strength (Metric); 2005.
   f. ASTM A 500 - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2003a.

3. American Welding Society (AWS)
1.03 SYSTEM DESCRIPTION

A. Performance Requirements

1. Handrails and Railing Systems: Design, engineer, fabricate, and install handrails and railing systems to comply with requirements of ASTM E 985 for structural performance based on testing performed in accordance with ASTM E 894 and E 935.

2. Structural Performance: Design, engineer, fabricate, and install metal fabrications to withstand the following structural loads without exceeding the allowable design working stress of the materials involved, including anchors and connections. Apply each load to produce the maximum stress in each respective component of each metal fabrication.
   a. Top of guardrail systems: Concentrated load at all points, of 300 pound-feet or uniform load of 100 pounds per linear foot applied non concurrently, vertically, downward, or horizontally. Concentrated and uniform loads need not be assumed to act concurrently.
   b. Handrails not serving as top rails: Concentrated load at all points, of 200 pound-feet or uniform load of 50 pounds per linear foot applied non concurrently, vertically, downward, or horizontally. Concentrated and uniform loads need not be assumed to act concurrently.
   c. Infill area of guardrail systems: Capable of withstanding a horizontal concentrated load of 200 pounds applied to one square foot at all points in the system including panels, intermediate rails, balusters, or other elements composing the infill area.
   d. An additional load of 25 pounds per square foot (psf) acting horizontally over the entire tributary area including openings shall be applied simultaneously with the load on the top rail.
   e. Treads of steel stairs: Capable of withstanding a uniform live load of 250 pound-feet per square foot or a concentrated load of 8000 pound-feet, whichever is the greater.
   f. Platforms of Steel Stairs: Capable of withstanding a uniform live load of 100 pound-feet per square foot.

1.04 SUBMITTALS

A. Procedures: Section 01 33 00, Submittal Procedures.

B. Product Data: Provide data on manufactured products; describe materials and finish, product criteria, limitations.

C. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable. Provide templates for anchors and bolts specified for installation under other sections.
   1. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.

D. Certifications:
1. Welders and welding procedures: Submit certifications as specified in Section 05 05 23, Metal Fastenings.

1.05 QUALITY ASSURANCE

A. Fabricator: Company specializing in manufacturing the types of products specified in this section, and with minimum five years of documented experience.

B. Installer: Company specializing in performing the work of this section with minimum four years of experience.

C. See Section 05 05 23, Metal Fastenings for requirements for welders, welding procedures, and inspections.

D. Design Metal Fabrications under direct supervision of a Professional Structural Engineer experienced in design of this Work and licensed in the State of Washington. Include structural computations, material properties, and other information needed for structural analysis that has been signed and sealed by the engineer.

1.06 PROJECT CONDITIONS

A. Field Measurements: Check actual locations of walls and other construction work which metal fabrications must fit, by accurate field measurements before fabrication; show recorded measurements on final shop drawings. Coordinate fabrication, delivery and installation schedule with construction progress to avoid delay of work.

1. Where field measurements cannot be made without delaying the Work, guarantee dimensions and proceed with fabrication of products without field measurements. Coordinate construction with work of other trades to ensure that actual dimensions correspond to guaranteed dimensions. Allow for fitting and trimming.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Metal Surfaces

1. For metal fabrications exposed to view upon completion of the Work, provide materials selected for their surface flatness, smoothness, and freedom from surface blemishes. Do not use materials whose exposed surfaces exhibit pitting, seam marks, roller marks, rolled trade names, roughness, and, for steel sheet, variations in flatness exceeding those permitted by referenced standards for stretcher-leveled sheet.

B. Steel

1. Steel Sections: ASTM A 36/A 36M.

2. Rolled Steel Floor Plates: ASTM A 786

3. Wire Rod for Grating Cross Bars: ASTM A 510

4. Steel Tubing: ASTM A 500, Grade B cold-formed structural tubing.

5. Uncoated Steel Sheet: Commercial quality, cold rolled sheet in accordance with ASTM A 366. Hot rolled sheet in accordance with ASTM A 569.
6. Galvanized Steel Sheet:
   a. Structural Quality: ASTM A 446, Grade A with G 90 coating unless noted otherwise.
   b. Commercial Quality: ASTM A 526, G 90 coating unless noted otherwise
11. Malleable Iron Castings ASTM A 47, Grade 32510
12. Brackets, Flanges, and Anchors: Cast or formed of the same type material and finish as supported rails, unless otherwise indicated.
13. Concrete inserts: Threaded or wedge type; galvanized ferrous castings, either malleable iron (ASTM A 47) or cast steel (ASTM A 27). Provide bolts, washers, and shims as required, hot-dip galvanized in accordance with ASTM A 153.
14. Fasteners: As indicated and specified herein.
15. Bolts, Nuts, and Washers: ASTM A 325 (ASTM A 325M), Type 1, galvanized to ASTM A 153/A 153M where connecting galvanized components.
16. Welding Materials: AWS D1.1; type required for materials being welded.

C. Stainless Steel
1. Bar Stock: ASTM A 276, Type 304. Type 316 Active for exterior applications.
2. Plate: ASTM A 167, Type 302 or 304. Type 316 active for exterior applications.
3. Rolled Shapes: ASTM A 276, Type 304. Type 316 Active for exterior applications.

D. Aluminum
3. Welding Materials: AWS D1.1; type required for materials being welded.

E. Grout and Anchoring Cement
1. Non-shrink-non-metallic Grout: Specified in Section 03 62 00, Non-Shrink Grouting.
2. Erosion-Resistant Anchoring Cement: Factory prepackaged, non-shrink, non-staining, hydraulic controlled expansion cement formulation for mixing with water at project site to create pourable anchoring, patching, and grouting compound. Provide formulation that is resistant to erosion from water exposure without need
for protection by a sealer or waterproof coating and is recommended for exterior use by manufacturer.

a. Interior Anchoring Cement:
   1) Bonsal Anchor Cement, W. R. Bonsal Co.
   2) Por Rok, Minwax Construction Products Division
   3) Approved equal

b. Erosion Resistant Anchoring Cement:
   1) Super Por Rok, Minwax Construction Products Division
   2) Approved equal

F. Fasteners
   1. Provide zinc-coated fasteners for exterior use or where built into exterior walls. Select fasteners for the type, grade, and class required.
   2. Bolts and Nuts: Regular hexagon head type ASTM A 307 Grade A.
   3. Lag Bolts: Square Head type: FS FF-B-561.
   5. Wood Screws: Flat head carbon steel FS FF-S-111
   6. Plain Washers: Round, carbon steel FS FF W 92
   7. Expansion Anchors: FS FF-S-325 type 1 (internally threaded tubular expansion anchors) and machine bolts in accordance with FS FF B 575 grade 5.

G. Paint:
   1. Bituminous paint: Cold-applied asphalt mastic complying with SSPC-Paint 12 except containing no asbestos fibers.
   2. Shop Primer for Steel Fabrications: Specified in Section 05 05 13, Shop Applied Coatings for Metal.

H. Concrete Fill and Reinforcing
   1. Comply with Section 03 30 00, Cast-In-Place Concrete, for normal weight ready-mix concrete with minimum 28-day compressive strength of 3,000 pounds per square inch.
   2. Non-slip aggregate finish: Factory graded, packaged material containing fused aluminum oxide grits or crushed emery as abrasive aggregate; rust-proof and non-glazing; unaffected by freezing, moisture, or cleaning materials.
   3. Reinforcing Bars: ASTM A 615 Grade 60.

I. Fabricated Items
   1. Rough Hardware: Furnish bent or otherwise custom fabricated bolts, plates, anchors, hangers, dowels, and other miscellaneous steel and iron shapes as
required for framing and supporting woodwork, and for anchoring woodwork to concrete or other structures. Straight bolts and other stock rough hardware items are specified in Section 06, 10 00, Rough Carpentry. Fabricate items to sizes, shapes, and dimensions required. Furnish malleable iron washers for heads and nuts which bear on wood structural connections; elsewhere, furnish steel washers.

2. Ships Ladders: Provide ship's ladders where indicated on Drawings. Fabricate of open type construction with structural steel channel or steel plate stringers, pipe handrails, and open steel grating treads, unless otherwise indicated. Provide all necessary brackets and fittings for installation. Galvanize ladders at all exterior locations, and at all indicated interior locations.

3. Nosings: Fabricate curb and dock edge nosings from structural steel shape as indicated, of all welded construction with mitered corners and continuously welded joints. Provide anchor welded to nosings for embedding in concrete or masonry construction, spaced not more than 6 inches from each curb end, 6 inches from corners and 24 inches on center, unless otherwise indicated. Provide galvanized nosings at all exterior locations and at interior locations as indicated.

4. Loose bearing and leveling plates: Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction, made flat, free from warps or twists, and of required thickness and bearing area. Drill plates to receive anchor bolts and for grouting as required. Galvanize after fabrication.

5. Miscellaneous Framing and Supports: Provide steel framing and supports for applications indicated or which are not a part of structural steel framework, as required to complete work. Coordinate with other trades for scope. Fabricate units to sizes, shapes, and profiles indicated or required to receive adjacent construction retained by framing and supports. Fabricate from structural steel shapes, plates, and steel bars of welded construction using mitered joints for field connection. Cut, drill, and tap units to receive hardware, hangers, and similar items. Equip units with integrally welded anchors for casting into concrete or building into masonry. Furnish inserts if units must be installed after concrete is placed. Galvanize miscellaneous framing and supports at all exterior locations and at indicated interior locations.

6. Miscellaneous Steel Trim: Provide shapes and sizes indicated for profiles shown. Unless otherwise indicated, fabricate units from structural steel shapes, plates, and steel bars, with continuously welded joints and smooth exposed edges. Use concealed field splices wherever possible. Provide cutouts, fittings, and anchorages as required for coordination of assembly and installation with other work.

7. Ladders: Steel; in compliance with ANSI A14.3; with mounting brackets and attachments; prime paint finish. Support at top, bottom, and 5 feet 0 inches on center intermediate points by means of welded or bolted brackets. Extend side rails 42 inches above top rung, and return rails to wall or structure, unless other secure hand holds are provided. At roof ladders, provide extendable side rails or safety post (such as Bilco "Ladder Up.")

   a. Side Rails: 1/2-inch by 2-1/2 inch-members spaced at 18 inches apart.
   b. Rungs: one inch diameter solid round bar spaced 12 inches on center.
   c. Space rungs 7 inches from wall surface.
8. Exterior Bumper Posts and Guard Rails: As detailed; galvanized finish.

9. Bollards: Steel pipe, concrete filled, crowned cap, as detailed; galvanized and painted finish.

10. Ledge Angles, Shelf Angles, Channels, and Plates Not Attached to Structural Framing: For support of metal decking, joists, and masonry; prime paint finish. Fabricated from sizes indicated and for attachment to concrete framing. Provide slotted holes to receive 3/4 inch bolts, space not more than 6 inches from ends and not more than 24 inches on center, unless indicated otherwise. For cavity walls, provide vertical channel brackets to support shelf and relief angles from backup masonry and concrete. Align expansion joints in angles with indicated expansion joints in masonry and concrete. Galvanize shelf angles to be installed on exterior concrete framing. Furnish wedge-type inserts, with fasteners for attachment of shelf angles to cast-in-place concrete.

11. Lintels: Provide as scheduled in General Structural Notes with shop prime paint finish on stainless steel. Provide loose structural stainless steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated. Weld adjoining members together to form single units where indicated. Size loose lintels for equal bearing of one inch per foot of clear span, but not less than 8 inches bearing at each side of each opening, unless otherwise indicated.

12. Door Frames for Overhead Door Openings, Wall Openings, and other Openings as detailed: Channel, and HSS sections; galvanized finish.

13. Elevator Hoistway Divider Beams: Beam sections; prime paint finish.

14. Toilet Partition Suspension Members: Steel channel sections; interior prime paint finish.

15. Steel Pipe Railings and Handrails: See Section 05 52 00, Metal Railings for requirements.

16. Other fabricated items as required or detailed on Drawings: See Schedule at end of this Section.

2.02 FABRICATION

A. Form metal fabrications from materials of size, thickness, and shapes indicated but not less than sizes required to comply with performance requirements indicated. Work to dimensions indicated, using proven details of fabrication and support. Use type of materials indicated or specified for various components of each metal fabrication.

B. Form exposed work true to line and level with accurate angles and surfaces and straight, sharp edges.

C. Allow for thermal movement resulting from the following maximum change in ambient temperature in the design, fabrication, and installation of installed metal assemblies to prevent buckling, opening up of joints, and overstressing of welds and fasteners. Base design calculations on actual surface temperatures of metals due to both solar heat gain and nighttime sky heat loss.

1. Temperature Change (Range): 100 degrees F

D. Shear and punch metals cleanly and accurately. Remove burrs.
E. Ease exposed edges to a radius of approximately 1/32 inch unless otherwise indicated. Form bent-metal corners to the smallest radius possible without causing grain separation or otherwise impairing the work.

F. Remove sharp or rough areas on exposed traffic surfaces.

G. Weld corners and seams continuously to comply with AWS recommendations and the following:
   1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
   2. Obtain fusion without undercut or overlap.
   3. Remove welding flux immediately.
   4. At exposed connections, finish exposed welds and surfaces smooth and blended so that no roughness shows after finishing and contour of welded surface matches those adjacent.
   5. On all steel members exposed to exterior, weld all joints and seams continuously all around to prevent moisture penetration of joints or seams.

H. Fit and shop assemble items in largest practical sections, for delivery to site. Minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

I. Fabricate items with joints tightly fitted and secured.

J. Continuously seal joined members by intermittent welds and plastic filler.

K. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.

L. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of component, except where specifically noted otherwise.

M. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

N. Fabrication Tolerances
   1. Squareness: 1/8 inch maximum difference in diagonal measurements.
   5. Maximum Deviation from Plane: 1/16 inch in 48 inches.

2.03 FINISHES

A. Steel: See Section 05 05 13, Shop Applied Coatings for Metal.
1. Hot-dipped galvanized finish is required at all exterior and other locations subject to moisture.

2. Primer paint finish is required at all other steel surfaces.

B. Aluminum: See Section 05 05 14, Fluoropolymer Coatings.

1. High Performance Organic Coating System: AAMA 2604 multiple coat, thermally-cured fluoropolymer Hylar 500 or Kynar 500 system; color as selected from manufacturer's standard colors.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive work.

1. Check elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Clean and strip primed steel items to bare metal where site welding is required.

B. Supply setting templates to the appropriate entities for steel items required to be cast into concrete or embedded in masonry.

3.03 ERECTION

A. Tolerances

1. Maximum Variation from Plumb: 1/4 inch per story, non-cumulative.


3.04 INSTALLATION

A. Install items plumb and level, accurately fitted, free from distortion or defects.

B. Provide anchorage devices and fasteners where necessary for securing miscellaneous metal fabrications to in-place construction; include threaded fasteners for concrete and masonry inserts, toggle bolts, through-bolts, lag bolts, wood screws, and other connections as required.

C. Perform cutting, drilling, and fitting required for installation of metal fabrications. Set metal fabrications accurately in location, alignment and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

D. Provide temporary bracing or anchors in formwork for items that are to be built into concrete masonry or similar construction.
E. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints, but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade the surfaces of exterior units which have been hot-dip galvanized after fabrication, and are intended for bolted or screwed field connections.

F. Field Welding: Comply with AWS Code for procedures of manual shielded metal-arc welding, appearance and quality of welds made, methods used in correcting welding work, and the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so that no roughness shows after finishing and contour of welded surface matches those adjacent.

G. Coat concealed surfaces of aluminum that will come into contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

H. Provide for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.


   1. Set loose leveling and bearing plates on wedges or other adjustable devices. After the bearing members have been positioned and plumbed, tighten the anchor bolts. Do not remove wedges or shims, but if protruding, cut off flush with the edge of the bearing plate before packing with grout. Use non-metallic non-shrink grout. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

J. Toilet Partition and other overhead supports: Anchor supports securely to, and rigidly brace from overhead building structure.

K. Bollards: Anchor bollards in concrete by means of pipe sleeves preset and anchored into concrete. After bollards have been inserted into sleeves, fill annular space between bollard and sleeve solid with non-shrink, nonmetallic grout, mixed and placed to comply with grout manufacturer's directions.

L. Install items plumb and level, accurately fitted, free from distortion or defects.

M. Provide for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.

N. Perform field welding in accordance with AWS D1.1.

O. Obtain written approval from Resident Engineer prior to site cutting or making adjustments not scheduled.
3.05 ADJUSTING
A. Obtain approval prior to site cutting or making adjustments not scheduled.

3.06 CLEANING
A. After erection, clean field welds, abrasions, and surfaces not shop primed or galvanized, in accordance with Section 05 05 13, Shop Applied Coatings for Metals.

3.07 SCHEDULES
A. The following list includes metal fabrications and finishes required in the work:
   1. Roof access ladders: galvanized finish only
   2. Elevator pit ladders: galvanized finish only
   3. Elevator sill supports: shop-primed finish
   4. Steel pipe bollards: galvanized and painted finish
   5. Overhead equipment supports: shop-primed finish
   6. Supports for overhead coiling grills: galvanized finish only
   7. Steel tube supports for HM doors: galvanized and painted finish
   8. Exterior utility grade railings: galvanized finish only

END OF SECTION
SECTION 05 51 00
METAL STAIRS

PART 1 - GENERAL

1.01 SUMMARY
A. This Section includes Specifications for steel stairs with poured-in-place concrete pan treads and landings; structural steel stair framing and supports; steel pan landings to receive concrete fill; and specifies engineering design of fabricated stairs and components.

1.02 RELATED SECTIONS
A. Related Sections: The work of the following Sections is related to the work of this Section. Other Sections, not referenced below, may also be related to the proper performance of this work.

1. Section 03 05 15, Portland Cement Concrete
2. Section 04 20 00, Unit Masonry.
3. Section 05 05 23, Metal Fastenings.
4. Section 05 05 13, Shop Applied Coatings for Metal.
5. Section 05 12 00, Structural Steel Framing and Section 03 45 00, Precast Architectural Concrete.
6. Section 05 50 00, Metal Fabrications.
7. Section 09 90 00, Painting and Coating.

1.03 REFERENCES
A. This Section incorporates by reference the latest revisions of the following documents.

1. American Society for Testing and Materials International (ASTM)
   a. ASTM A36/A36M Standard Specification for Carbon Structural Steel
   b. ASTM A53/A 53M Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless

g. ASTM A653/A653M Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

h. ASTM A1008/A1008M Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength, Low Alloy, and High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardened.

i. ASTM E985 Standard Specification for Permanent Metal Railing Systems and Rails for Buildings

2. American Welding Society (AWS)

   a. AWS A2.4 Standard Symbols for Welding, Brazing, and Nondestructive Examination; American Welding Society.

   b. AWS D1.1/D1.1M Structural Welding Code - Steel; American Welding Society.

3. National Association of Architectural Metal Manufacturers (NAAMM)

   a. NAAMM AMP 510 Metal Stairs Manual

   b. NAAMM MBG 531 Metal Bar Grating Manual

   c. NAAMM MBG 532 Heavy Duty Metal Bar Grating Manual; (ANSI/NAAMM MBG 532).

4. The Society for Protective Coatings (SSPC)


   b. SSPC-SP 2 Hand Tool Cleaning; Society for Protective Coatings.

5. Washington Industrial Health and Safety Act (WISHA)

1.04 SYSTEM DESCRIPTION

   A. Design and fabricate stair system from steel or aluminum to support a uniform live load of 100 pounds per square foot (lb/sq ft) and a concentrated load of 300 pounds (lb.). Deflection of treads, stringers or landing framing shall not exceed 1/360 of span under design live loading.

   B. Stair systems shall include stairs, landings, handrails, guardrails, floor edge channels or angle, and all supports and anchors to adjacent construction. Handrails may be mounted to the stairs, or to building walls at the Contractor's option. Where handrails are attached to walls, include metal backing within walls.

   C. Design, fabricate, and test railing assemblies in accordance with the most stringent requirements of ASTM E985 and applicable local code.

   D. Design details indicated may be modified by the fabricator subject to the specified requirements.
E. Fabricate metal stairs to comply with NAAMM AMP 510, Class: Architectural.

F. Floor construction, as indicated on the Contract Drawings, includes bearing capacity to support steel stairs and design live loading, except for slab edge supports which are to be provided under the work of this Section. Stair system shall accommodate the surrounding construction indicated. All modifications to structure as required to support or otherwise accommodate the design/build stairs shall be the responsibility of the Contractor. Changes in dimension or location of finish surfaces indicated are subject to prior approval by Resident Engineer.

G. Railing Reactions:
1. Railing attachments shall be capable of resisting a force of 200 lbs at all points in any direction without damage or permanent set.
2. Railing attachments shall be capable of resisting a force of 50 lbs per lineal foot in any direction without damage or permanent set.

H. Interior stair treads, nosings, and landing surfaces shall be concrete-filled steel pans or shop-cast concrete treads as indicated and detailed on Contract Drawings. Risers shall have closed design as detailed. Exterior treads and landings shall be concrete as detailed or indicated on Contract Drawings.

I. Regulatory Requirements:
1. Pre-engineered Metal Stairs shall meet the requirements of the Seattle Building Code and WISHA requirements for service stairs.
2. Furnish all calculations, engineer's stamps, drawings, and other items required by the code authorities to obtain approval of the installation.

1.05 SUBMITTALS

A. Procedures: Section 01 33 00, Submittal Procedures.

B. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories.
1. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.
2. Shop drawings for bidder-designed elements shall include the professional design engineer's stamp or seal on each sheet of the shop drawings.

C. Delegated Design Data: As required by Seattle Department of Planning and Development (DPD).

D. Certifications:
1. Welders and welding procedures: Submit certifications as specified in Section 05 05 23, Metal Fastenings.

E. Closeout Submittal:
1. Submit designing engineer's certification that all products and all installations for bidder-designed metal stair items comply with all design requirements.
1.06 QUALITY ASSURANCE

A. Structural Designer Qualifications: Professional Structural Engineer experienced in design of this work and licensed in the State of Washington, or personnel under direct supervision of such an engineer.

B. See Section 05 05 23, Metal Fastenings for requirements for welders, welding procedures, and inspections.

C. Testing and Inspection: All metal fabrications are subject to special inspection as specified in Section 01 45 00, Quality Control.

D. Regulatory Requirements:
   1. Design structural elements to meet all requirements of the Seattle Building Code.
   2. Furnish all calculations, engineer's stamps, drawings, and other items required by the code authorities to obtain approval of installations.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Metal Stair and Stair Tower Fabricators:
   1. The Sharon Companies Ltd. (Medina OH; 330-723-3225).
   2. American Stair Corporation (Romeoville, IL; 800-872-7824).
   3. O'Keeffe’s, Inc. (San Francisco, CA; 415-822-4222).
   4. Substitutions: See Section 01 60 00, Product Requirements.

2.02 DESIGN-BUILD METAL STAIRS - GENERAL

A. Metal Stairs: Provide stairs of the design specified, complete with landing platforms, vertical and horizontal supports, railings, and guards, fabricated accurately for anchorage to each other and to building structure.

   1. Regulatory Requirements: Provide stairs complying with the most stringent requirements of local, State, and federal regulations; where requirements of the contract documents exceed those of regulations, comply with the Contract Documents.

   2. Structural Design: Provide complete stair assemblies complying with the following:
      a. Stair Capacity: Uniform live load of 100 lb/sq ft and a concentrated load of 300 lb with deflection of stringer or landing framing not to exceed 1/180 of span.

   3. At exit stairwells, provide unit stair towers designed for stacking to height of building as a self-supporting structure. See Structural Drawings.

5. Shop-assemble components; disassemble into largest practical sections suitable for transport and access to site.

6. No sharp or rough areas on exposed travel surfaces and surfaces accessible to touch.

7. Separate dissimilar metals using paint or permanent tape.

B. Metal Jointing and Finish Quality Levels:

1. Architectural: All joints as inconspicuous as possible, whether welded or mechanical.
   a. Welded Joints: Continuously welded and ground smooth and flush.
   b. Mechanical Joints: Butted tight, flush, and hairline; concealed fastenings only.
   c. Exposed Edges and Corners: Eased to small uniform radius.
   d. Metal Surfaces to be Painted: Sanded or ground smooth, suitable for highest quality gloss finish.

2. Service: Exposed joints tight with face surfaces aligned; underside of stair not covered by soffit is not considered exposed to view.
   a. Welded Joints: Welded on back side wherever possible.
   b. Welds Exposed to View: Ground smooth; not required to be flush.
   c. Bolts Exposed to View: Countersunk flat or oval head bolts; no exposed nuts or screw threads.
   d. Metal Surfaces to be Painted: Sanded smooth, suitable for satin or matte finish.

C. Fasteners: Same material or compatible with materials being fastened; type consistent with design and specified quality level.

D. Anchors and Related Components: Same material and finish as item to be anchored, except where specifically indicated otherwise; provide all anchors and fasteners required.

2.03 METAL STAIRS WITH CONCRETE PAN TREADS

A. Jointing and Finish Quality Level: Architectural, as defined above.

B. Risers: Closed.

C. Metal Pan Treads: Metal pan with field-installed concrete fill.
   1. Concrete Depth: 2 inches, minimum.
   2. Tread Pan Material: Steel sheet.
   3. Tread Pan Thickness: As required by design; 14 gage, 0.075 inch minimum.
   4. Pan Anchorage to Stringers: Continuously welded, from top or bottom.
   5. Concrete Reinforcement: Welded wire mesh.
6. Concrete Finish: Steel-troweled.

D. Risers: Same material and thickness as tread pans.
   1. Riser/Nosing Profile: Sloped riser with rounded nosing of minimum radius.
   2. Nosing Depth: Not more than 1-1/2 inch overhang.
   3. Nosing Return: Flush with top of concrete fill, not more than 1/2 inch wide.

E. Stringers: Hot-Rolled steel channels.
   1. Stringer Depth: As indicated on Contract Drawings but not less than 12 inches.
   2. End Closure: Sheet steel of same thickness as risers welded across ends.

F. Landings: Same metal pan construction as treads, supported and reinforced as required to achieve design load capacity.

G. Under-Side of Stair: Where exposed to view, to be finished same as specified for other exposed to view surfaces.

2.04 MATERIALS

A. Steel Sections: ASTM A36/A36M.
B. Steel Plates: ASTM A283.
C. Ungalvanized Steel Sheet: ASTM A1008/A1008M, Designation SS, Grade 33, Type 1.
D. Galvanized Steel Sheet: ASTM A653/A653M, Structural Steel (SS) Grade 33/230 with G40/Z120 coating.
E. Gratings: Bar gratings complying with NAAMM MBG 531 or NAAMM MBG 532, whichever applies based on bar sizes.
F. Concrete Fill: Type 4000 A as specified in Section 03 05 15, Portland Cement Concrete.
G. Concrete Reinforcement: Mesh type as specified in Section 03 20 00, Concrete Reinforcing.
H. Steel Bolts, Nuts, and Washers: ASTM A325 (ASTM A325M), Type 1, galvanized to ASTM A153/A153M where connecting galvanized components.
I. Welding Materials: AWS D1.1; type required for materials being welded.

2.05 SHOP FINISHING

A. Shop finishing of ferrous metal items is specified in Section 05 05 13, Shop Applied Coatings for Metal. No shop finishing, other than cleaning is required for aluminum items.

2.06 COMPONENTS

A. Aluminum Treads: Comply with NAAMM MBG 531, Manufacturer’s standard fabricated design.
B. **Metal Pan Stair Treads:** Concrete in metal pan; 2 inches deep; smooth surface; non-slip edge.

C. **Shop-Cast Concrete Treads:** Provide pre-cast concrete tread and riser profile and width as detailed on Contract Drawings, wire mesh reinforcement; smooth finish, radiused nosings.

### 2.07 FABRICATION - GENERAL

A. Fit and shop assemble components in largest practical sections, for delivery to site.

B. Fabricate components with joints tightly fitted and secured.

C. Continuously seal joined pieces by intermittent welds and plastic filler (bondo).

D. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.

E. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of component, except where specifically noted otherwise.

F. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

G. Fabricate components accurately for anchorage to each other and to building structure.

### 2.08 FABRICATION - PAN STAIRS AND LANDINGS

A. Fabricate interior stairs and landings with closed risers and treads of metal pan construction using ungalvanized steel sheet, ready to receive concrete.

B. Fabricate exterior stairs and landings with closed risers and treads of metal pan construction using galvanized steel sheet, ready to receive concrete.

C. Form treads and risers with minimum 18 gage sheet steel stock.

D. Secure reinforced tread pans to stringers with clip angles; welded in place.

E. Form stringers with hot-rolled steel channels, 12 inches deep. Weld fascia plates to channels using 14 gage steel sheet across channel toes.

F. Form landings with minimum 18 gage sheet stock. Reinforce underside with angles to attain design load requirements.

### PART 3 - EXECUTION

#### 3.01 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive work.

#### 3.02 PREPARATION

A. When field welding is required, clean and strip primed steel items to bare metal.

B. Supply items required to be cast into concrete and embedded in masonry with setting templates.
3.03 INSTALLATION
A. Install components plumb and level, accurately fitted, free from distortion or defects.
B. Provide anchors, plates, angles, hangers, and struts required for connecting stairs to structure.
C. Allow for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.
D. Provide welded field joints where specifically indicated on Contract Drawings. Perform field welding in accordance with AWS D1.1.
E. Other field joints may be either welded or bolted provided the result complies with the limitations specified for jointing quality levels.
F. Obtain approval prior to site cutting or creating adjustments not scheduled.
G. After erection, prime welds, abrasions, and surfaces not shop primed or galvanized, except surfaces to be in contact with concrete.

3.04 ERECTION TOLERANCES
A. Maximum Variation from Plumb: 1/4 inch per story, non-cumulative.
B. Maximum Offset from True Alignment: 1/4 inch.

END OF SECTION
SECTION 05 52 00
METAL RAILINGS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Delegated engineering design of metal railings.
   2. Stair railings and guardrails as detailed on Contract Drawings.
   3. Guardrails for pedestrian bridge.
   4. Wall-mounted handrails.
   5. Stair railings and guardrails with picket infill for Metal Stairs specified in Section 05 51 00, Metal Stairs.
   6. Free-standing railings at steps.
   7. Metal tube handrails, balusters, and fittings.
   8. Transparent plastic glazing panels.

B. Related Sections: The work of the following Sections is related to the work of this Section. Other Sections, not referenced below, may also be related to the proper performance of this work.
   1. Section 03 30 00, Cast-in-Place Concrete: Placement of anchors in concrete.
   2. Section 04 20 00, Unit Masonry: Placement of anchors in masonry.
   3. Section 05 05 14, Fluoropolymer Coatings for Metal.
   4. Section 05 05 23, Metal Fastenings.
   5. Section 05 40 00, Cold-Formed Metal Framing: Placement of backing plates in stud wall construction.
   6. Section 05 51 00, Metal Stairs.
   7. Section 08 80 00, Glazing.
   8. Section 09 90 00, Painting and Coating: Finish for Interior Handrails and Guardrails.
   9. Section 09 96 00, High-Performance Coatings: Finish for Exterior Handrails, Stair Stringers and Guardrails.

1.02 REFERENCES

A. This Section incorporates by reference the latest revisions of the following documents.
1. The Aluminum Association, Inc. (AA)
   a. AA DAF-45 - Designation System for Aluminum Finishes

   c. ASTM A 500 - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
   d. ASTM A 554: Specification for Welded Stainless Steel Mechanical Tubing

3. American Welding Society (AWS)
   a. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
   b. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."

4. The Society for Protective Coatings (SSPC)
   a. SSPC-Paint 15 - Steel Joist Shop Paint
   b. SSPC-Paint 20 - Zinc-Rich Primers (Type I, "Inorganic,” and Type II, "Organic");

1.03 DESIGN REQUIREMENTS

A. Structural Performance: Engineer, fabricate, and install metal fabrications to withstand the following structural loads without exceeding the allowable design working stress of the materials involved, including anchors and connections. Apply each load to produce the maximum stress in each respective component of each metal fabrication.

1. Top of guardrail systems: Concentrated load at any point, of 300 lb-ft or uniform load of 100 plf applied non-concurrently, vertically, downward, or horizontally. Concentrated and uniform loads need not be assumed to act concurrently.

2. Handrails not serving as top rails: Concentrated load at any point, of 200 lb-ft or uniform load of 50 plf applied non-concurrently, vertically, downward, or horizontally.
horizontally. Concentrated and uniform loads need not be assumed to act concurrently.

3. Infill area of guardrail systems: Capable of withstanding a horizontal concentrated load of 200 lb applied to one sq. ft. at any point in the system including panels, intermediate rails, balusters, or other elements composing the infill area.

4. An additional load of 25 pounds per square foot (psf) acting horizontally over the entire tributary area including openings shall be applied simultaneously with the load on the top rail.

1.04 SUBMITTALS

A. Procedures: Section 01 33 00, Submittal Procedures.

B. Shop Drawings:

1. Indicate dimensions, materials, profiles, sizes, connection attachments, anchorage, size and type of fasteners, and accessories.

2. Indicate welded connections with standard AWS welding symbols. Indicate net weld lengths.

3. Include erection drawings, elevations, and details as necessary to completely show each installation.

4. Indicate fabrication and installation of handrails and railings, including plans, elevations, sections, details of components, and attachments to other units of Work.

5. Include structural analysis data sealed and signed by the qualified professional engineer who was responsible for their preparation.

C. Certifications: Submit for:

1. Delegated design engineer.

2. Welders and welding procedures: Submit certifications as specified in Section 05 05 23, Metal Fastenings.

D. Samples: Submit four each, 8-inch-long samples of handrail. Submit four each samples of elbow, wall bracket, and end stop.

1.05 QUALITY ASSURANCE

A. Delegated Design Engineer: Employ a registered structural engineer, licensed in the State of Washington, to engineer structural components of the metal railings, including, attachments and anchorages to the primary building structure. This engineer shall prepare, stamp, and sign required structural calculations; this same engineer shall also approve the fabricator's shop drawings.

B. See Section 05 05 23, Metal Fastenings for requirements for welders, welding procedures, and inspections.
1.06 PROJECT CONDITIONS

A. Field Measurements: Check actual locations of walls, slabs, framing, and other construction to which work of this section must fit, by accurate field measurements before fabrication; show recorded measurements on final shop drawings. Coordinate fabrication, delivery and installation schedule with construction progress to avoid delay of work.

1. Where field measurements cannot be made without delaying the Work, guarantee dimensions and proceed with fabrication of products without field measurements. Coordinate construction with work of other trades to ensure that actual dimensions correspond to guaranteed dimensions. Allow for fitting and trimming.

PART 2 - PRODUCTS

2.01 ALUMINUM RAILING MATERIALS

A. Aluminum Pipe: Schedule 40; ASTM B 429, ASTM B 241/B 241M, or ASTM B 483/B 483M.

B. Aluminum Tube: Minimum wall thickness of 0.127 inch; ASTM B 429, ASTM B 241/B 241M, or ASTM B 483/B 483M.

C. Rails: 1-1/2 inch diameter, extruded tubing conforming to ASTM B 221.

D. Bars, sheet, and plate: ASTM B 209 or ASTM B 211.

E. Welding Fittings: No exposed fasteners; cast aluminum.

F. Mounting: Adjustable Brackets and flanges, with aluminum inserts for casting in concrete.

G. Straight Splice Connectors: Concealed spigot; cast aluminum.

H. Exposed Fasteners: Flush countersunk screws or bolts; consistent with design of railing.

2.02 STEEL RAILING MATERIALS

A. Steel Tube: ASTM A 500, Grade B cold-formed structural tubing.

B. Steel Pipe: ASTM A 53/A 53M, Grade B Schedule 40, black finish.

C. Welding Fittings: Factory- or shop-welded from matching pipe or tube; seams continuously welded; joints and seams ground smooth.

D. Exposed Fasteners: No exposed bolts or screws allowed.

E. Mounting: Adjustable Brackets and flanges, with steel inserts for casting in concrete.

F. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of US Environmental Protection Agency (EPA).

2.03 STAINLESS STEEL HANDRAIL MATERIALS

A. Fabricate handrails for bridge and stairs (other than enclosed fire exit stairs) from Type 304 stainless steel tubing, meeting ASTM A 554.
2.04 TRANSPARENT PLASTIC GLAZING PANELS

A. Plastic Glazing: Polycarbonate sheet; ASTM C 1349, Appendix X1, Type I (standard, UV stabilized), with a polished finish.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
   a. Altuglas International, Division of Arkema Inc.; Tuffak XL.
   b. General Electric Company; Lexan XL-1.
   c. Sheffield Plastics Inc., a Bayer Material Science company; Makrolon SL.

2. Nominal Thickness: 0.25 inch (6mm).

3. Color: Transparent, colorless.

4. Flame-Spread Index: 25 or less.

B. See Section 08 80 00, Glazing, for setting blocks and other glazing accessories.

2.05 FABRICATION

A. Approved Fabricators - Aluminum Railings:

1. Amico; Seattle WA
2. Steel-Fab, Inc.; Arlington WA
3. Grating Pacific; Seattle WA
4. Substitutions: In addition to requirements of Section 01 25 00, Substitution Procedures, submit color photographs of welded railing systems completed in the past 2 years of similar design with clear anodized finish applied after fabrication.

B. Accurately form components to suit specific project conditions and for proper connection to building structure.

C. Fabricate to comply with requirements indicated for architectural design, dimensions, details, finish, and member sizes, including wall thickness of pipe, post spacing and anchorage, but not less than that required to support all structural loads.

1. Connect members by butt welding, unless indicated otherwise.
2. Change directions by insertion of elbow fittings or by radius bends.
3. Form curved sections by rolling produce uniform curvature indicated without buckling, twisting, or otherwise deforming exposed surfaces of railing component.
4. Provide wall returns at ends of wall mounted handrails.
5. Close exposed ends of pipe by welding 3/16 inch steel plate in place or by use of prefabricated fittings.
6. For steel railings and handrails formed from steel pipe with galvanized finish, galvanize fittings, brackets, fasteners, sleeves and other ferrous components.
7. For interior steel railings formed from black steel pipe, provide non-galvanized ferrous metal fittings, brackets, fasteners, and sleeves, except galvanize anchors embedded in exterior masonry and concrete construction.

D. Provide anchors and other components as required to attach to structure, made of same materials as railing components unless otherwise indicated; where exposed fasteners are unavoidable provide flush countersunk fasteners.

1. For anchorage to concrete, provide inserts to be cast into concrete, for bolting anchors.

2. For anchorage to masonry, provide brackets to be embedded in masonry, for bolting anchors.

3. For anchorage to metal-framed walls, provide backing plates, for bolting anchors.

4. Fillers: Provide steel sheet or plate fillers of size and thickness indicated or required to support structural loads of handrails where needed to transfer wall bracket loads through wall finishes to structural supports. Size fillers to suit wall finish thicknesses. Size fillers to produce adequate bearing to prevent bracket rotation and overstressing of substrate.

E. Provide welding fittings to join lengths, seal open ends, and conceal exposed mounting bolts and nuts, including but not limited to elbows, T-shapes, splice connectors, flanges, escutcheons, and wall brackets.

F. Dissimilar Metals: Provide Nylon or other manufacturer suggested gaskets at all mounting flanges, and other areas where railing system is scheduled to attach to dissimilar metals or concrete. Gaskets shall be cut to match profile of mounting flange.

G. Fit and shop assemble components in largest practical sizes for delivery to site.

H. Fabricate components with joints tightly fitted and secured. Provide spigots and sleeves to accommodate site assembly and installation.

I. Exterior Components: Continuously seal joined pieces by intermittent welds and plastic filler. Drill condensate drainage holes at bottom of members at locations that will not encourage water intrusion.

J. Interior Components: Continuously seal joined pieces by intermittent welds and plastic filler.

K. Welding Aluminum: Select welding wire, method, and weld temperature to produce welds that will match color of adjacent parent material after finishing.

L. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.

M. Accurately form components to suit specific project conditions and for proper connection to building structure.

2.06 ALUMINUM FINISHES

A. Finish exposed aluminum components with fluoropolymer finish (FP-1) specified in Section 05 05 14., Fluoropolymer Coatings.

B. Mill Finish Aluminum: AA M12C12, non-specular as fabricated, chemically cleaned.
PART 3 - EXECUTION

3.01 EXAMINATION
A. Verify that field conditions are acceptable and are ready to receive work.

3.02 PREPARATION
A. Clean and strip primed steel items to bare metal where site welding is required.
B. Supply items required to be cast into concrete or embedded in masonry with setting templates, for installation as work of other sections.
C. Apply one coat of bituminous paint to concealed aluminum surfaces that will be in contact with cementitious or dissimilar materials.

3.03 INSTALLATION
A. Install in accordance with fabricators and/or manufacturer's instructions.
B. Install components plumb and level, accurately fitted, free from distortion or defects, with tight joints.
C. Anchor railings securely to structure.
D. Field weld anchors as indicated on Contract Drawings. Touch-up welds with primer. Grind welds smooth.
E. Conceal anchor bolts and screws whenever possible. Where not concealed, use flush countersunk fastenings.
F. Pipe railings and handrails: Adjust railings prior to anchoring to ensure matching alignment of abutting joints. Space posts at spacing indicated or as required by design loadings. Plumb posts in each direction. Secure posts and railing ends to building as follows:
   1. Secure to concrete by epoxy anchoring system. Cover anchorage joint with round steel flange attached to post with set screws.
   2. Secure rail ends to wood with steel flanges welded to rail ends and bolted to structural members.
   3. Secure handrails to walls with wall brackets and end fittings. Provide 1-1/2 inch clearance between inside face of handrail and finished wall surface. Locate brackets as indicated, or as required to support structural loads. Secure wall brackets and wall return fittings to building construction as follows:
      a. Use bracket with flange tapped for concealed anchorage to threaded hanger bolt.
      b. For concrete and solid masonry, use drilled-in expansion shield and hanger bolt or lag bolt as applicable.
      c. For hollow masonry anchorage, use toggle bolts having square heads.
d. For wood stud partitions, use lag bolts set into wood backing between studs. Coordinate with stud installations for accurate location of backing members.

e. For steel framed gypsum board assemblies, fasten brackets directly to steel framing or concealed anchors using self-tapping screws of size and type required to support structural loads.

G. Assemble with spigots and sleeves to accommodate tight joints and secure installation.

3.04 ERECTION TOLERANCES

A. Maximum Variation from Plumb: 1/4 inch per floor level, non-cumulative.

B. Maximum Offset from True Alignment: 1/4 inch.


END OF SECTION
SECTION 05 53 31
STEEL GRATINGS

PART 1 - GENERAL

1.01 SUMMARY
A. This Section includes specifications for steel bar gratings:
B. Related Sections: The work of the following Sections is related to the work of this Section. Other Sections, not referenced below, may also be related to the proper performance of this work.
1. Section 03 15 25, Anchorage to Concrete
2. Section 05 05 23, Metal Fastenings.

1.02 REFERENCES
A. This Section incorporates by reference the latest revisions of the following documents.
1. American Society of Mechanical Engineers (ASME)
a. ASME B18.21: Lock Washers (Inch Series)
a. ASTM A 36/A 36M: Specification for Carbon Structural Steel
b. ASTM A 123/A 123M: Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
c. ASTM A 307: Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength
d. ASTM A 510: Specification for General Requirements for Wire Rods and Coarse Round Wire, Carbon Steel
e. ASTM A 563: Specification for Carbon and Alloy Steel Nuts
f. ASTM A 780: Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings
g. ASTM A 1011/A 1011M: Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability
h. ASTM B 633: Specification for Electrodeposited Coatings of Zinc on Iron and Steel
i. ASTM F 593: Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs
j. ASTM F 594: Specification for Stainless Steel Nuts
3. National Association of Architectural Metal Manufacturers (NAAMM)
   a. NAAMM MBG 531: Metal Bar Grating Manual
4. The Society for Protective Coatings (SSPC)
   a. SSPC-Paint 20: Paint Specification No. 20: Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic")

1.03 SUBMITTALS

A. Procedures: Section 01 33 00, Submittal Procedures

B. Manufacturer’s Product Data: Submit manufacturer’s product data for the following, including written directions for storage, handling, and installation.
   1. Steel grating
   2. Anchorage devices.
   3. Galvanizing repair paint

C. Shop Drawings: Submit shop drawings showing:
   1. Dimensioned grating layout noting grating type and size.
   2. Locations of and details for grating supports, grating anchors, concrete anchors, edges, and openings.

D. Certifications:
   1. Manufacturer’s certification that materials used conform to these Specifications.
   2. Welders and Welding Procedures: Section 05 05 23, Metal Fastenings.

1.04 QUALITY ASSURANCE

A. Steel Grating Standards: Conform to NAAMM MBG 531, "Metal Bar Grating Manual."

B. Qualifications of Welders and Welding Procedures: Section 05 05 23, Metal Fastenings

1.05 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of construction contiguous with gratings by field measurements before fabrication.

1.06 COORDINATION

A. Coordinate installation of anchorages for gratings, grating frames, and supports. Deliver such items to Project site in time for installation.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Alabama Metal Industries Corporation; a Gibraltar Industries company.
2. Grating Pacific, Inc.
3. IKG Industries; a division of Harsco Corporation.
4. Ohio Gratings, Inc.
5. McNichols, Inc.

2.02 FERROUS METALS
   A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
   B. Steel Bars for Bar Gratings: ASTM A 36/A 36M or steel strip ASTM A 1011/A 1011M
   C. Wire Rod for Bar Grating Crossbars: ASTM A 510.

2.03 FASTENERS
   A. General: Unless otherwise indicated, provide Type 316 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633 at exterior walls. Select fasteners for type, grade, and class required.
   B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A; with hex nuts, ASTM A 563; and, where indicated, flat washers.
   C. Stainless-Steel Bolts and Nuts: Regular hexagon-head annealed stainless-steel bolts, nuts, and, where indicated, flat washers; ASTM F 593 for bolts and ASTM F 594 for nuts, Alloy Group 2.
   E. Concrete Anchors: 03 15 25, Anchorage to Concrete
      1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 unless otherwise indicated.

2.04 MISCELLANEOUS MATERIALS
   A. Welding Rods and Bare Electrodes: 05 05 23, Metal Fastenings
   B. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.

2.05 FABRICATION
   A. Shop Assembly: Fabricate grating sections in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.
   B. Cut, drill, and punch material cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
C. Form from materials of size, thickness, and shapes indicated, but not less than that needed to support indicated loads.

D. Fit exposed connections accurately together to form hairline joints.

E. Shop Welding: 05 05 23, Metal Fastenings

F. Provide for anchorage of type indicated; coordinate with supporting structure. Fabricate and space the anchoring devices to secure gratings, frames, and supports rigidly in place and to support indicated loads.

2.06 STEEL GRATINGS

A. Welded Steel Grating

1. Provide steel gratings of type and size as noted on the Contract Documents.

2.07 GRATING FRAMES AND SUPPORTS

A. Frames and Supports for Metal Gratings: Fabricate from metal shapes, plates, and bars of welded construction to sizes, shapes, and profiles indicated and as necessary to receive gratings. Miter and weld connections for perimeter angle frames. Cut, drill, and tap units to receive hardware and similar items.

1. Unless otherwise indicated, fabricate from same basic metal as gratings.

2. Equip units indicated to be cast into concrete or built into masonry with integrally welded anchors. Unless otherwise indicated, space anchors 24 inches o.c. and provide minimum anchor units in the form of steel straps 1-1/4 inches wide by 1/4 inch thick by 8 inches long.

2.08 STEEL FINISHES

A. Finish gratings, frames, and supports after assembly.

B. Galvanizing: Hot-dip galvanize grating, frames, and supports in conformance with ASTM A 123/A 123M.

PART 3 - EXECUTION

3.01 INSTALLATION, GENERAL

A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing gratings to in-place construction. Include threaded fasteners for concrete and masonry inserts, through-bolts, lag bolts, and other connectors.

B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing gratings. Set units accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.

C. Provide temporary bracing or anchors in formwork for items that are to be built into concrete or masonry.

D. Fit exposed connections accurately together to form hairline joints.

1. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade the
surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

E. Field Welding: 05 05 23, Metal Fastenings:

3.02 INSTALLING STEEL GRATINGS

A. General: Install gratings to comply with recommendations of referenced steel grating standards that apply to grating types and bar sizes indicated, including installation clearances and standard anchoring details.

B. Attach removable units to supporting members with type and size of clips and fasteners indicated or, if not indicated, as recommended by grating manufacturer for type of installation conditions shown.

C. Attach nonremovable units to supporting members by welding where both materials are same; otherwise, fasten by bolting as indicated above.

3.03 ADJUSTING AND CLEANING

A. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION
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CONTRACT SPECIFICATIONS

SECTION 05 53 33
ALUMINUM GRATINGS

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes specifications for Aluminum bar gratings.

1. **GRTG-2**: Swaged aluminum (vertical bars)

2. **GRTG-3**: Press-locked aluminum; heel-proof.

3. Delegated design of brackets and attachments for vertically installed gratings.

B. Related Sections: The work of the following Sections is related to the work of this Section. Other Sections, not referenced below, may also be related to the proper performance of this work.

   1. Section 05 12 00, Structural Steel Framing: Structural-steel framing system components.

   2. Section 05 51 31, Steel Gratings: Welded steel, galvanized.

   3. Section 08 91 00, Louvers: Bird screens for air vents with aluminum grating.

1.02 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design grating attachment and brackets for GRTG-2 and GRTG-3, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Structural Performance: Grating attachment and brackets shall withstand the effects of gravity (self) loads and the wind loads specified on the (structural) Contract Drawings.

C. Seismic Performance: Provide gratings capable of withstanding the effects of earthquake motions determined according to ASCE/SEI 7.

1.03 REFERENCES

A. This Section incorporates by reference the latest revisions of the following documents.

   1. American Architectural Manufacturers Association (AAMA)
      a. AAMA 611: Voluntary Standards for Anodized Architectural Aluminum

   2. American Welding Society (AWS)
      a. AWS D1.2: Structural Welding Code - Aluminum

   3. American Society for Mechanical Engineers (ASME)
      a. ASME B18.21: Lock Washers (Inch Series)
4. American Society for Testing and Materials International
   a. ASTM B 209: Specification for Aluminum and Aluminum-Alloy Sheet and Plate
   b. ASTM B 221: Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
   c. ASTM D 1187: Specification for Asphalt-Base Emulsions for Use as Protective Coatings for Metal
   d. ASTM E 488: Test Method for Strength of Anchors in Concrete and Masonry Elements
   e. ASTM F 593: Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs
   f. ASTM F 594: Specification for Stainless Steel Nuts

5. National Association of Architectural Metal Manufacturers (NAAMM)
   a. NAAMM MBG 531: Metal Bar Grating Manual
   b. Metal Finishes Manual for Architectural and Metal Products.

1.04 SUBMITTALS
   A. Procedures: Section 01 33 00, Submittal Procedures
   B. Shop Drawings: Include plans, sections, details, and attachments to other work.
   C. Welding certificates.

1.05 QUALITY ASSURANCE
   A. Metal Bar Grating Standards: Comply with NAAMM MBG 531, "Metal Bar Grating Manual."
   B. Welding Qualifications: Qualify procedures and personnel according to the following:
      1. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."

1.06 PROJECT CONDITIONS
   A. Field Measurements: Verify actual locations of walls and other construction contiguous with gratings by field measurements before fabrication.

1.07 COORDINATION
   A. Coordinate installation of anchorages for gratings, grating frames, and supports. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.
PART 2 - PRODUCTS

2.01 ALUMINUM

A. Aluminum, General: Provide alloy and temper recommended by aluminum producer for type of use indicated, and with not less than the strength and durability properties of alloy and temper designated below for each aluminum form required.

B. Extruded Bars and Shapes: ASTM B 221, alloys as follows:
   1. 6061-T6 or 6063-T6, for bearing bars of gratings and shapes.
   2. 6061-T1, for grating crossbars.

C. Aluminum Sheet: ASTM B 209, Alloy 5052-H32.

2.02 FASTENERS

A. General: Unless otherwise indicated, provide Type 316 stainless-steel fasteners.

B. Stainless-Steel Bolts and Nuts: Regular hexagon-head annealed stainless-steel bolts, nuts, and, where indicated, flat washers; ASTM F 593 for bolts and ASTM F 594 for nuts, Alloy Group 2.


D. Post-Installed Anchors: Torque-controlled expansion anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488, conducted by a qualified Independent Testing Laboratory.

2.03 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy that is welded.

B. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

2.04 FABRICATION

A. Shop Assembly: Fabricate grating sections in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

B. Cut, drill, and punch material cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

C. Form from materials of size, thickness, and shapes indicated, but not less than that needed to support indicated loads.

D. Fit exposed connections accurately together to form hairline joints.

E. Welding: Comply with AWS recommendations and the following:
1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.

2. Select welding wire, method, and weld temperature to produce welds that will match color of adjacent parent material after finishing.

3. Obtain fusion without undercut or overlap.

4. Remove welding flux immediately.

F. Provide for anchorage of type indicated; coordinate with supporting structure. Fabricate and space the anchoring devices to secure gratings, frames, and supports rigidly in place and to support indicated loads.

1. Grating installed vertically: Provide welded lugs for bolting to support.

2. Grating installed horizontally: Provide weld lugs or saddle clips for anchorage.

2.05 METAL BAR GRATINGS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Alabama Metal Industries Corporation; a Gibraltar Industries company.

2. Grating Pacific, Inc.

3. IKG Industries; a division of Harsco Corporation.

4. Ohio Gratings, Inc.

5. McNichols, Inc.

B. Swaged, Aluminum Rectangular Bar Grating GRTG-2: Fabricated by swaging crossbars between bearing bars.

1. Bearing Bar Spacing: 1-3/16 inches o.c.

2. Bearing Bar Depth: 2 inches.


4. Crossbar Spacing: 4 inches o.c.

5. Aluminum Finish: Class I, clear, anodized finish.

C. Pressure-Locked, Rectangular Bar Aluminum Grating GRTG-3: Fabricated by pressing rectangular flush-top crossbars into slotted bearing bars.

1. Bearing Bar Spacing: 7/16 or 1/2 inch o.c.

2. Bearing Bar Depth: 1 inch.


4. Crossbar Spacing: 4 inches o.c.

5. Traffic Surface: Plain.
6. Aluminum Finish: Class I, clear, anodized finish.

2.06 GRATING FRAMES AND SUPPORTS

A. Frames and Supports for Metal Gratings: Fabricate from metal shapes, plates, and bars of welded construction to sizes, shapes, and profiles indicated and as necessary to receive gratings. Miter and weld connections for perimeter angle frames. Cut, drill, and tap units to receive hardware and similar items.

   1. Unless otherwise indicated, fabricate from same basic metal as gratings.

   2. Equip units indicated to be cast into concrete or built into masonry with integrally welded anchors. Unless otherwise indicated, space anchors 24 inches o.c. and provide minimum anchor units in the form of steel straps 1-1/4 inches wide by 1/4 inch thick by 8 inches long.

2.07 ALUMINUM FINISHES

A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

B. Class I, Clear Anodic Finish: AA-M12C22A41 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 611.

PART 3 - EXECUTION

3.01 INSTALLATION, GENERAL

A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing gratings to in-place construction. Include threaded fasteners for concrete and masonry inserts, through-bolts, lag bolts, and other connectors.

B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing gratings. Set units accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.

C. Provide temporary bracing or anchors in formwork for items that are to be built into concrete or masonry.

D. Fit exposed connections accurately together to form hairline joints.

   1. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations.

E. Field Welding: Comply with the following requirements:

   1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.

   2. Obtain fusion without undercut or overlap.

   3. Remove welding flux immediately.

F. Corrosion Protection: Coat concealed surfaces of aluminum that will come into contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.
3.02 INSTALLING METAL BAR GRATINGS

A. General: Install gratings to comply with recommendations of referenced metal bar grating standards that apply to grating types and bar sizes indicated, including installation clearances and standard anchoring details.

B. Attach removable units to supporting members with type and size of clips and fasteners indicated or, if not indicated, as recommended by grating manufacturer for type of installation conditions shown.

C. Attach nonremovable units to supporting members by welding where both materials are same; otherwise, fasten by bolting as indicated above.

END OF SECTION
CONTRACT SPECIFICATIONS

SECTION 05 58 27
LIGHT AND SPEAKER ASSEMBLIES

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes specifications for custom fabricated formed metal light and speaker assemblies consisting of the following principal components

1. Formed sheet steel enclosures.
2. Perforated metal speaker grilles.
3. Stainless steel support armatures
4. Stainless steel rod and clevis armature supports.
5. Stainless steel cable (wire rope) supports and stays.

1.02 REFERENCES

A. This Section incorporates by reference the latest revisions of the following documents.

1. ASTM A 36, Specification for Carbon Structural Steel
2. ASTM A 666, Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar
3. ASTM A 879, Specification for Steel Sheet, Zinc Coated by the Electrolytic Process
4. ASTM A 1008, Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability.
5. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
7. AWS D1.6, "Structural Welding Code - Stainless Steel."
8. SSPC-SP 1, Surface Preparation Specification No. 1: Solvent Cleaning; SSPC: The Society for Protective Coatings.
9. SSPC-SP 5/NACE No. 1, Surface Preparation Specification No. 5 White Metal Blast Cleaning; SSPC: The Society for Protective Coatings.
10. SSPC-SP 8, Surface Preparation Specification No. 8 Pickling; SSPC: The Society for Protective Coatings.

1.03 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design formed metal light and speaker assemblies including hangers, connectors, brackets and the housing. Provide comprehensive engineering analysis by an engineer using performance requirements and design criteria indicated.
B. Structural Performance: Formed metal light and speaker assemblies, including anchors and connections, shall withstand the effects of gravity loads and the following loads and stresses without exceeding the allowable design working stress of materials involved and without exhibiting permanent deformation in any components:


2. Maximum vertical load imposed on any given chamber rib by the lighting system should not exceed 300 pounds.

3. Assumed self-load of enclosures: Not to exceed 12 pounds per lineal foot including collateral loads of light fixtures, paging speakers, wiring, conduit, and wiring devices.

C. Seismic Performance: Formed metal light and speaker assemblies, including anchors and connections, shall withstand the effects of earthquake motions determined according to the Seattle Building Code.

1. Component Importance Factor is 1.0.

D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior metal fabrications by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.

1. Temperature Change: 100 degrees F, ambient.

1.04 SUBMITTALS

A. Procedures: Section 01 33 00, Submittal Procedures.

B. Product Data: For each type of product indicated. Include finishing materials.

C. Shop Drawings: Show fabrication and installation details for decorative formed metal.

1. Include plans, elevations, component details, and attachments to other work.

2. Indicate materials and profiles of each decorative formed metal member, fittings, joinery, finishes, fasteners, anchorages, and accessory items.

D. Samples for Verification: For each type of exposed finish required, prepared on 6-inch-square Samples of metal of same thickness and material indicated for the Work.

E. Delegated-Design Submittal: For installed products indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation. At a minimum, include the following:

1. Design Criteria

2. Selection of load-carrying members, components and connectors

3. Stress and deflection analysis

4. Reactions and imposed loads transmitted to primary structure and chamber ribs

1.05 QUALITY ASSURANCE

A. Fabricator Qualifications: A firm experienced in producing decorative formed metal similar to that indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
B. Powder-Coating Applicator Qualifications: A firm experienced in successfully applying powder coatings of type indicated to metals of types indicated and that employs competent control personnel to conduct continuing, effective quality-control program to ensure compliance with requirements.

C. Engineer Qualifications: A licensed structural engineer currently registered in the state of Washington.

D. Welding Qualifications: Qualify procedures and personnel according to the following:
   1. AWS D1.1/D1.1M, "Structural Welding Code - Steel

E. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.
   1. Build mockups for the following types of decorative formed metal:
      a. One 12-foot long bracket to bracket section, to include bracket arm assembly, speaker and lighting enclosure assembly, representative lighting fixtures and at least one speaker box enclosure and cover plate (speaker is NIC). Place at angle of escalator.
   2. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

F. Preinstallation Conference: Conduct conference at Project site.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver decorative formed metal products wrapped in protective coverings and strapped together in suitable packs or in heavy-duty cartons. Remove protective coverings before they stain or bond to finished surfaces.

B. Store products on elevated platforms in a dry location.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Sheet Metal
   1. General: Provide sheet metal without pitting, seam marks, roller marks, stains, discolorations, or other imperfections where exposed to view on finished units.
   2. Steel Sheet: Uncoated, cold-rolled, ASTM A 1008, commercial steel, exposed or electrolytic zinc-coated, ASTM A 879, with steel sheet substrate complying with ASTM A 1008, commercial steel, exposed.
   3. Stainless-Steel Sheet: ASTM A 240 or ASTM A 666, Type 304, stretcher-leveled standard of flatness.

B. Steel Shapes: ASTM A 36.
C. Stainless-Steel Plate, and Flat Bar: ASTM A 666, Type 304.

2.02 MANUFACTURED COMPONENTS

A. Stainless Steel Rod Hanger Components: Fabricated from Type 316 stainless steel; size and type to meet design requirements. Manufacturer's standard satin finish.

1. Manufacturer: Acceptable manufacturers include.
   a. Carl Stahl Décor Cable Systems.
   b. Cleveland City Forge
   c. Hayn Enterprises, LLC.
   d. Jakob, Inc.
   e. Seco South, Inc.

B. Cable Support Components:

1. Wire Rope (Cable): Type 316 stainless steel; 1 x 19 construction.

2. Fittings: Type 316 stainless steel; swaged where exposed to view, swaged or Nicopress where concealed from public view. Manufacturer's standard satin finish.

3. Manufacturer: Same as for steel rod hanger components.

C. Perforated Metal For Speaker Grilles:

1. Steel sheet, 0.030 inch thick (22 gage) perforated with 1/8 inch diameter holes at 3/16 inch 60-degree staggered centers.

2.03 MISCELLANEOUS MATERIALS

A. Sealants, Interior: Nonsag, paintable, nonstaining, latex sealant complying with ASTM C 834; of type and grade required to seal joints in decorative formed metal; and as recommended in writing by decorative formed metal manufacturer.

B. Filler Metal and Electrodes: Provide type and alloy of filler metal and electrodes as recommended by producer of metal to be welded or brazed and as necessary for strength, corrosion resistance, and compatibility in fabricated items.

1. Use filler metals that will match the color of metal being joined and will not cause discoloration.

C. Fasteners: Fabricated from same basic metal and alloy as fastened metal unless otherwise indicated. Do not use metals that are incompatible with materials joined.

1. Provide concealed fasteners for interconnecting decorative formed metal items and for attaching them to other work unless exposed fasteners are unavoidable or are the standard fastening method.

2. Provide square or hex socket flat-head machine screws for exposed fasteners unless otherwise indicated.

D. Structural Anchors: For applications indicated to comply with certain design loads, provide chemical or torque-controlled expansion anchors with capability to sustain, without failure, a
load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.


F. Sound-Deadening Materials:


G. Backing Materials: Provided or recommended by decorative formed metal manufacturer.

H. Laminating Adhesive: Adhesive recommended by metal fabricator that will fully bond metal to metal and that will prevent telegraphing and oil canning and is compatible with substrate and noncombustible after curing.

2.04 FORMED METAL LIGHT AND SPEAKER ASSEMBLIES

A. Form assemblies from metal of type and thickness indicated below. Coordinate size of fixtures, speakers, location of cutouts for electrical wiring, and method of attachment of installed components

1. Steel Sheet: 0.048 inch.
   a. Finish: Baked enamel or powder coat.

2. Fabricate formed metal light and speaker assemblies with swaged slip joints to facilitate assembly and allow thermal movement.

3. Provide factory endcaps.

4. Apply manufacturer's recommended sound-deadening material to internal surfaces.

2.05 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Apply organic finishes to formed metal after fabrication unless otherwise indicated.

D. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.06 STEEL SHEET FINISHES

A. Surface Preparation: Clean surfaces to comply with SSPC-SP 1, "Solvent Cleaning," to remove dirt, oil, grease, or other contaminants that could impair paint bond. Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning," or with SSPC-SP 8, "Pickling."
B. Pretreatment: Immediately after cleaning, apply a conversion coating of type suited to organic coating applied over it.

C. Baked-Enamel Finish: Immediately after cleaning and pretreating, apply manufacturer’s standard two-coat, baked-enamel finish consisting of prime coat and thermosetting topcoat. Comply with coating manufacturer’s written instructions for applying and baking to achieve a minimum dry film thickness of 2 mils.

D. Powder-Coat Finish: Immediately after cleaning and pretreating, apply manufacturer’s standard thermosetting polyester or acrylic urethane powder coating with cured-film thickness not less than 1.5 mils. Prepare, treat, and coat metal to comply with resin manufacturer’s written instructions.

2.07 STAINLESS-STEEL FINISHES

A. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.

B. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.
   1. Run grain of directional finishes with long dimension of each piece.

C. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of decorative formed metal.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Locate and place decorative formed metal items level and plumb and in alignment with adjacent construction. Perform cutting, drilling, and fitting required to install decorative formed metal.
   1. Do not cut or abrade finishes that cannot be completely restored in the field. Return items with such finishes to the shop for required alterations, followed by complete refinishing, or provide new units as required.

B. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where needed to protect metal surfaces and to make a weathertight connection.

C. Form tight joints with exposed connections accurately fitted together. Provide reveals and openings for sealants and joint fillers as indicated.
D. Install concealed gaskets, joint fillers, sealants, and insulation, as the Work progresses, to make interior decorative formed metal items soundproof or lightproof as applicable to type of fabrication indicated.

3.03 ADJUSTING AND CLEANING
A. Unless otherwise indicated, clean metals by washing thoroughly with clean water and soap, rinsing with clean water, and drying with soft cloths.
B. Restore finishes damaged during installation and construction period so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit or provide new units.

3.04 PROTECTION
A. Protect finishes of decorative formed metal items from damage during construction period. Remove temporary protective coverings at time of Substantial Completion.

END OF SECTION
PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes specifications for:
   1. Roofing nailers.
   2. Preservative-treated wood materials.
   4. Communications and electrical room mounting boards.
   5. Concealed wood blocking, nailers, and supports.

B. Related Sections: The work of the following Sections is related to the work of this Section. Other Sections, not referenced below, may also be related to the proper performance of this work.
   1. Section 05 50 00, Metal Fabrications: Miscellaneous steel connectors and support angles for wood framing at mechanical equipment units or penetrations.
   2. Section 07 54 23, Thermoplastic Polyolefin (TPO) Roofing: Wood roof curbs and blocking
   3. Section 07 62 00, Sheet Metal Flashing and Trim: Sill flashings.

1.02 REFERENCES

A. This Section incorporates by reference the latest revisions of the following documents.
   1. American Society of Mechanical Engineers (ASME)
      a. ASME B18.2.1-1: Square and Hex Bolts and Screws (Inch Series)
      b. ASTM A 307: Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength.
      c. ASTM C 954: Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs from 0.033 in. to 0.112 in. in Thickness
   3. American Wood-Preservers' Association (AWPA)
      a. AWPA U1 - Use Category System: User Specification for Treated Wood;
4. National Institute of Standards and Technology (Department of Commerce).
   a. PS 1 - U.S. Product Standard for Construction and Industrial Plywood
   b. PS 20 - American Softwood Lumber Standard
5. Western Wood Products Association.
   a. WWPA G-5 - Western Lumber Grading Rules

1.03 SUBMITTALS
   A. Procedures: Section 01 33 00, Submittal Procedures.
   B. Product Data: Provide technical data on wood preservative materials, application instructions, and fire-retardant wood materials.

1.04 QUALITY ASSURANCE
   A. Lumber: Comply with PS 20 and approved grading rules and inspection agencies.
      1. Lumber of other species or grades, or graded by other agencies, is acceptable provided structural and appearance characteristics are equivalent to or better than products specified.
   B. Fire-Retardant Treated Wood: Mark each piece of wood with producer's stamp indicating compliance with specified requirements.
   C. Preservative-Treated Wood: Provide lumber and plywood marked or stamped with producer's stamp indicating level and type of treatment in accordance with AWPA standards.

PART 2 - PRODUCTS

2.01 GENERAL REQUIREMENTS
   A. Dimension Lumber: Comply with PS 20 and requirements of specified grading agencies.
      1. Species: Douglas Fir-Larch or Hem-Fir, unless otherwise indicated.
      2. Grading Agency: Any grading agency whose rules are approved by the Board of Review, American Lumber Standard Committee (www.alsc.org) and who provides grading service for the species and grade specified; provide lumber stamped with grade mark unless otherwise indicated.

2.02 DIMENSION LUMBER FOR CONCEALED APPLICATIONS
   A. Sizes: Nominal sizes as indicated on Contract Drawings.
   B. Moisture Content: S-dry or MC19 (nominal 19 percent maximum).
   C. Miscellaneous Framing, Blocking, Nailers, Grounds, and Furring:
      1. Lumber: S4S (surfaced four sides), No. 2 or Standard Grade.
      2. Boards: Standard or better.
D. Construction Panels:

1. General: Identify each panel with appropriate APA (The Engineered Wood Association www.apawood.org) trademark or PS-1 grade stamp.

2. Plywood for Sheathing and Roof Parapets. as Indicated: APA Rated Sheathing 32/16, or PS-1 veneer plywood C-DX (Exterior Grade), or better, 1/2 inch thick unless otherwise indicated; square edges.

3. Plywood for Backing of Electrical or Communication Equipment: PS-1 veneer plywood, Exposure 1, 3/4 inch thick; fire-retardant treated.

2.03 ACCESSORIES

A. Fasteners and Anchors:


2. Screws for Fastening to Metal Framing: ASTM C 954, length as recommended by screw manufacturer for material being fastened.


4. Bolts: Steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washers.

2.04 FACTORY WOOD TREATMENT

A. Treated Lumber and Plywood: Comply with requirements of AWPA U1 - Use Category System for wood treatments determined by use categories, expected service conditions, and specific applications.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Reuse scrap to the greatest extent possible; clearly separate scrap for use on site as accessory components, including: shims, bracing, and blocking.

B. Where treated wood is used on interior, provide temporary ventilation during and immediately after installation sufficient to remove indoor air contaminants.

C. Construction Panels

1. Communications and Electrical Room Mounting Boards: Secure with screws to studs with edges over firm; space fasteners at maximum 24 inches on center on all edges and into studs in field of board.

   a. At fire-rated framed walls, install plywood over gypsum board.

   b. Install adjacent boards without gaps.

   c. Size and Location: As indicated on Contract Drawings.

D. Blocking, Nailers, and Supports
1. Provide fire-treated blocking members as indicated or as required to support finishes, fixtures, specialty items, and trim.

2. Specifically, provide the following non-structural framing and blocking:
   a. Cabinets and shelf supports.
   b. Wall brackets.
   c. Handrails.
   d. Grab bars.
   e. Wall-mounted door stops.
   f. Wall-mounted display or information boards.

E. Roof-Related Carpentry
   1. Provide preservative-treated lumber and plywood for roof-related carpentry.
   2. Coordinate installation of roofing carpentry with deck construction, framing of roof openings, and roofing assembly installation.
   3. Provide wood curb at all roof openings except where prefabricated curbs are specified and where specifically indicated otherwise. Form corners by alternating lapping side members.
   4. Provide miscellaneous members as indicated or as required to support finishes, fixtures, specialty items, and trim.

3.02 APPLICATION
   A. Site-Applied Wood Treatment
      1. Apply preservative treatment compatible with factory applied treatment at sitesawn cuts, complying with manufacturer’s instructions.
      2. Allow preservative to dry prior to erecting members.

3.03 CONSTRUCTION
   A. Tolerances
      1. Framing Members: 1/4 inch from true position, maximum.
      2. Variation from Plane (Other than Floors): 1/4 inch in 10 feet maximum, and 1/4 inch in 30 feet maximum.

END OF SECTION
SECTION 06 16 43
EXTERIOR GYPSUM SHEATHING

PART 1 - GENERAL

1.01 SUMMARY
A. This Section includes specifications for gypsum sheathing board and accessories behind exterior wall systems to receive direct application of water and air barrier indicated in related section, and used behind:
   1. Metal cladding (MP-#) assemblies as indicated.
B. Related Sections: The work of the following Sections is related to the work of this Section. Other Sections, not referenced below, may also be related to the proper performance of this work.
   1. Section 05 40 00, Cold-Formed Metal Framing: Exterior wall framing.
   2. Section 07 27 10, Water and Air Barrier: Membrane weather protective system (WAB-1) for application over sheathing.
   3. Section 07 42 10, Metal Wall Panels: Metal cladding (MP-#) assemblies.

1.02 REFERENCES
A. This Section incorporates by reference the latest revisions of the following documents.
   1. American Society for Testing and Materials International (ASTM)
      b. ASTM C 1002, Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs.
      c. ASTM C 1177, Glass Mat Gypsum Substrate Used as Sheathing.
   2. Gypsum Association (GA)
      a. GA-253, Application of Gypsum Sheathing

1.03 SUBMITTALS
A. Procedures: Section 01 33 00, Submittal Procedures.
B. Product Data: Submit manufacturer's literature on products handling, storage, and installation (cutting and fastening) requirements to be used under this Section, clearly marked and fully described and as required under material exposure warranty.

1.04 COORDINATION WITH OTHER TRADES
A. Installation Precautions: Follow manufacturer's installation instructions including the following:
1. For installation of surface applied flashings, trim and membrane waterproofing flashing, coordinate locations of concealed blocking and nailers for full support of applied materials with structural stud installer.

2. Within 30 days of sheathing installation cover the sheathing with specified water and air barrier.

1.05 DELIVERY, STORAGE AND HANDLING

A. Deliver gypsum sheathing board and related materials in original packages bearing brand name and identification of manufacturer.

B. Store gypsum sheathing board so that it is protected against damage from weather, direct sunlight, surface contamination, corrosion, construction traffic and other causes. Neatly stack gypsum sheathing boards flat on leveled supports off the ground under protective covering. Handle gypsum sheathing board to prevent damage to edges, ends, and surfaces.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Gypsum Sheathing Board: ASTMC 1177, fire resistant Type “X”, formulated water resistant throughout entire panel meeting performance criteria.

1. Acceptable Products:
   a. USG “Securerock Glass Mat Sheathing”
   b. Georgia-Pacific “Dens-Glas Gold”
   c. BPB America, Inc. “Glas-Roc Sheathing”

2. Thickness/Width: 5/8 inch thick by 48 inches wide; maximum permissible lengths, except as otherwise indicated.

3. Finish Edge and End Configuration: "Square" shaped edges and ends.

B. Accessories:

   a. Length as required by sheathing manufacturer, but not less than 1-1/4 inch long as required to obtain 3/8-inch penetration in metal studs.
   b. Finish: Galvanized or corrosion-resistant polymeric coating, coating, rated 2000 hours of salt-spray before developing 5 percent red rust when tested in accordance with ASTM B 117.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine metal framing to ensure concealed blocking and nailers are in place, and that framing is ready for installation of sheathing. Do not proceed with installation in areas of
discrepancy until all such discrepancies have been fully resolved. Commencement of work constitutes acceptance of conditions.

3.02 INSTALLATION

A. General: Except as otherwise indicated, comply with manufacturer’s instructions, GA-253, and the following for the installation of gypsum sheathing.

1. Cut boards using manufacturer’s approved method at penetrations, edges and other obstructions of the work; fit tight against abutting work.

2. Coordinate installation of sheathing with installation of flashing, joint sealers and water and air barrier installation so that these combined materials are installed in the sequence and manner which prevents exterior moisture from passing through completed exterior gypsum assembly to the interior.

3. Apply fasteners so that screw heads bear tightly against face of gypsum sheathing boards, but do not cut into substrate.

B. Installation of Sheathing: Apply sheathing in as longest lengths as practicable with orientation of boards running in manufacturer’s approved direction, either vertically or horizontally and with smooth face to exterior.

1. All finish edges shall occur centered over flanges of metal framing; staggering of joints in adjacent rows is not required, unless required to achieve component wind resistant data submitted as part of system design.

2. At end joints; bring end joints into contact with each other without forcing. Cut and fit snugly around all openings.

3. Fasten sheathing to metal framing with specified fasteners. Drive fasteners in field of panel first, working toward ends and edges. Space fasteners max. 12 inches o.c. for walls and soffits with perimeter fasteners at least 3/8 inch from edge and less than 5/8 inch from ends and edges with framing at maximum 24 inches o.c. for walls and 12 inches for soffits. Drive screws so heads are flush with surface.

3.03 PROTECTION

A. Protect exterior gypsum sheathing from damage and soiling.

END OF SECTION
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PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes specifications for plastic laminate (PLAM-#) faced wood millwork units for following locations:

1. Cabinets and countertops in crew rooms.
2. Counters in FCC room.

1.02 REFERENCES

A. This Section incorporates by reference the latest revision of the following documents.

1. American National Standard (ANSI)
   a. ANSI A208.2 for Medium Density Fiberboard for Interior Use; 2002.

2. Architectural Woodwork Institute (AWI) and Architectural Woodwork Manufacturers Association of Canada (AWMAC)
   a. AWI/AWMAC (QSI) - Architectural Woodwork Quality Standards Illustrated;

3. National Electrical Manufacturers Association (NEMA)
   a. NEMA LD 3 - High-Pressure Decorative Laminates

4. PS 20 - American Softwood Lumber Standard; National Institute of Standards and Technology (Department of Commerce)

1.03 SUBMITTALS

A. Shop Drawings: Show dimensioned plans, elevations and sections; types and thicknesses of materials, details of fabrication, joinery and assembly methods; note finishes, materials, and material colors for exposed and semi-exposed surfaces; indicate field dimensions where critical for satisfactory fabrication or installation.

1. Show location and sizing of reinforced backing in walls to support wall mounted cabinets and exposed shelf standards; reinforcement backing furnished and installed by other trades.

2. Show millwork hardware details, including types and manufacturer’s; show quantity and locations of door hinges, pulls and drawer slides.

3. Indicate type, size and spacing of screws for attachment of millwork to building structure.

4. Indicate cut outs for plumbing fixtures and faucets, being installed into millwork and requiring coordination of other trades.
B. Samples for Verification:
   1. Plastic Laminate: Submit two samples of each color and pattern selected.
   2. Low Pressure Laminates: Submit two samples of each color and pattern selected.

1.04 QUALITY ASSURANCE
A. Quality Standards: Conform to AWI/AWMAC (QSI) “Custom Grade” standards for materials, fabrication, finishing, certification, and installation.

1.05 DELIVERY, STORAGE & HANDLING
A. Delivery and Handling: Protect all items during transit, delivery, storage and handling to prevent damage, soiling and deterioration. Delay delivery of millwork until installation locations are ready. Do not install until room finishes have been applied and allowed to dry or cure and building’s design humidity and temperature levels have been achieved and maintained at those levels in installation areas.
B. Storage: If, due to unforeseen circumstances, items must be stored in other than installation areas, store only in areas meeting requirements specified for installation areas.
C. Upon delivery, inspect millwork for damage, quantity discrepancies, irregularities or defects. Do not proceed with the Work until delivered materials are acceptable to Installer.

1.06 PROJECT CONDITIONS
A. Conditioning:
1. Millwork Fabricator shall advise Contractor of temperature and humidity requirements for millwork storage and installation. Do not install millwork until required temperature and relative humidity have been stabilized and will be maintained in installation areas through remainder of construction period.
2. Allow millwork to acclimate to the above conditions for 72 hours prior to installation, unless millwork items have been stored off-site in a controlled environment and installation is to take place immediately upon delivery.

PART 2 - PRODUCTS

2.01 MATERIALS
A. Laminate Plastic (“PLAM-#”): High pressure decorative laminate (HPDL), conforming to NEMA LD-3; provide the following types:
   1. Types:
      a. Vertical Surfaces: General purpose type GP28, nominal 0.028 inch thick.
      b. Horizontal Surfaces: General purpose type GP50, nominal 0.050 inch thick.
B. Balancing Sheet: High pressure laminate, type CL20 conforming to NEMA standards for cabinet liner, 0.020 inch thick.
C. Core Material: Interior grade, medium density fiberboard (MDF) complying with ASTM D1037 and ANSI A208.2-2002, premium Grade 140 MDF.

1. Provide exterior grade MDF for countertops.
2. Density: Minimum of 48 pounds per cubic foot.

D. Adhesive: Type II (moisture resistant) type as selected by Fabricator, except the use of urea formaldehyde resin adhesive is not permitted.

1. Bonding Process: Performed in controlled environment between 40-60 percent relative humidity at temperature above 60 degrees F., at a pressure not less than 15 psi.

2.02 CASEWORK HARDWARE

A. General: Provide all hardware required for satisfactory fabrication, installation and operation of casework, including the following. Unless otherwise specified, provide hardware in US26D finish.

1. Cabinet Hinges: Blum "Clip 170" concealed hinges with 170 degree opening angle, or approved equal self-closing hinge.
2. Pulls: Epco Co. “MC-402-4”, solid brass with “DC” (dull chrome finish), 4 inches center to center, or approved equal
3. Adjustable Shelf Hardware (Pin Support): Hafele "283.50.709", or approved angle form support with expanding plug for screw attachment to side panels.

2.03 CABINET FABRICATION, GENERAL

A. Pre-Assemble: Complete fabrication and assembly in the shop to the maximum extent possible before shipment to building. Disassemble components only as necessary for handling and ship in unitized or panelized form ready for field installation.

B. Pre-Cut Openings: Fabricate millwork items with pre-cut openings, where possible, to receive hardware, sinks, electrical work and similar items. Locate openings accurately and use templates or roughing-in diagrams for proper size and shape. Smooth edges of all cutouts.

2.04 LAMINATED PLASTIC CASEWORK COUNTERTOPS & SHELVES

A. General: Comply with "Custom Grade" standards as established in AWI Section 400C and produce individual counters in one continuous length without visible joints. Field seams are not acceptable.

B. Core (Tops, Vertical Support Cleats): Nominal 3/4 inch thick MDF of types as previously specified.

C. Covering: Cover exposed to view surfaces and edges of tops with plastic laminate; apply balancing sheet to underside of tops and backside of splashes. Countertops requiring more than one sheet of laminate shall be fabricated from the longest sheet lengths available from manufacturer.

D. Edges: Provide square self-edged with matching plastic laminate in same thickness.
PART 3 - EXECUTION

3.01 EXAMINATION

A. Determine that conditions are acceptable to receive the work of this Section. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to the Installer. Starting of the work will be construed as acceptance of conditions.

3.02 INSTALLATION

A. General: Install millwork in accordance with requirements specified in AWI Section 1700 for "Custom Grade" quality.

1. Install in accordance with approved shop drawings.

2. Install millwork plumb, level, true and straight with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line; shim as required using concealed shims.

3. Assemble and install work without machine and tool marks.

4. Neatly fit and scribe work to adjacent surfaces.

B. Anchor millwork to anchors or blocking built-in or directly attached to substrate. Secure with concealed fasteners.

C. Cabinets: Install without distortion so that doors fit openings properly and are accurately aligned.

1. Fasten wall cabinets through back, near top and bottom, at ends and not more than 16 inches o.c. with No. 10 wafer-head sheet metal screws through metal backing or metal framing behind wall finish.

2. Adjust hardware to center doors in openings and to provide unencumbered operation. Complete the installation of hardware and accessory items as indicated.

D. Countertops: Anchor securely by screwing through corner blocks of base cabinets or other supports into underside of countertop.

1. Align adjacent surfacing-material countertops and form seams to comply with manufacturer's written recommendations using adhesive in color to match countertop. Carefully dress joints smooth, remove surface scratches, and clean entire surface.

2. Install countertops with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line; meeting edges shall not vary more than 0.10 inch.

3. Secure backsplashes to countertops in shop as indicated above.

4. Fill space between backsplash, cutouts and wall with sealant specified in Division 7 Section “Joint Sealants.”

E. Wood Base: Attach with fasteners through the face; countersink all fasteners and fill with putty. Provide scarf type joints between sections; miter outside and inside corners.
3.03 ADJUSTMENT, CLEANING, FINISHING AND PROTECTION

A. Clean, lubricate and adjust hardware.

B. Cover completed work with 4 mil polyethylene film protective enclosure, applied in a manner which will allow easy removal and without damage to casework. Place cover to permit ventilation. Remove cover at time of final cleaning.

C. A final dusting of exterior and interior surfaces shall be carefully done including the removal of fingerprints or other marks.

END OF SECTION
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PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes specifications for furnishing and installing the permanent waterproofing system and seepage management system for cut-and-cover structures. The waterproofing system is installed under invert slabs, on roof slabs and between support of excavation and at structural walls. The seepage management system is installed at the inside face of the slurry walls behind the architectural finishes. Perform, at minimum, the following activities:

1. Preparation of the surface.
2. Waterproofing system and seepage management system installation.
3. Protection of the waterproofing system.
4. Inspection of the waterproofing system and seepage management system for damage.
5. Leak remediation.

B. Related Sections: The work of the following Sections is related to the work of this Section. Other Sections, not referenced below, may also be related to the proper performance of this work. It is the Contractor’s responsibility to perform all the Work required by the Contract Documents.

1. Section 03 15 13, Waterstops.
2. Section 03 30 00, Cast-in-Place Concrete.
3. Section 22 14 01, Drainage System for Structures.
4. Section 31 23 33, Trenching and Backfilling.
5. Section 31 50 00, Excavation Support and Protection.

1.02 REFERENCES

A. This Section incorporates by reference the latest revision of the following documents.

1. American Society for Testing and Materials (ASTM)
   a. ASTM D374 Standard Test Method for Thickness of Solid Electrical Insulation
   b. ASTM D568 Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Flexible Plastics in a Vertical Position
   c. ASTM D638 Standard Test Method of Tensile Properties of Plastics
d. ASTM D1593 Standard Specification for Nonrigid Vinyl Chloride Plastic Sheeting

e. ASTM D1621 Standard Test Method for Compressive Properties of Rigid Cellular Plastics


g. ASTM D1785 Standard Specification for Polyvinyl Chloride (PVC) Plastic Pipe, Schedules 40, 80, and 120

h. ASTM D3776 Standard Test Methods for Mass per Unit Area (Weight) of Woven Fabric

i. ASTM D3786 Standard Test Method for Hydraulic Bursting Strength of Knitted Goods and Nonwoven Fabrics - Diaphragm Bursting Strength Tester Method

j. ASTM D4533 Standard Test Method of Trapezoid Tear Strength of Geotextiles

k. ASTM D4632 Standard Test Method for Breaking Load and Elongation of Geotextiles (Grab Method)

l. ASTM D4716 Standard Test Method for Transmissivity

2. Deutsches Institut für Normung (DIN)

a. DIN 4102-1, Fire behavior of building materials and building components - Part 1: Building materials; concepts, requirements and tests

b. DIN 16726-5.12 Mechanical Puncture Resistance

1.03 DEFINITIONS

A. Control and Grouting Pipes: Pipes typically installed near water barrier. If leakage should occur the pipes are used for remedial grouting.

B. Double Weld: Machine welded seams achieved by use of automatic hot-double-wedge welding equipment.

C. Geodrain: Composite panel providing a groundwater drainage channel and protection for the synthetic membrane from sharp projections on the surface to which membrane is applied.

D. Geotextile: Non-woven fabric providing a groundwater drainage channel and protection of the membrane from sharp projections on the surface to which the membrane is applied.

E. Leakage: Damp spots or water seeping from the structure walls, slabs, joints or control and grouting pipes.

F. Membrane: Synthetic waterproofing membrane specifically formulated for sealing underground structures against intruding groundwater.

G. Membrane Protection Layer: A PVC membrane layer specifically designed to be attached to and completely cover the membrane to protect it from damage.
H. Patent Strip: Channel shaped stainless steel bar with pre-punched holes used to achieve a tight fit at waterproofing terminations.

I. Protective Boards: Rigid material, for example plywood or Styrofoam, used in conjunction with a membrane protection layer to protect the membrane from damage during backfilling and other construction activities detrimental to the integrity of the membrane.

J. Protective Concrete: Concrete placed on waterproofing installed below the invert slab and on the roof slab to prevent damage.

K. Protective Metal Sheet: Lightweight metal sheet used to protect membrane, at terminations near the ground surface.

L. Regroutable Hose: Hose installed at invert slab joints and along the slurry wall as shown in the Contract Documents which must be grouted and flushed for reuse.

M. Sealant Strip: Polymer swelling gasket strip applied in conjunction with patent strips at waterproofing terminations.

N. Sectioning: Water barriers arranged to seal off individual membrane sections. Used in conjunction with control and grouting pipes.

O. Seepage Management: Layered system consisting of synthetic membrane and geodrain to collect water that leaks through the slurry walls and to transport it to the structure's drainage system, thus preventing groundwater intrusion into the interior of the finished structures.

P. Seepage Management Drainage Pipe: Perforated or non-perforated pipe which collects water that leaks through the slurry walls and transports it to the structure's drainage system.

Q. Single Weld: Hand welded seam consisting of a tack weld, a thin continuous weld and a rolled end weld. Single seams are sealed with liquid PVC at membrane welds.

R. Temporary Construction Drainage: Contractor designed perforated drain pipe buried in a layer of crushed stone at the toe of the support of excavation wall to divert water run off to the temporary sump pumps.

S. Temporary Relief Pipe: Temporary groundwater relief pipe installed in the invert or side walls as needed to relieve groundwater pressure during construction.

T. WA Anchor: Rigid plastic shell with an inside threads, for steel rod attachment, and membrane flange used to create watertight penetrations through the membrane.

U. Water Barrier: A base seal waterstop welded to the membrane.

V. Waterproofing: Layered system consisting of membrane, geodrain, protective layers, water barriers, control and grouting pipes, regroutable hoses, and other sealing products, combined which prevent intrusion of groundwater into the interior of the finished structures.

1.04 SYSTEM REQUIREMENTS

A. Performance Requirements

1. No water leakage shall be acceptable through the waterproofing system and no uncontrolled water leakage shall be acceptable through the seepage management system.
1.05 SUBMITTALS

A. Qualifications including a resume listing applicable project experience, position held, duration and project description.

1. Waterproofing Installer
2. Waterproofing Supervisor
3. Remedial Grout Supervisor

B. Product Data for the Following: Include, where applicable, catalogue cuts, MSDS sheets, certification of compliance, manufacturers recommendations for storage, handling, installation and protection, testing, welding, detection for damage and repair:

1. Geotextile
2. Geodrain
3. Membrane
4. Membrane Protection Layer
5. Water Barrier
6. Control and Grouting Pipe Assembly
7. WA Anchor
8. Patent Strip
9. Sealant Strip
10. Perforated and non-perforated seepage management drainage pipe
11. Remedial Grout
12. Regroutable Hose

C. Shop Drawings. Include plans, sections and details showing as a minimum:

1. Sequence of waterproofing and seepage management installation relative to construction sequence.
2. Typical sheet layouts. Include splice locations and types of welds.
3. Build-up of layered waterproofing and seepage management in invert, at support of excavation, and on roof slabs.
4. Layout of water barriers for sectioning including location of control and grouting pipes.
5. Layout of regroutable hoses and junction boxes with labeling system to identify each hose and its location as well as fixation.
7. Waterproofing at all penetrations.
8. Waterproofing at corners.
10. Control and grouting pipe assembly Including protection from concrete intrusion during concrete pours.

D.防水和渗漏管理保护计划，包括防止施工操作期间损坏的程序描述，例如安装模板、钢筋和嵌入物，混凝土的放置，回填，和调平。

E. 防水安装人员的认证，由膜供应商提供。

F. 材料样品:
1. 地布：一平方英尺。
2. 地砖：一平方英尺。
3. 膜片：一平方英尺，包括双焊缝一英尺长。
4. 膜片保护层：一平方英尺，附着在 membrane。
5. 防护金属片：一平方英尺。
6. 连接装配：三个。
7. 水屏障：一英尺长焊接到 membrane。
8. 控制和注浆管：一英尺长度（包括法兰，连接件，螺纹和帽）。
9. 硅胶：两瓶，每瓶四液。
10. 环形金属夹：一个。
11. WA 钢钉：一个，包括带螺纹的杆。
12. 专利条：一英尺长度，附有紧固件。
13. 聚合物密封条：一英尺长度。
14. 再注浆软管：一英尺长度。
15. 连接盒：三件，包括盖子。
16. 渗漏管理排水管：一英尺长度的穿孔和非穿孔管。

G. 场地样品：
1. 双焊样品，三英尺长，从每个双楔焊接机，需在每日开始时提交。
2. 准备并提交现场样品，每日需在焊缝焊接前。

H. 报告/记录/表格：

1. Surface Acceptance Form completed and signed prior to start of installation.
2. Waterproofing and Seepage Management Installation Acceptance Form completed and signed immediately after completion of an installation / testing area.
3. Waterproofing and Seepage Management Condition Form completed and signed prior to placing concrete or backfill material against the waterproofing system and prior to installing the architectural finishes in front of the seepage management system.
4. Test (including Re-Tests) and Repair Reports.

I. As-built drawings:
1. Control and Grouting Pipes:
   a. Location and elevation of control and grouting pipes.
   b. Date of pipe installation.
   c. Date of concreting.
   d. Names of workers and supervisors for respective work.
2. Water Barriers: Location and elevation of water barriers and size of sections.
3. Regroutable Hose:
   a. Location and elevation of junction boxes, where regroutable hoses start and terminate.
   b. Location and elevation of regroutable hoses.
   c. Labeling system to correspond with labels attached to hoses in the field.

J. Leak Remediation Plan:
1. Submit leak remediation plan prior to the start of any work associated with stopping leakage.
2. Include product data for all materials and equipment proposed, narrative outlining procedures and stages for grouting, coordination with other work, location, as-built locations of the water barriers within the area of sectioning targeted, and the details associated with grouting and cleaning regroutable hoses.

1.06 QUALITY ASSURANCE

A. Waterproofing Supervisor shall have a minimum five years experience in the installation of waterproofing systems for underground structures using membrane and associated waterproofing materials indicated.

B. Waterproofing Installer shall be trained for installation and testing operations proposed, and have a minimum of five years of experience in the installation of flexible membranes in underground waterproofing installations.

C. Remedial Grouting Supervisor shall have minimum five years experience with grouting of flexible membrane and regroutable hoses using the grout materials indicated.
D. Perform test welding, using the membrane and equipment planned for the production work, for all types of welds. Perform and test the welds in the presence of the Resident Engineer prior to production installation.

E. Readiness Review Meetings:

1. Before installation of waterproofing and concrete over same, meet at project site with waterproofing installer, waterproofing installation supervisor, and other entities concerned with waterproofing installation performance, and Resident Engineer.

2. Record discussions and agreements and furnish copy to each participant.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials and products in labeled packages.

B. Store, and handle materials and products in strict accordance with manufacturer's instructions, recommendations, and material safety data sheets.

1. Place material on smooth surface free of rocks or other protrusions which may damage the material.

2. Protect from damage from sunlight, weather, excessive temperatures, chemicals, and construction operations.

3. Remove damaged material from the site and dispose of in accordance with applicable regulations.

C. Store all flammable materials in a cool, dry area distant from sparks and open flames.

1.08 SITE CONDITIONS

A. Refer to Geotechnical Baseline Report.

B. Refer to As-Built Drawings from the U220 Contract.

C. Provide sufficient access for Resident Engineer during and after installation of waterproofing and seepage management systems, to allow for inspection of the work

D. Install waterproofing at surfaces only after the surface is in compliance with smoothness criteria shown on the Contract Drawings and has been accepted by the Waterproofing Installer and Resident Engineer in writing with a Surface Acceptance Form.

E. Prior to waterproofing installation, prove the absence of any continuing and significant deflection or increase of stress.

F. Prior to waterproofing installation, install contractor-designed temporary construction drainage system.

G. Prior to installation of seepage management system, install seepage management drainage system consisting of perforated and non-perforated pipes.

1.09 WARRANTY

A. Provide a warranty for the water tightness of the structure up to two years beyond the final contract completion date.
PART 2 - PRODUCTS

2.01 MATERIALS

A. Geotextile: Non-woven polypropylene geotextile of uniform thickness and surface texture with the following minimum physical properties and testing methods:

<table>
<thead>
<tr>
<th>PHYSICAL PROPERTIES</th>
<th>VALUES</th>
<th>TEST METHOD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thickness</td>
<td>285 mil</td>
<td>ASTM D1777</td>
</tr>
<tr>
<td>Unit Weight</td>
<td>22 oz./sqyd.</td>
<td>ASTM D3776</td>
</tr>
<tr>
<td>Grab Tensile Strength</td>
<td>285 pounds lbs.</td>
<td>ASTM D4632</td>
</tr>
<tr>
<td>Elongation</td>
<td>85 percent</td>
<td>ASTM D4632</td>
</tr>
<tr>
<td>Trapezoid Tear Strength</td>
<td>135 lbs.</td>
<td>ASTM D4533</td>
</tr>
<tr>
<td>Burst Strength</td>
<td>400 psi</td>
<td>ASTM D3786</td>
</tr>
<tr>
<td>Chemical Resistance</td>
<td>pH-value 2 to 13</td>
<td></td>
</tr>
</tbody>
</table>

B. Geodrain: Composite panel consisting of a rigid drain core and filter fabric bonded on one side with the following minimum physical properties and testing methods:

1. Fabric

<table>
<thead>
<tr>
<th>PHYSICAL PROPERTIES</th>
<th>VALUES</th>
<th>TEST METHOD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unit Weight</td>
<td>4 oz./sqyd.</td>
<td>ASTM D3776</td>
</tr>
<tr>
<td>Grab Tensile Strength</td>
<td>110 lbs</td>
<td>ASTM D4632</td>
</tr>
<tr>
<td>Elongation</td>
<td>60 percent</td>
<td>ASTM D4632</td>
</tr>
<tr>
<td>Trapezoid Tear Strength</td>
<td>50 lbs.</td>
<td>ASTM D4533</td>
</tr>
<tr>
<td>Burst Strength</td>
<td>215 psi.</td>
<td>ASTM D3786</td>
</tr>
</tbody>
</table>

2. Core Properties:

<table>
<thead>
<tr>
<th>PHYSICAL PROPERTIES</th>
<th>VALUES</th>
<th>TEST METHOD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thickness</td>
<td>0.45 inch</td>
<td>ASTM D3776</td>
</tr>
<tr>
<td>Compressive Strength</td>
<td>15,000 psi</td>
<td>ASTM D1621 (Mod.)</td>
</tr>
<tr>
<td>Flow Capacity</td>
<td>15 gpm/ft.</td>
<td>ASTM D4716</td>
</tr>
</tbody>
</table>

C. Membrane for Waterproofing System: Polyvinyl chloride (PVC), waterproofing membrane or approved equal, of uniform thickness and surface texture and whose double weld seams are tested as described in Section 3.03 B.2. PVC membrane is non-reinforced with the following minimum physical properties and testing methods:

<table>
<thead>
<tr>
<th>PHYSICAL PROPERTIES</th>
<th>VALUES</th>
<th>TEST METHOD</th>
</tr>
</thead>
</table>

D. Membrane for Seepage Management System: Flexible polyolefin (FPO) waterproofing membrane or approved equal, of uniform thickness and surface texture and whose double weld seams are tested as described in Section 3.03 B.2. FPO membrane is reinforced with the following minimum physical properties and testing methods:

<table>
<thead>
<tr>
<th>PHYSICAL PROPERTIES</th>
<th>VALUES</th>
<th>TEST METHOD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thickness</td>
<td>80 mil</td>
<td>ASTM D374</td>
</tr>
<tr>
<td>Ultimate Tensile Strength</td>
<td>1450 psi</td>
<td>ASTM D638</td>
</tr>
<tr>
<td>Ultimate Elongation</td>
<td>450 percent</td>
<td>ASTM D638</td>
</tr>
<tr>
<td>Mechanical Puncture Resistance</td>
<td>31.5 in.</td>
<td>Din 16726-5.12</td>
</tr>
<tr>
<td>Chemical Resistance</td>
<td>pH-value 2 to 13</td>
<td></td>
</tr>
<tr>
<td>Flammability</td>
<td>Class B-2</td>
<td>Din 4102-1</td>
</tr>
</tbody>
</table>

E. Membrane Protection Layer: 60 mil thick PVC membrane that is a different color than the waterproofing membrane, such as PVC REPRO PRODUCT # 1842 as manufactured by HPG International or approved equal.

F. Attachments: Membrane attachment disk manufactured of membrane compatible material with minimum 3-inch diameter with one steel washer embedded in disk. Attachment of disks with minimum 1-1/4 inch nails.

G. Water Barrier: Continuous PVC strip weldable to membrane with embedment ribs of the following minimum dimensions:

1. 10.8-inch width and four ribs of 1.4 inch minimum rib height (including base).
2. Intersections pre-fabricated on site or by manufacturer.

H. Control and Grouting Pipes: 1-inch nominal pipe size flexible polyvinyl chloride (PVC) pipe with open mesh polyester braiding encapsulated in the pipe wall such as Nylobraid as manufactured by New Age Industries or approved equal. Length as shown on the Contract Drawings. Pipes must have secure fittings with inside thread and a removable cap.

I. WA Anchor:

1. Rigid plastic shell with inside thread and 12 inches diameter membrane compatible flange for attachment to waterproofing and seepage management membranes. Rigid plastic shell minimum 8-inches long with outside grooves and 5/8 inch diameter inside thread for application of threaded steel rod.
2. Use epoxy resin to grout rigid shell and flange in place prior to attachment to membrane.
J. Protective Metal Sheet: Lightweight metal sheet of dimensions on the Contract Drawings; minimum 24 gage.

K. Protective Concrete: As specified in Specification Section 03 30 00, Cast-in-Place Concrete.

L. Temporary Relief Pipe: 1-inch to 8-inch nominal size polyvinyl chloride (PVC) pipe Schedule 40, ASTM D1785; each with fitted cap.

M. Patent Strip: 14 gage channel shaped stainless steel bar, 1-inch wide, pre-punched one inch on center, used at membrane termination.

N. Sealant Strip: Polymer based seal, designed to undergo controlled expansion in the presence of moisture, Type Duroseal Expansion Waterstop, by BBZ or approved equal.
   1. Minimum dimensions: 0.8 inch wide by 0.4 inch thick.
   2. Designed to perform in salt water and shall have a water pressure resistance of 75 psi.
   3. Compatible with membrane.

O. Perforated Pipe: 4-inch nominal diameter, flexible, corrugated, perforated pipe with circumferential perforations, Type N12 by Advanced Drain Systems, Incorporated or approved equal.

P. Non-Perforated Pipe: 4-inch nominal diameter smooth pipe to be compatible with the perforated pipe.

Q. Regroutable Hose: FUKO Type II, by BBZ USA, Inc. or approved equal.
   1. Minimum 1-inch outside diameter PVC hose, consisting of a solid core with lateral openings covered by neoprene strips and the entire system wrapped with a webbed nylon mesh, suitable for injection with resin grouts.
   2. Equipped with color coded injection and ventilation ends, closure plugs and anchoring system.
   3. Anchoring system shall not puncture the waterproofing membrane.

R. Junction Box: Heavy duty plastic box with removable cover compatible with the regroutable hose system and of sufficient size to accommodate injection and ventilation ends of hoses.

S. Remedial grout:
   1. Ultra-fine micro-fine cement grout compatible with the regroutable hose, consisting of a one component, injection grout mix of ultra-fine slag and Portland cement particles, mixed with water and dispersant to form grout for low pressure injection methods such as Tricodur Micro-cement by BBZ/Greenstreak or approved equal.
   2. Water soluble, hydrophilic, acrylate ester resin compatible with the regroutable hose such as Duroseal Inject 2000 by BBZ/Greenstreak, HA Flex LV by DeNeef, or approved equal.
PART 3 - EXECUTION

3.01 PREPARATION

A. Prepare surfaces which receive membrane according to the criteria specified herein and shown in the Contract Drawings.

1. All surfaces shall be free of oils, grease, and gasoline.
2. Install Contractor-designed temporary construction drainage as necessary.
3. Install 1-inch by 1-inch chamfer at all inside corners of the invert and roof slabs unless otherwise shown.
4. Provide a smooth finish of horizontal and inclined concrete surfaces such as the invert mud slab and the roof slab equivalent to a smooth float finish or better.
5. Repair all joints, offsets, voids, cracks and spalled areas which are greater than ½ inch in width or depth with quick setting grout, mortar, or approved equal.
6. Remove all loose shotcrete, concrete, and debris.
7. Cover embedded elements such as tiebacks with a minimum 1 inch of shotcrete or mortar prior to installing the waterproofing or seepage management systems.
8. Any protrusions of more than 1/2 inch shall be covered with shotcrete, quick setting grout, or mortar such that no sharp edges are observed.
9. For overall smoothness of support of excavation surface apply General Smoothness Criteria as shown in the Contract Drawings with the exception of the invert, where a level surface has to be provided to avoid standing water.
10. Apply leveling material to all areas that do not conform the above requirements.

B. Surface Inspection and Acceptance:

1. Inspect all surfaces to which waterproofing and seepage management systems will be applied to, in the presence of the Waterproofing Installer and Resident Engineer.
2. Correct deficiencies identified during inspection and re-inspect after corrective action has been taken.
3. Complete Surface Acceptance Forms to release an area for waterproofing or seepage management system installation, and obtain the Waterproofing Supervisor’s, Waterproofing Installer’s, and Resident Engineer’s signatures on the Surface Acceptance Form.
4. Distribute signed Surface Acceptance Forms in accordance with Specification Section 01 45 00, Quality Control.

3.02 INSTALLATION

A. Install waterproofing and seepage management systems only after Surface Acceptance Form has been signed by the Resident Engineer.
B. Install waterproofing and seepage management systems as soon as practical following completion of Surface Acceptance Form.

C. Installation of geotextile, geodrain, and membrane:

1. Attachment:
   a. Place attachment assemblies in surface depressions to achieve tight fit of geotextile and geodrain.
   b. Provide attachments on vertical walls at maximum 2-foot centers horizontally and vertically. At invert and roof slabs, provide attachments as required. Provide a uniformly snug fit to receiving surfaces.
   c. Provide additional attachment where necessary to achieve secure support and tight fit to support of excavation.

2. Geotextile and geodrain:
   a. Place geotextile or geodrain prior to the installation of waterproofing membrane.
   b. Use geodrain in lieu of geotextile at open cut excavation support where groundwater infiltration is noticeable.

3. Membrane:
   a. Install membrane with sufficient overlap for welding. Trim overlap if necessary to achieve snug fit.
   b. Provide double wedge welded seams unless otherwise approved.
   c. Test all welds as specified.
   d. Terminate as shown on the Contract Drawings.

D. Installation of water barriers for sectioning:

1. Install at locations and elevations shown on the Contract Drawings.
2. Weld water barriers to membrane with one single weld on each side.
3. Clean water barriers from dirt, debris, and concrete, prior to concrete pour.
4. At areas where waterproofing is installed on the completed structure wall, place water barriers in form work prior to wall pours.
5. At roof slabs, place water barriers on reinforcement and vibrate into concrete during pour to achieve proper embedment of the water barrier ribs.

E. Installation of control and grouting pipes:

1. Install control and grouting pipes as shown on the Contract Drawings prior to concrete placements.
2. Arrange exact location of control and grouting pipes to avoid interference with rebar or embedments.
3. Protect control and grouting pipes from damage, from filling up with concrete, or from becoming dislodged during concrete pour.

F. Installation of regROUTable hoses:
1. Install regROUTable hose in the invert slab as shown on the Contract Drawings.
2. Fasten regROUTable hose with manufacturer recommended anchor clips to hold the hose in place during application of concrete.
3. Provide junction boxes to house injection and ventilation ends of hose in the topping slab as shown on the Contract Drawings.
4. Provide a labeling system for regROUTable hoses and maintain written records of their locations for inclusion on the as-built drawings.

G. Installation of seepage management drainage pipes:
1. Install non-perforated pipes through the slabs as shown in the Contract Drawings prior to pouring slabs.
2. Protect non-perforated pipes from filling with concrete during slab construction.
3. Install perforated pipes on the slabs and connect to non-perforated pipes as shown in the Contract Drawings prior to termination of the seepage management system at the slurry wall. Perforated pipes to be installed on a mortar pad in order to create a minimum 2 percent slope.

H. Protect all membrane during installation and concrete placement:
1. Protect invert and roof slab waterproofing by placing protective concrete over it as soon as practical after installation.
2. Place membrane protection as soon as practical after installation of membrane and prior to starting any work which might damage the membrane.
3. Do not drill holes through concrete that has been placed over membrane.
4. Where reinforcement is placed, use approved methods to achieve required spacing between membrane and rebar.
5. Relieve water build-up behind membrane through use of temporary relief pipes and pumps, prior to concrete pours.
6. Do not penetrate membrane for other than permanent purposes with approved methods or temporary purposes authorized by the Resident Engineer.
7. Do not allow construction debris or equipment to accumulate on the waterproofing membrane.
8. Check integrity of waterproofing during installation of rebar, formwork, and during pouring concrete.
   a. Inspect waterproofing for damage prior to placement of concrete in the presence of the Waterproofing Supervisor and the Resident Engineer.
   b. Note location of any breach, damaged areas, or potentially damaged membrane on as-built drawings.
3.03 FIELD QUALITY CONTROL

A. Installation inspection shall confirm or otherwise document the following:
   1. Use of specified materials.
   2. Proper storing and handling of material.
   3. Ambient temperature.
   4. Adequate supervision by Waterproofing Supervisor.
   5. Approved Waterproofing Installer has passed the daily welding test.
   6. Seam direction and layout as shown on shop drawings.
   7. Number and layout of attachments.
   8. Overlap of membrane at seams for welding.
   9. Application of welds as specified.
  10. Penetrations are performed as shown on shop drawings.
  11. Installation of corner patches.
  12. Location, type, and elevation of water barriers. Provide as-built documentation as specified.
  13. Location and elevation of control and grouting pipes and regroutable hoses. Provide as-built documentation as specified.
  14. Location and elevation of seepage management drainage pipes as well as clean outs. Provide as-built documentation as specified.
  15. Installation of protective layer.

B. Testing of Membrane Welds:
   1. General:
      a. Perform tests in the presence of Resident Engineer.
      b. Perform tests as installation progresses. Repair and retest seams that fail before continuing installation.
      c. Maintain records of test results, repairs, and retesting. Retain records on site and provide copies to the Resident Engineer upon request.
   2. Double Welds: Perform test by applying internal air pressure between seams as follows:
a. Test Pressure: 30 psi.
b. Hold pressure for 10 minutes.
c. Acceptance criteria: Air pressure loss shall be less than 10 percent after 10 minutes.

3. Single Welds including corners and water barriers:
   a. Check all welds for continuity by either of the following inspection methods. Single welds at membrane splices or patches to be tested prior to the application of liquid PVC:
      1) Run a rounded screwdriver along the joint after the weld has cooled.
      2) Blow stream of air under high pressure against the weld and observe opening of the weld. Re-weld and test any discontinuity.

4. Replace or repair sections of the membrane determined to be defective then re-test.

C. Testing of Seepage Management Drainage Pipes:
   1. Flush all pipes with water and check for communication at the drainage inlets prior to terminating the seepage management system at the slurry wall.
   2. Clean or replace clogged pipes at no additional cost.

3.04 GROUTING
   A. Remedial Grouting Supervisor to oversee the grouting of all regroutable hoses after structural concrete has obtained the required 28-day strength.
   B. Determine injection pressure by means of on-site demonstration; do not exceed structural capacity of the structure.
   C. Grout all regroutable hoses with cementitious grout.
   D. Clean hoses and pipes after grouting.

3.05 REPAIR/RESTORATION
   A. Leak Remediation
      1. Observe structure interior and control and grouting pipes by regular inspection for water leakage until the final contract completion date.
      2. If structure roof slabs or control and grouting pipes indicate water leakage undertake remedial measures including:
         a. Grouting first through regroutable hoses as required and then through control and grouting pipes using suitable remedial grout within the section that indicates the leak.
         b. Determine injection pressure by means of on-site demonstration; do not exceed structural capacity of the structure.
c. Clean hoses and pipes after grouting and repeat grouting operation if leak persists.

3. Do not penetrate or puncture membrane except for permanent purposes using proven water tightness techniques to be approved by Resident Engineer.

END OF SECTION
SECTION 07 14 19
TRENCH DRAIN WATERPROOFING

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes specifications for cold fluid-applied, reinforced, polymeric waterproofing membrane for trench drains at pedestrian bridge; indicated (WP-2) on drawings. Acceptable types include:

1. Reinforced urethane membrane.
2. Reinforced polymethy methacrylate (PMMA) membrane.

B. Related Sections: The work of the following Sections is related to the work of this Section. Other Sections, not referenced below, may also be related to the proper performance of this work.

1. Section 03 30 00, Cast-In-Place Concrete: Coordination for concrete finishing.
2. Section 07 92 00, Joint Sealants: General requirements for joint-sealant materials and installation.

1.02 SUBMITTALS

A. Product Data: Submit for each type of product indicated. Include manufacturer's written instructions for evaluating, preparing, and treating substrate, technical data, and tested physical and performance properties of waterproofing.

B. Shop Drawings: Show locations and extent of waterproofing. Include project specific details for substrate joints and cracks, membrane flashings, penetrations, inside and outside corners, and other termination conditions.

C. Warranty:

1. Draft: Submit draft of warranty with required inclusions for review. Submit draft warranty with product data.
2. Executed warranty: Submit at time of Project Closeout; include in “Warranties Manual” specified in Section 017836.

1.03 QUALITY ASSURANCE

A. Source Limitations: Obtain waterproofing materials, membrane flashing and accessories from single source from single manufacturer.

B. Membrane Manufacturer: Company specializing in manufacturing the products specified with five years, minimum, documented successful performance.

C. Installer Qualifications: A firm that is specialized in type of waterproofing specified for last three years, minimum, and approved by waterproofing manufacturer for installation of waterproofing required for this Project. Submit written copy of manufacturer’s certification.
D. Preinstallation Conference: Conduct conference at Project site with Architect, Sound Transit’s Representative, Waterproofing Membrane Installer and Manufacturer’s Representative.

1. Review waterproofing requirements including condition of substrates and minimum curing period, surface preparation procedures, substrate pretreatment, special details and flashings, general installation procedures, forecasted weather conditions, testing and inspection procedures, and protection and repairs.

E. Field Evaluation and Testing:

1. Moisture Evaluation: Comply with Section 01 78 23, Operation and Maintenance Data, unless otherwise accepted by membrane manufacturer for determining acceptable substrate moisture content throughout the work.

2. Bond Tests: Comply with membrane manufacturer’s bond strength to substrate in accordance with “Elcometer Adhesion Tester Model 106”, or similar device. Perform random tests at beginning of the Work, and at intervals in the Work to confirm compliance, except not less than three tests per 1,000 sq-ft, or less. Comply with following:

   a. Bond Strength to Substrate: 220 psi, minimum.

   b. Remedial Action for Tested Values above specified: Additional substrate preparation and retesting to attain specified values.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Deliver liquid materials to Project site in original containers with seals unbroken, labeled with manufacturer’s name, product brand name and type, date of manufacture, shelf life, and directions for storing and mixing with other components.

B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by waterproofing manufacturer.

C. Remove and replace liquid materials that cannot be applied within their stated shelf life.

D. Protect stored materials protected from direct sunlight.

1.05 PROJECT CONDITIONS

A. Environmental Limitations: Apply cold fluid-applied waterproofing installation while air temperature is between 40 and 85 degrees F, providing substrate is a minimum of 5 degrees above the dew point, unless expressly granted by membrane manufacturer’s special procedures.

1. Do not apply waterproofing to a damp or wet substrate, when relative humidity exceeds 85 percent, or when temperatures are less than 5 degrees F above dew point.

2. Do not apply waterproofing in snow, rain, fog or mist, or when such weather conditions are imminent during application and curing period.

B. Coordination: Coordinate the work with the installation of associated trades for metal counterflashings and finishes adjacent or integral to work of this Section.

C. Protection:
1. Building Components: Provide tarps or other suitable material to prevent soiling or damage to adjacent building materials and finishes.

2. Finish Waterproofing Membrane: Provide barriers and instructions to general contractor for protection to finished waterproofing membrane and to prevent construction activities or waste contaminants from damaging finished waterproofing membrane.

1.06 WARRANTY

A. Special Manufacturer’s Warranty: Manufacturer’s standard form in which waterproofing manufacturer agrees to repair or replace waterproofing that does not comply with requirements or that fails to remain watertight within specified warranty period.

1. Warranty does not include failure of waterproofing due to failure of substrate prepared and treated according to requirements or formation of new joints and cracks in substrate that exceed 1/16 inch in width.

2. Warranty Period: Ten years, with no dollar limit from date of Substantial Completion.

B. Special Installer’s Warranty: Specified form, signed by Installer, covering Work of this Section, for warranty period of two years.

PART 2 - PRODUCTS

2.01 POLYURETHANE WATERPROOFING SYSTEM

A. Two-Component, Reinforced, Unmodified Polyurethane Waterproofing:

1. Products: Subject to compliance with requirements, provide the following or approved equal:

   a. Kemper System, Inc.; Kemperol 2K-PUR.

   b. Color: Gray

B. Membrane-Reinforcing Fabric: Nonwoven, needle-punched white polyester fabric, Kemperol 165 (weight – in g/m2), 50 mils thick.

2.02 PMMA WATERPROOFING SYSTEM

A. Reinforced, Poly Methyl Methacrylate waterproofing:

1. Products: Subject to compliance with requirements, provide the following or approved equal:

   a. Siplast, Inc., “Parapro Roof Membrane”.

B. Reinforced PMMA Membrane/Flashing System Components

1. Catalyst: A reactive agent used to induce curing of polymethylmethacrylate (PMMA) resins.


4. Color Finish Resin: A pigmented, multi-component, flexible, polymethylmethacrylate (PMMA) based resin for use as a wearing coat over the field of the finished roof membrane to provide a desired color finish.
   a. Color: Gray

5. Thixotropic Agent: A liquid additive used to increase the viscosity of the PMMA resin products, allowing the resins to be applied over sloped areas.

C. Membrane-Reinforcing Fabric: Nonwoven, needle-punched white polyester fabric, 165 grams per square meter, 50 mils thick.

2.03 AUXILIARY MATERIALS

A. General: Provide auxiliary materials recommended by manufacturer to be compatible with one another and with waterproofing, as demonstrated by waterproofing manufacturer, based on testing and field experience.

B. Leveling and Patching Aggregate: Silica sand, washed, kiln-dried, dust-free, and suitable for troweling or pourable leveling, gradation as recommended by membrane manufacturer.

C. Primer: Manufacturer's standard, two-component, solvent-free epoxy primer coating.

D. Membrane Flashing: A composite of the same resin materials and membrane-reinforcing fabric as field membrane.

E. Top Coat Surfacing: Kiln-dried surfacing silica sand; washed, and dust-free.
   1. Aggregate Size: 0.45 – 0.55 mm.

F. Joint Sealant: Multi-component polyurethane sealant, compatible with waterproofing, complying with “Type C” per Section 07 92 00.
   1. Backer Rod: Closed-cell polyethylene foam.

G. Miscellaneous Materials: Include transition strips, fasteners, temporary night sealant, etc., as required and recommended by membrane manufacturer for inclusion under warranty.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance.
   2. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 SURFACE PREPARATION

A. Clean and prepare substrate according to manufacturer's written recommendations. Provide clean, dust-free, and dry substrate for waterproofing application.
B. Mask off adjoining surfaces not receiving waterproofing to prevent spillage or overspray affecting other construction.

C. Close off deck drains and other deck penetrations to prevent spillage and migration of waterproofing fluids.

3.03 PREPARATION AT TERMINATIONS AND PENETRATIONS

A. Prepare vertical and horizontal surfaces at terminations and penetrations through waterproofing and at expansion joints, drains, and sleeves according to manufacturer's written instructions.

B. Prime substrate unless otherwise instructed by waterproofing manufacturer.

C. Apply waterproofing in two separate applications, and embed a joint reinforcing strip in the first preparation coat when recommended by waterproofing manufacturer.

1. Provide sealant cants around penetrations and at inside corners of trench drain when recommended by waterproofing manufacturer.

3.04 WATERPROOFING APPLICATION

A. Apply waterproofing according to manufacturer's written instructions.

B. Apply primer over prepared substrate, applied evenly by roller or brush; do not allow to pond or collect in low areas. Allow to cure 12 hours minimum before membrane application.

1. Application Rate: Approximately 0.6 gallons per 100 sq-ft.

C. Install membrane flashing and bond to deck and wall substrates where indicated or required according to waterproofing manufacturer's written instructions.

1. Extend membrane flashings onto perpendicular surfaces and other work penetrating substrate.

2. Details at Drains and Penetrations: Extend membrane flashing into drain rings and completely coating the existing trench drain in strict accordance to manufacturer’s approved details. Maintain the ability to re-install the existing trench drain covers with the waterproofing membrane in place. Field verify with a test installation before proceeding with installation. Modify trench drain covers if necessary to fit within the drain with the coating build-up.

D. Reinforced Waterproofing Applications: Mix materials and apply waterproofing by roller, notched squeegee, trowel, or other suitable application method.

1. Apply first coat of waterproofing, embed membrane-reinforcing fabric by roller or brush to work the resin into the fleece, and to remove air bubble and wrinkles. Apply second coat of waterproofing to completely saturate reinforcing fabric and to obtain a seamless reinforced membrane free of entrapped gases.

   a. Overall Waterproofing Thickness: Average dry film total thickness of 70 mils.

2. Application Rates for Waterproofing:

   a. Bottom Coat: Approximately 4.5 gallons per 100 sq-ft, not exceeding 15-20 sq-ft at a time.
b. Second Coat: Approximately 2 gallons per 100 sq-ft, not exceeding 15-20 sq-ft at a time.

3. Apply reinforced waterproofing to prepared wall terminations and vertical surfaces.

4. Verify wet film thickness of waterproofing every 100 sq. ft.

E. Surfacing: After waterproofing membrane is cured, broadcast a full coverage of top coat surfacing sand into uncured application of membrane manufacturer’s approved primer, sealer or membrane resin at respective recommended coverage rate. Allow three days curing time and remove loose aggregate by blowing with and oil-free compressed air or vacuuming surface. Reapply sealer coat over top coat surfacing sand at 1.0 gallons per 1000 sq-ft. and allow to cure.

3.05 CURING, PROTECTION, AND CLEANING

A. Cure waterproofing according to manufacturer’s written recommendations, taking care to prevent contamination and damage during application stages and curing.

1. Do not permit foot or vehicular traffic on unprotected membrane.

B. Protect waterproofing from damage and wear during remainder of construction period.

C. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION
PART 1 - GENERAL

1.01 SUMMARY
A. This Section includes specifications for bentonite composite sheet waterproofing (WP-1) for below-grade walls and slab of pit, machine room, and associated spaces for Elevator 3.

B. Related Sections: The work of the following Sections is related to the work of this Section. Other Sections, not referenced below, may also be related to the proper performance of this work.
   1. Section 03 30 00, Cast-in-Place Concrete: Waterstops and concrete placement.
   2. Section 07 10 00, Waterproofing and Seepage Management: Below-grade waterproofing for tunnel and station.

1.02 REFERENCES
A. This Section incorporates by reference the latest revisions of the following documents.
   1. American Society for Testing and Materials International (ASTM)

1.03 SUBMITTALS
A. Procedures: Section 01 33 00, Submittal Procedures.
B. Product Data: For each type of product indicated. Include product specifications and manufacturer’s written installation instructions.

1.04 QUALITY ASSURANCE
A. Source Limitations: Obtain bentonite waterproofing system from single source from single manufacturer. Obtain accessory products used with bentonite waterproofing from sources acceptable to bentonite waterproofing manufacturer.

1.05 DELIVERY, STORAGE, AND HANDLING
A. Deliver materials to Project site in manufacturer’s original unopened and undamaged containers.
B. Store materials in a dry, well-ventilated space.
C. Remove and replace bentonite materials that have been prematurely exposed to moisture.

1.06 PROJECT CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit bentonite waterproofing to be installed according to manufacturers' written instructions and warranty requirements.

1. Do not apply waterproofing materials to surfaces where ice or frost is visible. Do not apply bentonite waterproofing materials in areas with standing water.

2. Placing bentonite clay products in panel or composite form on damp surfaces is allowed if approved in writing by manufacturer.

PART 2 - PRODUCTS

2.01 BENTONITE COMPOSITE SHEETS

A. Composite HDPE/Bentonite Membrane: Minimum of 1.1 lb/sq. ft. of bentonite clay granules bonded to nonwoven geotextile polypropylene fabric, with HDPE sheet on opposite side.

1. Products: Subject to compliance with requirements, [available products that may be incorporated into the Work include, but are not limited to, the following]:

   a. CETCO; Voltex DS.
   b. Tremco; Paraseal LG

2. Minimum Grab Tensile Strength: 120 pounds force according to ASTM D 4632.


4. Maximum Vapor Permeance: 0.031 perms according to ASTM E 96.

2.02 INSTALLATION ACCESSORIES

A. Bentonite Mastic: Trowelable consistency, bentonite compound, specifically formulated for application at joints and penetrations.

B. Granular Bentonite Tubes: Manufacturer's standard 2-inch-diameter, water-soluble tube containing approximately 1.5 lb/ft. of bentonite; hermetically sealed; designed specifically for placing on wall footings at line of joint with exterior base of wall.

C. Masonry Fasteners: Case-hardened nails or hardened-steel, powder-actuated fasteners. Depending on manufacturer's written requirements, provide 1/2- or 1-inch-diameter washers under fastener heads.

D. Sealants: As recommended in writing by waterproofing manufacturer. Comply with requirements specified in Section 07 92 00, Joint Sealants.

E. Tapes: Waterproofing manufacturer's recommended tape for joints between sheets, membranes, or panels.
PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for substrate preparations affecting performance of bentonite waterproofing.

B. Verify that substrate is complete and that work that will penetrate waterproofing is complete and rigidly installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Coordinate work in the vicinity of waterproofing to ensure proper conditions for installing the waterproofing system and to prevent damage to waterproofing after installation.

B. Formed Concrete Surfaces: Remove fins and projections. Fill voids, rock pockets, form-tie holes, and other defects with bentonite mastic or cement grout patching material according to manufacturer’s written instructions.

C. Horizontal Surfaces: Remove debris, standing water, oily substances, mud, and similar substances that could impair the effectiveness of waterproofing. Fill voids and other defects with compacted granular material according to manufacturer’s written instructions.

3.03 INSTALLATION, GENERAL

A. Install waterproofing and accessories according to manufacturer’s written instructions.

B. Apply granular bentonite tubes, bentonite mastic, or both at changes of plane, construction joints in substrate, projections, and penetrations.

C. Protect waterproofing from damage and wetting before and during subsequent construction operations. Repair punctures, tears, and cuts according to manufacturer’s written instructions.

3.04 COMPOSITE BENTONITE MEMBRANE INSTALLATION

A. General: Install a continuous layer of waterproofing membrane with ends and edges lapped a minimum of 3 inches. Stagger end joints between membranes. Seal joints with permanent seam tape.

B. Below Structural Slabs-on-Grade: Apply waterproofing membrane with HDPE side down and staple ends and edges.

1. Install under footings, grade beams, and pile caps; or continue waterproofing through key joints between footings and foundation walls, and extend a minimum of 8 inches up or beyond perimeter slab forms.

2. Protect waterproofing from damage caused by reinforcing bar supports with sharp edges.
C. Concrete Walls: Starting at bottom of wall, apply waterproofing membrane with HDPE side facing Installer; overlap sheets 3 inches. Secure with powder-actuated fasteners or case-hardened nails. Extend to bottom of footing, grade beam, or wall, and secure.

END OF SECTION
PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes specifications for batt/blanket insulation and rigid insulation as indicated on Contract Drawings, including, but not limited to:

1. INSUL-1: Thermal batt/blanket insulation with vapor retarder facing installed within framing of walls enclosing conditioned space.

2. INSUL-2: Polyisocyanurate foam plastic boards installed inboard of framing of walls enclosing conditioned space.

3. INSUL-3: Polyisocyanurate foam plastic boards for exposed underside of ceiling slab with conditioned space below. Impaled installation.

4. INSUL-4: Perimeter insulation. Expanded polystyrene foam (EPS) plastic boards on earth side of below grade walls enclosing conditioned space.

5. INSUL-5: Unfaced thermal batt/blanket insulation laid atop suspended ceiling.

6. Accessories for installation as indicated.

B. Related Sections: The work of the following Sections is related to the work of this Section. Other Sections, not referenced below, may also be related to the proper performance of this work.

1. Section 07 54 23, Thermoplastic Polyolefin (TPO) Roofing
2. Section 22 07 00, Plumbing Insulation.
3. Section 23 07 00, HVAC, Insulation.

1.02 PERFORMANCE REQUIREMENTS

A. General: Provide fire-resistive joint systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of assembly in which fire-resistive joint systems are installed.

1.03 REFERENCES

A. This Section incorporates by reference the latest revisions of the following documents:

1. American Society for Testing and Materials International (ASTM)
   b. ASTM C 665: Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing
c. ASTM C 1289: Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board

d. ASTM E84: Test Method for Surface Burning Characteristics of Building Materials

1.04 SUBMITTALS

A. Procedures: Section 01 33 00, Submittal Procedures.

B. Product Data: Submit manufacturer's product data for each different type of insulation, impaling pins with self-locking washers, and fire resistant seal compound verifying compliance with specifications herein. Submittal shall include spacing of impaling pins for each different type of insulation.

1.05 QUALITY ASSURANCE

A. Installation Responsibility: Assign installation of fire-resistive joint systems in Contract to a single qualified Installer.

B. Source Limitations: Obtain fire-resistive joint systems, for each kind of joint and construction condition indicated, through one source from a single manufacturer.

1.06 DELIVERY, STORAGE & HANDLING

A. Protect insulation from physical damage and from deterioration by moisture, soiling, and other sources. Store inside and in dry location. Comply with manufacturer's recommendations for handling, storage, and protection during installation.

B. Protection for Plastic Insulation:

1. Do not expose to sunlight, except to extent necessary for period of installation and concealment.

2. Protect against ignition at all times. Do not deliver plastic insulating materials to project site until site is prepared for installation. Complete installation and concealment of plastic materials as rapidly as possible in each area of work.

PART 2 - PRODUCTS

2.01 GENERAL

A. Provide insulation in performed units from manufacturer's standard thicknesses, widths, and lengths sized to fit applications indicated. Insulation between metal studs shall be friction fit type.

B. "R" values for various insulation types are listed under each insulation type. "R" values listed are at 75 degrees F mean temperature.

C. Insulation types and locations are indicated on Contract Drawings.

2.02 BATT/BLANKET INSULATION (THERMAL INSULATION) AND VAPOR RETARDER

A. (INSUL-1) Glass Fiber Insulation (typically in exterior walls as indicated on Contract Drawings): Flame resistant thermal glass batt/blanket type insulation with FSK facer conforming to ASTM C665, Type III, Class A.
B. **(INSUL-5)** Unfaced Glass Fiber Insulation; Flame resistant thermal glass batt/blanket type insulation without facers conforming to ASTM C665, Type I.

### 2.03 RIGID POLYISO-CYANURATE FOAM PLASTIC BOARDS

A. **(INSUL-2)** Foil-Faced, Polyisocyanurate Board Insulation: ASTM C 1289, Type I, Class 1 or Class 2, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, in accordance with ASTM E 84.

B. **(INSUL-3)** Rigid polyiso-cyanurate foam plastic boards, reinforced with glass fibers with white embossed acrylic coated aluminum facing.

1. Fire Classification: Flame spread rating of 25 or less and a smoke development of 450 or less when tested in accordance with ASTM E84; complying with ICC Evaluation Report ER-3223, waiving thermal barrier as stated.

2. Manufacturer/Product: Dow Chemical "Thermax Heavy Duty Insulation/Finish Board", or "R-Max TSX-8500", or approved equal.

### 2.04 RIGID EXPANDED POLYSTYRENE FOAM PLASTIC BOARDS

A. **(INSUL-4)** EPS Insulation meeting ASTM C 578, Type II with bonded plastic facers, intended for below-grade use by manufacturer.

1. Basis of design: Insulfoam "R-Tech."

### 2.05 MISCELLANEOUS MATERIALS

A. Vapor-Retarder Seam Tape: Pressure-sensitive tape of type recommended by vapor retarder manufacturer for sealing joints and penetrations in vapor retarder facing on insulation.

B. Impaling Pins and Washers: AGM Industries, Inc. “Tactoo Insul-Hangers Series T” (glue-on) and “Series TSA” (weld-on), or approved equal meeting the following requirements:

1. Anchor Pins: Minimum 12 gage with manufacturer’s standard corrosion resistant coating. Provide pins with 2-inch square perforated base plate of galvanized steel for glue-on application to concrete, and weld pins for attachment to metal deck. Provide pins in lengths as required.

2. Self-Locking Washers: Provide all anchors with insulation washers. For ceiling areas and walls above 7 feet, use AGM Industries, Inc. “RC-150”, 1-1/2 inch diameter, 0.015 inch thick, galvanized steel washers, or approved equal. For walls up to a height of 7 feet, use AGM Industries, Inc. “RC-100” galvanized steel washers with cupped heads for exposed ends of pins, or approved equal.


C. Miscellaneous Materials: Materials such as fasteners, retainers and splicing and patching tape, not specially described but required for a complete installation of building insulation, shall be as recommended by the insulation manufacturer. Wire for tying shall be 18 gage galvanized, soft annealed wire.
PART 3 - EXECUTION

3.01 EXAMINATION
A. Prior to installing insulation, carefully inspect and verify the completion of the installed work of other trades. Verify adjacent materials are dry and that building insulation may be installed in accordance with the original design and manufacturer's recommendations.
B. Verify that inspections and approval required for work to be concealed by insulation have been completed prior to beginning insulation installation.
C. Discrepancies: In the event of discrepancies in other trade's work, immediately notify the Resident Engineer and do not proceed with installation until discrepancies have been corrected.

3.02 INSTALLATION (GENERAL)
A. General: Apply insulation by methods indicated complying with manufacturer's recommended procedures. Friction fit batt/blanket insulation between framing members.
1. Extend insulation full thickness as shown over entire area to be insulated, using a single layer wherever possible to provide “R” values or thickness indicated. Cut insulation neatly to fit tightly around obstructions.
2. Completely seal off and fill all voids in insulated areas to preclude direct passage of air between interior and exterior spaces.
3. Remove projections, which interfere with placement.

3.03 INSTALLATION OF BATT/BLANKET INSULATION
A. Thermal Batt/blanket Insulation (Walls): Install batt/blankets between studs using friction method; install full width batt/blankets to heights as indicated on Contract Drawings. Install insulation type at exterior walls where interior side is covered with gypsum wallboard and elsewhere as indicated.
1. Place insulation with vapor retarder facing interior side (warm side) of building heated spaces. Do not obstruct ventilation spaces.
2. Form tight seal between insulation and surrounding construction. Tape joints and ruptures in vapor retarders to ensure vapor-tight installation.
3. At locations where no framing is present to support the insulation, provide metal impaling clips or wire supports to hold the insulation in position. Mechanically or adhesively bond the clips to the substrate in accordance with the manufacturer's recommendations to seal penetration points.
4. For continuity between wall and roof edge, strip in a separate vapor retarder sheet matching insulation facing and overlap onto underside of roof deck and secure in place with adhesives or other anchorage systems as recommended by vapor retarder manufacturer for the type of installation.
5. Repair punctures and tears in vapor retarders immediately before concealment by gypsum wallboard. Cover with adhesively applied vapor retarder material or with self-adhesive vapor retarder tape.
6. Where insulation edges are exposed (unframed), extend facing onto substrates and seal entire perimeter with manufacturer’s approved seam tape.

B. Installation of Insulation over Ceilings: Install blanket insulation loose laid with ends and edges tightly butted over entire ceiling area in thicknesses indicated.

3.04 INSTALLATION OF INSULATION FOR FRAMED CONSTRUCTION (INSUL-2)

A. Apply insulation units to substrates by method indicated, complying with manufacturer's written instructions. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.

3.05 INSTALLATION OF RIGID POLYISO-CYANURATE FOAM PLASTIC BOARDS (INSUL-3)

A. Thermal Semi-Rigid Insulation: Install insulation type using impaling pins and washers fasteners. Adhere anchors in place, spaced a maximum of 12 inches on center in one direction and 24 inches on center in the other direction; provide additional anchors as required.

1. Install panels full width and in largest lengths to limit end joints; provide supplementary adhesive recommended by insulation board manufacturer to prevent sagging.

2. Place un-faced side of insulation directly against concrete slab with aluminum facing down and seal exposed ends and meeting edges of insulation with matching seam tape.

3.06 INSTALLATION OF BELOW-GRADE INSULATION

A. On wall surfaces, set insulation units using manufacturer's recommended adhesive according to manufacturer's written instructions.

1. If not otherwise indicated, extend insulation a minimum of 48 inches below exterior grade line.

3.07 PROTECTION

A. General: Protect installed insulation and vapor retarders from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION
PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes specifications for self-adhering, vapor-retarding, modified bituminous sheet water and air barriers indicated WAB-1 on the Contract Drawings.

B. Related Sections: The work of the following Sections is related to the work of this Section. Other Sections, not referenced below, may also be related to the proper performance of this work.

1. Section 06 16 43, Exterior Gypsum Sheathing
2. Section 07 92 00, Joint Sealants

1.02 REFERENCES

A. This Section incorporates by reference the latest revisions of the following documents.

1. American Society for Testing and Materials International (ASTM)
   a. ASTM A 240: Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications
   b. ASTM C 836: Specification for High Solids Content, Cold Liquid-Applied Elastomeric Waterproofing Membrane for Use with Separate Wearing Course
   c. ASTM D 412: Test Methods for Vulcanized Rubber and Thermoplastic Elastomers - Tension
   d. ASTM D 570: Test Method for Water Absorption of Plastics
   e. ASTM D 1970: Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayerment for Ice Dam Protection
   f. ASTM D 6135-97: Practice for Application of Self-Adhering Modified Bituminous Waterproofing
   g. ASTM E 96: Test Methods for Water Vapor Transmission of Materials
   h. ASTM E 154: Test Methods for Water Vapor Retarders Used in Contact with Earth under Concrete Slabs, on Walls, or as Ground Cover
   i. ASTM E 2178: Test Method for Air Permeance of Building Materials
1.03 DEFINITIONS

A. Air Barrier Assembly: The collection of air barrier materials and auxiliary materials applied to an opaque wall, including joints and junctions to abutting construction, to control air movement through the wall.

1.04 PERFORMANCE REQUIREMENTS

A. General: Air barrier shall be capable of performing as a continuous vapor-retarding air barrier and as a liquid-water drainage plane flashed to discharge to the exterior incidental condensation or water penetration. Air barrier assemblies shall be capable of accommodating substrate movement and of sealing substrate expansion and control joints, construction material changes, penetrations, and transitions at perimeter conditions without deterioration and air leakage exceeding specified limits.

1.05 SUBMITTALS

A. Procedures: Section 01 33 00, Submittal Procedures.
B. Product Data: Include manufacturer's written instructions for evaluating, preparing, and treating substrate; technical data; and tested physical and performance properties of air barrier.
C. Product Test Reports: Based on evaluation of comprehensive tests performed by an Independent Testing Laboratory, for air barriers.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Store liquid materials in their original undamaged packages in a clean, dry, protected location and within temperature range required by air barrier manufacturer.
B. Remove and replace liquid materials that cannot be applied within their stated shelf life.
C. Store rolls according to manufacturer's written instructions.
D. Protect stored materials from direct sunlight.

1.07 PROJECT CONDITIONS

A. Environmental Limitations: Apply air barrier within the range of ambient and substrate temperatures recommended by air barrier manufacturer. Protect substrates from environmental conditions that affect performance of air barrier. Do not apply air barrier to a damp or wet substrate or during snow, rain, fog, or mist.

PART 2 - PRODUCTS

2.01 SELF-ADHERING SHEET AIR BARRIER

A. Modified Bituminous Sheet: 40-mil-thick, self-adhering sheet consisting of 36 mils of rubberized asphalt laminated to a 4-mil-thick polyethylene film with release liner on adhesive side.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
   a. Carlisle Coatings & Waterproofing; CCW-705.
c. Henry Company; Blueskin SA.
e. Tremco, Incorporated; ExoAir 110

2. Physical and Performance Properties:

a. Membrane Air Permeance: Not to exceed 0.004 cfm/sq. ft. of surface area at 1.57-lbf/sq. ft. pressure difference; ASTM E 2178.
b. Tensile Strength: 250 psi minimum; ASTM D 412, Die C, modified.
e. Crack Cycling: Unaffected after 100 cycles of 1/8-inch movement; ASTM C 836.
f. Puncture Resistance: 40 lbf minimum; ASTM E 154.
g. Water Absorption: 0.15 percent weight-gain maximum after 48-hour immersion at 70 degrees F; ASTM D 570.
h. Vapor Permeance: 0.05 perm; ASTM E 96, Water Method.

2.02 AUXILIARY MATERIALS

A. General: Auxiliary materials recommended by air barrier manufacturer for intended use and compatible with air barrier. Liquid-type auxiliary materials shall comply with VOC limits of Environmental Protection Agency.

B. Primer: Liquid primer or surface conditioner recommended for substrate by manufacturer of air barrier material.

C. Counterflashing Strip: Modified bituminous 40-mil- thick, self-adhering sheet consisting of 32 mils of rubberized asphalt laminated to an 8-mil- thick, crosslaminated polyethylene film with release liner backing.

D. Modified Bituminous (Transition) Strip: Strip form of air barrier material.

E. Termination Mastic: Cold fluid-applied elastomeric liquid; trowel grade.

F. Substrate Patching Membrane: Manufacturer's standard trowel-grade substrate filler.

G. Stainless-Steel Sheet: ASTM A 240/A 240M, Type 304, 0.0187 inch thick, and Series 300 stainless-steel fasteners.

H. Sealant: Silyl-terminated polyether, specified in Section 07 92 00, Joint Sealants, Type "C".

I. Sprayed Polyurethane Foam Sealant: 1- or 2-component, foamed-in-place, polyurethane foam sealant, 1.5 to 2.0 lb/cu. ft. density; flame spread index of 25 or less according to ASTM E 162; with primer and noncorrosive substrate cleaner recommended by foam sealant manufacturer.
PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance.

1. Verify that substrates are sound and free of oil, grease, dirt, or other contaminants.
2. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 SURFACE PREPARATION

A. Clean, prepare, and treat substrate according to manufacturer's written instructions. Provide clean, dust-free, and dry substrate for air barrier application.

B. Bridge and cover isolation joints expansion joints and discontinuous deck-to-wall joints with overlapping modified bituminous strips.

C. At changes in substrate plane, apply sealant or termination mastic beads at sharp corners and edges to form a smooth transition from one plane to another.

D. Cover gaps in substrate plane and form a smooth transition from one substrate plane to another with stainless-steel sheet mechanically fastened to structural framing to provide continuous support for air barrier.

3.03 INSTALLATION

A. Apply primer or surface conditioner to substrates at required rate and allow to dry. Limit priming to areas that will be covered by air barrier sheet in same day. Reprime areas exposed for more than 24 hours.

1. Prime glass-fiber-surfaced gypsum sheathing with number of prime coats needed to achieve required bond, with adequate drying time between coats.

B. Install modified bituminous sheets according to air barrier manufacturer's written instructions and according to recommendations in ASTM D 6135.

1. When ambient and substrate temperatures range between 25 and 40 degrees F, install self-adhering, modified bituminous air barrier sheets produced for low-temperature application. Do not use low-temperature sheets if ambient or substrate temperature is higher than 60 degrees F.

C. Corners: Prepare and treat inside and outside corners according to ASTM D 6135.

1. Install modified bituminous strips centered over vertical inside corners. Install 3/4-inch fillets of termination mastic on horizontal inside corners.

D. Prepare, treat, and seal vertical and horizontal surfaces at terminations and penetrations with termination mastic and according to ASTM D 6135.

E. Apply and firmly adhere modified bituminous sheets horizontally over area to receive air barrier sheets. Accurately align sheets and maintain a uniform 2-1/2-inch minimum lap widths and end laps. Overlap and seal seams and stagger end laps to ensure airtight installation.
1. Apply sheets in a shingled manner to shed water without interception by any exposed sheet edges.

2. Roll sheets firmly to enhance adhesion to substrate.

F. Apply continuous modified bituminous sheets over modified bituminous strips bridging substrate cracks, construction, and contraction joints.

G. Seal top of through-wall flashings to air barrier sheet with an additional 6-inch-wide, counterflashing strip.

H. Seal exposed edges of sheets at seams, cuts, penetrations, and terminations not concealed by metal counterflashings or ending in reglets with termination mastic.

I. Install air barrier sheets and auxiliary materials to form a seal with adjacent construction and to maintain a continuous air barrier.

J. Wall Openings: Prime concealed perimeter frame surfaces of windows, curtain walls, storefronts, and doors. Apply modified bituminous transition strip so that a minimum of 3 inches of coverage is achieved over both substrates. Maintain 3 inches of full contact over firm bearing to perimeter frames with not less than 1 inch of full contact.

K. Fill gaps in perimeter frame surfaces of windows, curtain walls, storefronts, doors, and miscellaneous penetrations of air barrier membrane with foam sealant.

L. At end or each working day, seal top edge of membrane to substrate with termination mastic.

M. Apply joint sealants forming part of air barrier assembly within manufacturer's recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.

N. Repair punctures, voids, and deficient lapped seams in air barrier. Slit and flatten fishmouths and blisters. Patch with air barrier sheet extending 6 inches beyond repaired areas in all directions.

O. Do not cover air barrier until it has been tested and inspected.

P. Correct deficiencies in or remove air barrier that does not comply with requirements; repair substrates and reapply air barrier components.

3.04 CLEANING AND PROTECTION

A. Protect air barrier system from damage during application and remainder of construction period, according to manufacturer's written instructions.

1. Protect air barrier from exposure to UV light and harmful weather exposure as required by manufacturer. Remove and replace air barrier exposed to these conditions for more than 30 days.

2. Protect air barrier from contact with creosote, uncured coal-tar products, TPO, EPDM, flexible PVC membranes, and sealants not approved by air barrier manufacturer.

B. Clean spills, stains, and soiling from adjacent construction that would be exposed in the completed work using cleaning agents and procedures recommended by manufacturer of affected construction.

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PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes specifications for:

1. Prefinished, aluminum panel system for unconditioned interior applications:
   a. MP-1: Solid panels.
   b. MP-1A: Perforated panels with acoustical backing.
   c. MP-3: Artist's Metal Wall Panels

2. Stainless panel system for unconditioned interior applications:
   a. MP-4: Flat panels.
   b. MP-9: Heavy-gage flat panels for stair/escalator sidewall cladding.

3. Porcelain enamel on steel panel system for exterior and unconditioned interior applications:
   a. MP-5: Flat, concealed fastener panels.
      1) MP-5A: Exterior.
      2) MP-5B: Interior.
   b. MP-6: Same as MP-5, perforated.

4. Prefinished, roll-formed steel panel systems:
   a. MP-2A: 12-inch wide flat liner panels for elevator hoistway.
   b. MP-2B: 24-inch wide flat liner panels for unconditioned interior applications.
   c. MP-7: Corrugated for unconditioned interior applications
   d. MP-8: Corrugated for exterior applications

5. Delegated engineering design.

6. Accessories for mounting, including perimeter extrusions, mating panel clips, and shims.

7. Concealed sub-framing and furring members for mounting panels to walls.

B. Related Sections: The work of the following Sections is related to the work of this Section. Other Sections, not referenced below, may also be related to the proper performance of this work.
1. Section 05 05 14, Fluoropolymer Coatings For Metal.
2. Section 05 40 00, Cold-Formed Metal Framing
3. Section 07 27 00, Water and Air Barrier
4. Section 09 06 00, Schedules for Finishes
5. Section 09 51 36, Acoustical Ceilings.
6. Section 12 10 00, Art

1.02 SYSTEM DESCRIPTION

A. Design Requirements:
   1. Contractor: Responsible for designing system, including anchorage to structural system and necessary modifications to meet specified requirements and maintain visual design concepts.

1.03 PERFORMANCE REQUIREMENTS

A. Performance Requirements - Exterior Applications
   1. Design and size components to withstand the following load requirements indicated on the Contract Drawings (Structural General Notes) without damage or permanent set:
   2. System Internal Drainage: Drain to the exterior by means of a weep drainage network all water entering joints, condensation occurring in glazing channel, and migrating moisture occurring within system.
   3. Expansion/Contraction: Provide for expansion and contraction within system components caused by cycling temperature range of 170 degrees F over a 12 hour period without causing detrimental effect to system components, anchorages, and other building elements.

B. Performance Requirements - Interior Applications: Design panel system to safely withstand air pressure loading of specified below and environmental conditions within the station and tunnel.
   1. Pressure loading requirements are shown on the Partition Schedule for walls and partitions with special loading criteria.
   2. Other interior walls and partitions: Plus or minus 15 psf

C. Interface With Adjacent Systems:
   1. Integrate design and connections with adjacent construction.
   2. Accommodate allowable tolerances and deflections for structural members in installation.

1.04 REFERENCES

A. This Section incorporates by reference the latest revisions of the following documents.
   1. American Society for Testing and Materials International (ASTM)
a. ASTM A 424 - Steel Sheet for Porcelain Enameling.
b. ASTM A 641/ASTM A 641M: Specification for Zinc-Coated (Galvanized) Carbon Steel Wire
c. ASTM A 653/A 653M: Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
d. ASTM A 666: Specification for Annealed or Cold-Worked Austenitic Stainless Steel, Sheet, Strip, Plate, and Flat Bar
e. ASTM A 755/A 755M: Specification for Steel Sheet, Metallic Coated by the Hot-Dip Process and Prepainted by the Coil-Coating Process for Exterior Exposed Building Products
f. ASTM A 792/A 792M: Specification for Steel Sheet, 55 Percent Aluminum-Zinc Alloy-Coated by the Hot-Dip Process
g. ASTM B 209: Specification for Aluminum and Aluminum-Alloy Sheet and Plate
h. ASTM B 221: Specification for Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
i. ASTM B 370: Specification for Copper Sheet and Strip for Building Construction
j. ASTM C 645: Specification for Nonstructural Steel Framing Members
k. ASTM E 84: Test Method for Surface Burning Characteristics of Building Materials

2. American Society of Civil Engineers (ASCE)
a. ASCE 7: Minimum Design Loads for Buildings and Other Structures

3. National Association of Architectural Metal Manufacturers (NAAMM)
a. Metal Finishes Manual for Architectural and Metal Products.

4. Porcelain Enamel Institute (PEI)
a. PEI-1001(ALS-100) Specifications for Architectural Porcelain Enamel.

5. Sheet Metal and Air Conditioning Contractors’ National Association

6. The Society for Protective Coatings (SSPC)
a. SSPC-Paint 12: Paint Specification No. 12: Cold Applied Asphalt Mastic (Extra Thick Film)

1.05 SUBMITTALS

A. Procedures: Section 01 33 00, Submittal Procedures
B. Shop Drawings: Show fabrication and installation layouts of wall panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details. Distinguish among factory-, shop-, and field-assembled work.

1. Accessories: Include details of the following items, at a scale of not less than 1-1/2 inches per 12 inches:
   a. Flashing and trim.
   b. Anchorage systems.

C. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below:

1. Wall Panels: 12 inches long by actual panel width. Include fasteners, closures, and other panel accessories.
2. Trim and Closures: 12 inches long. Include fasteners and other exposed accessories.
3. Accessories: 12-inch-long Samples for each type of accessory.

D. Design Data: For wall panel assemblies indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

E. Manufacturer’s Certification: Submit written certification that metal panel system manufacturer has a minimum of five years experience in the design, engineering, and manufacturing of the type of panel system specified. Submit three reference projects of similar size and scope utilizing the specified type of panel system.

F. Coordination Drawings: Elevations, drawn to scale, on which the following items are shown and coordinated with each other, using input from Installers of the items involved:

1. Wall panels and attachments.
2. Furring (girts).
3. Wall-mounted items including doors, windows, louvers, and lighting fixtures.
4. Penetrations of wall by pipes and utilities.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer shall have minimum five years experience in the design and manufacturing of preformed metal wall panel systems and shall have minimum three projects of similar size and scope of this project, utilizing this type of panel system.

B. Installer Qualifications: An employer of workers trained and approved by manufacturer.

C. Mock-up, Panel System MP-3: Erect mockup of not fewer than four full-size panels, with two panels having aluminum above polycarbonate and including adhesive bonding of polycarbonate infill. Include 4-way joint, perimeter conditions and typical panel-to-panel joint.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver components, wall panels, and other manufactured items so as not to be damaged or deformed. Package panels for protection during transportation and handling.
B. Unload, store, and erect wall panels in a manner to prevent bending, warping, twisting, and surface damage.

C. Stack wall panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store panels to ensure dryness, with positive slope for drainage of water. Do not store panels in contact with other materials that might cause staining, denting, or other surface damage.

D. Retain strippable protective covering on aluminum wall panel for period of installation.

1.08 PROJECT CONDITIONS

A. Field Measurements: Verify locations of structural members and wall opening dimensions by field measurements before aluminum wall panel fabrication and indicate measurements on Shop Drawings.

PART 2 - PRODUCTS

2.01 PANEL MATERIALS

A. Aluminum Plate: ASTM B 209. Alloy and temper as recommended by manufacturer for application.

B. Stainless Steel Sheet: ASTM A 666; Type 304.

C. Porcelain Enameling Steel Sheet: ASTM A 424.

D. Metallic-Coated Steel Sheet: Restricted flatness steel sheet metallic coated by the hot-dip process and prepainted by the coil-coating process to comply with ASTM A 755/A 755M.
   1. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 coating designation; structural quality.
   2. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A 792/A 792M, Class AZ50 coating designation, Grade 40; structural quality.
   4. Exposed Coil-Coated Finish:
      a. 2-Coat Fluoropolymer as specified in Section 05 05 14, Fluoropolymer Coatings for Metal.

2.02 MISCELLANEOUS METAL FRAMING

A. Miscellaneous Metal Framing, General: ASTM C 645, cold-formed metallic-coated steel sheet, ASTM A 653/A 653M, G60 hot-dip galvanized or coating with equivalent corrosion resistance unless otherwise indicated.

B. Zee Furring: 0.079-inch nominal thickness.

C. Fasteners for Miscellaneous Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten miscellaneous metal framing members to substrates.
2.03 MISCELLANEOUS MATERIALS

A. Aluminum Extrusions: ASTM B 221, alloy and temper recommended by manufacturer for type of use and finish indicated.

B. Panel Fasteners: Self-tapping screws; bolts and nuts; self-locking rivets and bolts; end-welded studs; and other suitable fasteners designed to withstand design loads. Provide exposed fasteners with heads matching color of metal wall panels by means of plastic caps or factory-applied coating. Provide EPDM, PVC, or neoprene sealing washers.

2.04 CUSTOM ALUMINUM WALL PANELS (MP-1, MP-1A)

A. Wall Panels: Factory-formed, metal panels fabricated from single sheets of metal formed into profile for installation method indicated. Include attachment system components, panel stiffeners, and accessories required for weathertight system.
   1. Assembly detail: Concealed full-width cleats.
   3. Exposed Finish: Fluoropolymer FP-1 as specified in Section 05 05 14, Fluoropolymer Coatings for Metal.
   4. Concealed Finish: Mill finish or manufacturer's standard coating.
   5. Perforation Pattern (MP-1A): Rectangular grid pattern, 1/8 by 1-inch rectangular holes at 3/8 by 1-1/4 inch straight centers; 1-1/8 inch margins at panel edges.

B. Panel System Basis of Design: Ceilings Plus "WallForms" with continuous support rail.

2.05 METAL ART PANELS (MP-3)

A. Materials
   1. Metal Panels: Aluminum sheet with routed, water-jet cut, or laser cut pattern. Minimum 0.125 inch thick.
   2. Metal "hat" channels: Formed or extruded aluminum. Minimum 0.125 inch thick.
   3. Plastic Glazing: Polycarbonate sheet; ASTM C 1349, Appendix X1, Type I (standard, UV stabilized), with a polished finish.
      a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
         1) Altuglas International, Division of Arkema Inc.; Tuffak XL.
         2) General Electric Company; Lexan XL-1.
         3) Sheffield Plastics Inc., a Bayer Material Science company; Makrolon SL.
      b. Nominal Thickness: 0.093 inch (2.5 mm).
      c. Color: Transparent blue
      d. Fire hazard classification per ASTM E 84
1) Flame-Spread Index: 25 or less.

2) Smoke Developed: 450 or less

e. Adhesive for bonding polycarbonate panels to aluminum: 3M 9472 "Adhesive Transfer Tape with Adhesive 300 LSE" or similar acrylic adhesive providing high bond strength to low surface energy materials such as smooth polycarbonate.

B. Fastening Components: Locate as shown on Contract Drawings.

1. Fasteners: Stainless steel, self-drilling, pan head; square or Torx drive.

2. Bushings: Plastic, black or clear.

3. Grommets: Neoprene, EPDM, or Silicone rubber; 60-70 durometer.

C. Artist's Metal Wall Panels: See section 12 10 00, Art, for procedures and coordination.

1. Artist design: Fabricate wall and ceiling panels to Artist's design by cutting perforation patterns using router, laser cutter, water jet, or other means that will produce smooth-edge holes without distorting surface of metal. Artist will furnish CADD drawings in DXF format for perforation patterns for all panels, and overall layout elevations, and reflective ceiling plan identifying panel locations.

D. Metal Finish: Clear Acrylic-Hybrid Powder Coat over Random Orbital Finish:

1. Powder coat material: Tiger Drylac Clear Flat Matte, Series 16/00030 or approved equal.

2. Preparation:
   a. Wipe panel surface with acetone, using lint free rags, and air dry.
   b. Blast surface per SSPC-SP10, with anchor profile of 2 to 3 mils.
   c. Random Orbital Sand, 180 Grit, non-directional, 6” media.
   d. After proper surface preparation, protect surfaces from finger prints, dust, flash corrosion, or other contamination until powder coat is applied and cured.


4. Apply powder coat using electrostatic spray.

5. Heat cure and control cooling in accordance the production data sheet.

E. Joining Polycarbonate Sheet With Aluminum Panels:

1. Adhesive: For inclined panels where polycarbonate is not above aluminum, apply nominal 3-inch spots of adhesive to field of panels approximately 18 inches on center and located so that adhesive is not exposed at aluminum panel perforations. Apply pressure or roll to ensure full adhesive bond.

2. Bolt polycarbonate panels to aluminum panels as shown on drawings.
2.06 STAINLESS STEEL WALL PANELS

A. Flat Panels (MP-4): Factory-formed, metal panels fabricated from single sheets of metal formed into profile for installation method indicated. Include attachment system components, panel stiffeners, and accessories required for weathertight system.

1. Material: Tension-leveled, smooth Stainless steel sheet 0.040 inch thick.

B. Ribbed Panels: Roll formed exposed fastener panels. Minimum 0.030 inch metal thickness.

1. Rib Pattern: 1 inch deep, 4-inch centers, trapezoidal ribs; nominal 36-inch panel coverage.
2. Finish: AISI No. 4 bright directional polished finish.

C. Stair/Escalator Sidewall Cladding (MP-9): Factory-formed, metal panels fabricated from single sheets of metal formed into profile for concealed fastener installation system (fastener concealed by joint filler (sealant). Include attachment system components, panel stiffeners, and accessories required for vandal-resistant system.

1. Material: Tension-leveled, smooth Stainless steel sheet 0.074 inch thick (14 gage).
3. Finish: Random Orbital Sand, 180 Grit, non-directional, 6” media.

2.07 PORCELAIN ENAMEL ON STEEL PANELS (MP-5A, MP-5B, MP-6)

A. Manufacturers: Subject to compliance with requirements, provide products of one of the following manufacturers:

1. CSP Architectural Metals.
3. or approved equal.

B. Porcelain Enamel Metal Panels: Custom fabricated panels from 16-gauge porcelain enameling steel sheet. Fabrication shall include shearing, punching, and forming of panels to sizes indicated on approved shop drawings. Brake formed flanges shall be formed to provide maximum 0.125-inch radius and shall be fully welded and ground smooth.

1. Perforated panels: 3/4-inch square holes at 1-1/4 inch straight centers; equal margins on opposite panel sides, not less than 1 inch or more than 1-1/2 inches.

C. Fabrication

1. Fabricate panels to sizes and configurations as indicated on Contract Drawings.
2. Panels shall be sheared and formed, with corners welded and ground smooth.
3. Panel stiffeners required for flatness and deflection shall be applied to the panel with structural silicon and compatible glazing tape.
4. Where possible, apply attachment clips and alignment pins in manufacturer's facility.
5. Metal Panel System Fabrication Tolerances:
a. Maximum panel bow shall not exceed 2 percent of panel dimensions in width or length, with an overall maximum tolerance of 0.240 inch within panel face.

b. Face of panel shall not vary in plane to any adjacent panel greater than 1/16 inch.

c. Brake form exposed panel edges to radius not to exceed 1/4 inch.

D. Porcelain Enamel Finish:
   1. Provide porcelain enamel finish consisting of ground coats and finish coats in accordance with PEI 1001 specifications.
   2. Provide porcelain enamel color according Section 09 06 00, Schedules for Finishes.
   3. To optimize panel finish uniformity, complete panel elevations shall be finished from the same enamel batch, in the same production run, utilizing directional arrows for consistency of application. A continuous line furnace is required for enameling process.

2.08 EXPOSED-FASTENER, LAP-SEAM METAL WALL PANELS

A. General: Provide factory-formed metal wall panels designed to be field assembled by lapping side edges of adjacent panels and mechanically attaching panels to supports using exposed fasteners in side laps. Include accessories required for weathertight installation where panels are used at exterior.


   a. Finish: Fluoropolymer according to Section 05 05 14, Fluoropolymer Coatings for Metal.

B. Manufacturer: Subject to compliance with requirements, acceptable manufacturers include:

   1. AEP Span
   2. CENTRIA Architectural Systems.
   4. Fabral.
   5. Metal Sales.
   6. Metecno/Morin.

C. Corrugated Profile, Exposed-Fastener Metal Wall Panels (MP-7): Formed with raised, trapezoidal major ribs and flat pan between major ribs.

   1. Basis-of-Design Product: Subject to compliance with requirements, provide Metecno/Morin "VB-36 or comparable product by one of the other acceptable manufacturers.
   2. Rib spacing: 4 inches on center.
   4. Panel Height: 1 inch.
D. Corrugated Profile, Exposed-Fastener Metal Wall Panels (MP-8): Formed with sinusoidal corrugations.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Metecno/Morin "C-40-1/2" or comparable product by one of the other acceptable manufacturers.

2. Corrugation spacing: 2.67 inches on center.


4. Panel Height: 1/2 inch.

2.09 CONCEALED-FASTENER, LAP-SEAM METAL WALL PANELS

A. Acceptable Manufacturers

1. AEP Span.

2. CENTRIA Architectural Systems.


4. Fabral.

5. Metecno-Morin.

6. Metal Sales.

B. General: Provide factory-formed metal wall panels designed to be field assembled by lapping and interconnecting side edges of adjacent panels and mechanically attaching through panel to supports using concealed fasteners. Include accessories required for non-weathertight installation.


2. (MP-2A) Flat Profile, Concealed-Fastener Metal Wall Panels: Formed with flat face and V-groove appearance at joints.

   a. Basis-of-Design Product: Subject to compliance with requirements, provide Fabral "Décor-Flush" or comparable product by one of the other acceptable manufacturers.

   b. Panel Coverage: 12 inches.

   c. Panel Height: 1 inch.

3. (MP-2B) Flat Profile, Concealed-Fastener Metal Wall Panels: Formed with flat face and V-groove appearance at joints.

   a. Basis-of-Design Product: Subject to compliance with requirements, provide Metecno-Morin "L2-24W-0" or comparable product by one of the other acceptable manufacturers.

   b. Panel Coverage: 24 inches.

   c. Panel Height: 1-1/2 to 2 inches.
2.10 ACCESSORIES

A. Provide components required for a complete aluminum wall panel assembly including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of panels unless otherwise indicated.

B. Panel Fasteners: Self-tapping screws, bolts, nuts, self-locking rivets and bolts, end-welded studs, and other suitable fasteners designed to withstand design loads. Provide exposed fasteners with heads matching color of metal wall panels by means of plastic caps or factory-applied coating. Provide EPDM or neoprene sealing washers.

C. Flashing and Trim: Same material, finish, and color as adjacent aluminum wall panels, minimum 0.030 inch thick unless otherwise indicated.

D. Acoustical Backing: Porous plastic foam; expanded polypropylene or polyethylene beads compressed into panels; black color; water resistant:
   1. NRC: Minimum 0.55.
   2. Thickness: 1 to 1-1/4 inch.
   3. Acceptable products:
      a. Dow Chemical: "Quash"
      b. Robin Reigi: "TAC Acoustical Panels".

2.11 FABRICATION

A. General: Fabricate and finish metal wall panels and accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.

B. Fabricate flat panels to the following dimensional tolerances:
   1. Length and Width: Plus or minus 0.032 inch up to 48 inches; 0.064 inch more than 48 inches.
   2. Diagonal: Plus or minus 0.1875 inch.
   3. Panel Bow: Not more than 0.2 percent of panel width or length up to 0.1875 inch maximum.
   4. Thickness: Plus or minus 0.008 inch.
   5. Squareness: 0.1875-inch difference between diagonal measurements.
   6. Camber: 0.032 inch.

C. Sheet Metal Accessories: Fabricate closures and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.
   1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
2. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.

3. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended by aluminum wall panel manufacturer.
   a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or aluminum wall panel manufacturer for application, but not less than thickness of metal being secured.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, aluminum wall panel supports, and other conditions affecting performance of the Work.

1. Examine wall framing to verify that girts, angles, channels, studs, and other structural panel support members and anchorage have been installed within alignment tolerances required by aluminum wall panel manufacturer.

2. Examine wall sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by aluminum wall panel manufacturer.

B. Examine roughing-in for components and systems penetrating aluminum wall panels to verify actual locations of penetrations relative to seam locations of panels before installation.

C. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Miscellaneous Framing: Install subgirts, base angles, sills, furring, and other miscellaneous wall panel support members and anchorage according to ASTM C 754 and panel manufacturer's written instructions.

3.03 WALL PANEL INSTALLATION

A. General: Install wall panels according to manufacturer's written instructions in orientation, sizes, and locations indicated on Drawings. Install panels perpendicular to girts and subgirts unless otherwise indicated. Anchor panels and other components of the Work securely in place, with provisions for thermal and structural movement.

1. Shim or otherwise plumb substrates receiving aluminum wall panels.

2. Flash and seal aluminum wall panels with weather closures at perimeter of all openings. Do not begin installation until weather barrier and flashings that will be concealed by panels are installed.

3. Install flashing and trim as wall panel work proceeds.
4. Apply elastomeric sealant continuously between metal base channel (sill angle) and concrete, and elsewhere as indicated or, if not indicated, as necessary for waterproofing.

5. Provide weathertight escutcheons for pipe and conduit penetrating exterior walls.

B. Fasteners:

1. Aluminum Plate Wall Panels: Use aluminum or stainless-steel fasteners for surfaces exposed to the exterior and aluminum or galvanized-steel fasteners for surfaces exposed to the interior.

2. Other Wall Panels: Use fasteners recommended by panel manufacturer appropriate for panel system exposure. Provide fasteners with heads finished to match panels where fastener head will be exposed in the finished work.

C. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action as recommended by aluminum wall panel manufacturer.

D. Joint Sealers: Install gaskets, joint fillers, and sealants where indicated and where required for weathertight performance of metal wall plate panel assemblies. Provide types of gaskets, fillers, and sealants indicated or, if not indicated, types recommended by panel manufacturer.

1. Prepare joints and apply sealants to comply with requirements in Section 07 92 00, Joint Sealants.

E. Attachment System, General: Install attachment system required to support aluminum wall panels and to provide a complete weathertight wall system, including subgirts, perimeter extrusions, tracks, drainage channels, panel clips, and anchor channels.

1. Include attachment to supports, panel-to-panel joinery, panel-to-dissimilar-material joinery, and panel-system joint seals.

F. Flange-Attachment Installation: Attach aluminum wall panels, formed with extended perimeter flanges, to supports at locations, spacing, and with fasteners recommended by manufacturer.

1. Seal horizontal and vertical joints between adjacent panels with sealant backing and sealant. Install sealant backing and sealant according to requirements specified in Section 07 92 00, Joint Sealants.

2. Seal horizontal and vertical joints between adjacent panels with manufacturer's standard gaskets.

3.04 ART PANELS

A. Secure panels to grid system in accordance with approved shop drawings and approved mock-up.

3.05 ACCESSORY INSTALLATION

A. General: Install accessories with positive anchorage to building and weathertight mounting and provide for thermal expansion. Coordinate installation with flashings and other components.

1. Install components required for a complete wall panel assembly including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.
B. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.

1. Install exposed flashing and trim that is without excessive oil canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof and weather-resistant performance.

2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).

3.06 ERECTION TOLERANCES

A. Installation Tolerances: Shim and align aluminum wall panel units within installed tolerance of 1/4 inch in 20 feet, noncumulative, on level, plumb, and location lines as indicated and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

3.07 CLEANING

A. Remove temporary protective coverings and strippable films, if any, as aluminum wall panels are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of aluminum wall panel installation, clean finished surfaces as recommended by panel manufacturer. Maintain in a clean condition during construction.

B. After aluminum wall panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.

C. Replace aluminum wall panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION
PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes specifications for cementitious wall panels (WF-1).
   1. Delegated engineering design of metal furring and fastener spacing of panels.
   2. Metal furring channels.

B. Related Sections: The work of the following Sections is related to the work of this Section.
   Other Sections, not referenced below, may also be related to the proper performance of this
   work.
   1. Section 05 40 00, Cold-Formed Metal Framing.
   2. Section 07 92 00, Joint Sealants

1.02 REFERENCES

A. American Society for Testing and Materials International (ASTM)
   2. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building
      Materials.
      Furnace at 750 degrees C.

1.03 PERFORMANCE REQUIREMENTS

A. Performance Requirements - Interior Applications: Design furring gage, furring spacing,
   and panel fastenings to safely withstand air pressure loading of specified below and
   environmental conditions within the station and tunnel.
   1. Air pressure loading: Negative (suction) of 52 pounds per square foot.

1.04 SUBMITTALS

A. Procedures: Section 01 33 00, Submittal Procedures

B. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Installation methods.
C. Design Data: For wall panel assemblies indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.05 DELIVERY, STORAGE, AND HANDLING
A. Store products in manufacturer’s unopened packaging until ready for installation.
B. Store siding flat on a smooth level surface. Protect edges and corners from chipping. Store sheets under cover and keep dry prior to installing.

PART 2 - PRODUCTS

2.01 MANUFACTURERS
A. Manufacturers/Products: Subject to compliance with requirements, provide one of the following products:
   1. James Hardie Building Products, Inc.; Artisan Matrix Panel
   2. CEP Panels, Inc.; Petrarch
   3. American Fiber Cement Co.; Minerit
   4. US Architectural Products; Cem-Clad Cement Board
B. Requests for approval of equal substitutions will be considered in accordance with provisions of Section 01 25 00, Substitution Procedures.
C. Cementitious Panels (WF-1):
D. Exterior Cement Board: Not less than 7/16-inch- thick, fiber cement board complying with ASTM C 1186, Type A, for exterior applications.
   1. Size: Nominal 4 by 8 feet.
   2. Non-combustible when tested in accordance with ASTM E136.

2.02 METAL FURRING
A. Metal Furring, General: ASTM C 645, cold-formed metallic-coated steel sheet, ASTM A 653/A 653M, G60 hot-dip galvanized or coating with equivalent corrosion resistance unless otherwise indicated.
B. Zee Furring: 0.036-inch (20 gage) nominal thickness unless heavier gage required by delegated engineering design.
C. Fasteners for Miscellaneous Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten miscellaneous metal framing members to substrates.

2.03 ACCESSORIES
A. Fasteners: Hex-head steel drill screws ("Teks screws") complying with ASTM C 954, with an organic-polymer coating or other corrosion-protective coating having a salt-spray resistance of more than 500 hours per ASTM B 117.
1. Size: Minimum #10 by 1-1/4 inches.
2. Provide EPDM, PVC, or neoprene sealing washers.

B. Joint Sealant: Paintable latex sealant; refer to Section 07 92 00, Joint Sealants.

2.04 FINISHES

A. Factory Primer: Provide factory applied universal primer.
B. Topcoat: Refer to Section 09 90 00, Painting and Coating.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.
B. Examine work of Section 05 40 00, Cold-Formed Metal Framing, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of cementitious wall panels.

1. Application of cement board indicates acceptance of surfaces and conditions.

3.02 INSTALLATION

A. Install materials in strict accordance with manufacturer’s installation instructions.
B. Place fasteners no closer than 3/8 inch from panel edges and 2 inches from panel corners.
C. All field cut edges will be primed or sealed during the installation process using an exterior grade primer or sealer which is compatible with the type of paint to be used.
D. Specific framing and fastener requirements refer to the applicable building code compliance reports.
E. Apply sealant to edge of in-place panel and place adjacent panel snugly to squeeze out sealant, then fasten panel in place.

1. Strike sealant flush with panel face.

3.03 FINISHING

A. Finish painting is specified in Section 09 90 00, Painting and Coating. Apply paint within 180 days of installation.

3.04 PROTECTION

A. Protect installed products until completion of project.
B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION
SECTION 07 54 23
THERMOPLASTIC POLYOLEFIN (TPO) ROOFING

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes specifications for membrane roof system key-noted (RT-1) on the Contract Drawings:
   1. Adhered TPO membrane roofing system.
   2. Tapered insulation to achieve slope-to-drain.
   3. Substrate board (sheathing) attached to metal roof deck.
   4. Installation of acoustical insulation, furnished under Section 05 34 23, in flutes of acoustical metal roof decking.

B. Related Sections: The work of the following Sections is related to the work of this Section. Other Sections, not referenced below, may also be related to the proper performance of this work.
   1. Section 05 34 23, Acoustical Metal Roof Decking.
   2. Section 06 10 00, Rough Carpentry: Wood nailers, curbs, and blocking.
   3. Section 07 56 00, Fluid Applied Roofing: (RT-2).
   4. Section 07 62 00, Sheet Metal Flashing and Trim: Metal roof penetration flashings, flashings, and counterflashings.
   5. Section 22 14 23, Storm Drainage Piping Specialties: Roof drains.

1.02 DEFINITIONS

A. TPO: Thermoplastic polyolefin.


1.03 PERFORMANCE REQUIREMENTS

A. General Performance: Installed membrane roofing and base flashings shall withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Membrane roofing and base flashings shall remain watertight.

B. Material Compatibility: Provide roofing materials that are compatible with one another under conditions of service and application required, as demonstrated by membrane roofing manufacturer based on testing and field experience.
C. Roofing System Design: Provide membrane roofing system that is identical to systems that have been successfully tested by an Independent Testing Laboratory to resist uplift pressure calculated according to ASCE/SEI 7.

1. Corner Uplift Pressure: 40 lbf/sq. ft.
2. Perimeter Uplift Pressure: 30 lbf/sq. ft.

1.04 REFERENCES

A. This Section incorporates by reference the latest revisions of the following documents.

1. American Society for Testing and Materials International (ASTM)
   a. ASTM C 1177: Specification for Glass-Mat, Gypsum Substrate for Use as Sheathing
   b. ASTM C 1278: Specification for Fiber-Reinforced Gypsum Panel
   c. ASTM D 6878: Specification for Thermoplastic Polyolefin Based Sheet Roofing
   d. ASTM E 108: Test Methods for Fire Tests of Roof
   e. ASTM E 108: Test Methods for Fire Tests of Roof Coverings

2. American Society of Civil Engineers (ASCE)
   a. ASCE 7: Minimum Design Loads for Buildings and Other Structures

1.05 SUBMITTALS

A. Procedures: Section 01 33 00, Submittal Procedures

B. Product Data: For each type of product indicated.

C. Shop Drawings: For roofing system. Include plans, elevations, sections, details, and attachments to other work.
   1. Base flashings and membrane terminations.
   2. Insulation:
      a. Tapered insulation layout plan.
      b. Fastening patterns for corner, perimeter, and field-of-roof locations.

D. Samples for Verification: For the following products:
   1. Sheet roofing, of color specified, including T-shaped side and end lap seam.
   2. Walkway pads or rolls.
   3. Metal termination bars.

E. Research/Evaluation Reports: For components of membrane roofing system, from the ICC-ES.
1.06 QUALITY ASSURANCE

A. Installer Qualifications: A qualified firm that is approved, authorized, or licensed by membrane roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's special warranty.

B. Source Limitations: Obtain components including fasteners for membrane roofing system from same manufacturer as membrane roofing or approved by membrane roofing manufacturer.

C. Exterior Fire-Test Exposure: ASTM E 108, Class B; for application and roof slopes indicated, as determined by testing identical membrane roofing materials by an Independent Testing Laboratory. Materials shall be identified with appropriate markings of applicable Independent Testing Laboratory.

D. Preinstallation Roofing Conference: Conduct conference at Project site.

1. Meet with Resident Engineer, Independent Testing Laboratory representative, roofing Installer, roofing system manufacturer's representative, deck Installer, and installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.

2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.

3. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.

4. Examine deck substrate conditions and finishes for compliance with requirements, including flatness and fastening.

5. Review structural loading limitations of roof deck during and after roofing.

6. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect roofing system.

7. Review governing regulations and requirements for insurance and certificates if applicable.

8. Review temporary protection requirements for roofing system during and after installation.

9. Review roof observation and repair procedures after roofing installation.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, approval or listing agency markings, and directions for storing and mixing with other components.

B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored liquid material from direct sunlight.

1. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.
C. Handle and store roofing materials and place equipment in a manner to avoid permanent deflection of deck.

1.08 PROJECT CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to manufacturer’s written instructions and warranty requirements.

PART 2 - PRODUCTS

2.01 TPO MEMBRANE ROOFING


1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Carlisle SynTec Incorporated.
   b. Firestone Building Products Company.
   c. Johns Manville.

2. Thickness: 60 mils, nominal.

3. Exposed Face Color: Gray.

2.02 AUXILIARY MEMBRANE ROOFING MATERIALS

A. General: Auxiliary membrane roofing materials recommended by roofing system manufacturer for intended use, and compatible with membrane roofing.

1. Liquid-type auxiliary materials shall comply with VOC limits of Environmental Protection Agency rules.

B. Sheet Flashing: Manufacturer’s standard unreinforced thermoplastic polyolefin sheet flashing, 55 mils thick, minimum, of same color as sheet membrane.

C. Bonding Adhesive: Manufacturer’s standard, water based.

D. Metal Termination Bars: Manufacturer’s standard, predrilled stainless-steel or aluminum bars, approximately 1 by 1/8 inch thick; with anchors.

E. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening membrane to substrate, and acceptable to membrane roofing system manufacturer.

F. Miscellaneous Accessories: Provide pourable sealers, preformed cone and vent sheet flashings, preformed inside and outside corner sheet flashings, T-joint covers, lap sealants, termination reglets, and other accessories.
2.03 TAPERED ROOF INSULATION

A. General: Preformed roof insulation boards manufactured or approved by TPO membrane roofing manufacturer, selected from manufacturer's standard sizes suitable for application, of thicknesses indicated.

B. Perlite Board Insulation: ASTM C 728, rigid, mineral-aggregate thermal insulation board composed of expanded perlite, cellulosic fibers, binders, and waterproofing agents with top surface seal coated.
1. Tapered Insulation: Provide factory-tapered insulation boards fabricated to slope of 1/4 inch per 12 inches unless otherwise indicated.
2. Provide preformed saddles, crickets, tapered edge strips, and other insulation shapes where indicated for sloping to drain. Fabricate to slopes indicated.

2.04 SUBSTRATE BOARDS

1. Products: Subject to compliance with requirements, provide one of the following:
   a. Georgia-Pacific Corporation; Dens Deck.
   b. USG Corporation; Securock.

B. Fasteners: Factory-coated corrosion-resistant steel fasteners and metal or plastic plates designed for fastening substrate board to roof deck.
1. Length: AS required to penetrate and secure substrate board to metal roof deck but not more than 2-1/2 inches (to avoid projection past bottom of decking).

2.05 WALKWAYS

A. Flexible Walkways: Factory-formed, nonporous, heavy-duty, slip-resisting, surface-textured walkway pads or rolls, approximately 3/16 inch thick and acceptable to membrane roofing system manufacturer.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with the following requirements and other conditions affecting performance of roofing system:
1. Verify that roof openings and penetrations are in place and curbs are set and braced and that roof drain bodies are securely clamped in place.
2. Verify that wood blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.

B. Proceed with installation only after unsatisfactory conditions have been corrected.
3.02 PREPARATION

A. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing installation according to roofing system manufacturer’s written instructions. Remove sharp projections.

B. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.

C. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at the end of the workday or when rain is forecast. Remove and discard temporary seals before beginning work on adjoining roofing.

3.03 SUBSTRATE BOARD

A. Install substrate board with long joints in continuous straight lines, perpendicular to roof slopes with end joints staggered between rows. Tightly butt substrate boards together.

1. Fasten substrate board to top flanges of steel deck to resist uplift pressure at corners, perimeter, and field of roof according to membrane roofing system manufacturers' written instructions.

3.04 INSULATION INSTALLATION

A. Coordinate installing membrane roofing system components so insulation is not exposed to precipitation or left exposed at the end of the workday.

B. Comply with membrane roofing system and insulation manufacturer's written instructions for installing roof insulation.

C. Install tapered insulation under area of roofing to conform to slopes indicated.

D. Trim surface of insulation where necessary at roof drains so completed surface is flush and does not restrict flow of water.

E. Install insulation with long joints of insulation in a continuous straight line with end joints staggered between rows, abutting edges and ends between boards. Fill gaps exceeding 1/4 inch with insulation.

1. Cut and fit insulation within 1/4 inch of nailers, projections, and penetrations.

F. Adhered Insulation: Install each layer of insulation and adhere to substrate as follows:

1. Set each layer of insulation in ribbons of bead-applied insulation adhesive, firmly pressing and maintaining insulation in place.

3.05 ADHERED MEMBRANE ROOFING INSTALLATION

A. Adhere membrane roofing over area to receive roofing and install according to membrane roofing system manufacturer's written instructions.

B. Start installation of membrane roofing in presence of membrane roofing system manufacturer's technical personnel.

C. Accurately align membrane roofing and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.
D. Bonding Adhesive: Apply to substrate and underside of membrane roofing at rate required by manufacturer and allow to partially dry before installing membrane roofing. Do not apply to splice area of membrane roofing.

E. In addition to adhering, mechanically fasten membrane roofing securely at terminations, penetrations, and perimeter of roofing.

F. Apply membrane roofing with side laps shingled with slope of roof deck where possible.

G. Seams: Clean seam areas, overlap membrane roofing, and hot-air weld side and end laps of membrane roofing and sheet flashings according to manufacturer's written instructions to ensure a watertight seam installation.
   1. Test lap edges with probe to verify seam weld continuity. Apply lap sealant to seal cut edges of sheet membrane.
   2. Verify field strength of seams a minimum of twice daily and repair seam sample areas.
   3. Repair tears, voids, and lapped seams in roofing that does not comply with requirements.

H. Spread sealant bed over deck drain flange at roof drains and securely seal membrane roofing in place with clamping ring.

3.06 BASE FLASHING INSTALLATION

A. Install sheet flashings and preformed flashing accessories and adhere to substrates according to membrane roofing system manufacturer's written instructions.

B. Apply bonding adhesive to substrate and underside of sheet flashing at required rate and allow to partially dry. Do not apply to seam area of flashing.

C. Flash penetrations and field-formed inside and outside corners with cured or uncured sheet flashing.

D. Clean seam areas, overlap, and firmly roll sheet flashings into the adhesive. Hot-air weld side and end laps to ensure a watertight seam installation.

E. Terminate and seal top of sheet flashings and mechanically anchor to substrate through termination bars.

3.07 WALKWAY INSTALLATION

A. Flexible Walkways: Install walkway products in locations indicated. Heat weld to substrate or adhere walkway products to substrate with compatible adhesive according to roofing system manufacturer's written instructions.

3.08 FIELD QUALITY CONTROL

A. Independent Testing Laboratory: Sound Transit will engage a qualified Independent Testing Laboratory to perform tests and inspections.

B. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion.

C. Repair or remove and replace components of membrane roofing system where inspections indicate that they do not comply with specified requirements.
D. Additional inspections, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.09 PROTECTING AND CLEANING

A. Protect membrane roofing system from damage and wear during remainder of construction period. When remaining construction will not affect or endanger roofing, inspect roofing for deterioration and damage, describing its nature and extent in a written report, with copies to Resident Engineer.

B. Correct deficiencies in or remove membrane roofing system that does not comply with requirements; repair substrates; and repair or reinstall membrane roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.

C. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION
PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes specifications for fluid-applied roofing.
   1. (RT-2) Exposed to weather.
   2. (RT-3) With protection board for split-slab application.

B. Related Sections: The work of the following Sections is related to the work of this Section. Other Sections, not referenced below, may also be related to the proper performance of this work.
   1. Section 03 30 00, Cast-in-Place Concrete: Concrete substrates.
   2. Section 05 30 00, Metal Decking: Permanent metal forms for concrete substrates.

1.02 REFERENCES

A. This Section incorporates by reference the latest revisions of the following documents.
   1. American Society for Testing and Materials International (ASTM)
      a. ASTM C 920: Specification for Elastomeric Joint Sealants
      b. ASTM C 957: Specification for High-Solids Content, Cold Liquid-Applied Elastomeric Waterproofing Membrane with Integral Wearing Surface
      c. ASTM C 1127: Guide for Use of High Solids Content, Cold Liquid-Applied Elastomeric Waterproofing Membrane with an Integral Wearing Surface
      d. ASTM C 1193: Guide for Use of Joint Sealants
      e. ASTM D 4258: Practice for Surface Cleaning Concrete for Coating
      f. ASTM D 4259: Practice for Abrading Concrete
      g. ASTM D 4263: Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method
      h. ASTM D 5957: Guide for Flood Testing Horizontal Waterproofing Installations
      i. ASTM E 108: Test Methods for Fire Tests of Roof Coverings
   2. Underwriters Laboratories, Inc. (UL)
      a. UL 790: Standard Test Methods for Fire Tests of Roof Coverings;
1.03 SUBMITTALS

A. Procedures: Section 01 33 00, Submittal Procedures.

B. Product Data: For each product indicated.

C. Samples for Verification: For each type of fluid-applied roofing required, prepared on rigid backing and of same thickness and material indicated for the Work.
   1. Provide stepped Samples on backing large enough to illustrate buildup of fluid-applied roofing.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of fluid-applied roofing required for this Project.

B. Source Limitations:
   1. Obtain fluid-applied roofing from a single manufacturer.
   2. Obtain primary fluid-applied roofing materials, including primers, from fluid-applied roofing manufacturer. Obtain secondary materials including aggregates, sheet flashings, joint sealants, and substrate repair materials of type and from source recommended in writing by primary material manufacturer.

C. Fire-Test-Response Characteristics: Provide fluid-applied roofing materials with the fire-test-response characteristics as determined by testing identical products in accordance with test method below for deck type and slopes indicated by an Independent Testing Laboratory that is acceptable to Seattle DPD.
   1. Class B roof covering in accordance with ASTM E 108 or UL 790.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in original packages and containers with seals unbroken and bearing manufacturer's labels showing the following information:
   1. Manufacturer's brand name.
   2. Type of material.
   3. Directions for storage.
   4. Date of manufacture and shelf life.
   5. Lot or batch number.
   6. Mixing and application instructions.
   7. Color.

B. Store materials in a clean, dry location protected from exposure to direct sunlight. In storage areas, maintain environmental conditions within range recommended in writing by manufacturer.
1.06 PROJECT CONDITIONS

A. Environmental Limitations: Apply fluid-applied roofing within the range of ambient and substrate temperatures recommended in writing by manufacturer. Do not apply fluid-applied roofing to damp or wet substrates, when temperatures are below 40 degrees F, when relative humidity exceeds 85 percent, or when temperatures are less than 5 degrees F above dew point.

1. Do not apply fluid-applied roofing in snow, rain, fog, or mist, or when such weather conditions are imminent during the application and curing period. Apply only when frost-free conditions occur throughout the depth of substrate.

B. Do not install fluid-applied roofing until items that will penetrate membrane have been installed.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Fluid-applied roofing: In accordance with ASTM C 957.

B. Material Compatibility: Provide primers; base, intermediate, and topcoats; and miscellaneous materials that are compatible with one another and with substrate under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.

2.02 MANUFACTURER

A. Available Manufacturers: Subject to compliance with requirements, products of the following manufacturers may be incorporated into the Work include, but are not limited to, the following:

1. Carlisle Coatings & Waterproofing, Inc.
2. Gaco Western Inc.
3. LymTal International, Inc.
4. Neogard, Division of Jones-Blair
5. Pacific Polymers International, Inc.
6. Tremco Incorporated, Sealant/Waterproofing Division

B. Basis of Design Product/System: Lym-Tal "Iso-Flex 760 U HVT Low Odor Coating System" without aggregate.

2.03 FLUID-APPLIED ROOFING

A. Primer: Manufacturer's standard factory-formulated low-odor primer recommended for substrate and conditions indicated.

B. Preparatory and Base Coats: Single- or multicomponent, aromatic liquid urethane elastomer.

C. Intermediate Coat: Single- or multicomponent, aliphatic liquid urethane elastomer.

D. Topcoat: Single- or multicomponent, aliphatic liquid urethane elastomer.
1. Color: As selected by Resident Engineer from manufacturer’s full range.

E. Component Coat Thicknesses: As recommended by manufacturer for substrate and service conditions indicated, but not less than the following (measured excluding aggregate):

2. Intermediate Coat: 15 mils minimum dry film thickness.
3. Topcoat: 15 mils minimum dry film thickness.

2.04 MISCELLANEOUS MATERIALS

A. Joint Sealants: As specified in Section 07 92 00, Joint Sealants.
B. Sheet Flashing: Nonstaining.
1. Minimum Thickness: 50 mils.
C. Adhesive: Contact adhesive recommended in writing by fluid-applied roofing manufacturer.
D. Reinforcing Strip: Fiberglass mesh or non-woven polyester recommended in writing by fluid-applied roofing manufacturer.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements and for other conditions affecting performance of fluid-applied roofing.

1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance.
2. Verify compatibility with and suitability of substrates.
3. Begin coating application only after minimum concrete curing and drying period recommended by fluid-applied roofing manufacturer has passed, after unsatisfactory conditions have been corrected, and after surfaces are dry.
4. Verify that substrates are visibly dry and free of moisture.
   a. Test for moisture vapor transmission by plastic sheet method in accordance with ASTM D 4263.
   b. Test for moisture content by method recommended in writing by manufacturer.
5. Application of coating indicates acceptance of surfaces and conditions.

3.02 PREPARATION

A. Clean and prepare substrates in accordance with ASTM C 1127 and manufacturer’s written recommendations to produce clean, dust-free, dry substrate for fluid-applied roofing application.
B. Mask adjoining surfaces not receiving fluid-applied roofing, deck drains, and other deck substrate penetrations to prevent spillage, leaking, and migration of coatings.

C. Concrete Substrates: Mechanically abrade concrete surfaces to a uniform profile in accordance with ASTM D 4259. Do not acid etch.
   1. Remove grease, oil, paints, and other penetrating contaminants from concrete.
   2. Remove concrete fins, ridges, and other projections.
   3. Remove laitance, glaze, efflorescence, curing compounds, concrete hardeners, form-release agents, and other incompatible materials that might affect coating adhesion.
   4. Remove remaining loose material to provide a sound surface, and clean surfaces in accordance with ASTM D 4258.

3.03 TERMINATIONS AND PENETRATIONS

A. Prepare vertical and horizontal surfaces at terminations and penetrations through fluid-applied roofing and at expansion joints, drains, and sleeves in accordance with ASTM C 1127 and manufacturer’s written recommendations.

B. Provide sealant cants at penetrations and at reinforced and nonreinforced, deck-to-wall butt joints.

C. Terminate edges of deck-to-deck expansion joints with preparatory base-coat strip.

D. Install sheet flashings at deck-to-wall expansion and dynamic joints, and bond to deck and wall substrates according to manufacturer’s written recommendations.

3.04 JOINT AND CRACK TREATMENT

A. Prepare, treat, rout, and fill joints and cracks in substrates in accordance with ASTM C 1127 and manufacturer’s written recommendations. Before coating surfaces, remove dust and dirt from joints and cracks in accordance with ASTM D 4258.

3.05 FLUID-APPLIED ROOFING APPLICATION

A. Apply fluid-applied roofing material in accordance with ASTM C 1127 and manufacturer’s written recommendations.
   1. Start fluid-applied roofing application in presence of manufacturer’s technical representative.
   2. Verify that wet film thickness of each component coat complies with requirements every 100 square feet.

B. Apply fluid-applied roofing to prepared wall terminations and vertical surfaces to height indicated.

C. Cure fluid-applied roofing in accordance with manufacturer’s written recommendations. Prevent contamination and damage during application and curing stages.
3.06 FIELD QUALITY CONTROL

A. Flood Testing: Flood test each deck area for leaks, in accordance with ASTM D 5957, after fluid-applied roofing has completely cured. Install temporary containment assemblies, plug or dam drains, and flood with potable water.

1. Flood to an average depth of 2-1/2 inches with a minimum depth of 1 inch and not exceeding a depth of 4 inches.

2. Flood each area for 24 hours.

3. After flood testing, repair leaks, repeat flood tests, and make further repairs until fluid-applied roofing installation is watertight.

4. Engage an Independent Testing Laboratory to observe flood testing and examine underside of decks and terminations for evidence of leaks during flood testing.

B. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.07 PROTECTING AND CLEANING

A. Protect fluid-applied roofing from damage and wear during remainder of construction period.

B. Clean spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION
SECTION 07 62 00
SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes specifications for:

1. Fabricated sheet metal items, including miscellaneous flashings, counterflashings, gutters, downspouts, and other items indicated in Schedule at end of this Section and as detailed on Contract Drawings.

2. Reglets and accessories.

3. Attachment blocks for exterior mounted items, including but not limited to: canopy supports, exterior lighting, mechanical vents and penetrations, hose bibs.

B. Related Sections: The work of the following Sections is related to the work of this Section. Other Sections, not referenced below, may also be related to the proper performance of this work.

1. Section 04 20 00, Unit Masonry: Unit masonry at through-wall flashings and counter-flashings specified in this Section.

2. Section 05 05 13, Shop-Applied Coatings for Metal: Metal finishes.

3. Section 07 54 23, Thermoplastic Polyolefin Roofing: Roofing systems.

4. Section 07 72 00, Roof Accessories: Roof-mounted units, rails and pedestals.

5. Section 07 92 00, Joint Sealants.

6. Section 09 90 00, Painting and Coating: Field painting.

1.02 REFERENCES

A. This Section incorporates by reference the latest revisions of the following documents.

1. American Architectural Manufacturers Association (AAMA)

   a. ASTM A 666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.


3. Sheet Metal and Air Conditioning Contractors’ National Association (SMACN)

a. SMACNA (ASMM) - Architectural Sheet Metal Manual;

1.03 SUBMITTALS

A. Procedures: Section 01 33 00, Submittal Procedures.

B. Shop Drawings: Shop drawings shall be fully coordinated and shall indicate layout, material profile, jointing pattern, jointing details, fastening methods, flashings, terminations, counterflashings, gutters, downspouts, scuppers, and expansion joint systems, and installation details. Provide fully coordinated detailed drawings, which account for construction trade interfacing, installation sequencing, adjacent materials, and attachment methods. Ensure best possible weather resistance and durability of work. Provide for protection of materials and finishes.

C. Samples: Submit two samples, 6 inch in size illustrating material and finish of typical visible trim materials. Submit for each color of trim to be used.

1.04 QUALITY ASSURANCE

A. Perform work in accordance with SMACNA Architectural Sheet Metal Manual requirements, except as otherwise indicated.

B. Field Measurements: Where possible, take field measurements for installation of flashings and sheet metal items. Allow for overlapping or trimming where final dimensions cannot be established prior to fabrication.

C. Sequencing: Coordinate and sequence work with that of other trades to ensure a fully waterproof exterior envelope.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Stack material on covered pallets or platforms to prevent twisting, bending, and abrasion, and to provide ventilation. Slope metal sheets to ensure drainage. Package materials to protect them from transportation damage.

B. Prevent contact with materials which may cause discoloration or staining.

1.06 PROJECT CONDITIONS

A. Coordinate with the work of interfacing and adjoining work for proper sequencing of installation. Ensure weather resistance and durability of work, including protection of materials and finishes.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Sheet Materials
1. Aluminum: ASTM B 209 (ASTM B 209M); 0.032 inch thick; mill finish.

2. Pre-Finished Aluminum: ASTM B 209 (ASTM B 209M); 0.032 inch thick; plain finish shop pre coated with fluoropolymer coating of color as selected.
   a. Fluoropolymer Coating: High Performance Organic Finish, AAMA 2604; multiple coat, thermally cured fluoropolymer finish system; color as scheduled or as approved by Resident Engineer.
   b. See requirements of Section 05 05 14, Fluoropolymer Coatings for Metal.

3. Stainless Steel: ASTM A 666 Type 316, soft temper, min. 24 gage thick; 0.025 inch thick; smooth mill finish.

B. Reglets and Accessories

1. Fasteners for Flashing and Trim: Same material and finish as flashing metal, with soft neoprene washers, as recommended by sheet manufacturer. Match finish of exposed heads with material being fastened.

2. Bituminous Coating: SSPC - Paint 12, solvent-type bituminous mastic, nominally free of sulfur, compounded for 15-mil dry film thickness per coat.

3. Underlayment: Polyethylene, 6 mils, resistant to decay, when tested in accordance with ASTM E 154.


5. Primer: Zinc chromate type.


7. Sealants: Type recommended by manufacturer of metal and fabricator of components being sealed, and complying with requirements of Section 07 92 00, Joint Sealants.

8. Epoxy Seam Sealer: Two-part noncorrosive metal seam cementing compound, recommended by metal manufacturer for exterior nonmoving joints including riveted joints.


10. Solder: ASTM B 32; 60/40 tin/lead type, with acid chloride flux. Use rosin flux over tinned surfaces.

11. Metal Accessories: Provide sheet metal clips, straps, anchoring devices, and similar accessory units as required for installation for work, matching or compatible with material being installed, noncorrosive, size and gauge required for performance.


13. Elastic Flashing Filler: Closed-cell polyethylene or other soft closed cell material recommended by elastic flashing manufacturer as filler under flashing loops to ensure movement with minimum stress on flashing sheet.
2.02 FABRICATION

A. General Metal Fabrication: Shop-fabricate work to greatest extent possible. Comply with details shown and applicable requirements of SMACNA "Architectural Sheet Metal Manual" and other recognized industry practices. Fabricate for waterproof and weather-resistant performance, with expansion provisions for running work, sufficient to permanently prevent leakage, damage, or deterioration of the work. Form work to fit substrates. Comply with material manufacturer instructions and recommendations for forming material. Form exposed sheet metal work without excessive oil-canning, buckling, and tool marks, true to line and levels indicated, with exposed edges folded back to form hems.

B. Seams: Fabricate nonmoving seams in sheet metal with flat-lock seams. Tin edges to be seamed, form seams, and solder. Form aluminum seams with epoxy seam sealer; rivet joints for additional strength where fabrication will allow.

C. Expansion: Where lapped or bayonet-type expansion provisions in work cannot be used or would not be sufficiently water or weatherproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints.)

D. Sealant Joints: Where movable, non-expansion type joints are indicated or required for proper performance of the work, form metal to provide for proper installation of elastomeric sealant, in compliance with SMACNA standards.

E. Separations: Provide for separation of metal from non-compatible metal or corrosive substrates by coating concealed surfaces at locations of contact, with bituminous coating or other permanent separation as recommended by manufacturer/fabricator.

F. Aluminum Extrusions: Fabricate extruded aluminum running units with joint covers for installation behind main members where possible. Fabricate mitered and welded corner units.

G. Form sections true to shape, accurate in size, square, and free from distortion or defects.

H. Form pieces in longest possible lengths.

I. Hem exposed edges on underside 1/2 inch; miter and seam corners.

J. Form material with flat lock seams, except where otherwise indicated. At moving joints, use sealed lapped, bayonet-type or interlocking hooked seams.

K. Fabricate corners from one piece with minimum 18-inch long legs; seam for rigidity, seal with sealant.

L. Fabricate vertical faces with bottom edge formed outward 1/4 inch and hemmed to form drip.

M. Sill Pan Flashing: Fabricate with 1/2-inch upstanding edge at sides and back of unit, fully welded corners, and 1/2-inch turned under drip edge.

N. Fabricate flashings to allow toe to extend two inches over roofing gravel. Return and brake edges.

O. Parapet Scuppers: Fabricate scuppers of dimensions required with closure flange trim to exterior, 4-inch- wide wall flanges to interior, and base extending 4 inches beyond cant or tapered strip into field of roof.
P.  Gutter and Downspout


2.  Downspouts:  Profile as indicated on Drawings.


4.  Accessories:  Profiled to suit gutters and downspouts.
   a.  Anchorage Devices:  In accordance with SMACNA requirements.
   b.  Gutter Supports:  Brackets.
   c.  Downspout Supports:  Brackets.

5.  Seal metal joints.

PART 3 - EXECUTION

3.01 EXAMINATION

A.  Verify roof openings, curbs, pipes, sleeves, ducts, and vents through roof are solidly set, reglets in place, and nailing strips located.

B.  Verify roofing termination and base flashings are in place, sealed, and secure.

3.02 PREPARATION

A.  Install starter and edge strips, and cleats before starting installation.

B.  Back paint concealed metal surfaces with protective backing paint to a minimum dry film thickness of 15 mils.

3.03 INSTALLATION

A.  General:  Comply with manufacturer's installation instructions and recommendations and with SMACNA Sheet Metal Manual.  Anchor units securely, providing for thermal expansion.  Conceal fasteners where possible, and set units true to line and level.  Install work with laps, joints, and seams that will be permanently watertight and weatherproof.

B.  Underlayment:  Where stainless steel or aluminum is to be installed directly on cementitious or wood substrates, install a slip sheet of red rosin paper and a course of polyethylene underlayment.

C.  Install reglets to receive counterflashing in manner and by methods indicated.  Where shown in concrete, furnish reglets to trades of concrete work for installation as work to be performed in Division 3, Concrete.  Where shown in masonry, furnish reglets to trades of masonry work, for installation as work to be performed in Division 4, Masonry.

D.  Install counterflashing in reglets, either in snap-in seal arrangement or by welding in place for anchorage and filling reglet with mastic or elastomeric sealant, as indicated and depending on degree of sealant exposure.
E. Nail flanges of expansion joint units to curb nailers, at a maximum spacing of 6 inches on center. Fabricate seams at joints between units with minimum 3-inch overlap, to form a continuous, waterproof system.

F. Conform to drawing details:
   1. Counter Flashings: SMACNA Architectural Sheet Metal Manual, Detail 4-4C.
   2. Roof Penetration Flashing: SMACNA Architectural Sheet Metal Manual, Detail 4-14B.

G. Secure flashings in place using concealed fasteners as much as possible.

H. Apply plastic cement compound between metal flashings and felt flashings.

I. Fit flashings tight in place. Make corners square, surfaces true and straight in planes, and lines accurate to profiles.

J. Solder metal joints for full metal surface contact. After soldering, wash metal clean with neutralizing solution and rinse with water.

K. Secure gutters and downspouts in place using concealed fasteners.

L. Slope gutters 1/4 inch per foot minimum.

3.04 CLEANING
   A. Clean exposed metal surfaces, removing substances that might cause corrosion of metal or deterioration of finishes.
   B. Clean and neutralize flux materials. Clean off excess solder.
   C. Clean off excess sealants.
   D. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of installation, remove unused materials and clean finished surfaces. Maintain in a clean condition during construction.
   E. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

3.05 PROTECTION
   A. Advise workmen of required procedures for surveillance and protection of flashings and sheet metal work during construction to ensure that work will remain undamaged at time of completion.

3.06 SCHEDULE
   A. Sheet Metal Flashing and Trim
      1. Through-Wall Flashing in Masonry:
         b. Thickness: Min. 24 gage thick.
c. Finish: Mill.
d. Drawing Detail: SMACNA 4-4C (similar).

2. Reglets:
b. Thickness: Min. 24 gage thick.
c. Finish: Mill.
d. Styles: Concrete, masonry, and surface-mounted (as detailed).

3. Gutters and Downspouts: Stainless Steel:
b. Thickness: Min. 18 gage thick.
c. Finish: Mill.

4. Parapet Scuppers:
b. Thickness: Min. 24 gage thick.
c. Finish: Mill.

5. Coping, Cap, Parapet, Sill and Ledge Flashings: Pre-Finished Aluminum.

6. Sheet Metal Roof Expansion Joint Covers, and Roof-to-Wall Joint Covers: Pre-Finished Aluminum.

7. Counterflashings at Roofing Terminations (over roofing base flashings): Stainless steel.


9. Roofing Penetration Flashings, for Pipes, Structural Steel, and Equipment Supports: Lead sheet or accessories provided by roofing membrane system manufacturer.

END OF SECTION
SECTION 07 72 00
ROOF ACCESSORIES

PART 1 - GENERAL

1.01 SUMMARY
A. This Section includes specifications for:
   1. Manufactured curbs, equipment rails, and pedestals.
   2. Roof hatches, manual and automatic operation, including smoke vents.
B. Related Sections: The work of the following Sections is related to the work of this Section. Other Sections, not referenced below, may also be related to the proper performance of this work.
   1. Section 07 54 23, Thermoplastic Polyolefin (TPO) Roofing.

1.02 REFERENCES
A. This Section incorporates by reference the latest revisions of the following documents.
   1. American Society for Testing and Materials International (ASTM)
   2. Underwriter Laboratories (UL)

1.03 SUBMITTALS
A. Procedures: Section 01 33 00, Submittal Procedures.
B. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Installation methods.
   4. Maintenance requirements.
   5. For smoke hatches, submit evidence of approval by evaluation agency specified.

1.04 QUALITY ASSURANCE
A. Smoke Hatches: Provide units bearing UL label.
1.05  DELIVERY, STORAGE, AND HANDLING
A. Store products in manufacturer's unopened packaging until ready for installation.
B. Store products under cover and elevated above grade.

PART 2 - PRODUCTS

2.01 MANUFACTURED UNITS
A. Curbs and Rails
   1. Manufactured Curbs, Equipment Rails, and Other Roof Mounting Assemblies:
      a. AES Manufacturing Inc.
      b. The Pate Company
      c. Roof Products, Inc
      d. RPS Accessories
      e. Thaler Metal Industries, Inc.
      f. Substitutions: See Section 01 60 00, Product Requirements.
   2. Manufactured Curbs, Equipment Rails, and Other Roof Mounting Assemblies:
      Factory-assembled hollow sheet metal construction with fully mitered and welded
      corners, integral counterflashing, internal reinforcing, and top side and edges
      formed to shed water.
      a. Sheet Metal: Hot-dip zinc coated steel sheet complying with ASTM A
         653/A 653M, SS Grade 33; G60 coating designation; 18 gage, 0.048
         inch thick.
      b. Roofing Cants: Provide integral sheet metal roofing cants dimensioned
         to begin slope at top of roofing insulation; 1:1 slope; minimum cant height
         4 inches.
      c. Manufacture curb bottom and mounting flanges for installation directly on
         roof deck, not on insulation; match slope and configuration of roof deck.
      d. Provide the layouts and configurations shown on the Contract Drawings.
   3. Curbs Adjacent to Roof Openings: Provide curb on all sides of opening, with top
      of curb horizontal for equipment mounting.
      a. Provide preservative treated wood nailers along top of curb.
      b. Insulate inside curbs with 1-1/2 inch thick fiberglass insulation.
      c. Height Above Finished Roof Surface: 8 inches, minimum.
      d. Height Above Roof Deck: 14 inches, minimum.
   4. Equipment Rails: Two-sided curbs in straight lengths, with top horizontal for
      equipment mounting.
a. Provide preservative treated wood nailers along top of rails.
b. Height Above Finished Roof Surface: 8 inches, minimum.
c. Height Above Roof Deck: 14 inches, minimum.

5. Pipe, Duct, and Conduit Mounting Pedestals: Vertical posts, minimum 8 inches square unless otherwise indicated.
   a. Provide sliding channel welded along top edge with adjustable height steel bracket, manufactured to fit item supported.
   b. Height Above Finished Roof Surface: 8 inches, minimum.
   c. Height Above Roof Deck: 16 inches, minimum.

B. Roof Hatches, Manual and Automatic Operation

1. Manufacturers - Roof Hatches:
   a. Bilco Co
   b. Dur-Red Products
   c. Milcor Inc
   d. Substitutions: See Section 01 60 00 - Product Requirements.

2. Roof Hatches: Factory-assembled steel frame and cover, complete with operating and release hardware.
   a. Style: Provide insulated flat metal covers unless otherwise indicated.
   b. Mounting: Provide frames and curbs suitable for mounting on flat roof deck.
   c. Smoke Hatches: Where "smoke" or "smoke/heat" operation is indicated, provide the following additional features:
      1) Smoke Release Mechanism: Automatic opening on melting of replaceable UL-listed fusible link at 165 degrees F.
      2) UL-listed as automatically operated smoke and heat vent.
   d. Size(s): As indicated on Drawings; single-leaf style.
      1) For Ladder Access: Single leaf; 30 by 36 inches.
      2) For Ships Ladder Access: Single leaf; 30 by 54 inches.
   e. For Equipment Access: Double leaf; 48 by 48 inches.
   f. For Smoke Venting without Access: 24 by 24 inches.

3. Frames/Curbs: One-piece curb and frame with integral cap flashing to receive roof flashings; extended bottom flange to suit mounting.
a. Material: Galvanized steel, 0.0747 inch thick (14 gage).
c. Insulation: 1 inch rigid glass fiber, located on outside face of curb.
d. Curb Height: 12 inches from finished surface of roof, minimum.

   a. Capable of supporting 40 pounds per square foot live load.
   b. Material: Galvanized steel; outer cover 14 gage, 0.0747 inch thick, liner 22 gage, 0.03 inch thick.
   c. Finish: Factory prime paint.
   d. Insulation: 2 inches rigid glass fiber.
   e. Gasket: Neoprene, continuous around cover perimeter.

5. Hardware: Steel, zinc coated and chromate sealed, unless otherwise indicated or required by manufacturer.
   a. Lifting Mechanisms: Compression or torsion spring operator with shock absorbers that automatically opens upon release of latch; capable of lifting covers despite 10 pounds per square foot load.
   b. Hinges: Heavy duty pintle type.
   c. Hold open arm with vinyl-coated handle for manual release.
   d. Latch: Upon closing, engage latch automatically and reset manual release.
   f. Smoke Hatches: Manual release operation not to disturb automatic release mechanisms; easy resetting by Sound Transit's maintenance personnel; provide latch designed to prevent re-latching unless the automatic release mechanism has been properly reset for automatic operation.
   g. Locking: Padlock hasp on interior.

PART 3 - EXECUTION

3.01 EXAMINATION
   A. Do not begin installation until substrates have been properly prepared.
   B. If substrate preparation is the responsibility of another Installer, notify Resident Engineer of unsatisfactory preparation before proceeding.

3.02 PREPARATION
   A. Clean surfaces thoroughly prior to installation.
B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.03 INSTALLATION

A. Install in accordance with manufacturer’s instructions, in manner that maintains roofing weather integrity.

3.04 REPAIR/RESTORATION

A. Touch-up, repair or replace damaged products before Substantial Completion.

3.05 CLEANING

A. Clean installed work to like-new condition.

3.06 PROTECTION

A. Protect installed products until completion of project.

END OF SECTION
SECTION 07 81 16

SPRAY-APPLIED FIRE RESISTIVE MATERIALS

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes specifications for:

1. Spray-applied fire resistive materials (SFRM's) to structural steel members enumerated in the Performance Requirements in this Section.

2. Patching of spray-applied fire resistive materials due to testing and inspection or damaged by construction.

B. Related Sections: The work of the following Sections is related to the work of this Section. Other Sections, not referenced below, may also be related to the proper performance of this work.

1. Section 05 12 00, Structural Steel Framing: Surface preparation and absence of shop prime coat under steel to receive fireproofing.

1.02 SYSTEM REQUIREMENTS

A. Hourly Ratings: Apply fireproofing to thickness required for indicated hourly ratings, in accordance with the appropriate manufacturer's IBC ES Report or UL Designs for unrestrained members and approved by governing code authority. Refer to Life Safety Plans, Sheet A05X and A001 for Fire Resistive Requirements.

1. Structural Frame: Structural frame consists of the columns, and the girders, beams, struts and spandrels having direct connections to the columns, bearing walls, slurry walls and bracing members designed to carry gravity loads: Members having no direct connection to the columns, bearing walls or slurry walls shall be considered as part of the roof/floor assemblies:

2. Floor and Roof Assemblies.

B. Performance Criteria: Provide spray-applied fire resistive materials material certified and tested to equal or exceed the following performance characteristics, except as otherwise indicated under individual product requirements:

1. Deflection: Material must not crack or delaminate from the surface to which applied when tested in accordance with ASTM E759.

2. Bond Impact: Material must not crack or delaminate from the surface to which applied when tested in accordance with ASTM E760.

3. Bond (Cohesion/Adhesion) Strength: Minimum average bond strength of 200 psf when tested in accordance with ASTM E736.

4. Compressive Strength: Minimum compressive strength of 750 psf when tested in accordance with ASTM E761.
5. Air Erosion: Maximum amount of weight loss of 0.005 grams/square foot when subjected to an air stream in accordance with ASTM E859.

6. Corrosion Resistance: No evidence of corrosion to bare, shop-coated, and galvanized steel sheets with the fireproofing material applied when tested in accordance with ASTM E937.

7. Resistance To Mold: Show resistance to mold growth for a period of 28 days for general use and 60 days for materials to be installed in plenums when tested in accordance with ASTM G 21.

8. Combustibility: Material shall have a maximum total heat release of 20 MJ/m$^2$ and a maximum 125 kw/m$^2$ peak rate of heat release 600 seconds after insertion when tested in accordance with ASTM E 1354 at a radiant heat flux of 75 kw/m$^2$ with the use of electric spark ignition, sample shall be tested in the horizontal orientation.

1.03 REFERENCES

A. This Section incorporates by reference the latest revisions of the following documents. It is a part of this Section as specified and modified. In case of a conflict between the requirements of this Section and those of a listed document, the requirements of this Section will prevail.

B. American Society for Testing and Materials International (ASTM)
1. ASTM E 84: Test Method for Surface Burning Characteristics of Building Materials
3. ASTM E 136: Test Method for Behavior of Materials in a Vertical Tube Furnace at 750 Degrees C
5. ASTM E 736: Test Method for Cohesion/Adhesion of Sprayed Fire-Resistive Materials Applied to Structural Members
8. ASTM E 761: Test Method for Compressive Strength of Sprayed Fire-Resistive Material Applied to Structural Members
11. ASTM E 1529: Test Methods for Determining Effects of Large Hydrocarbon Pool Fires on Structural Members and Assemblies
12. ASTM G 21: Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi

C. Association of the Wall and Ceiling Industries International (AWCI)

D. Code of Federal Regulations (CFR)
   1. 40 CFR 763, Subpart E (7-1-95 Edition): Asbestos-Containing Materials in Schools

E. International Code Conference (ICC):
   2. ICC-ES: Evaluation Service Reports.

F. Underwriters Laboratories Inc. (UL)
   2. UL 1709: Safety for Rapid Rise Fire Tests of Protection Materials for Structural Steel

1.04 SUBMITTALS

A. Procedures: Section 01 33 00, Submittal Procedures.

B. Product Data: Submit manufacturer's brochure on fireproofing materials, including application instructions and procedures. Include data on patching materials and impact resistant coating materials.

C. Fireproofing Shop Drawings: Submit fireproofing shop drawings to the Resident Engineer and governing code officials for review; drawings must include the following information:
   1. Code Compliance: Indicate the Code edition to which the fireproofing schedule conforms; the type of fireproofing material; number of ICC ES Report. Research/Evaluation Report acceptable to Seattle DPD, UL Design number, or equivalent; details of all non-standard configuration or assembly required to clarify compliance or obtain approval.
   2. Thickness Schedule: Clearly identify thicknesses required for designated primary and secondary members and floor and roof assemblies (color code or other acceptable method).

D. Test Data: Submit evidence of (SFRM's) compliance with Seattle Building Code, and verified by an Independent Testing Laboratory indicating compliance with all specified fire and system performance criteria as indicated.

E. Certification: Minimum thicknesses needed to achieve required fire-resistance ratings of structural components and assemblies.

F. Qualification Data: Refer to article Quality Assurance for requirements. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

1.05 QUALITY ASSURANCE

A. Applicator’s Qualifications: Certified, licensed, and preferably accredited by the National Fireproofing Contractors Association (NFCA), or otherwise approved by spray-applied fire resistive materials manufacturer as having the necessary experience, staff, and training to install manufacturer's products according to specified requirements.
B. Single Source: Obtain all sprayed-on fireproofing materials, regardless of type, from a single manufacturer.

C. Acceptance Criteria: Provide products containing no detectable asbestos as determined according to the method specified in 40 CFR 763, Subpart E, Appendix E, Section 1, "Polarized Light Microscopy."

D. Fire-Test Response Characteristics: Provide sprayed fire-resistant materials and assemblies identical to those tested for the following fire-test response characteristics in accordance with the test method indicated below by UL, or other Independent Testing Laboratory acceptable to Seattle DPD. Identify packages (bags) containing sprayed fire-resistant material with appropriate markings of applicable Independent Testing Laboratory. All assemblies are identified as “Unrestrained” for SFRM thickness determination, unless otherwise indicated on the Structural Drawings.

1. Fire-Resistive Ratings: As indicated by reference to fire-resistant designs listed in UL’s “Fire Resistance Directory”, or in the comparable publication of another testing and inspecting agency acceptable to Seattle DPD, for sprayed fire-resistant material serving as direct-applied protection, tested in accordance with ASTM E119.

2. Surface-Burning Characteristics: As indicated for each sprayed fire-resistant product required, tested in accordance with ASTM E84.

E. Allowable Tolerances: Only tolerances allowed by Underwriters' Laboratories for samples tested will be permitted for the material as applied on the Work, except as otherwise required IBC Section 1704.11.3.

F. Minimum Thickness Determination: Comply with requirements of IBC Section 721.5.2.2.1.

G. Special Tests & Inspections IBC Section 1704.11: Refer to article entitled “Field Quality Control” of this Section for special inspection and testing which will be performed by Independent Testing Agency.

1. Test Agency Qualifications: An Independent Testing Laboratory with the experience and capability to conduct the testing indicated without delaying the Work, as documented according to ASTM E 699.

H. Pre-Application Conference: Schedule a job conference to review the work approximately two weeks prior to starting work. Conference shall be attended by Independent Testing Laboratory; the fireproofing applicator; representative of fireproofing manufacturer; Construction Manager and other representatives directly concerned with performance of the work. The following major considerations shall be reviewed at conference:

1. Review all facets of the work so as to prevent any misunderstandings of the full intent of this Specification and areas of responsibilities.

2. Review ICC ES Report or UL Designs, and approved shop drawings.

3. Trade related schedules, including the installation of mechanical and electrical equipment.

4. Review methods of inspections and responsibility for “follow-up” inspections, including patching of damaged areas.

5. Review requirements for environmental limitations, ventilation, and protection.

6. Review article entitled Sequencing and Coordination for specific project requirements.
I. Pre-Application Inspection: Refer to article entitled “Field Quality Control” of this Section for visual inspection of structural steel prior to fireproofing application.

J. Coordination:
   1. Coordinate use of primer with Section 05 12 00, Structural Steel Framing, as applicable to ensure primer is type and thickness compatible with spray-applied fire resistive materials.

1.06 DELIVERY, STORAGE & HANDLING

A. Deliver materials in unopened containers or packages bearing manufacturer’s name, trade name, type, and Underwriters’ Laboratories label.

B. Use materials with limited shelf life within period indicated. Remove from Project site and discard materials whose shelf life has expired.

C. Keep materials dry, off the ground, under cover, and away from damp surfaces. Discard materials exposed to moisture. Rotate stock of materials and use before expiration date.

1.07 PROJECT CONDITIONS

A. Environmental Limitations: Do not apply sprayed fire-resistive material when ambient or substrate temperatures are 40 degrees F or lower, unless temporary protection and heat is provided to maintain temperatures at or above this level for 24 hours before, during, and for 24 hours after product application. If necessary to job progress, the Contractor shall provide enclosures and heat to maintain temperatures.

B. Ventilation: Provide ventilation to allow for proper drying of fireproofing during and subsequent to its application. In poorly ventilated areas lacking natural ventilation, provide forced air circulation during and after application until fireproofing dries thoroughly; at a minimum ventilation rate of four complete air exchanges per hour.

C. Protection: Provide temporary enclosures to confine overspray of the application within building and to prevent defacement and damage to adjacent buildings and personnel; take precautions to prevent air pollution or broadcast of fireproofing material during application. Protect applied material from damage during subsequent construction; repair or replace material damaged.

1.08 SEQUENCING AND COORDINATION

A. General: Avoid unnecessary exposure of fire-resistive material to abrasion and other damage likely to occur during construction operations subsequent to its application. Delay installation of mechanical and electrical ducts, piping and conduit that would interfere with applying fireproofing until fireproofing application has been completed.

B. Provide temporary enclosures for interior applications to prevent deterioration of fire-resistive material due to exposure to unfavorable environmental conditions.

C. Install clips, hanger supports, insulation stick pins, and other attachments to the fireproofing bases prior to application of fireproofing material, where their locations can be determined in advance.

D. Coordinate installation of fireproofing with other construction to minimize the need to cut or remove fireproofing. As installation of other construction proceeds, inspect fireproofing and patch all areas where fireproofing was removed or damaged.
E. Do not install enclosing or concealing construction until after fire-resistive material has been applied, inspected, tested, and corrections have been made to defective applications.

PART 2 - PRODUCTS

2.01 SFRM (TYPE-1) COMMERCIAL DENSITY

A. Type and Manufacturer: Carboline Co. Fireproofing Products Div. “Pyrolite 15”; Isolatek International “Cafo 300”; W.R. Grace & Company “Monokote Type MK-6/HY or MK-6’s”; or approved equal gypsum plaster based spray-applied fire resistive materials listed in accordance with UL 263 (ASTM E119) procedures and certified to meet the performance criteria specified and the following:

1. Fire Hazard Classification: 0 flame spread and 0 smoke development when tested in accordance with ASTM E84.

2. Dry Density: Minimum in-place individual dry density either 15 pounds per cubic foot when tested in accordance with ASTM E605, or minimum density as required by ICC–ES and/or UL Design for particular rating, whichever value is greater.

3. Cohesion/Adhesion (Bond Strength): 390 psf. average when tested in accordance ASTM D736.

4. Deflection: Will not crack or delaminate when tested in accordance ASTM E759.

B. Optional Product: At Contractor’s options, Isolatek International ‘Blaze-Shield II, Portland Cement base fireproofing may be used without a Substitution Request form.

C. Locations of Application: All interior locations.

2.02 RELATED MATERIALS

A. Accessories: Provide accessories to comply with manufacturer’s recommendations and to meet fire resistance design and code requirements. Such accessories include, but are not limited to, any required or optional items such as; adhesive or bonding agents, accelerator, mechanical attachments; application aids such as metal lath, scrim, or netting.

B. Patching Material: Same material as spray-applied fire resistive materials.

C. Water: Clean, potable consumption and free from such amounts of mineral or organic substances as would affect the set of the fireproofing material. Provide water with sufficient pressure and volume to meet the fireproofing application schedule.

D. Metal Lath (If Required for Fire Rating): Expanded metal lath of weight, configuration, material, and finish required to comply with fire resistance rated designs indicated and fireproofing manufacturer’s recommendations. Provide clips, lathing accessories, and other anchorage devices required to attach lath to substrates.

2.03 INSTALLATION EQUIPMENT

A. General: Equipment shall be types recommended by the spray-applied fire resistive materials manufacturer and shall include pumping equipment, metering devices, booster pumps, injection pumps and accessories as required.
PART 3 - EXECUTION

3.01 EXAMINATION

A. General: Examine steel surfaces with Applicator present. Verify that surfaces and conditions are acceptable to receive fireproofing. Do not proceed with fireproofing application in areas of discrepancy until all discrepancies have been fully resolved.

B. Verify Following Conditions:

1. Verify that surfaces to receive fireproofing are free of oil, grease, loose mill scale, dirt, or other substances which may impair proper bond of fireproofing with substrate under conditions of normal use or fire exposure.

2. Bond Strength and Compatibility Over Shop Prime Coat: Where approved, verify compatibility of spray-applied fire resistive materials as meeting the following:
   a. UL Classified in accordance with UL 263, ASTM E119.
   b. Bond Tested in accordance with ASTM E736.
   c. Compatible for use with approved spray-applied fire resistive materials and certified by fireproofing manufacturer as meeting all fire and performance criteria.
   d. Application friendly.
   e. Corrosion protective barrier over steel and tested in accordance with ASTM C117, rated for 10,000 hours.

3. Verify clips, hangers, supports, sleeves, and other items required to penetrate fireproofing are in place.

4. Verify that substrates are not obstructed by ducts, piping, equipment, or other suspended construction which might interfere with application of fireproofing.

C. Commencement of fireproofing application indicates acceptance of surface conditions and full responsibility for failure of bond between fireproofing and substrate.

3.02 PREPARATION

A. General: Clean substrates of substances that could impair bond of fire-resistant material, including oil, grease, rolling compounds, primers, and loose mill scale. Prior to application of the fireproofing material, apply a bonding agent, approved by the fireproofing material manufacturer, to all substrates to receive fireproofing.

B. Protection: Cover other work subject to damage from fall-out or overspray of fireproofing materials during application. Drapes shall be used to prevent damage to surrounding surfaces not scheduled to receive fireproofing.

1. Actual method of protection is at Applicator’s option, and must be reviewed with the Contractor prior to starting the Work.

2. Provide temporary enclosures as required to confine spraying operations.
3.03 APPLICATION

A. Mixing & Application: Mix and apply the fireproofing in strict accordance with manufacturer's printed instructions, quality control procedures stated in NFCA-200 – Field Quality Assurance Procedures for Application of Spray-Applied Fire Resistant Materials (SFRM), and as required to meet requirements of approved fire rated assemblies. Apply fireproofing in as many passes as necessary to cover with monolithic blanket of uniform density and texture.

B. Mechanically control material and water ratio. Do not retemper material. Complete application in an area before removing equipment and proceeding with further work.

C. Use only equipment approved by fireproofing manufacturer for conveying and dispersal of fireproofing.

D. Install metal lath if required to achieve fire resistance rating, or if required to comply with fireproofing manufacturer's recommendation for indicated application. Secure lath to substrate in position required, using fireproofing manufacturer's recommended anchorage devices and methods. Attach lathing accessories where indicated or required.

E. Install metal lath with fireproofing to provide closure of the fireproofing to other fire resistant assemblies where all surfaces of the beam or column are not accessible.

F. Apply fireproofing by spraying material on substrate wherever conditions permit. Complete coverage of miscellaneous areas by trowel application or other placement method recommended by fireproofing manufacturer, following spraying application in each area. Apply sprayed fireproofing to produce a spray-textured finish with no further treatment.

G. Protection during Curing: Take precautions to allow spray-applied fire resistive materials to cure without physical abuse or damage, including restrictions regarding roof traffic as stated above.

1. Provide and maintain heating and ventilation as stated above.

2. Limit deflection or impact to spray-applied fire resistive materials within manufacturer's prescribed recommendations.

H. Thicknesses and Densities: Provide thickness and density to meet required fire resistance ratings. Comply with the rated designs for thermally "unrestrained" ratings for steel framing in accordance with "Sprayed fire-resistant materials" of SFRM, IBC Section 1704.11, and as defined in ASTM E119 for elements of building envelope included in Fireproofing Schedule, below. Control thickness utilizing a depth gage to meet required thickness.

3.04 PATCHING

A. Test Areas: Repair test areas and reapply areas where tests revealed deficient density or thickness. Where tests reveal thickness deficiencies, add extra course of fireproofing where feasible, or remove course and replace with new fireproofing. Where tests reveal density deficiencies, remove affected material and replace with new fireproofing.

B. Patch fireproofing which has been damaged by construction operations or damaged as a result of wash-off and replace with compatible material which maintains the project approved UL Designs and fire-resistant ratings. Costs for patching damaged fireproofing shall be borne by the trade causing such damage.

3.05 CLEAN UP AND PROTECTION

A. Cleanup: After approval of the application in each containable area, remove equipment and temporary enclosures; clean floors, walls, and other surfaces of overspray and fallout.
B. Protect fire-resistive material, according to advice of product manufacturer and Installer, from damage resulting from construction operations or other causes so fire protection will be without damage or deterioration at the time of Substantial Completion.

3.06 FIELD QUALITY CONTROL

A. General: All sprayed-on fireproofing work shall be subject to special inspection and testing by an Independent Testing Laboratory in conformance with IBC Section 1704.11. Only special inspectors registered in the category of spray-applied fireproofing shall perform such inspections.

1. All inspections shall be made in accordance with approved shop drawings which clearly identify the fireproofing material and the thickness of fireproofing material required for the primary, secondary and other framing elements.

2. No fireproofing shall be covered prior to inspection.

B. Pre-Application Inspection: Independent Testing Laboratory shall conduct a visual inspection of structural steel prior to application of fireproofing material in accordance with IBC Section 1704.11.1. The purpose of this inspection is to check for foreign substances on the surfaces which could impair adhesion. This inspection shall be made with the sprayed-on fireproofing applicator, Contractor, and structural steel erector.

1. Results of inspection, including all remedial action (if any) shall be furnished to the Resident Engineer in a special written report.

2. Application of fireproofing shall not commence until all steel surfaces have been accepted by sprayed-on fireproofing applicator and material manufacturer; no additional compensation will be allowed on account of adhesion failure due to failure to remove all detrimental substances.

C. Thickness Determination: Visually check all structural frame members and floor and roof sections in each area sprayed. All generalized areas appearing to be less than required thickness, including damaged areas are to be checked for thickness and marked for recoating where required. The applicator will be directed to recoat all deficient areas.

1. Ducts, conduits, piping and similar mechanical, electrical and plumbing installations shall not be embedded within the required thickness of fireproofing material.

D. Test Method for Thickness: Conduct test method for thickness of fireproofing in accordance with IBC ASTM E605, Section 1704.11.4. The random areas selected for test measurements shall be marked on shop drawings before inspection is started. Record results of test measurements on separate data sheets.

1. Test locations on columns and beams are to be selected at the end thirds or middle thirds in a rotating order to vary the location of test areas.

2. Where thickness is less than that required, the condition shall be corrected. The location of all uncorrected areas shall be reported to the Resident Engineer.

3. Frequency of Tests: IBC Section 1704.11.3.1 for floor, roof and wall assemblies, and Section 1704.11.3.2 for structural framing.

E. Test Method for Density: Conduct test method to determine density of fireproofing in accordance with IBC ASTM E605, Section 1704.11.4. No sample shall have a density less than 5 percent below the specified density. Where the density is less than 5 percent tolerance allowed, the work shall be corrected to the satisfaction of the Resident Engineer.
1. Frequency of Tests: IBC Section 1704.11.4 – one specimen from each column, and beam for each 10,000 sq.-ft. of floor area or fraction thereof, or from each floor if the floor area is smaller than 10,000 sq.-ft.

F. Test Method for Cohesion/Adhesion: Conduct test method to determine the cohesion/adhesion of spray-applied fireproofing in accordance with IBC ASTM E736, Section 1704.11.5. No sample shall have a cohesive/adhesive force of less than 150 pounds per square foot. Where the cohesive/adhesive force is less than 150 pounds per square foot, the work shall be corrected to the satisfaction of the Resident Engineer.

1. Frequency of Tests: IBC Section 1704.11.5.1 for floor, roof and wall assemblies, and Section 1704.11.5.2 for structural framing.

G. Patching Inspections: All patching of damaged areas on beams, columns, bracing, and floor sections must be approved by the Resident Engineer.

H. Final Acceptance: Final inspection will be made when all corrections are completed. Sprayed fireproofing shall not show any deep or wide cracks, voids, spalls or any exposure of the substrate. The Independent Testing Laboratory will submit a final acceptance report and test data sheets to the Contractor and the building official on completion.

END OF SECTION
PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes specifications for:
   1. Firestopping materials.
   2. Firestopping of all penetrations and interruptions to fire rated assemblies, whether indicated on Contract Drawings or not, and other openings indicated.

B. Related Sections: The work of the following Sections is related to the work of this Section. Other Sections, not referenced below, may also be related to the proper performance of this work.
   1. Section 04 42 00, Unit Masonry.
   2. Section 09 21 16, Gypsum Board Assemblies.

1.02 REFERENCES

A. This Section incorporates by reference the latest revisions of the following documents.
   1. FM Global (FMG)
      a. FMG 4991: Approval of Firestop Contractors
   2. Underwriters Laboratories, Inc.(UL)
      a. UL (FRD) - Fire Resistance Directory

1.03 SUBMITTALS

A. Procedures: See Section 01 33 00, Submittal Procedures.

B. Schedule of Firestopping: List each type of penetration, fire rating of each penetrated assembly, and firestopping test or design number.

C. Product Data: Provide data on product characteristics.
   1. Include firestopping assembly product test reports (UL Design or equivalent by an Independent Testing Laboratory acceptable to Seattle DPD) for each required firestopping design

D. Manufacturer's Installation Instructions: Indicate preparation and installation instructions.

E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

F. Certificate from the Seattle Fire Department indicating approval of materials used.

G. Installer’s Qualification statements for installing mechanics as listed in Article 1.05 below.
1.04 SYSTEM DESCRIPTION

A. General: For penetrations through fire-resistance-rated constructions, including both empty openings and openings containing penetrating items, provide through-penetration firestop systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated.

B. Rated Systems: Provide through-penetration firestop systems with the following ratings determined in accordance with ASTM E 814 or UL 1479:

1. F-Rated Systems: Provide through-penetration firestop systems with F-ratings indicated, but not less than that equaling or exceeding fire-resistance rating of constructions penetrated.

2. T-Rated Systems: For the following conditions, provide through-penetration firestop systems with T-ratings indicated, as well as F-ratings, where systems protect penetrating items exposed to potential contact with adjacent materials in occupiable floor areas:
   a. Penetrations located outside wall cavities.
   b. Penetrations located outside fire-resistance-rated shaft enclosures.

3. L-Rated Systems: Where through-penetration fire stop systems are indicated in smoke barriers, provide through-penetration firestop systems with L-ratings of not more than 3.0 cfm/sq. ft at both ambient temperatures and 400 degrees F.

C. For through-penetration firestop systems exposed to view, traffic, moisture, and physical damage, provide products that, after curing, do not deteriorate when exposed to these conditions both during and after construction.

1. For piping penetrations for plumbing and wet-pipe sprinkler systems, provide moisture-resistant through-penetration firestop systems.

2. For floor penetrations with annular spaces exceeding 4 inches in width and exposed to possible loading and traffic, provide firestop systems capable of supporting floor loads involved, either by installing floor plates or by other means.

3. For penetrations involving insulated piping, provide through-penetration firestop systems not requiring removal of insulation.

D. For through-penetration firestop systems exposed to view, provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined in accordance with ASTM E 84.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this Section with minimum 3 years documented experience.

B. Installer Qualifications: Company specializing in performing the work of this Section and:

1. Approved under FMG Standard 4991.

2. With minimum five years documented experience installing work of this type.

3. Approved by firestopping manufacturer.
C. Installing Mechanic’s Qualifications: Trained by firestopping manufacturer and able to provide evidence thereof.

D. Mock-Up

1. Install one firestopping assembly representative of each fire rating design required on project.

   a. Where one design may be used for different penetrating items or in different wall constructions, install one assembly for each different combination.

   b. Where firestopping is intended to fill a linear opening, install minimum of 1 linear foot.

2. Obtain approval of the Resident Engineer and the Seattle Fire Department before proceeding.

3. If accepted, mock-up shall represent the minimum standard for the Work.

4. If accepted, mock-up may remain as part of the Work. Remove and replace all mock-ups not accepted.

1.06 PROJECT CONDITIONS

A. Environmental Requirements

1. Comply with firestopping manufacturer’s recommendations for temperature and conditions during and after installation. Maintain minimum temperature before, during, and for 3 days after installation of materials.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Typical Firestopping Assemblies: UL Designs specified below are basis of design. Comparable assemblies by other specified manufacturers are acceptable.

1. Firestopping at Uninsulated Metallic Pipe and Conduit Penetrations, of diameter 4 inches or less: Any material meeting requirements.


2. Firestopping at Insulated Metallic Pipe Penetrations, of all diameters: Any material meeting requirements.


3. Firestopping at Non-Metallic Pipe Penetrations, of diameter 4 inches or less: Any material meeting requirements.


4. Firestopping at Cable Trays:


5. Head of Wall Firestopping at Concrete Slab:


   b. Concrete masonry wall - Mechanical room: UL Design No. HW-D-0156, F Rating 2-hour.


B. 3-Hour Firestopping Assemblies for High KVA Electrical Equipment Rooms: UL Designs specified below are basis of design. Comparable assemblies by other specified manufacturers are acceptable.

1. Firestopping at Uninsulated Metallic Pipe and Conduit Penetrations, of diameter 4 inches or less: Any material meeting requirements.


   b. Concrete or masonry wall: UL Design No. C-AJ-1001

2. Firestopping at Non-Metallic Pipe Penetrations, of diameter 4 inches or less: Any material meeting requirements.


   b. Concrete or masonry wall: UL Design No. C-AJ-2228.

3. Firestopping at Cable Trays:
a. Concrete or masonry walls: C-AJ-4003.

4. Head of Wall Firestopping at Concrete Slab:
   a. Concrete or masonry wall: UL Design No. HW-D-1002, (nominal 1-inch joint width will accommodate anticipated movement).

C. Elastomeric Silicone Firestopping: Single component silicone elastomeric compound and compatible silicone sealant; conforming to the following:
   1. Durability and Longevity: Permanent.
   2. Color: Black, dark gray, or red.
   3. Manufacturers:
      b. 3M Fire Protection Products: www.3m.com/firestop.
      d. Substitutions: Section 01 25 00, Substitution Procedures.

D. Foam Firestopping: Single component foam compound; conforming to the following:
   1. Durability and Longevity: Permanent.
   2. Color: Dark grey.
   3. Manufacturers:
      a. 3M Fire Protection Products: www.3m.com/firestop.
      d. Substitutions: Section 01 25 00, Substitution Procedures.

E. Fiber Firestopping: Mineral fiber insulation used in conjunction with elastomeric surface sealer forming airtight bond to opening; conforming to the following:
   1. Durability and Longevity: Permanent.
   2. Manufacturers:
      d. Substitutions: Section 01 25 00, Substitution Procedures.

F. Intumescent Putty: Compound which expands on exposure to surface heat gain; conforming to the following:
   1. Potential Expansion: Minimum 1000 percent.
2. Durability and Longevity: Permanent.
3. Color: Black, dark gray, or red.
4. Manufacturers:
   b. 3M Fire Protection Products: www.3m.com/firestop.
   d. Substitutions: Section 01 25 00, Substitution Procedures.

G. Primers, Sleeves, Forms, Insulation, Packing, Stuffing, and Accessories: Type required for tested assembly design.

PART 3 - EXECUTION

3.01 EXAMINATION
   A. Verify openings are ready to receive the work of this section.

3.02 PREPARATION
   A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other matter, which may affect bond of firestopping material.
   B. Remove incompatible materials, which may affect bond.
   C. Install backing materials to arrest liquid material leakage.

3.03 INSTALLATION
   A. Install materials in accordance with firestopping assembly product test reports (UL Design or equivalent by other testing agency acceptable to Seattle DPD) and in accordance with manufacturer's instructions, completely closing openings.
   B. Do not cover installed firestopping until inspected by the Resident Engineer.
   C. Install labeling required by code.

3.04 CLEANING
   A. Clean adjacent surfaces of firestopping materials.

3.05 PROTECTION
   A. Protect adjacent surfaces from damage by material installation.

END OF SECTION
PART 1 - GENERAL

1.01 SUMMARY
A. This Section includes specifications for fire-resistive head of wall assemblies for the following types of partitions where fire rating is required.
   2. Concrete masonry.
B. Related Sections: The work of the following Sections is related to the work of this Section. Other Sections, not referenced below, may also be related to the proper performance of this work.
   1. Section 07 84 00, Firestopping: Firestopping of penetrations in fire-resistance-rated walls, horizontal assemblies, and smoke barriers.
   2. Section 09 21 16, Gypsum Board Assemblies: Coordination of head-of-wall framing and fastening of drywall with firestopping system requirements.

1.02 REFERENCES
A. This Section incorporates by reference the latest revision of the following documents.
   1. ASTM E 1966, "Test for Fire Resistant Joint Systems".
   2. FM Global 4991, "Approval of Firestop Contractors".
   4. UL Fire Resistance Directory

1.03 SUBMITTALS
A. Procedures: Section 01 33 00, Submittal Procedures.
B. Product Data: For each type of product indicated.
C. Product Schedule: For each fire-resistive joint system. Include location and design designation of qualified testing agency.
   1. Where Project conditions require modification to a qualified testing agency's illustration for a particular fire-resistive joint system condition, submit illustration, with modifications marked, approved by fire-resistive joint system manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly.
D. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for fire-resistive joint systems.

E. Proof of Qualifications: Submit certificate or other proof of qualifications for installers of firestopping work.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: A firm that has been approved by FM Global according to FM Global 4991, "Approval of Firestop Contractors," or been evaluated by UL and found to comply with UL's "Qualified Firestop Contractor Program Requirements."

B. Fire-Test-Response Characteristics: Fire-resistive joint systems shall comply with the following requirements:
   1. Fire-resistive joint system tests are performed by a qualified testing agency acceptable to Seattle DPD.
   2. Fire-resistive joint systems are identical to those tested per testing standard referenced in "Fire-Resistive Joint Systems" Article. Provide rated systems complying with the following requirements:
      a. Fire-resistive joint system products bear classification marking of qualified testing agency.
      b. Fire-resistive joint systems correspond to those indicated by reference to designations listed by the following:
         1) UL in its "Fire Resistance Directory."

C. Preinstallation Conference: Conduct conference at Project site.

1.05 PROJECT CONDITIONS

A. Environmental Limitations: Do not install fire-resistive joint systems when ambient or substrate temperatures are outside limits permitted by fire-resistive joint system manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.

B. Install and cure fire-resistive joint systems per manufacturer's written instructions using natural means of ventilation or, where this is inadequate, forced-air circulation.

1.06 COORDINATION

A. Coordinate construction of joints to ensure that fire-resistive joint systems are installed according to specified requirements.

B. Coordinate sizing of joints to accommodate fire-resistive joint systems.

C. Notify Owner's testing agency at least seven days in advance of fire-resistive joint system installations; confirm dates and times on day preceding each series of installations.

PART 2 - PRODUCTS

2.01 FIRE-RESISTIVE JOINT SYSTEMS

A. Where required, provide fire-resistive joint systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases,
and maintain original fire-resistance rating of assemblies in or between which fire-resistant joint systems are installed. Fire-resistant joint systems shall accommodate building movements without impairing their ability to resist the passage of fire and hot gases.

B. Joints in or between Fire-Resistance-Rated Construction: Provide fire-resistant joint systems with ratings determined per ASTM E 1966 or UL 2079:

1. Joints include those installed in or between fire-resistance-rated walls and floor assemblies.

2. Fire-Resistance Rating: Equal to or exceeding the fire-resistance rating of of partition/wall as shown on the Life Safety Plans of the drawings

3. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. Fire Trak Corp.
   b. Grace Construction Products.
   c. Hilti, Inc.
   d. Nelson Firestop Products.
   e. RectorSeal Corporation.
   f. Specified Technologies Inc.
   g. 3M Fire Protection Products.
   i. USG Corporation.
   j. CEMCO (California Expanded Metals).

C. Exposed Fire-Resistive Joint Systems: Provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.

D. Accessories: Provide components of fire-resistant joint systems, including primers and forming materials that are needed to install fill materials and to maintain ratings required. Use only components specified by fire-resistant joint system manufacturer and approved by the qualified testing agency for systems indicated.

2.02 FIRE-RESISTIVE JOINT SYSTEM SCHEDULE

A. Where UL-classified systems are indicated, they refer to system numbers in UL's "Fire Resistance Directory" under product Category XHBN.

1. Provide basis of design system or listed system by approved manufacturer meeting performance requirements.

B. Basis of design: Head-of-wall, fire-resistant joint systems for cast-in-place concrete and concrete masonry walls:

1. UL-Classified System: HW-D-0086.
   a. Fire resistance: 1 to 3 hours.
b. Nominal joint width: 1.5 inches.

c. Minimum movement capability: Plus and minus 25 percent for 1 or 2-hour rating. Plus and minus 19 percent for 3-hour rating.

C. Basis of design: Head-of-wall, fire-resistive joint systems for metal stud and gypsum board walls; either of the following:

1. UL-Classified System: HW-D-0043 (shown on drawings)
   a. Fire resistance: 1 or 2 hours.
   b. Nominal joint width: 1.5 inches.

2. UL-Classified System: HW-D-0420 (optional system using Cemco FS-2)
   a. Fire resistance: 1 or 2 hours.
   b. Nominal joint width: 1.5 inches.
   c. Minimum movement capability: Plus and minus 50 percent.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for joint configurations, substrates, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Surface Cleaning: Clean joints immediately before installing fire-resistive joint systems to comply with fire-resistive joint system manufacturer's written instructions and the following requirements:

1. Remove from surfaces of joint substrates foreign materials that could interfere with adhesion of fill materials.

2. Clean joint substrates to produce clean, sound surfaces capable of developing optimum bond with fill materials. Remove loose particles remaining from cleaning operation.

3. Remove laitance and form-release agents from concrete.

B. Masking Tape: Use masking tape to prevent fill materials of fire-resistive joint system from contacting adjoining surfaces that will remain exposed on completion of the Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove stains. Remove tape as soon as possible without disturbing fire-resistive joint system's seal with substrates.
3.03 INSTALLATION

A. General: Install fire-resistant joint systems to comply with manufacturer's written installation instructions and published drawings for products and applications indicated.

B. Install forming materials and other accessories of types required to support fill materials during their application and in position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.

1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of fire-resistant joint system.

C. Install fill materials for fire-resistant joint systems by proven techniques to produce the following results:

1. Fill voids and cavities formed by joints and forming materials as required to achieve fire-resistance ratings indicated.

2. Apply fill materials so they contact and adhere to substrates formed by joints.

3. For fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.04 IDENTIFICATION

A. Identify fire-resistant joint systems with preprinted metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches of joint edge so labels will be visible to anyone seeking to remove or penetrate joint system. Use mechanical fasteners or self-adhering-type labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:


2. Contractor's name, address, and phone number.

3. Designation of applicable testing agency.

4. Date of installation.

5. Manufacturer's name.

6. Installer's name.

3.05 FIELD QUALITY CONTROL

A. Inspecting Agency: Engage a qualified testing agency to perform tests and inspections.

B. Where deficiencies are found or fire-resistant joint systems are damaged or removed due to testing, repair or replace fire-resistant joint systems so they comply with requirements.

C. Proceed with enclosing fire-resistant joint systems with other construction only after inspection reports are issued and installations comply with requirements.
3.06 CLEANING AND PROTECTING

A. Clean off excess fill materials adjacent to joints as the Work progresses by methods and with cleaning materials that are approved in writing by fire-resistive joint system manufacturers and that do not damage materials in which joints occur.

B. Provide final protection and maintain conditions during and after installation that ensure fire-resistive joint systems are without damage or deterioration at time of Substantial Completion. If damage or deterioration occurs despite such protection, cut out and remove damaged or deteriorated fire-resistive joint systems immediately and install new materials to produce fire-resistive joint systems complying with specified requirements.

END OF SECTION
SECTION 07 92 00

JOINT SEALANTS

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes specifications for sealant and backing materials for sealing of joints in construction. In general this includes, but not limited to, the following:

1. Penetrations in exterior metal wall panel systems.
2. Perimeter joints between materials listed above and door frames, aluminum windows and, louvers.
3. Horizontal expansion joints.
4. Perimeter joints between interior wall surfaces and frames of doors, and windows.
5. All locations noted on Contract Drawings as sealant or caulking.
6. Tape for isolation and gasketing as indicated.

B. Related Sections: The work of the following Sections is related to the work of this Section. Other Sections, not referenced below, may also be related to the proper performance of this work.

1. Section 07 42 10, Metal Wall Panels.
2. Section 07 54 23, Thermoplastic Polyolefin (TPO) Roofing.
3. Section 07 62 00, Sheet Metal Flashing and Trim.
4. Section 07 84 00, Firestopping.

1.02 REFERENCES

A. This Section incorporates by reference the latest revisions of the following documents.

B. American Architectural Manufacturers Association (AAMA)
   1. AAMA 800: Voluntary Specifications and Test Methods for Sealants

C. American Society for Testing and Materials International (ASTM)
   1. ASTM C 834: Specification for Latex Sealing Compounds
   2. ASTM C 920: Specification for Elastomeric Joint Sealants
   3. ASTM C 1021: Practice for Laboratories Engaged in Testing of Building Sealants
   4. ASTM C 1085: Specification for Butyl Rubber-Based Solvent-Release Sealant


7. ASTM C 1248: Test Method for Staining of Porous Substrate by Joint Sealants

8. ASTM C 1281: Specification for Preformed Tape Sealants for Glazing Applications


11. ASTM E 548: Guide for General Criteria Used for Evaluating Laboratory Competence

1.03 SUBMITTALS

A. Procedures: Section 01 33 00, Submittal Procedures.

B. General: Identify areas of use by each product submitted according with Sealant Schedule in this Section.

C. Product Data: Submit manufacturer's technical data for each joint sealer product required, including instructions for joint preparation, primer (if required), and recommended back-up material.

D. Samples for Initial Selection: Submit initial color samples in the form of manufacturer’s bead samples consisting of strips of actual products showing full range of colors available for each product.

E. Certification: Submit written certification from sealant manufacturer stating that materials forming joint substrates and joint backings (e.g. concrete, fluoropolymer coatings) have been tested for compatibility and adhesion with proposed joint sealants and are suitable for the use intended as specified; certification shall state that proposed sealant has been tested for non-staining characteristics when applied to precast concrete. Include recommendations for primers and substrate preparation needed to obtain adhesion.

1.04 QUALITY ASSURANCE

A. Installer's Qualifications: Engage experienced Installers who have completed joint sealant applications similar in material, design, and extent to that indicated for Contract.

B. Single Source Responsibility: Obtain joint sealant materials for each application from a single manufacturer. Obtain exterior joint sealants between architectural precast concrete and face brick from one manufacturer.

C. Preconstruction Compatibility and Adhesion Testing: Prior to installation of joint sealants, field test their adhesion to joint substrates of each type encountered, and determine if priming and other specific joint preparation techniques are required. Perform tests under normal environmental conditions that will exist during actual installation in accordance with Field Quality Control requirements in this section. Schedule sufficient time for testing and analysis of results to prevent delay in the progress of the Work.
1.05 PROJECT CONDITIONS

A. Environmental Conditions: Do not proceed with installation of joint sealants under the following conditions:

1. Ambient and substrate temperature conditions are outside the limits permitted by joint sealant manufacturer or below 40 degrees F.
2. Joint substrates are wet due to rain, condensation or other causes.
3. Joint Width Conditions: Do not proceed with installation of joint sealant when joint widths are less than allowed by joint sealant manufacturer for application indicated.
4. Joint Substrate Conditions: Do not proceed with installation of joint sealants until contaminants capable of interfering with their adhesion are removed from joint substrates.

PART 2 - PRODUCTS

2.01 MATERIALS, GENERAL

A. Compatibility: Provide joint sealants, joint fillers, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.

B. Color And Texture Criteria (Exterior Exposed to View Locations): Unless noted otherwise provide color of joint sealant selected from manufacturer's standard colors.

C. Color Coated (PVDF) Aluminum Framing: Provide custom color to match the Resident Engineer's approved (PVDF) color sample.

D. Sealants (Type C) used in horizontal applications shall match adjacent color tone.

2.02 SEALANT TYPES AND MANUFACTURERS

A. Type "A" Sealant: Dow Corning "795 Building Sealant"; General Electric "Silglaze SSG4000"; Tremco "Spectrum 2"; or approved equal one-part, low-modulus silicone elastomeric sealant meeting requirements of ASTM C920, Type S, Grade NS, Class 25.

1. Application: Exposed exterior joints not subject to foot or vehicle traffic.

B. Type B: Self-leveling 2-part urethane meeting requirements of ASTM C920, Type M, Grade P, Class 25.

1. Application: Interior and exterior joints subject to foot or vehicle traffic.


1. Applications: Metal to metal open joints, either back groove or top of surface mounted flashing, exposed to weather, and for bedding thresholds and break formed flashings.

D. Type "D" Sealant: Geocel "834"; Pecora Chemical Corporation "AC-20 Acrylic Latex"; Sonneborn "Sonolac"; Tremco "Tremflex 834"; Sherwin-Williams "Pro Select 850A", or approved equal one part acrylic latex sealant complying with requirements of ASTM C834.
1. Applications: Interior joints not subject to traffic, except in wet areas.

E. Type "E" Sealant: Dow Corning "786 Mildew Resistant Silicone"; General Electric "SCS1702"; Pecora Corporation "898 Sanitary Mildew Resistant Silicone Sealant", or approved equal one part mildew resistant silicone sealant complying with requirements of ASTM C920, Type S, Grade NS, Class 25.

F. Type "F Series" Sealants: Non-curing, non-hardening, synthetic rubber sealer, recommended for use by manufacturer for concealed locations joint is where subject to changes in temperature, water and vibration.

1. Type "F-1": Tape consistency, solvent-free, butyl-based sealant with a solids content of 100%; meeting the requirements of AAMA 804.1-85 (as described in AAMA 800). Packaged in rolls with release paper backing.
   a. Acceptable products include:
      1) Tremco "440 Tape".
      2) Pecora, "Extru-Seal".
      3) PTI "606 Architectural Sealant Tape".
   b. Applications: Metal to metal, and dissimilar materials, compression joints subject to shear.

2. Type "F-2": Mastic consistency, one-part non-drying, non-hardening, non-bleeding and permanently resilient butyl sealant, meeting or exceeding ASTM C 1085.
   a. Acceptable products include:
      1) Bostik 5612
      2) Pecora, “BR-96”.
      3) Tremco “JS-773 Sealant”.
   b. Applications: Metal to metal laps, concealed compression joints.

2.03 TAPES

A. PVC Tape (Type "G"): Norton Norseal V740, or approved equal black PVC with self-adhesive backing; 1/8 inch thickness by 1/2 inch, nominal width, unless noted otherwise.

   1. Typical application: Gasket/sealant to reduce air movement, acoustical and vibration isolation and between dissimilar materials and elsewhere indicated.

2.04 COMPRESSIBLE SEAL

A. Expanding Foam Tape (Type "H"): Sandell Mfg. Co. Inn., “Polyseal”, Bosig “Wintape Expand 600”, or approved equal, self-expanding polyurethane foam impregnated with modified acrylic flame retarding polymer meeting UL 94 HF-1 (Self-Extinguishing).

   1. Typical application: For cold joints on exterior envelope components, interior side of window to WAB.
2.05 RELATED MATERIALS

A. Plastic Foam Backer Rod: ASTM C 1330. Preformed compressible, resilient, non-waxing, non-extruding foam, of size, shape and density to suit various conditions and control sealant depth. Provide open or closed cell as recommended by sealant manufacturer.

B. Backer rod type recommended for compatible with sealant by sealant manufacturer, and of type which does not cause staining or discoloration of joint based on field experience and laboratory testing.

C. Sizes as recommended by sealant manufacturer, with diameter never less than 30 percent greater than width of joint.

D. Bond Breaker Tape: Polyethylene tape or other plastic tape as recommended by sealant manufacturer for preventing bond between sealant and back surface of joint. Provide self-adhesive tape wherever applicable.

E. Primer: Provide type recommended by joint sealer manufacturer where required for adhesion of sealant to joint substrates indicated.

F. Cleaners for Nonporous Surfaces: Provide non-staining, chemical cleaner of type acceptable to manufacturer of sealant and sealant backing materials, which are not harmful to substrates and adjacent nonporous materials, and which do not leave oily residues or otherwise have a detrimental effect on sealant adhesion or in-service performance.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances and other conditions affecting joint sealant performance. Do not proceed with joint sealer work until unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Cleaning of Joints: Clean joints immediately before installing joint sealers to comply with recommendations of joint sealer manufacturers and the following requirements:

B. Edges of precast concrete and face brick shall be sound, smooth, clean, and dry. Clean joint surfaces by light abrasive blast, free from dirt, dust, and all other contaminants that may affect adhesion such as form release agents, retarders, or sealers.

C. Remove lacquers and protective films from metal surfaces. Clean metal, glass, and other nonporous surfaces by chemical cleaners or other means which are not harmful to substrates or leave residues capable of interfering with adhesion of joint sealants.

D. Jointing Priming: Prime joint substrates where recommended by joint sealer manufacturer based on preconstruction compatibility and adhesion testing or prior experience. Apply primer undiluted in uniform coating over surface. Confine primers to areas of joint sealer bond; do not allow spillage or migration onto adjoining surfaces.

E. Masking Tape: Apply masking tape around joints where required to prevent contact of sealant with adjoining surfaces which otherwise would be stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.
3.03 SEALANT APPLICATION

A. General: Comply with joint sealer manufacturer's printed installation instructions applicable to products and applications indicated, except where more stringent requirements apply.

B. Installation Standards: Comply with recommendations of ASTM C1193 for use of joint sealants as applicable to materials, applications and conditions indicated.

C. Installation of Sealant Backings:

D. Install backer rods in all butt type joints receiving sealant where depth of joint exceeds manufacturer's recommendations. Install joint filler using a blunt tool or plain faced roller. Do not puncture, stretch, or twist joint fillers.

E. Do not leave gaps between ends of joint fillers. Remove joint fillers that become wet prior to sealant application and replace with dry material.

F. Generally, install joint fillers to a depth of 1/4 inch below surface of joint. Where depth of joint is not sufficient to require joint filler, install bond breaker tape to cover full width and length of joint cavity to prevent three sided adhesion.

G. Joint Width: Width-to-depth ratio of sealant as recommended by sealant manufacturer. Do not exceed a depth of 1/2 inch when joint is 1/2 inch wide; joints exceeding 1/2 inch in width shall not exceed 1/4 inch in depth.

H. Mixing: Mix two component sealant in accordance with manufacturer's directions using premeasured units. Do not thin or adulterate sealant in any way.

I. Installation of Sealants: Apply sealant over backing to uniform thickness in continuous beads, filling all joints and voids solid; superficial pointing with skim bead will not be accepted. Use nozzle of proper size to completely fill the joints.

J. Tooling of Nonsag Sealants: Immediately after sealant application and prior to time skinning or curing begins, tool sealants to form smooth, uniform beads, free of air pockets; ensure contact and adhesion of sealant with sides of joint. Remove excess sealants from surfaces adjacent to joint.

K. Provide concave joint configuration, unless noted otherwise.

L. Do not use tooling agents which discolor sealants or adjacent surfaces or are not approved by sealant manufacturer.

M. Pourable sealants shall be applied by gun or by pouring, filling the joint completely with a slight recessed finish. Additional material shall be added if low spots develop. Seal along outside slab edges of joints to prevent water from entering cavity formed by backer rod.

3.04 FIELD QUALITY CONTROL

A. General: Test sealants in accordance with ASTM C 1021 and as follows:

B. Field-Adhesion Testing: Perform Field-test of joint-sealant in accordance with test recommended in ASTM C 1193, except as modified below. Method described is similar to method described in less detail in AAMA's "Aluminum Curtain Wall Series No. 13" and in SWRI's "Sealants: The Professionals' Guide."

1. Extent of Testing: Test completed elastomeric sealant joints as follows:
a. Perform ten tests for the first 1000 feet of joint length for each type of elastomeric sealant and joint substrate.

2. Test Method: Test joint sealants by hand-pull method described below:
   a. Make knife cuts from one side of joint to the other, followed by two cuts approximately 2 inches long at sides of joint and meeting cross cut at one end. Place a mark 1 inch from cross-cut end of 2-inch piece.
   b. Use fingers to grasp 2-inch piece of sealant between cross-cut end and 1-inch mark; pull firmly at a 90-degree angle or more in direction of side cuts while holding a ruler along side of sealant. Pull sealant out of joint to the distance recommended by sealant manufacturer for testing adhesive capability, but not less than that equaling specified maximum movement capability in extension; hold this position for 10 seconds.
   c. For joints with dissimilar substrates, check adhesion to each substrate separately. Do this by extending cut along one side, checking adhesion to opposite side, and then repeating this procedure for opposite side.

C. Inspect joints for complete fill, for absence of voids, and for joint configuration complying with specified requirements. Record results in a field adhesion test log.
   1. Inspect tested joints and report on the following:
      a. Whether sealants in joints connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each type of product and joint substrate. Compare these results to determine if adhesion passes sealant manufacturer's field-adhesion hand-pull test criteria.
      b. Whether sealants filled joint cavities and are free from voids.
      c. Whether sealant dimensions and configurations comply with specified requirements.

D. Record test results in a field adhesion test log. Include dates when sealants were installed, names of persons who installed sealants, test dates, test locations, whether joints were primed, adhesion results and percent elongations, sealant fill, sealant configuration, and sealant dimensions.

E. Repair sealants pulled from test area by applying new sealants following same procedures used to originally seal joints. Ensure that original sealant surfaces are clean and new sealant contacts original sealant.

F. Evaluation of Field-Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements, will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.
3.05 CLEANING

A. Clean off excess sealants or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

END OF SECTION
SECTION 07 95 13
EXPANSION JOINT COVER ASSEMBLIES

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes specifications for expansion joint assemblies for floor, wall, ceiling and soffit surfaces as detailed on Drawings or required. (EJ-1, EJ-2, EJ-3, EJ-4, EJ-5, EJ-6, EJ-7, EJ-8)

B. Related Sections: The work of the following Sections is related to the work of this Section. Other Sections, not referenced below, may also be related to the proper performance of this work.

1. Section 03 11 00, Concrete Forming: Placement of joint assembly frames in formwork.
2. Section 03 30 00, Cast-in-Place Concrete: Expansion and contraction joints in exterior concrete joints.
3. Section 04 20 00, Unit Masonry: Placement of joint assembly frames in masonry.

1.02 REFERENCES

A. This Section incorporates by reference the latest revisions of the following documents.

1. American Society for Testing and Materials International (ASTM)
   a. ASTM B 221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes

1.03 SUBMITTALS

A. Procedures: Section 01 33 00, Submittal Procedures.

B. Product Data: Provide joint assembly profiles, profile dimensions, anchorage devices, available colors and finish.

C. Shop Drawings: Indicate joint and splice locations, miters, layout of the work, affected adjacent construction and anchorage locations.

D. Samples: Submit two samples 6 inches long each, illustrating profiles, dimensions, colors, and finishes selected.

E. Manufacturer's Installation Instructions: Indicate rough-in sizes; provide templates for cast-in or placed frames or anchors; required tolerances for item placement.

1.04 QUALITY ASSURANCE

A. Field Measurements: Verify compliance with manufacturer's requirements.
PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Expansion Joint Cover Assemblies:
   1. Architectural Art Mfg., Inc.
   2. Balco, Inc.
   3. Construction Specialties, Inc.
   4. InPro Corp. (Jointmaster).
   5. Michael Rizza Co. (Rizza)
   6. MM Systems Corp.
   7. Substitutions: See Section 01 60 00, Product Requirements.

2.02 MATERIALS

C. Threaded Fasteners: Stainless steel.
D. Backing Paint: Asphalitic type.

2.03 JOINT COVER ASSEMBLIES:

A. EJ-1: Exterior Roof - Curb to Curb
   1. Basis of Design: Rizza "Roof Seal" with continuous waterstop membrane (gutter)
   2. Exterior seal: Neoprene extrusion half-round with flanges.
   3. Secondary Seal: Continuous closed cell neoprene or EPDM.
   4. Accessories: Splicing kit for in-line splices and factory transition to vertical joint.

B. EJ-2: Vertical wall joint
   1. Basis of Design: Rizza "Exterior Vertical Seal".
   2. Frame: Continuous extruded aluminum with mill finish; provide continuous extruded aluminum pan nosing and turn bar frame.
   3. Exterior Weather Seal: Extruded neoprene; continuous flush profile.
   4. Secondary Seal: Continuous closed cell neoprene or EPDM.

C. EJ-3: Floor to floor, Metal
   1. Basis of Design: Construction Specialties PTC Series; accommodating movement on x, y, and z axis.
2. Frame: Continuous extruded aluminum with mill finish; provide continuous extruded aluminum pan nosing and turn bar frame.

3. Floor plate: Extruded aluminum.

4. Secondary Seal: Continuous closed cell neoprene or EPDM.

5. Installation accessory: Elastomeric concrete.

D. EJ-4: Floor to wall, Metal

1. Basis of Design: Construction Specialties PTCW Series; accommodating movement on x, y, and z axis.

2. Frame: Continuous extruded aluminum with mill finish; provide continuous extruded aluminum pan nosing and turn bar frame.

3. Floor plate: Extruded aluminum.

4. Secondary Seal: Continuous closed cell neoprene or EPDM.

5. Installation accessory: Elastomeric concrete.

E. EJ-5: Floor to floor, Rubber, small joint:


2. Construction: Extruded neoprene "hybrid" compression seal.


F. EJ-6: Floor to floor, Rubber, wide joint


2. Construction: Extruded EPDM bellows compression seal with integral nosing extensions.


G. EJ-7: Wall-to-wall at floor; Elevator 1 & 2 shaft where there is differential movement between shaft and floor slab.


2. Construction: Extruded aluminum cover plate fastened to one side of joint and free to move at opposite side; captured gaskets both sides.

3. Installation: Surface mounted using drilled-in anchors or screws.

H. EJ-8: Flush wall to wall cover at personnel door frame at mezzanine level.


2. Frame: Extruded aluminum receivers with mill finish; continuous both sides of joint.


2.04 FABRICATION

A. Joint Covers: Aluminum cover plate, aluminum frame construction, retainers with resilient elastomeric filler strip, designed to permit plus or minus 50 percent joint movement with full recovery, flush mounted.

2.05 FINISHES

A. Floors: Non-slip surfacing of aluminum oxide grit.
B. Walls and Ceilings: Clear anodized.
C. Resilient Filler Exposed to View: Gray.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that joint preparation and affected dimensions are acceptable.

3.02 PREPARATION

A. Provide anchoring devices for installation and embedding under Section 03 11 00, Concrete Forming.
   1. Provide templates and rough-in measurements.

3.03 INSTALLATION

A. Install components and accessories in accordance with manufacturer’s instructions.
B. Align work plumb and level, flush with adjacent surfaces.
C. Rigidly anchor to substrate to prevent misalignment.

3.04 PROTECTION

A. Do not permit traffic over unprotected floor joint surfaces.

END OF SECTION
CONTRACT SPECIFICATIONS

SECTION 08 11 13
HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes specifications for:
   1. Non-fire-rated steel doors and frames.
   2. Fire-rated steel doors and frames.
   3. Thermally insulated steel doors.
   4. Steel glazing (relite) frames.
   5. Accessories, including glazing and matching panels.

B. Related Sections: The work of the following Sections is related to the work of this Section. Other Sections, not referenced below, may also be related to the proper performance of this work.

   1. Section 04 20 00, Unit Masonry: Grouting of frames in masonry walls.
   2. Section 08 71 00, Door Hardware.
   3. Section 08 80 00, Glazing: Glass for doors and borrowed lites.
   4. Section 09 90 00, Painting and Coating: Field painting.

1.02 REFERENCES

A. This Section incorporates by reference the latest revision of the following documents.

   1. American National Standards Institute (ANSI), International Code Council (ICC)
      b. ANSI A250.3 - Test Procedure and Acceptance Criteria for Factory-Applied Finish Painted Steel Surfaces for Steel Doors and Frames
      c. ANSI A250.8 - SDI-100 Recommended Specifications for Standard Steel Doors and Frames
      d. ANSI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames

      a. ASTM A 653/A 653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
3. Door and Hardware Institute (DHI)
   a. DHI A115 Series - Specifications for Steel Doors and Frame Preparation for Hardware; Door and Hardware Institute (ANSI/DHI A115 Series).

4. The National Association of Architectural Metal Manufacturers (NAAMM)
   a. NAAMM HMMA 840 - Guide Specifications for Installation and Storage of Hollow Metal Doors and Frames

5. National Fire Protection Association (NFP)
   a. NFPA 80 - Standard for Fire Doors and Fire Windows

6. Underwriters Laboratories Inc. (UL)
   a. UL (BMD) - Building Materials Directory
   b. UL 1784 - Standard for Air Leakage Tests of Door Assemblies.

1.03 SUBMITTALS
A. Procedures: Section 01 33 00, Submittal Procedures.
B. Product Data: Materials and details of design and construction, hardware locations, reinforcement type and locations, anchorage and fastening methods, and finishes; and one copy of referenced grade standard.
C. Shop Drawings: Details of each opening, showing elevations, glazing, frame profiles, and identifying location of different finishes, if any.
D. Samples: Submit two samples of metal, 2 by 2 inches in size showing factory finishes, colors, and surface texture.
E. Installation Instructions: Manufacturer's published instructions, including all special installation instructions relating to this project.

1.04 QUALITY ASSURANCE
A. Manufacturer: Company specializing in manufacturing the products specified in this section with minimum 3 years documented experience.
B. Maintain at the project site a copy of all reference standards dealing with installation.

1.05 DELIVERY, STORAGE, AND HANDLING
A. Store in accordance with NAAMM HMMA 840.
B. Protect with resilient packaging; avoid humidity build-up under coverings; prevent corrosion.

PART 2 - PRODUCTS

2.01 MANUFACTURERS
A. Steel Doors and Frames:
1. Amweld Building Products, LLC.
2. Benchmark; a division of Therma-Tru Corporation.
3. Ceco Door Products; an Assa Abloy Group company.
4. Curries Company; an Assa Abloy Group company.
5. Deansteel Manufacturing Company, Inc.
6. Fleming Door Products Ltd.; an Assa Abloy Group company.
8. Kewanee Corporation (The).
10. Security Metal Products Corp.
11. Steelcraft; an Ingersoll-Rand company.

2.02 MATERIALS

A. Doors and Frames

1. Requirements for All Doors and Frames:
   b. Door Top Closures: Flush with top of faces and edges.
   c. Door Edge Profile: Beveled on both edges.
   d. Door Texture: Smooth faces.
   e. Glazed Lights: Non-removable stops on non-secure side; sizes and configurations as indicated on Contract Drawings.
   f. Hardware Preparation: In accordance with DHI A115 Series, with reinforcement welded in place, in addition to other requirements specified in door grade standard.
   g. Galvanizing for Units in Wet Areas: All components hot-dip zinc-iron alloy-coated (galvannealed), ASTM A 653, A40 coating thickness.
   h. Finish: Factory primed, for field finishing.

2. Combined Requirements: If a particular door and frame unit is indicated to comply with more than one type of requirement, comply with all the specified requirements for each type; for instance, an exterior door that is also indicated as being sound-rated must comply with the requirements specified for exterior doors and for sound-rated doors; where two requirements conflict, comply with the most stringent.

B. Steel Doors

1. Exterior Doors:
a. Grade: ANSI A250.8 Level 3, physical performance Level A, Model 2, seamless.
b. Galvanizing: All components hot-dipped zinc-iron alloy-coated (galvannealed) in accordance with ASTM A 653/A 653M, with manufacturer's standard coating thickness.

2. Thermal-Rated (Insulated) Doors: For exterior doors enclosing conditioned space provide doors fabricated with thermal-resistance value (R-value) of not less than 6.0 when tested according to ASTM C 1363.

3. Interior Doors, Non-Fire-Rated:
   a. Grade: ANSI A250.8 Level 1, physical performance Level C, Model 1, full flush.

4. Interior Doors, Fire-Rated:
   a. Grade: ANSI A250.8 Level 2, physical performance Level B, Model 1, full flush.
   b. Fire Rating: As indicated on Door and Frame Schedule, tested in accordance with UL 10C ("positive pressure").
      1) Provide units listed and labeled by UL.
      2) Attach fire rating label to each fire rated unit.
   c. Smoke and Draft Control Doors (Indicated as "S" on Drawings): In addition to required fire rating, provide door assemblies tested in accordance with UL 1784 with maximum air leakage of 3.0 cubic feet per minute per square foot of door opening at 0.10 inch water gage. pressure at both ambient and elevated temperatures; with "S" label; if necessary, provide additional gasketing or edge sealing.

5. Panels: Same construction, performance, and finish as doors.

C. Steel Frames

1. General:
   a. Comply with the requirements of grade specified for corresponding door.
      1) ANSI A250.8 Level 3 Doors: Minimum 14 gage frames (typical, unless noted or specified otherwise).
   b. Finish: Same as for door where doors are not factory-finished.
   c. Provide mortar guard boxes for hardware cut-outs in frames to be installed in masonry.
   d. Frames in Masonry Walls: Size to suit masonry coursing with head member 4 inches high to fill opening without cutting masonry units.
   e. Frames Wider than 48 Inches: Reinforce with steel channel fitted tightly into frame head, flush with top.

2. Exterior Door Frames: Face welded, seamless with joints filled.
a. Galvanizing: All components hot-dip zinc-iron alloy-coated (galvannealed) in accordance with ASTM A 653/A 653M, with manufacturer's standard coating thickness.

b. Weatherstripping: Separate, see Section 08 71 00, Door Hardware.

   a. Finish: Factory primed, for field finishing.

   a. Fire Rating: Same as door, labeled.

5. Frames for Interior Glazing or Borrowed Lights (Relites): Construction and face dimensions to match door frames, and as indicated on Contract Drawings.

D. Accessory Materials

1. Glazing: As specified in Section 08 80 00, Glazing, factory installed.

2. Removable Stops: Formed sheet steel, shape as indicated on Contract Drawings, mitered or butted corners; prepared for countersink style tamper proof screws.

3. Astragals for Double Doors: Specified in Section 08 71 00, Door Hardware.
   a. Fire-Rated Doors: Steel, shape as required to accomplish fire rating.

4. Silencers: Resilient rubber, fitted into drilled hole; three on strike side of single door, three on center mullion of pairs, and two on head of pairs without center mullions.

5. Temporary Frame Spreaders: Provide for all factory- or shop-assembled frames.

E. Finish Materials

1. Primer: Rust-inhibiting, complying with ANSI A250.10, door manufacturer's standard.
   a. Siliconized primers are not compatible with finish paints specified and are not permitted.

2. Bituminous Coating: Asphalt emulsion or other high-build, water-resistant, resilient coating.

PART 3 - EXECUTION

3.01 EXAMINATION

   A. Verify existing conditions before starting work.

   B. Verify that opening sizes and tolerances are acceptable.
3.02 PREPARATION
A. Coat inside of frames to be installed in masonry or to be grouted, with bituminous coating, prior to installation.
B. Coat inside of grouted frames with bituminous coating to a thickness of 1/16 inch.

3.03 INSTALLATION
A. Install in accordance with the requirements of the specified door grade standard and NAAMM HMMA 840.
B. In addition, install fire rated units in accordance with NFPA 80.
C. Coordinate frame anchor placement with wall construction.
D. Grouting Door Frames:
   1. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout. Grout and installation are work of Section 04 20 00, Unit Masonry.
   2. Concrete Walls: Do not grout frames.
   3. Metal Stud-Framed Walls: Do not grout frames.
E. Coordinate installation of hardware.
F. Coordinate installation of glazing.
G. Coordinate installation of electrical connections to electrical hardware items.
H. Touch up damaged factory finishes.

3.04 CONSTRUCTION
A. Erection Tolerances
   1. Clearances Between Door and Frame: As specified in ANSI A250.8.
   2. Maximum Diagonal Distortion: 1/16 in measured with straight edge, corner to corner.

3.05 ADJUSTING
A. Adjust for smooth and balanced door movement.

3.06 SCHEDULES
A. Refer to Door and Frame Schedule on the Contract Drawings.

END OF SECTION
PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes specifications for:
   1. Access door and frame units, fire-rated, in wall, ceiling, and floor locations.
   2. Sidewalk access doors in bridge walkway.
   3. Access doors indicated in the contract documents, or otherwise required to access concealed construction requiring regular maintenance or repair.

B. Related Sections

   1. Related Sections: The work of the following Sections is related to the work of this Section. Other Sections, not referenced below, may also be related to the proper performance of this work.
      a. Section 03 30 00, Cast-In-Place Concrete: Installation of sidewalk door frames.
      b. Section 09 21 16, Gypsum Board Assemblies.
      c. Section 09 90 00, Painting and Coating.
      d. Division 23, Mechanical: Mechanical requirements through finished walls and ceilings.
      e. Division 26, Electrical: Electrical requirements for access panels through finished walls and ceilings.

1.02 REFERENCES

A. This Section incorporates by reference the latest revisions of the following documents.

   1. Underwriters Laboratories (UL)
      a. UL (FRD) - Fire Resistance Directory

1.03 SYSTEM DESCRIPTION

A. Design Requirements

   1. Fabricate floor access assemblies to support live load of 100 pounds per square foot with deflection not to exceed 1/180 of span.

B. Regulatory Requirements

   1. Conform to Seattle Building Code requirements for fire-rated access doors.
a. Provide access doors of fire-rating equivalent to the fire-rated assembly in which they are to be installed. Fire rated-door assemblies shall comply with NFPA 80.

2. Provide products listed and labeled by UL as suitable for the purpose specified and indicated. Test for vertical installations: ASTM E 152. Test for horizontal installations: ASTM E 119.

1.04 SUBMITTALS
A. Procedures: Section 01 33 00, Submittal Procedures.
B. Product Data: Provide a schedule of access doors including sizes, types, finishes, hardware, locations, finishes, profiles, and details of adjoining work.
C. Shop Drawings: Indicate exact position of all access door units, details of frames, anchorage, and accessory items.
D. Project Record Documents: Record actual locations of all access units.
E. Closeout: Submit keys to the Project Engineer.

1.05 PROJECT CONDITIONS
A. Coordinate the work with other work requiring access doors. Determine specific locations and sizes needed to gain access to concealed equipment, and indicate on schedule specified in Article 1.04, herein.

PART 2 - PRODUCTS

2.01 MANUFACTURERS
A. Access Doors: Acceptable manufacturers include:
   1. Acudor Products Inc.
   2. The Bilco Company.
   3. The Williams Brothers Corporation of America
   4. Milcor Inc.
   5. Nystrom Products Co.

2.02 MATERIALS
A. Steel Sheet: ASTM A 366/A 366 M commercial quality, cold-rolled steel sheet with baked-on, rust-inhibitive primer for interior doors
B. Zinc-Coated Steel Sheet: ASTM A 591/A 591 M, electrolytic zinc-cated steel sheet with Class C coating and phosphate treatment to prepare surface for painting for all exterior doors.
C. Aluminum Extrusions: ASTM B 221, Alloy 6063-T6.
   1. Mill finish, AA-M10 (Mechanical Finish: as fabricated, unspecified).

1. Mill finish, AA-M10 (Mechanical Finish: as fabricated, unspecified).
2. Non-slip finish: Bonded aluminum oxide grit or proprietary plasma-bonded metal matrix such as W.S. Molnar "Slip-Not" or IKG "Mebac".
   a. Static coefficient of friction not less than 0.80, wet condition, as determined by ASTM C 1028.

2.03 MANUFACTURED UNITS

A. Access Doors and Panels

1. All Units: Factory fabricated, fully assembled units with corner joints welded, filled, and ground flush; square and without rack or warp; coordinate requirements with assemblies units are to be installed in.

B. Access Door Units – Walls and Ceilings

1. Door and Frame Units with Exposed Trim: Formed steel.
   a. Metal for frames and flanges: 0.058 inch steel.
   b. Trim: 1-inch flange overlapping surfaces surrounding door frame

2. Trimless Flush Frame Units:
   a. Metal: 0.058 inch steel
   b. Frame Configuration: Minimum 16 gage steel flange integral with frame and overlapping face of adjoining gypsum board, with surface formed to receive joint compound
   c. Door panels: 0.070 inch (14 gage) single thickness steel sheet.
   d. Sizes:
      1) Walls: 12 x 12 inches.
      2) Ceilings: 12 x 12 inches.
      3) Man entry: To fit masonry opening 24 inches wide x 40 inches high.

3. Hardware:
   b. Lock: Flush cylinder lock with latch, two keys for each unit.

4. Fire Ratings: Match rating of the partition or floor/ceiling assembly in which the access panel is to be installed.
   a. Galvanized, hot dipped finish.
5. Finish: Phosphate-treated with manufacturer’s standard electrostatically-applied baked-enamel finish.
   a. Prime coat with alkyd primer.

C. Access Units - Interior Floors

   a. Frames and anchors: 0.058 inch thick.
   b. Type and Size: As indicated on Contract Drawings.
   c. Hardware:
      1) Hinge: 175 degree steel hinges with removable pin.
      2) Lock: Screw driver slot for quarter turn cam lock.
      3) Removable wrench lift handle.
   d. Galvanized, hot dipped finish.
   e. Prime coat with alkyd primer.

D. Watertight Aluminum Sidewalk Access Door: Single-leaf opening. Extruded-aluminum gutter frame with NPS 1-1/2 drainage coupling and 1/4-inch-thick, non-slip finish aluminum plate door; watertight; loading capacity to support 300-lbf/sq. ft. pedestrian live load.

   1. Hardware: Provide the following:
      a. Hinges: Heavy-duty, aluminum or stainless-steel butt hinges with stainless-steel pins.
      b. Lift mechanism: Adjustable counterbalancing springs and heavy-duty hold-open arm that automatically locks door open at 90 degrees
      c. Latch: Stainless-steel slam latch.
      d. Lock: Keyed deadlock bolt
      e. Hardware Material: Stainless steel, including latch and lifting mechanism assemblies, hold-open arms, and all brackets, hinges, pins, and fasteners.

2.04 FABRICATION

A. Manufacture each access door assembly as an integral unit ready for installation.

B. Weld, fill, and grind joints to ensure flush and square unit. Construction should be continuous, and welded. Grind welds smooth and flush with adjacent surfaces. Furnish attachment devices and fasteners of type required to secure access panels to types of supports indicated.

   1. For exposed flange units, provide 1 inch (nominal) wide trim around perimeter of frame.
2. For gypsum board assemblies, furnish frames with edge trim for gypsum board or gypsum base.

3. For masonry installations, furnish frames with adjustable metal masonry anchors.

C. Recessed Panel Doors: Form face of panel to provide recess for application of applied finish. Reinforce panel as required to prevent buckling.
   1. Furnish recessed panel doors for concealed installation in acoustic tile ceiling systems.
   2. Furnish recessed panel doors and frames for concealed installation in gypsum wall board

D. Locking Devices: Furnish as required to hold door in flush smooth plane when closed. Provide 2 keys per lock and key all locks alike. Provide access sleeves and plastic grommets installed in holes cut through finish for recessed panel doors.

E. Extruded Aluminum: After fabrication, apply manufacturer's standard protective coating on aluminum that will come in contact with concrete.

PART 3 - EXECUTION

3.01 EXAMINATION
   A. Verify that rough openings for door and frame are correctly sized and located. Coordinate installation with mechanical and electrical.

   B. Advise Installers of other work about specific access door installation requirements, including sizes of openings, locations of supports, inserts, and anchoring devices. Furnish inserts and anchoring devices for access doors that must be built into other construction. Coordinate delivery with other work to avoid delay.

3.02 INSTALLATION
   A. Install units in accordance with manufacturer's instructions.

   B. Install frames plumb and level in openings. Secure rigidly in place, with plane of face panels aligned with adjacent finished surfaces.

   C. Position units to provide convenient access to the concealed work requiring access.

3.03 ADJUSTING
   A. Adjust hardware and panels after installation for proper operation.

   B. Remove and replace panels or frames which are warped, bowed, or otherwise damaged.

END OF SECTION
SECTION 08 33 26
OVERHEAD COILING GRILLES

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes specifications for:
   1. Overhead coiling metal grilles and operating hardware, electric operation.
   2. Wiring from electric circuit disconnect to operator and wiring to control station.

B. Related Sections: The work of the following Sections is related to the work of this Section. Other Sections, not referenced below, may also be related to the proper performance of this work.
   1. Section 08 71 00, Door Hardware: Cylinder cores and keys.
   2. Section 26 05 25, Wire and Cable: Conduit from electric circuit to operator and from operator to control station.

1.02 REFERENCES

A. This Section incorporates by reference the latest revisions of the following documents.
   1. American Society for Testing and Materials International (ASTM)
      a. ASTM A 666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
   2. National Electrical Manufacturers Association (NEMA)
      a. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum);
      b. NEMA ICS 2 - Industrial Control and Systems: Controllers, Contactors, and Overload Relays, Rated Not More Than 2000 Volts AC or 750 Volts DC; National Electrical Manufacturers Association.
      c. NEMA MG 1 - Motors and Generators; National Electrical Manufacturers Association.
   3. Underwriters Laboratories Inc. (UL)
      a. UL (EAUED) - Electrical Appliance and Utilization Equipment Directory;
1.03 SYSTEM DESCRIPTION

A. Regulatory Requirements

1. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.04 SUBMITTALS

A. Procedures: Section 01 33 00, Submittal Procedures.

B. Product Data: Submit general construction, component connections and details, and electrical equipment including motors.

C. Shop Drawings: Indicate details and dimensions of installation including tracks, structural supports, connection points, anchorage methods, closures, hardware locations, locations of control boxes and installation details.

D. Wiring Diagrams: Submit for coordination with the electrical subcontractor.

E. Samples: Submit four each grille members, 8 by 10 inch in size illustrating shape, color and finish texture.

F. Manufacturer’s Instructions: Indicate installation sequence and procedures, adjustment and alignment procedures.

G. Maintenance Data: Indicate lubrication requirements and frequency.

H. Warranty:

1. Draft: Submit draft of manufacturer's warranty. Draft warranty shall be submitted concurrent with shop drawings.

2. Executed Warranty: Submit at time of Project Closeout; include in Operation and Maintenance Manual specified in Section 01 78 23, Operations and Maintenance Data.

1.05 WARRANTY:

A. Special Warranty: Furnish door manufacturer's single source warranty agreeing to repair or replace counterbalance mechanism should any failure or malfunction occur prior to reaching 20,000 cycles; all other components shall be warranted for a period of two (2) years from date of Substantial Completion. Warranty shall be inclusive of all labor and materials, and not limited to original cost of materials and labor.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Overhead Coiling Grille Manufacturers:


5. Substitutions: See Section 01 60 00, Product Requirements.

2.02 MATERIALS
A. Aluminum: ASTM B 221 (ASTM B 221M).
B. Stainless Steel: ASTM A 666, Type 304, rollable temper.

2.03 COMPONENTS
A. Grille and Components
1. Grille: Aluminum; horizontal bar curtain, coiling on overhead counterbalanced shaft.
   a. Finish: As selected.
   b. Lock: Inside cylinder lock.
   c. Manual hand crank lift operation to open in event of power failure.
   d. Electric operation for typical use.
   e. Mounting: Within framed opening.
2. Curtain: Round horizontal bars connected with vertical links.
   a. Horizontal bars: 5/16 inch diameter.
   b. Bar spacing: 1 1/2 inch on center.
   c. Tube spacers: 1/2 inch diameter.
   d. Spacer spacing: 3 1/4 inch on center.
   e. Vertical links: 5/8 by 1/8 inch flat bar.
   f. Link spacing: 6 inch on center.
   g. Bar Ends: Provide with nylon runners for quiet operation.
3. Guides: Stainless steel angles, of profile to retain grille in place, mounting brackets of same metal.
4. Hood Enclosure: Sheet metal same material as grille; 20 gage; finish to match.
5. Hardware:
   a. Lock Cylinders: Specified in Section 08 71 00, Door Hardware.
   b. Latch Handle: Interior and exterior handle.
   c. Operator Interlock: Provide interlock for operator to prevent actuation of operator when grille is latched.
6. **Roller Shaft Counterbalance:** Steel pipe and helical steel spring system, capable of producing torque sufficient to ensure smooth operation of curtain from all positions and capable of holding position at mid-travel; with adjustable spring tension; requiring 25-pound nominal force to operate.

### 2.04 EQUIPMENT

#### A. Electric Operation

1. **Electric Operators:**
   
   a. **Mounting:** Side mounted.
   
   b. **Motor Enclosure:**
      
      1) **Exterior grilles:** NEMA MG 1 Type 4; open drip proof.
      
      2) **Interior grilles:** NEMA MG 1 Type 1; open drip proof.
   
   c. **Motor Rating:** 1/2 hp; continuous duty.
   
   d. **Motor Voltage:** 120 volt, single phase, 60 Hz.
   
   e. **Motor Controller:** NEMA ICS 2, full voltage, reversing magnetic motor starter.
   
   f. **Controller Enclosure:** NEMA 250 Type 1.
   
   g. **Opening Speed:** 12 inches per second.
   
   h. **Brake:** Adjustable friction clutch type, activated by motor controller.
   
   i. **Manual override in case of power failure.**

2. **Control Station:** Standard three-position key switch momentary control for each operator.
   
   a. **24 volt circuit.**
   
   b. **Exterior type; flush mounted in single gang box.**
   
   c. **Lock Cylinders:** Provide cylinders specified in 08 71 00, Door Hardware, and keyed to building keying system.
   
   d. **Keys:** Two for each cylinder.
   
   e. **Basis of design:** MMTC, Inc., model HB FX-1.

3. **Safety Edge:** Located at bottom of curtain, full width, electro-mechanical sensitized type, wired to stop operator upon striking object, hollow neoprene covered.

4. **Remote Monitoring and Control:** Provide Remote Interface Terminal Strip inside the door control station for remote monitoring and control of coiling door or grille through dry contacts.
   
   a. **Terminal blocks shall accept up to #14AWG wire.**
b. Wire to left side of terminal blocks. Right side for remote interface terminations by others.

c. Two terminal blocks per monitoring or control.

d. Label blocks as shown in the table below.

e. Point functionality as defined in table below.

f. Wetting voltage nominally 24VDC.

<table>
<thead>
<tr>
<th>Remote Interface Terminal Strip</th>
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<tbody>
<tr>
<td><strong>Term Block Label</strong></td>
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PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that opening sizes, tolerances and conditions are acceptable.

3.02 INSTALLATION

A. Install grill unit assembly in accordance with manufacturer’s instructions.

B. Use anchorage devices to securely fasten assembly to wall construction and building framing without distortion or stress.

C. Securely and rigidly brace components suspended from structure. Secure guides to structural members only.

D. Fit and align assembly including hardware; level and plumb, to provide smooth operation.

E. Coordinate installation of electrical service and functioning wiring from disconnect to all unit components with the requirements of Division 26, Electrical.
3.03 CONSTRUCTION

A. Erection Tolerances
   1. Maintain dimensional tolerances and alignment with adjacent work.
   3. Maximum Variation From Level: 1/16 inch.

3.04 ADJUSTING

A. Adjust grille, hardware and operating assemblies for smooth and noiseless operation.

3.05 CLEANING

A. Clean grille and components.
B. Remove labels and visible markings.

END OF SECTION
SECTION 08 44 10
GLAZED ALUMINUM-FRAMED STOREFRONTS AND CURTAIN WALLS

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes specifications for:
   1. Aluminum-framed, face-glazed curtain wall assemblies, with transparent vision glazing.
      a. CW-1: Two sided silicone structural glazing. Caps on vertical mullions and horizontals structural silicone glazed.
      b. CW-2: Four sided silicone structural glazing.
   2. Delegated engineering design to meet performance requirements/  
   3. Perimeter sealant.

B. Related Sections: The work of the following Sections is related to the work of this Section. Other Sections, not referenced below, may also be related to the proper performance of this work.
   1. Section 03 11 00 - Concrete Forming: Placement of weld plates embedded in concrete for attachment of anchors.
   2. Section 05 05 14, Fluropolymer Coating.
   3. Section 05 12 00, Structural Steel Framing: Steel attachment members.
   4. Section 05 50 00, Metal Fabrications: Steel attachment devices and supplemental supports.
   5. Section 07 92 00, Joint Sealants: Perimeter sealant and back-up materials.
   6. Section 08 80 00, Glazing: Glazing requirements for work of this Section.

1.02 REFERENCES

A. This Section incorporates by reference the latest revisions of the following documents.
   1. American Architectural Manufacturers Association (AAMA)
      a. AAMA CW-10 - Care and Handling of Architectural Aluminum from Shop to Site
   2. American Society of Civil Engineers (ASCE)
      a. ASCE 7-02 - Minimum Design Loads for Buildings and Other Structures
   3. American Society for Testing and Materials International (ASTM)
e. ASTM E 283 - Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.
h. ASTM E 1105 - Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls, by Uniform or Cyclic Static Air Pressure Difference.

1.03 SYSTEM DESCRIPTION

A. Performance Requirements - Exterior Curtainwall

1. Design and size components to withstand the following load requirements without damage or permanent set:

a. Positive Design Wind Load (inward): 30 pounds per square foot.
b. Negative Design Wind Load (outward): 35 pounds per square foot.
c. Positive Design Wind Load at Corners (inward): 30 pounds per square foot.
d. Negative Design Wind Load at Corners (outward): 40 pounds per square foot.
e. Member Deflection: Limit member deflection to 1/175 in all directions, and maximum of 1/2 inch, with full recovery of glazing materials.
f. Design to resist flexural, shear, and torsional stresses caused by positive and negative wind loads in accordance with the Seattle Building Code.
g. Measure performance by testing in accordance with ASTM E 330, using test loads equal to 1.5 times the design wind loads and 10-second duration of maximum pressure.

2. Seismic Loads: Design and size components to withstand seismic loads and sway displacement as calculated in accordance with the Seattle Building Code.
3. Movement: Accommodate the following movement without damage to components or deterioration of seals:
   a. Movement of curtain wall relative to perimeter framing.
   b. Deflection of structural support framing, under permanent and dynamic loads.
   c. Creep of structural concrete members.

4. Air Infiltration: Limit air infiltration through assembly to 0.06 cubic feet per minute per square foot of wall area, measured at a reference differential pressure across assembly of 6.24 pounds per square foot as measured in accordance with ASTM E 283.

5. Water Leakage: None, when measured in accordance with ASTM E 331 at a test pressure difference of 8.00 lbf/sq ft.

6. System Internal Drainage: Drain to the exterior by means of a weep drainage network any water entering joints, condensation occurring in glazing channel, and migrating moisture occurring within system.

7. Expansion/Contraction: Provide for expansion and contraction within system components caused by cycling temperature range of 170 degrees F over a 12 hour period without causing detrimental effect of any kind to system components, anchorages, and other building elements.

8. Design system to eliminate noises caused by wind and thermal movement and to prevent vibration harmonics.


B. Performance Requirements - Interior Curtainwall

1. Design and size components to withstand the following load requirements without damage or permanent set:
   a. Positive Design Wind Load (inward): 15 pounds per square foot.
   b. Negative Design Wind Load (outward): 15 pounds per square foot.

2. Seismic loads and movement criteria: Same as for exterior curtainwall.

1.04 SUBMITTALS

A. Procedures: Section 01 33 00, Submittal Procedures.

B. Product Data: Provide component dimensions, describe components within assembly, anchorage and fasteners, glazing and infill, and internal drainage details.

C. Shop Drawings: Indicate system dimensions for each elevation, referenced to floor lines and grid lines, framed opening requirements and tolerances, affected related Work and method of attachment, expansion and contraction joint location and details, and field welding required.

1. Include layout of walls, beams, columns and slabs with dimensions noted.

2. Include all special and typical details. Details shall be fully drawn (not outlined).
3. Indicate adjacent construction and sealant and gasketing systems; sealant identification by product name.

4. Glazing types and glazing details; glass thicknesses; dimensioned position of glass edge reality to metal daylight.

5. Connection and installation details at sliding glass doors including method of attachment and weatherproofing.

6. Connection and installation details at hopper window units including method of attachment and weatherproofing.

D. Samples: Submit four each samples at least 4 by 4 inches in size illustrating finished aluminum surfaces, infill panels, and glazing materials.

E. Design Data: Provide framing member structural and physical characteristics and engineering calculations, and identify dimensional limitations.

F. Structural Glazing Adhesive: Submit product data and calculations showing compliance with performance requirements.

G. Manufacturer's Certificate: Certify that the products supplied meet or exceed the specified requirements.

H. Report of field testing for water leakage.

I. Warranty: Submit manufacturer warranty and ensure forms have been completed in Sound Transit's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

A. Design structural support framing components under direct supervision of a Professional Structural Engineer experienced in design of this Work and licensed in the State of Washington.

B. Shop drawings shall be stamped by the designing Professional Structural Engineer.

C. Manufacturer and Installer: Company specializing in manufacturing aluminum glazing systems with minimum 5 years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Handle products of this section in accordance with AAMA CW-10.

B. Protect finished aluminum surfaces with wrapping. Do not use adhesive papers or sprayed coatings which bond to aluminum when exposed to sunlight or weather.

1.07 PROJECT CONDITIONS

A. Field Measurements: Check actual locations of walls, slabs, framing, and other construction to which work of this section must fit, by accurate field measurements before fabrication; show recorded measurements on final shop drawings. Coordinate fabrication, delivery and installation schedule with construction progress to avoid delay of work.

1. Where field measurements cannot be made without delaying the Work, guarantee dimensions and proceed with fabrication of products without field measurements. Coordinate construction with work of other trades to ensure that
actual dimensions correspond to guaranteed dimensions. Allow for fitting and trimming.

B. Environmental Requirements

1. Do not install sealants when ambient temperature is less than 40 degrees F. Maintain this minimum temperature during and 48 hours after installation.

1.08 WARRANTY

A. Correct defective Work within a 5-year period after Date of Substantial Completion.

B. Provide ten year manufacturer warranty against failure of glass seal on insulating glass units, including interpane dusting or misting. Include provision for replacement of failed units.

C. Provide 10-year manufacturer warranty against excessive degradation of exterior finish. Include provision for replacement of units with excessive fading, chalking, or flaking.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Curtainwall: Basis-of-Design Product Manufacturer:

1. CW-1: Kawneer Company, Inc.; "1600 Wall System 2" (2-side silicone glazed), profile and depths as detailed or required by structural loads.

2. CW-2: Kawneer Company, Inc.; “PG Unitwall” or “SGS 2550” (4-side silicone glazed)

B. Other Acceptable Manufacturers:


4. Substitutions: See Section 01 25 00, Substitution Procedures.

2.02 MATERIALS


C. Structural Supporting Anchors: See Section 05 12 00, Structural Steel Framing.

D. Structural Supporting Anchors Attached to Reinforced Concrete Members: Design for welded attachment to weld plates embedded in concrete.

E. Fasteners: Stainless steel.

F. Exposed Flashings: 0.032 inch thick aluminum sheet; finish to match framing members.
G. Concealed Flashings: 0.018 inch thick stainless steel.

H. Structural Glazing Adhesive: Silicone, neutral cure; formulated specifically for structural sealant glazing and complying with ASTM C 1184.

1. Ultraviolet radiation resistant for 2000 to 4000 micro-watts minimum for 21 days.
2. Adhesion when subjected to ultraviolet radiation through glass in accordance with ASTM C 794 without failure.
3. Minimum adhesion tensile strength of 100 pounds per square inch.
4. Tested for compatibility with glazing accessories and weatherseal sealant.

I. Weatherseal Sealant: Silicone, type recommended by glazing adhesive manufacturer.

J. Perimeter Sealant: Type 1 as specified in Section 07 92 00, Joint Sealants.

K. Glazing: As specified in Section 08 80 00, Glazing.

L. Glazing Gaskets: Type to suit application to achieve weather, moisture, and air infiltration requirements.

M. Glazing Accessories: As specified in Section 08 80 00, Glazing.

2.03 COMPONENTS


B. Aluminum Framing Members: Tubular aluminum sections, thermally broken with interior section insulated from exterior, drainage holes and internal weep drainage system.

1. Framing members for interior applications need not be thermally broken.
2. Cross-Section: Profile and sizes as indicated on Contract Drawings.

2.04 FABRICATION

A. Fabricate components with minimum clearances and shim spacing around perimeter of assembly, yet enabling installation and dynamic movement of perimeter seal.

B. Accurately fit and secure joints and corners. Make joints flush, hairline, and weatherproof.

C. Prepare components to receive anchor devices. Fabricate anchors.

D. Coat concealed metal surfaces that will be in contact with cementitious materials or dissimilar metals with bituminous paint.

E. Arrange fasteners and attachments to conceal from view.

F. Reinforce interior horizontal head rail to receive blind brackets and attachments.
2.05 FINISHES

A. Exposed Aluminum Surfaces: Fluropolymer Coating. See Section 05 05 14, Fluoropolymer Coatings for Metal.
   1. Fluropolymer Coating: FP-2 (2-coat mica flake).

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify dimensions, tolerances, and method of attachment with other work.
B. Verify that wall openings are ready to receive work of this Section.
C. Verify that anchorage devices have been properly installed and located.

3.02 INSTALLATION

A. Install wall system in accordance with manufacturer's instructions.
B. Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.
C. Provide alignment attachments and shims to permanently fasten system to building structure.
D. Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances, aligning with adjacent work.
E. Install sill flashings. Turn up ends and edges; seal to adjacent work to form water tight dam.
F. Coordinate attachment and seal of perimeter air and vapor barrier materials.
G. Glazing and Pressure Plate Framing: Install glazing in accordance with Section 08 80 00, Glazing, using exterior dry glazing and structural silicone.
H. Install perimeter sealant in accordance with Section 07 92 00, Joint Sealants.

3.03 REPAIR/RESTORATION

A. Touch-up minor damage to factory applied finish; replace components that cannot be satisfactorily repaired.

3.04 FIELD QUALITY CONTROL

A. See Section 01 45 00, Quality Control, for independent testing and inspection requirements. Inspection will monitor quality of installation and glazing.
B. Test installed "Storefront" and Curtain Wall System installations for water leakage in accordance with ASTM E 1105 with a uniform test pressure difference of 6.00 pounds per square foot. Test shall include a minimum of five cycles, each lasting a minimum of five minutes.
C. Manufacturer’s Field Services:
1. Provide curtain wall manufacturer’s field surveillance of the installation. Monitor and report installation procedures and all unacceptable conditions.
   a. Observation frequency: Daily during first week of installation; two per week thereafter until completion of curtainwall and storefront work.
   b. Prepare and submit inspection reports in accordance with Section 01 45 00, Quality Control.

D. Erection Tolerances

1. Maximum Variation from Plumb: 0.06 inch every 3 feet non-cumulative or 0.5 inch per 100 feet, whichever is less.

3.05 CLEANING

A. Wash down surfaces with a solution of mild detergent in warm water, applied with soft, clean wiping cloths. Take care to remove dirt from corners. Wipe surfaces clean.
B. Remove excess sealant by method acceptable to sealant manufacturer.

3.06 PROTECTION

A. Protect finished work from damage.

END OF SECTION
1.01 SUMMARY

A. This Section includes specifications for heat-resistant window-wall systems shown as CW-3 on the Contract Drawings.

1. Delegated engineering design to meet performance requirements/
2. Frames fabricated from cold-formed steel members.
3. Tempered glass panels specified in Section 08 80 00, Glazing
5. Silicone rubber glazing accessories and sealants.

1.02 REFERENCES

A. This Section incorporates by reference the latest revisions of the following documents.

1. American Society for Testing and Materials International (ASTM)
   b. ASTM A 653/A 653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
   c. ASTM A780 Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings

2. The National Association of Architectural Metal Manufacturers (NAAMM)
   a. NAAMM HMMA 861 - Guide Specifications for Commercial Hollow Metal Doors and Frames

1.03 SUBMITTALS

A. Procedures: Section 01 33 00, Submittal Procedures.

B. Product Data: For each type of product indicated. Include construction details, material descriptions, fabrication methods, dimensions of individual components and profiles, hardware, finishes, and operating instructions.

C. Shop Drawings: Include plans, elevations, sections, details, hardware, attachments to other work, operational clearances, installation details, and the following:
   1. Mullion details including reinforcement and stiffeners.
2. Joinery details.
5. Accessories.

D. Design Data: Provide framing member structural and physical characteristics and engineering calculations, and identify dimensional limitations.

E. Samples for Verification: For steel components required, prepared on Samples of size indicated below:
   1. Main Framing Member: 12-inch-long, full-sized sections, with glazing bead and factory-applied color finish.

F. Field quality-control reports.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: A manufacturer capable of fabricating steel glazed framing that meet or exceed performance requirements indicated and of documenting this performance by inclusion in lists, and by labels, test reports, and calculations.

B. Design structural support framing components under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in the State of Washington.

C. Shop drawings shall be stamped by the designing Professional Structural Engineer.

D. Installer Qualifications: An installer acceptable to window manufacturer for installation of units required for this Contract.
   1. Installer's responsibilities include providing professional engineering services needed to assume engineering responsibility including preparation of data for steel glazed framing, including Shop Drawings and Designated Design Submittal based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Contract.

E. Source Limitations: Obtain steel glazed framing from single source from single manufacturer.

1.05 PROJECT CONDITIONS

A. Field Measurements: Verify actual dimensions of steel window openings by field measurements before fabrication.

1.06 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of steel glazed framing that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Failure shall meet performance requirements.
b. Structural failures including excessive deflection.

c. Water leakage or air infiltration.

d. Deterioration of metals, metal finishes, and other materials beyond normal weathering.

2. Warranty Period: Three years from date of Substantial Completion.

3. Warranty Period for Metal Finishes: Ten years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Structural Performance:

1. Design and size components to withstand the following load requirements without damage or permanent set:

   a. Positive Design Wind Load (inward): 15 pounds per square foot.

   b. Negative Design Wind Load (outward): 15 pounds per square foot.

2. Seismic Loads: Design and size components to withstand seismic loads and sway displacement as calculated in accordance with the Seattle Building Code.

2.02 FRAME MATERIALS

A. Cold-Formed Steel Framing Members: Provide frame and ventilator members mechanically formed from metallic-coated, low-carbon, cold-rolled steel sheet complying with ASTM A 653/A 653M. For combined weight of frame and ventilator members and front-to-back depth of frame or ventilator members:

1. Finish: Powder coat.

B. Fasteners: Provide fasteners of bronze, brass, stainless steel, or other metal that are warranted by manufacturer to be noncorrosive and compatible with trim, hardware, anchors, and other components of steel glazed framing.

1. Exposed Fasteners: If exposed fasteners are used, provide Phillips flat-head machined screws that match finish of member or hardware being fastened, as appropriate.

C. Anchors, Clips, and Window Accessories: Provide units of stainless steel, hot-dip zinc-coated steel, bronze, brass, or iron complying with ASTM A 123/A 123M. Provide units with sufficient strength to withstand design pressure indicated.

D. Glazing Stops: Manufacturer’s standard.

E. Sealant: For sealants required within fabricated glazed framing, provide Room-Temperature-Vulcanizing (RTV) silicone or other heat-resisting sealant, permanently elastic, nonshrinking, and nonmigrating type recommended by sealant manufacturer for joint size and movement.

2.03 GLAZING

A. Glazing Units: Clear, fully tempered float glass.
B. Glazed-In Metal Panels: MP-5 specified in Section 07 42 53.

C. Attached Metal Panels: Perforated panels, MP-5a specified in Section 07 42 53, Cementitious Wall Panels.

2.04 FABRICATION

A. General: Fabricate steel glazed framing of type and in sizes indicated to comply with HMMA 861 standards. Include a complete system for assembly of components and anchorage of window units.

B. Mullions: Formed of cold-formed steel matching window units; with anchors for support to structure and for installation of window units and having sufficient strength to withstand design pressure indicated. Provide mullions of profile indicated and with cover plates. Allow for erection tolerances and provide for movement of window units due to thermal expansion and building deflections.

C. Glazing Stops: Provide glazing stops to match panel frames. Finish glazing stops to match window units if fabricated of steel; otherwise, provide manufacturer’s standard finish.

2.05 METALLIC-COATED STEEL SHEET FINISHES

A. Surface Preparation: Clean surfaces with nonpetroleum solvent so surfaces are free of oil and other contaminants. After cleaning, apply a conversion coating suited to the organic coating to be applied over it. Clean welds, mechanical connections, and abraded areas and apply galvanizing repair paint complying with SSPC-Paint 20 and ASTM A 780.

B. Powder-Coat Finish: Immediately after cleaning and pretreating, apply two-coat, baked-on finish consisting of prime coat and thermosetting topcoat, with a minimum dry film thickness of 1 mil for topcoat. Comply with coating manufacturer’s written instructions for applying and baking to achieve a minimum dry film thickness of 2 mils.


2. Color and gloss: Match PNT-1 specified in Section 09 90 00, Painting and Coating.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Comply with manufacturer’s written instructions for installing glazed framing, hardware, operators, accessories, and other components.

B. Install framing level, plumb, square, true to line, without distortion or impediment to thermal movement, anchored securely in place to structural support, and in proper relation to wall flashing and other adjacent construction.

C. Set sill members in bed of sealant or with gaskets, as indicated, to provide airtight construction.
3.03 ADJUSTING, CLEANING, AND PROTECTION

A. Clean factory-finished steel surfaces immediately after installing glazed framing. Comply with manufacturer’s written recommendations for final cleaning and maintenance. Avoid damaging protective coatings and finishes.

B. Clean glass immediately after installing glazed framing. Comply with manufacturer’s written recommendations for final cleaning and maintenance. Remove nonpermanent labels, and clean surfaces.

C. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.

D. Protect window surfaces from contact with contaminating substances resulting from construction operations. Remove contaminants immediately according to manufacturer’s written recommendations.

END OF SECTION
PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes specifications for:

1. Hardware as indicated and specified herein for hollow steel and aluminum doors, including appropriate fasteners and miscellaneous materials required to complete the work.
2. Hardware for fire-rated doors.
3. Electrically operated and controlled hardware.
4. Lock cylinders for doors for which hardware is specified in other Sections.
5. Thresholds.
6. Weatherstripping, seals, and door gaskets.
7. Complete hardware schedule preparation. The Contract Drawings and Specifications are indications of the design intent for the Contract. Full provision of an itemized hardware schedule shall be the responsibility of the Contractor.

B. Related Sections: The work of the following Sections is related to the work of this Section. Other Sections, not referenced below, may also be related to the proper performance of this work.

1. Section 08 11 13, Hollow Metal Doors and Frames.

1.02 REFERENCES

A. This Section incorporates by reference the latest revision of the following documents.

1. American National Standards Institute (ANSI)
   a. ANSI A 156.18 – Materials and Finishes; Latest edition.

2. Builders Hardware Manufacturers Association, Inc. (BHMA)
   a. BHMA A156.18 - American National Standard for Materials and Finishes; 2006 (ANSI/BHMA A156.18).

3. Door and Hardware Institute (DHI)
   a. DHI (LOCS) - Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames;
b. DHI WDHS.3 - Recommended Locations for Architectural Hardware for Flush Wood Doors

   a. NFPA 80 - Standard for Fire Doors and Fire Windows

5. Underwriters Laboratories Inc. (UL).
   a. UL (BMD) - Building Materials Directory

1.03 SUBMITTALS

A. Procedures: Section 01 33 00, Submittal Procedures

B. Schedules and Product Data
   1. Schedules to be in vertical format, listing each door opening, and organized into "hardware sets" indicating complete designations of every item required for each door opening to function as intended. Hardware schedule shall be submitted within two weeks from date the purchase order is received by the finish hardware supplier. Furnish four copies of revised schedules after approval for field and file use. Note any special mounting instructions or requirements with the hardware schedule. Schedules to include the following information:
      a. Location of each hardware set cross-referenced to indications on drawings, both on floor plans and in door and frame schedule.
      b. Handing and degree of swing of each door.
      c. Door and frame sizes and materials.
      d. Keying information.
      e. Type, style, function, size, and finish of each hardware item.
      f. Elevation drawings and operational descriptions for all electronic openings.
      g. Name and manufacturer of each hardware item.
      h. Fastenings and other pertinent information.
      i. Explanation of all abbreviations, symbols and codes contained in schedule
      j. Mounting locations for hardware when varies from standard.

   2. Submit catalog cuts and/or product data sheets for all scheduled finish hardware.

   3. Submit separate detailed keying schedule for approval indicating clearly how Sound Transit's final instructions on keying of locks has been fulfilled.

C. Samples
   1. Upon request, samples of each type of hardware in finish indicated shall be submitted. Samples are to remain undamaged and in working condition through
submittal and review process. Items will be returned to the supplier or incorporated into the work within limitations of keying coordination requirements.

D. Templates

1. Furnish a complete list and suitable templates, together with finish hardware schedule to contractor, for distribution to necessary trades supplying materials to be prepped for finish hardware.

E. Electronic Hardware Systems

1. Provide complete wiring diagrams prepared by an authorized factory employee for each opening requiring electronic hardware, except openings where only magnetic hold-open devices are specified. Provide a copy with each hardware schedule submitted after approval.

2. Provide complete operational descriptions of electronic components listed by opening in the hardware submittals. Operational descriptions to detail how each electrical component functions within the opening incorporating all conditions of ingress and egress. Provide a copy with each hardware schedule submitted for approval.

3. Provide elevation drawings of electronic hardware and systems identifying locations of the system components with respect to their placement in the door opening. Provide a copy with each hardware schedule submitted for approval.

4. Prior to installation of electronic hardware, arrange conference between supplier, Installers and related trades to review materials, procedures and coordinating related work.

5. The electrical products contained herein represent a complete engineered system. If alternate electrical products are submitted, it is the responsibility of the distributor to bear the cost of providing a complete and working system including re-engineering of electrical diagrams and system layout, as well as power supplies, power transfers and all required electrical components. Coordinate with electrical engineer and electrician to ensure that line voltage and low voltage wiring is coordinated to provide a complete and working system.

6. For each item of electrified hardware specified, provide standardized molex plug connectors to accommodate up to twelve wires. Molex plug connectors shall plug directly into through-door wiring harnesses, frame wiring harnesses, electric locking devices and power supplies.

F. Operations and Maintenance Manuals

1. Upon completion of construction and building turnover, furnish two complete maintenance manuals to Sound Transit. Manuals to include the following items:
   a. Approved hardware schedule, catalog cuts and keying schedule.
   b. Hardware installation and adjustment instructions.
   c. Manufacturer’s written warranty information.
   d. Wiring diagrams, elevation drawings and operational descriptions for all electronic openings.
1.04 QUALITY ASSURANCE

A. Substitutions

1. All substitution requests must be submitted before bidding and within the procedures and time frame as outlined in Division 1, General Requirements. Approval of products is at the discretion of the Resident Engineer and his hardware consultant.

B. Supplier Qualifications

1. A recognized architectural door hardware supplier who has maintained an office and has been furnishing hardware in the Contract’s vicinity for a period of at least two years.

2. Hardware supplier shall have office and warehouse facilities to accommodate this Contract.

3. Hardware supplier shall have in his employment at least one Architectural Hardware Consultant (AHC) who is available at reasonable times during business hours for consultation about the project’s hardware and requirements to Sound Transit, Resident Engineer and Contractor.

4. Hardware supplier must be an authorized factory distributor of all products specified herein.

C. FIRE-RATED OPENINGS

1. Provide door hardware for fire-rated openings that comply with NFPA 80 and requirements of Seattle Building Code. Provide only items of door hardware that are listed by Underwriter’s Laboratories (UL) or Warnock Hersey (WH) for use on types and sizes of doors indicated.

2. Project requires door assemblies and components that are compliant with positive pressure and S-label requirements. Specifications must be cross-referenced and coordinated with door manufacturers to ensure that total opening engineering is compatible with UL10C Standard for Positive Pressure Fire Tests of Door Assemblies.

a. Hardware required for fire doors shall be listed with Underwriters Laboratories for ratings specified.

b. Certification(s) of compliance shall be made available upon request by the Seattle DPD

1.05 DELIVERY, STORAGE AND HANDLING

A. Marking and Packaging

1. Properly package and mark items according to the approved hardware schedule, complete with necessary screws and accessories, instructions and installation templates for spotting mortising tools. Contractor shall check deliveries against accepted list and provide receipt for them, after which he is responsible for storage and care. Any shortage or damaged good shall be made without cost to Sound Transit.

2. Packaging of door hardware is the responsibility of the supplier. As hardware supplier receives material from various manufacturers, sort and repack in
containers clearly marked with appropriate hardware set and door numbers to match the approved hardware schedule. Two or more identical sets may be packed in same container.

B. Delivery

1. The supplier shall deliver all hardware to the project site; direct factory shipments are not allowed unless agreed upon beforehand. Hardware supplier shall coordinate delivery times and schedules with the contractor. Inventory door hardware jointly with representatives of hardware supplier and hardware Installer/Contractor until each is satisfied that count is correct.

2. No keys, other than construction master keys and/or temporary keys are to be packed in boxes with the locks.

3. At time of hardware delivery, door openings supplier in conjunction with the contractor shall check in all hardware and set up a hardware storage room.

C. Storage

1. Provide secure lock-up for door hardware delivered to the Project, but not yet installed. Control handling and installation of hardware items that are not immediately replaceable so that completion of work will not be delayed by hardware losses both before and after installation.

1.06 WARRANTY

A. See Section 01 77 00, Closeout Procedures, for additional warranty requirements.

B. All items, except as noted below, shall be warranted in writing by the manufacturer against failure due to defective materials and workmanship for a minimum period of one year commencing on the date of final completion and acceptance. In the event of product failure, promptly repair or replace item with no additional cost to Sound Transit.

1. Mortise locksets: Five years
2. Exit Devices: Five years
3. Door closers: Ten years
4. Securitron (and approved equals) electrified hardware: Unlimited Lifetime

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Only manufacturers as listed below shall be accepted. Obtain each type of finish hardware (hinges, latch and locksets, exit devices and door closers) from a single manufacturer.

2.02 MATERIALS

A. Screws and Fasteners

1. All required screws shall be supplied as necessary for securing finish hardware in the appropriate manner. Thru-bolts shall be supplied for exit devices and door
closers where required by code and the appropriate blocking or reinforcing is not present in the door to preclude their use.

B. Hanging Devices

1. Hinges
   a. Hinges shall conform to ANSI A156.1 and have the number of knuckles as specified, oil-impregnated bearings as specified with NRP (non-removable pin) feature, at all exterior reverse bevel doors. Unless otherwise scheduled, supply one hinge for every 30 inches of door height, or fraction thereof. Hinges shall be a minimum of 4 1/2 inches high and 4 1/2 inches wide; heavy weight hinges (.180) shall be supplied at all doors where specified.

   1) Specified Manufacturer: McKinney
   2) Approved Substitutes: Bommer, Hager, Stanley

2. Continuous Stainless Steel Hinges
   a. All hinges to be non-handed and of slim barrel design. Hinges to be made of type 304 stainless steel and shall have a concealed teflon-coated stainless steel pin with twin self-lubricated nylon bearings at each knuckle. Hinges shall be UL list up to and including three hours and shall be available with power transfer cutouts when necessary.

   1) Specified Manufacturers: Markar
   2) Approved Manufacturers: McKinney, Select

C. Flush Bolts and Accessories

1. All manual and automatic flush bolts to be furnished as specified.
   a. Specified Manufacturer: Rockwood
   b. Approved Substitutes: McKinney, Trimco

D. Cylinders and Keying

1. Cylinders
   a. All cylinders shall be high security tested, drill & pick proof, extreme attack configured, patent protected in U.S. and Canada, and include a unique double row of pins.

   1) Specified Manufacturer: BiLock
   2) Approved Substitutes: None

2. Keying
   a. All locks and cylinders shall be provided with construction cylinders/cores, for use during the construction phase. All permanent cores shall be keyed to the existing BiLock Master key system, per the approved key schedule. Provide the following quantity of keys:

   1) Two change keys per lock
2) Six master keys per master level
3) Five construction/temporary keys

3. Cylinder Installation
   a. The general contractor shall install all construction cylinders/cores at the time of hardware installation.
   b. Sound Transit, or their representative, shall remove all construction cylinders/cores and install all permanent cylinders/cores.

4. Key Box
   a. Model: KNOX 3200 X Recessed Mounting Kit (RMK)
   b. Provide quantity as shown on plan.

E. Locking Devices
1. Mortise Locksets
   a. All locksets shall be ANSI 156.13 Series 1000, Grade 1 Certified. All functions shall be manufactured in a single sized case formed from 12 gauge steel minimum. The lockset shall have a field-adjustable, beveled armored front, with a 0.125-inch minimum thickness and shall be reversible without opening the lock body. The lockset shall be 2-3/4-inch backset with a one-piece 3/4-inch anti-friction stainless steel latchbolt. The deadbolt shall be a full 1-inch throw made of stainless steel and have two hardened steel roller inserts. All strikes shall be non-handed with a curved lip. To insure proper alignment, all trim, shall be thru-bolted and fully interchangeable between rose and escutcheon designs and shall be the product of one manufacturer.
      1) Specified Manufacturer: Corbin Russwin
      2) Approved Substitutes: Sargent, Schlage

2. Electrified Locksets
   a. Mechanical features of locksets shall conform to standards as specified above. Locksets shall be fail-secure unless otherwise specified. Where specified electrified locksets shall be provided with a switch to monitor inside or outside lever handle or signal remote location.
      1) Specified Manufacturers: Corbin Russwin
      2) Approved Manufacturers: Sargent, Schlage

3. Lockset Strikes
   a. Strikes shall be non-handed and available with curved lip, full lip or ASA type strikes as required. Provide strikes with lip-length required to accommodate jamb and/or trim detail and projection.

F. Exit Devices
1. Conventional Devices – Push Rail
a. All exit devices shall be ANSI A156.3, Grade 1 Certified and shall be listed by Underwriters Laboratories and bear the UL label for life safety in full compliance with NFPA 80 and NFPA 101. Mounting rails shall be formed from a solid single piece of stainless steel, brass or bronze no less than 0.072-inch thick. Push rails shall be constructed of 0.062-inch thick material. Painted or anodized aluminum shall not be considered heavy duty and is not acceptable. Lever trim shall be available in finishes and designs to match that of the specified locksets.

1) Specified Manufacturer: Corbin Russwin ED4000/ED5000 Series
2) Approved Substitutes: Precision, Sargent

G. Door Closers
1. Surface-Mounted Closers – Heavy Duty
   a. All door closers shall be ANSI 156.4, Grade 1 Certified. All closers shall have aluminum alloy bodies, forged steel arms, and separate valves for adjusting backcheck, closing and latching cycles and adjustable spring to provide up to 50 percent increase in spring power. Closers shall be furnished with parallel arms mounting on all doors opening into corridors or other public spaces and shall be mounted to permit 180 degrees door swing wherever wall conditions permit. Closers shall not be installed on exterior or corridor side of doors; where possible install closers on door for optimum aesthetics.

1) Specified Manufacturer: Corbin Russwin DC6000 Series
2) Approved Substitutes: Norton, Sargent

H. Door Trim and Protective Plates
1. Kick plates shall be .050 gauges and two inches less full width of door, or as specified. Push plates, pull plates, door pulls and miscellaneous door trim shall be as shown in the hardware schedule.
   a. Specified Manufacturer: Rockwood
   b. Approved Substitutes: McKinney, Trimco

I. Door Stops and Holders
1. Wall-mounted Door Stops
   a. Where a door is indicated on the plans to strike flush against a wall, wall bumpers shall be provided. Provide convex or concave design as indicated.

1) Specified Manufacturers: Rockwood
2) Approved Substitutes: McKinney, Trimco

2. Overhead Stops/holders
   a. Where specified, overhead stops/holders as shown in the hardware sets are to be provided. Track, slide, arm and jamb bracket shall be
constructed of extruded bronze and shock absorber spring shall be of heavy tempered steel. Overhead stops shall be of non-handed design.

1) Specified Manufacturers: Rixson
2) Approved Substitutes: ABH, Sargent

J. Gasketing and Thresholds

1. Provide continuous weatherseal on exterior doors and smoke, light, or sound seals on interior doors where indicated or scheduled. Provide intumescent seals as required to meet UL10C Standard for Positive Pressure Fire Tests of Door Assemblies. Provide only those units where resilient or flexible seal strip is easily replaceable and readily available from stocks maintained by manufacturer.

2. Provide threshold units not less than 4 inches wide, formed to accommodate change in floor elevation where indicated, fabricated to accommodate door hardware and to fit door frames. All threshold units shall comply with the Americans with Disabilities Act (ADA).

   a. Specified Manufacturers: Pemko
   b. Approved Substitutes: Reese, Zero

K. Door Silencers

1. Furnish rubber door silencers all hollow metal frames; two per pair and three per single door frame.

L. Power Supplies

1. Power supplies shall furnish regulated 24VDC and shall be UL class 2 listed. LED’s shall monitor zone status (voltage/no voltage) and slide switches shall be provided to connect or disconnect the load from power; 1, 4 or 8 separate output circuit breakers shall be provided to divide the load. Power supplies shall have the internal capability of charging optional 24VDC sealed lead acid batteries in addition to operating the DC load. Power supplies shall be supplied complete requiring only 120VAC to the fused input and shall be supplied in an enclosure. Power supplies shall be provided with emergency release terminals that allow the release of all devices upon activation of the fire alarm system. Multiple hardware sets may list power supplies but the total quantity can be decreased by installing larger power supplies to power multiple doors. Operating amperage and voltage must be within limits recommended by the hardware manufacturer.

   a. Specified Manufacturer: Securitron BPS
   b. Approved Substitutes: Corbin Russwin

2.03 HARDWARE FINISHES

A. The designations used in schedules and elsewhere to indicate hardware finishes are those listed in ANSI/BHMA A156.18 or traditional U.S. finishes shown by certain manufacturers for their products.

B. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness, and other qualities complying with manufacturer’s standards, but in no case less than specified by referenced standards for the applicable units of hardware.
C. Where specified hardware shall have an antimicrobial coating which permanently suppresses the growth of bacteria, algae, fungus, mold and mildew applied. The finish shall control the spread and growth of bacteria, mold and mildew and shall be FDA listed for use in medical and food preparation equipment.

PART 3 - EXECUTION

3.01 EXAMINATION
A. Contractor shall ensure that the building is secured and free from weather elements prior to installing interior door hardware. Examine hardware before installation to ensure it is free of defects.

3.02 INSTALLATION
A. Mount hardware units at heights indicated in the following applicable publications, except as specifically indicated or required to comply with the governing regulations.

1. “Recommended Locations for Builders Hardware for Standard Steel Doors and Frames” by the Door and Hardware Institute (DHI.)
2. NWWDA Industry Standard I.S.1.7, “Hardware Locations for Wood Flush Doors.”

B. All hardware shall be applied and installed in accordance with best trade practice by an experienced hardware Installer. Care shall be exercised not to mar or damage adjacent work.

C. Install each hardware item in compliance with the manufacturer's instructions and recommendations. Where cutting and fitting is required to install hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation or application of surface protection with finishing work specified in the Division 9 Sections. Do not install surface-mounted items until finishes have been completed on the substrates involved.

D. Provide a secure lock up for hardware delivered to the project but not yet installed. Control the handling and installation of hardware items so that the completion of the work will not be delayed by hardware losses before and after installation.

3.03 FIELD QUALITY CONTROL
A. The Contractor shall comply with AIA A201 1997 section 3.3.1 which reads as follows: “The Contractor shall be solely responsible for and have control over construction means, methods, techniques, sequences and procedures and for coordinating all portions of the Work under the Contract, unless the contract Documents give other specific instructions concerning these matters.”

B. The hardware supplier shall do a final inspection prior to building completion to ensure that all hardware was correctly installed and is in proper working order.

3.04 ADJUSTING, CLEANING, AND DEMONSTRATING
A. Adjust and check each operating item of hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate freely and smoothly or as intended for the application made.
B. Where door hardware is installed more than one month prior to acceptance or occupancy of a space or area, return to the installation during the week prior to acceptance or occupancy and make final check and adjustment of all hardware items in such space or area. Clean operating items as necessary to restore to proper function and finish of hardware and doors. Adjust door control devices to compensate for final operation of heating and ventilating equipment.

C. Instruct Sound Transit personnel in the proper adjustment and maintenance of door hardware and hardware finishes and usage of all electronic devices.

3.05 PROTECTION

A. Contractor shall protect all hardware, as it is stored on construction site in a covered and dry place. Protect exposed hardware installed on doors during the construction phase. Install any and all hardware at the latest possible time frame.

3.06 HARDWARE SCHEDULE

A. The following Hardware Schedule is provided for whatever assistance it may afford the Contractor; who shall not consider it to be entirely inclusive. Should any particular door or item be omitted in any scheduled hardware heading, provide door or item with hardware same as required for similar purposes. Hardware supplier is responsible for handing and sizing all products as listed in the hardware heading. Quantities listed are for each pair of doors, or for each single door.

B. Manufacturer’s Abbreviations:

1. BL BiLock
2. CR Corbin Russwin
3. DE Detex
4. KS Kant-Slam
5. KD Kedex
6. MA Markar
7. MC McKinney
8. PE Pemko
9. RO Rockwood
10. RX Rixson
11. SN Securitron
<table>
<thead>
<tr>
<th>Item Description</th>
<th>Model/Part Number</th>
<th>Finish</th>
<th>Color</th>
</tr>
</thead>
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<td>* Hinge</td>
<td>T4A3386-NRP</td>
<td>32D</td>
<td>MC</td>
</tr>
<tr>
<td>1 Exit Device</td>
<td>ED5200S-K157-M51</td>
<td>626, 630</td>
<td>CR</td>
</tr>
<tr>
<td>1 Exit Device (Exit Only)</td>
<td>ED5200S-M51 (LESS DOGGING)</td>
<td>630</td>
<td>CR</td>
</tr>
<tr>
<td>1 Mullion (Keyed)</td>
<td>710 KM</td>
<td>600</td>
<td>CR</td>
</tr>
<tr>
<td>2 Rim Cylinder</td>
<td>2301QC X CC</td>
<td>26D</td>
<td>BL</td>
</tr>
<tr>
<td>1 Mortise Cylinder</td>
<td>5361QC X CC (VERIFY CAM)</td>
<td>26D</td>
<td>BL</td>
</tr>
<tr>
<td>3 Permanent Core</td>
<td>PL2301QC</td>
<td>26D</td>
<td>BL</td>
</tr>
<tr>
<td>1 Flush Pull</td>
<td>94L</td>
<td>US32D</td>
<td>RO</td>
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<tr>
<td>2 OH Stop (Concealed)</td>
<td>1 SERIES STOP (VERIFY SIZE)</td>
<td>630</td>
<td>RX</td>
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<tr>
<td>2 Closer (PUSH)</td>
<td>DC6210</td>
<td>689</td>
<td>CR</td>
</tr>
<tr>
<td>1 Gasket</td>
<td>S88D (HEAD &amp; JAMBS)</td>
<td></td>
<td>PE</td>
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<tr>
<td>2 Door Bottom</td>
<td>234AV</td>
<td></td>
<td>PE</td>
</tr>
<tr>
<td>1 Threshold</td>
<td>2727A-FHSL25 (VERIFY LENGTH)</td>
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<tr>
<td>2 Door Silencers</td>
<td>608</td>
<td>GREY</td>
<td>RO</td>
</tr>
<tr>
<td>2 Door Position Switch</td>
<td>DPS-M-GY</td>
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<td>SN</td>
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**NOTE: ELEC ITEM***

**NOTE:** SEQUENCE OF OPERATION: DOOR POSITION SWITCH SEND SIGNAL TO SECURITY MONITORING SYSTEM WHEN DOOR IS OPEN. KEY OVERRIDE FROM EXTERIOR BY CYLINDER AND FLUSH PULL.
**SET #U-1B**

<table>
<thead>
<tr>
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<tr>
<td>* Hinges</td>
<td>TA2314 NRP</td>
<td>32D MC</td>
</tr>
<tr>
<td>1 Lock (Storeroom)</td>
<td>ML2057 PSA</td>
<td>630 CR</td>
</tr>
<tr>
<td>1 Permanent Core</td>
<td>PL2301QC</td>
<td>26D BL</td>
</tr>
<tr>
<td>1 Mortise Cylinder</td>
<td>5361QC X CC (VERIFY CAM)</td>
<td>26D BL</td>
</tr>
<tr>
<td>1 Closer (PUSH)</td>
<td>DC6210</td>
<td>689 CR</td>
</tr>
<tr>
<td>1 Wall Stop</td>
<td>400</td>
<td>US26D RO</td>
</tr>
<tr>
<td>1 Gasket</td>
<td>S88D (HEAD &amp; JAMBS)</td>
<td>PE</td>
</tr>
<tr>
<td>1 Door Bottom</td>
<td>234AV</td>
<td>PE</td>
</tr>
<tr>
<td>1 Threshold</td>
<td>270A (VERIFY LENGTH)</td>
<td>PE</td>
</tr>
<tr>
<td>1 Door Position Switch</td>
<td>DPS-M-GY</td>
<td>SN</td>
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**NOTE: ***ELEC ITEM***

NOTE: SEQUENCE OF OPERATION: DOOR POSITION SWITCH SEND SIGNAL TO SECURITY MONITORING SYSTEM WHEN DOOR IS OPEN.

**SET #U-1C**

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<tr>
<td>1 Lock (Storeroom)</td>
<td>ML2057 PSA</td>
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<tr>
<td>1 Permanent Core</td>
<td>PL2301QC</td>
<td>26D BL</td>
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<tr>
<td>1 Mortise Cylinder</td>
<td>5361QC X CC (VERIFY CAM)</td>
<td>26D BL</td>
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<tr>
<td>1 Closer (PULL)</td>
<td>DC6200</td>
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<td>1 Wall Stop</td>
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<tr>
<td>1 Gasket</td>
<td>S88D (HEAD &amp; JAMBS)</td>
<td>PE</td>
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<tr>
<td>1 Door Position Switch</td>
<td>DPS-M-GY</td>
<td>SN</td>
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**NOTE: ***ELEC ITEM***

NOTE: SEQUENCE OF OPERATION: DOOR POSITION SWITCH SEND SIGNAL TO SECURITY MONITORING SYSTEM WHEN DOOR IS OPEN.
<table>
<thead>
<tr>
<th>Item Description</th>
<th>Model/Part Number</th>
<th>Quantity</th>
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<tbody>
<tr>
<td>* Hinges</td>
<td>TA2314 NRP</td>
<td>32D MC</td>
</tr>
<tr>
<td>1 set Auto Flushbolts (HM)</td>
<td>1842 US26D RO</td>
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</tr>
<tr>
<td>1 Dust Proof Strike</td>
<td>570 US26D RO</td>
<td></td>
</tr>
<tr>
<td>1 Coordinator</td>
<td>1600 SERIES PC RO</td>
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</tr>
<tr>
<td>1 Exit Device (Mortise-FR)</td>
<td>ED5657AL x PR9M57 630 CR</td>
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<td>1 Mortise Cylinder</td>
<td>1E74 STD (VERIFY CAM) 626 BE</td>
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<tr>
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<tr>
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<td>1601AB OR 1601C PC RO</td>
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<tr>
<td>2 Protection Plate</td>
<td>K1062-4BE X 16” X 1” LTDW US32D RO</td>
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<tr>
<td>1 Gasket</td>
<td>S88D (HEAD &amp; JAMBS) PE</td>
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<tr>
<td>1 Astragal x Gasket</td>
<td>357SS X S88D PE</td>
<td></td>
</tr>
<tr>
<td>1 Door Bottom</td>
<td>234AV PE</td>
<td></td>
</tr>
<tr>
<td>1 Threshold</td>
<td>270A (VERIFY LENGTH) PE</td>
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<tr>
<td>2 Door Silencers</td>
<td>608 GREY RO</td>
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<tr>
<td>2 Door Position Switch</td>
<td>DPS-M-GY SN</td>
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**NOTE: KEY TO SEATTLE CITY LIGHT**

**NOTE: SEQUENCE OF OPERATION: DOOR POSITION SWITCH SEND SIGNAL TO SECURITY MONITORING SYSTEM WHEN DOOR IS OPEN.**
### SET #U-1E

<table>
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<td>* Hinges</td>
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<td>32D</td>
<td>MC</td>
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<td>1 set Auto Flushbolts (HM)</td>
<td>1842</td>
<td>US26D</td>
<td>RO</td>
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<tr>
<td>1 Dust Proof Strike</td>
<td>570</td>
<td>US26D</td>
<td>RO</td>
</tr>
<tr>
<td>1 Coordinator</td>
<td>1600 SERIES</td>
<td>PC</td>
<td>RO</td>
</tr>
<tr>
<td>1 Lock (Storeroom)</td>
<td>ML2057 PSA</td>
<td>630</td>
<td>CR</td>
</tr>
<tr>
<td>1 Mortise Cylinder</td>
<td>5361QC X CC (VERIFY CAM)</td>
<td>26D</td>
<td>BL</td>
</tr>
<tr>
<td>1 Permanent Core</td>
<td>PL2301QC</td>
<td>26D</td>
<td>BL</td>
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<tr>
<td>2 Closer (PUSH X STOP)</td>
<td>DC6210 A11</td>
<td>689</td>
<td>CR</td>
</tr>
<tr>
<td>2 Mounting Bracket</td>
<td>1601AB OR 1601C</td>
<td>PC</td>
<td>RO</td>
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<tr>
<td>2 Protection Plate</td>
<td>K1062-4BE X 16&quot; X 1&quot; LTDW</td>
<td>US32D</td>
<td>RO</td>
</tr>
<tr>
<td>1 Astragal x Gasket</td>
<td>357SS X S88D</td>
<td>PE</td>
<td></td>
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<tr>
<td>1 Gasket</td>
<td>S88D (HEAD &amp; JAMBS)</td>
<td>PE</td>
<td></td>
</tr>
<tr>
<td>1 Door Bottom</td>
<td>234AV</td>
<td>PE</td>
<td></td>
</tr>
<tr>
<td>1 Threshold</td>
<td>270A (VERIFY LENGTH)</td>
<td>PE</td>
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<tr>
<td>2 Door Silencers</td>
<td>608</td>
<td>GREY</td>
<td>RO</td>
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<tr>
<td>2 Door Position Switch</td>
<td>DPS-M-GY</td>
<td>SN</td>
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**NOTE:** ***ELEC ITEM***

NOTE: SEQUENCE OF OPERATION: DOOR POSITION SWITCH SEND SIGNAL TO SECURITY MONITORING SYSTEM WHEN DOOR IS OPEN.
**SET #U-1F**

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<thead>
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<th>Item Description</th>
<th>Model/Part Number</th>
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<th>Color</th>
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</thead>
<tbody>
<tr>
<td>* Hinge</td>
<td>T4A3386-NRP</td>
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<td>MC</td>
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<tr>
<td>2 Exit Device</td>
<td>ED5860B x PR910</td>
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<td>CR</td>
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<tr>
<td>2 Closer (PUSH X STOP)</td>
<td>DC6210 A11</td>
<td>689</td>
<td>CR</td>
<td></td>
</tr>
<tr>
<td>1 Gasket</td>
<td>S88D (HEAD &amp; JAMBS)</td>
<td>PE</td>
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<tr>
<td>2 Meeting Stile Gasket</td>
<td>18061CNB</td>
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<tr>
<td>1 Door Bottom</td>
<td>234AV</td>
<td>PE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 Threshold</td>
<td>270A (VERIFY LENGTH)</td>
<td>PE</td>
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<tr>
<td>2 Door Silencers</td>
<td>608</td>
<td>GREY</td>
<td>RO</td>
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<tr>
<td>2 Door Position Switch</td>
<td>DPS-M-GY</td>
<td>SN</td>
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**NOTE: ***ELEC ITEM***

NOTE: SEQUENCE OF OPERATION: DOOR POSITION SWITCH SEND SIGNAL TO SECURITY MONITORING SYSTEM WHEN DOOR IS OPEN.
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<th>Manufacturer Code</th>
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<td>MC</td>
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<tr>
<td>1 set</td>
<td>Auto Flushbolts (HM)</td>
<td>1842</td>
<td>US26D</td>
</tr>
<tr>
<td>1</td>
<td>Dust Proof Strike</td>
<td>570</td>
<td>US26D</td>
</tr>
<tr>
<td>1</td>
<td>Coordinator</td>
<td>1600 SERIES</td>
<td>PC</td>
</tr>
<tr>
<td>1</td>
<td>Lock (Storeroom)</td>
<td>ML2057 PSA</td>
<td>630</td>
</tr>
<tr>
<td>1</td>
<td>Mortise Cylinder</td>
<td>5361QC X CC (VERIFY CAM)</td>
<td>26D</td>
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<tr>
<td>1</td>
<td>Permanent Core</td>
<td>PL2301QC</td>
<td>26D</td>
</tr>
<tr>
<td>2</td>
<td>Closer (PUSH)</td>
<td>DC6210</td>
<td>689</td>
</tr>
<tr>
<td>2</td>
<td>Mounting Bracket</td>
<td>1601AB OR 1601C</td>
<td>PC</td>
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<td>2</td>
<td>Wall Stop</td>
<td>400</td>
<td>US26D</td>
</tr>
<tr>
<td>2</td>
<td>Protection Plate</td>
<td>K1062-4BE X 16&quot; X 1&quot; LTDW</td>
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<tr>
<td>1</td>
<td>Astragal x Gasket</td>
<td>357SS X S88D</td>
<td>PE</td>
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<td>1</td>
<td>Gasket</td>
<td>S88D (HEAD &amp; JAMBS)</td>
<td>PE</td>
</tr>
<tr>
<td>2</td>
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<td>GREY</td>
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<tr>
<td>2</td>
<td>Door Position Switch</td>
<td>DPS-M-GY</td>
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**NOTE: ***ELEC ITEM***

**NOTE: SEQUENCE OF OPERATION:** DOOR POSITION SWITCH SEND SIGNAL TO SECURITY MONITORING SYSTEM WHEN DOOR IS OPEN.
<table>
<thead>
<tr>
<th>Item Description</th>
<th>Model/Part Number</th>
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<tbody>
<tr>
<td>* Hinges</td>
<td>TA2314 NRP</td>
</tr>
<tr>
<td>1 set Auto Flushbolts (HM)</td>
<td>1842</td>
</tr>
<tr>
<td>1 Dust Proof Strike</td>
<td>570</td>
</tr>
<tr>
<td>1 Coordinator</td>
<td>1600 SERIES</td>
</tr>
<tr>
<td>1 Lock (Storeroom)</td>
<td>ML2057 PSA</td>
</tr>
<tr>
<td>1 Mortise Cylinder</td>
<td>5361QC X CC (VERIFY CAM)</td>
</tr>
<tr>
<td>1 Permanent Core</td>
<td>PL2301QC</td>
</tr>
<tr>
<td>1 Closer (PUSH X STOP)</td>
<td>DC6210 A11</td>
</tr>
<tr>
<td>2 Mounting Bracket</td>
<td>1601AB OR 1601C</td>
</tr>
<tr>
<td>2 Protection Plate</td>
<td>K1062-4BE X 16&quot; X 1&quot; LTDW</td>
</tr>
<tr>
<td>1 Astragal x Gasket</td>
<td>357SS X S88D</td>
</tr>
<tr>
<td>1 Gasket</td>
<td>S88D (HEAD &amp; JAMBS)</td>
</tr>
<tr>
<td>1 Door Bottom</td>
<td>234AV</td>
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<tr>
<td>1 Threshold</td>
<td>270A (VERIFY LENGTH)</td>
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<tr>
<td>2 Door Silencers</td>
<td>608</td>
</tr>
<tr>
<td>2 Door Position Switch</td>
<td>DPS-M-GY</td>
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**NOTE: ***ELEC ITEM***

NOTE: SEQUENCE OF OPERATION: DOOR POSITION SWITCH SEND SIGNAL TO SECURITY MONITORING SYSTEM WHEN DOOR IS OPEN.
## SET #U-1J

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<tr>
<td>* Hinge</td>
<td>TA2314</td>
<td>32D</td>
<td>MC</td>
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<tr>
<td>1 Latch (No lock)</td>
<td>ML2010 PSA</td>
<td>630</td>
<td>CR</td>
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<tr>
<td>1 Closer (PULL)</td>
<td>DC6200</td>
<td>689</td>
<td>CR</td>
</tr>
<tr>
<td>1 Protection Plate</td>
<td>K1062-4BE 16&quot; X 1 1/2&quot; LTDW</td>
<td>US32D</td>
<td>RO</td>
</tr>
<tr>
<td>1 Wall Stop</td>
<td>400</td>
<td>US26D</td>
<td>RO</td>
</tr>
<tr>
<td>1 Gasket</td>
<td>S88D (HEAD &amp; JAMBS)</td>
<td></td>
<td>PE</td>
</tr>
<tr>
<td>3 Door Silencers</td>
<td>608</td>
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<td>GREY RO</td>
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<tr>
<td>1 Door Position Switch</td>
<td>DPS-M-GY</td>
<td></td>
<td>SN</td>
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**NOTE: ***ELEC ITEM***

**NOTE: SEQUENCE OF OPERATION: DOOR POSITION SWITCH SEND SIGNAL TO SECURITY MONITORING SYSTEM WHEN DOOR IS OPEN.**

## SET #U-1K

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<tr>
<td>* Hinge</td>
<td>TA2314</td>
<td>32D</td>
<td>MC</td>
</tr>
<tr>
<td>1 Exit Device (Mortise-FR)</td>
<td>ED5657AL x PR9M57</td>
<td>630</td>
<td>CR</td>
</tr>
<tr>
<td>1 Permanent Core</td>
<td>PL2301QC</td>
<td>26D</td>
<td>BL</td>
</tr>
<tr>
<td>1 Mortise Cylinder (1 1/2&quot;)</td>
<td>5362QC X CC (VERIFY CAM)</td>
<td>26D</td>
<td>BL</td>
</tr>
<tr>
<td>1 Closer (PUSH)</td>
<td>DC6210</td>
<td>689</td>
<td>CR</td>
</tr>
<tr>
<td>1 Protection Plate</td>
<td>K1062-4BE 16&quot; X 1 1/2&quot; LTDW</td>
<td>US32D</td>
<td>RO</td>
</tr>
<tr>
<td>1 Wall Stop</td>
<td>400</td>
<td>US26D</td>
<td>RO</td>
</tr>
<tr>
<td>1 Gasket</td>
<td>S88D (HEAD &amp; JAMBS)</td>
<td></td>
<td>PE</td>
</tr>
<tr>
<td>1 Door Bottom</td>
<td>234AV</td>
<td></td>
<td>PE</td>
</tr>
<tr>
<td>1 Threshold</td>
<td>270A (VERIFY LENGTH)</td>
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<td>PE</td>
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<tr>
<td>3 Door Silencers</td>
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<td>GREY RO</td>
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<tr>
<td>1 Door Position Switch</td>
<td>DPS-M-GY</td>
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<td>SN</td>
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**NOTE: ***ELEC ITEM***

**NOTE: SEQUENCE OF OPERATION: DOOR POSITION SWITCH SEND SIGNAL TO SECURITY MONITORING SYSTEM WHEN DOOR IS OPEN.**
## SET #U-1L

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<td>TA2314</td>
<td>32D</td>
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<tr>
<td>1 Exit Device (M-FR-No Lock)</td>
<td>ED5600AL x PR9M10</td>
<td>630</td>
</tr>
<tr>
<td>1 Closer (PUSH)</td>
<td>DC6210</td>
<td>689</td>
</tr>
<tr>
<td>1 Protection Plate</td>
<td>K1062-4BE 16” X 1 1/2” LTDW</td>
<td>US32D</td>
</tr>
<tr>
<td>1 Wall Stop</td>
<td>400</td>
<td>US26D</td>
</tr>
<tr>
<td>1 Gasket</td>
<td>S88D (HEAD &amp; JAMBS)</td>
<td>PE</td>
</tr>
<tr>
<td>3 Door Silencers</td>
<td>608</td>
<td>GREY</td>
</tr>
<tr>
<td>1 Door Position Switch</td>
<td>DPS-M-GY</td>
<td>SN</td>
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**NOTE: ***ELEC ITEM***

NOTE: SEQUENCE OF OPERATION: DOOR POSITION SWITCH SEND SIGNAL TO SECURITY MONITORING SYSTEM WHEN DOOR IS OPEN.

## SET #U-1M

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<tbody>
<tr>
<td>* Hinges</td>
<td>TA2314 NRP</td>
<td>32D</td>
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<tr>
<td>1 Lock (Storeroom)</td>
<td>ML2057 PSA</td>
<td>630</td>
</tr>
<tr>
<td>1 Permanent Core</td>
<td>PL2301QC</td>
<td>26D</td>
</tr>
<tr>
<td>1 Mortise Cylinder</td>
<td>5361QC X CC (VERIFY CAM)</td>
<td>26D</td>
</tr>
<tr>
<td>1 Closer (PUSH X STOP)</td>
<td>DC6210 A11</td>
<td>689</td>
</tr>
<tr>
<td>1 Wall Stop</td>
<td>400</td>
<td>US26D</td>
</tr>
<tr>
<td>1 Gasket</td>
<td>S88D (HEAD &amp; JAMBS)</td>
<td>PE</td>
</tr>
<tr>
<td>1 Door Position Switch</td>
<td>DPS-M-GY</td>
<td>SN</td>
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**NOTE: ***ELEC ITEM***

NOTE: SEQUENCE OF OPERATION: DOOR POSITION SWITCH SEND SIGNAL TO SECURITY MONITORING SYSTEM WHEN DOOR IS OPEN.
## SET #U-2A

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<th>Model/Spec</th>
<th>Quantity</th>
<th>Code Description</th>
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<tbody>
<tr>
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<td>2 Closer (PUSH)</td>
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<td>S88D (HEAD &amp; JAMBS)</td>
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<td>2 Door Bottom</td>
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<td>1 Threshold</td>
<td>2727A-FHSL25 (VERIFY LENGTH)</td>
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<td>2 Door Silencers</td>
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### Notes:
- **NOTE: ELEC ITEM**
- **NOTE: MULLION**
- **NOTE: SEQUENCE OF OPERATION:** ALARMED EXIT DEVICE SOUNDS WHEN DOOR IS OPEN FROM "PUSH" SIDE, UNLESS CARD READER IS USED TO MOMENTARILY SHUNT ALARM. LEVER TRIM ON "PULL" SIDE MOMENTARILY SHUNTS ALARM AND RETRACTS ALARMED EXIT DEVICE LATCHBOLT. DOOR POSITION SWITCH SEND SIGNAL TO SECURITY MONITORING SYSTEM WHEN DOOR IS OPEN.
## SET #U-2B

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<td>32D MC</td>
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<td>1 EM Lock (FSE-LBM-REX)</td>
<td>ML20905 PSA M91 x M92</td>
<td>630 CR</td>
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<td>1 Permanent Core</td>
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<td>1 Closer (PUSH)</td>
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<td>689 CR</td>
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<tr>
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<td>K1062-4BE 16&quot; X 1 1/2&quot; LTDW</td>
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<td>1 SERIES STOP (VERIFY SIZE)</td>
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<td>1 Latch Protector</td>
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NOTE: SEQUENCE OF OPERATION: NORMALLY LOCKED FROM EXTERIOR. FREE EGRESS AT ALL TIMES FROM INTERIOR. DOOR POSITION SWITCH (DPS) SIGNALS SECURITY SYSTEM WHEN DOOR IS OPEN. CARD READER MOMENTARILY UNLOCKS EM LOCK AND SHUNTS DPS SIGNAL. REQUEST TO EXIT (REX) SWITCH IN EM LOCK INTERIOR LEVER MOMENTARILY SHUNTS DPS SIGNAL.

## SET #U-2C

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<td>1 EM Lock (FSE-LBM-REX)</td>
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<td>NOTE: <em><strong>ELEC ITEM</strong></em></td>
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<td>1 Mortise Cylinder</td>
<td>5361 QC X CC (VERIFY CAM)</td>
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<td>1 Permanent Core</td>
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<td>1 Closer (PUSH)</td>
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<tr>
<td>1 Protection Plate</td>
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<td>1 Gasket</td>
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<td>1 Door Bottom</td>
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<td>PE</td>
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<td>1 Threshold</td>
<td>2727A-FHSL25 (VERIFY LENGTH)</td>
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<tr>
<td>1 Door Position Switch</td>
<td>DPS-M-GY</td>
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SET #U-2D

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<td>* Hinges</td>
<td>TA2314 NRP</td>
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<td>357SS X S88D</td>
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**SET #U-2E**

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<td><strong>NOTE: <em><strong>ELEC ITEM</strong></em></strong></td>
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<td>1 Mortise Cylinder</td>
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<td>1 Astragal x Gasket</td>
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<td>2 Door Position Switch</td>
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<td><strong>NOTE: <em><strong>ELEC ITEM</strong></em></strong></td>
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**SET #U-2F**

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<td>PE</td>
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<td>Door Position Switch</td>
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<td>Card Reader</td>
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### SET #U-2G

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<td>* Hinges</td>
<td>TA2314 NRP</td>
<td>32D MC</td>
</tr>
<tr>
<td>1 EM Exit Dev (FSE-LBM-REX)</td>
<td>ED5200SA x PR9905 M91 M92</td>
<td>630 CR</td>
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<tr>
<td></td>
<td>**NOTE: <em><strong>ELEC ITEM</strong></em></td>
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</tr>
<tr>
<td>1 Mortise Cylinder (1 1/2”)</td>
<td>5362QC X CC (VERIFY CAM)</td>
<td>26D BL</td>
</tr>
<tr>
<td>1 Permanent Core</td>
<td>PL2301QC</td>
<td>26D BL</td>
</tr>
<tr>
<td>1 Closer (PUSH)</td>
<td>DC6210</td>
<td>689 CR</td>
</tr>
<tr>
<td>1 Protection Plate</td>
<td>K1062-4BE 16” X 1 1/2” LTDW</td>
<td>US32D RO</td>
</tr>
<tr>
<td>1 Wall Stop</td>
<td>400</td>
<td>US26D RO</td>
</tr>
<tr>
<td>1 Gasket</td>
<td>S88D (HEAD &amp; JAMBS)</td>
<td>PE</td>
</tr>
<tr>
<td>1 Door Bottom</td>
<td>234AV</td>
<td>PE</td>
</tr>
<tr>
<td>1 Threshold</td>
<td>270A (VERIFY LENGTH)</td>
<td>PE</td>
</tr>
<tr>
<td>3 Door Silencers</td>
<td>608</td>
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</tr>
<tr>
<td>1 Controller</td>
<td>781N-120</td>
<td>CR</td>
</tr>
<tr>
<td>1 Door Position Switch</td>
<td>DPS-M-GY</td>
<td>SN</td>
</tr>
<tr>
<td>Card Reader</td>
<td>PROVIDED BY ACCESS CONTROL</td>
<td></td>
</tr>
<tr>
<td></td>
<td>INTEGRATOR</td>
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</tr>
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<td>**NOTE: <em><strong>ELEC ITEM</strong></em></td>
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**NOTE: SEQUENCE OF OPERATION:**
NORMALLY LOCKED FROM STAIR SIDE. FREE EGRESS AT ALL TIMES FROM ROOM SIDE. DOOR POSITION SWITCH (DPS) SIGNALS SECURITY SYSTEM WHEN DOOR IS OPEN. CARD READER MOMENTARILY UNLOCKS EM EXIT DEVICE AND SHUNTS DPS SIGNAL. REQUEST TO EXIT (REX) SWITCH IN EM EXIT DEVICE PUSH RAIL MOMENTARILY SHUNTS DPS SIGNAL.
### SET #U-3A

<table>
<thead>
<tr>
<th>Item Description</th>
<th>Model No.</th>
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<th>Type</th>
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<tbody>
<tr>
<td>* Hinges</td>
<td>TA2314 NRP</td>
<td>32D</td>
<td>MC</td>
</tr>
<tr>
<td>1 Lock (Storeroom)</td>
<td>ML2057 PSA</td>
<td>630</td>
<td>CR</td>
</tr>
<tr>
<td>1 Mortise Cylinder</td>
<td>5361QC X CC (VERIFY CAM)</td>
<td>26D</td>
<td>BL</td>
</tr>
<tr>
<td>1 Permanent Core</td>
<td>PL2301QC</td>
<td>26D</td>
<td>BL</td>
</tr>
<tr>
<td>1 Closer (PUSH)</td>
<td>DC6210</td>
<td>689</td>
<td>CR</td>
</tr>
<tr>
<td>1 Wall Stop</td>
<td>400</td>
<td>US26D</td>
<td>RO</td>
</tr>
<tr>
<td>1 Gasket</td>
<td>S88D (HEAD &amp; JAMBS)</td>
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### SET #U-3B

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<td>MA</td>
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<tr>
<td>1 set Auto Flushbolts (HM)</td>
<td>1842</td>
<td>US26D</td>
<td>RO</td>
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<tr>
<td>1 Dust Proof Strike</td>
<td>570</td>
<td>US26D</td>
<td>RO</td>
</tr>
<tr>
<td>1 Coordinator</td>
<td>1600 SERIES</td>
<td>PC</td>
<td>RO</td>
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<tr>
<td>1 Lock (Storeroom)</td>
<td>ML2057 PSA</td>
<td>630</td>
<td>CR</td>
</tr>
<tr>
<td>1 Mortise Cylinder</td>
<td>5361QC X CC (VERIFY CAM)</td>
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<td>BL</td>
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<tr>
<td>1 Permanent Core</td>
<td>PL2301QC</td>
<td>26D</td>
<td>BL</td>
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<tr>
<td>2 Closer (PULL)</td>
<td>DC6200</td>
<td>689</td>
<td>CR</td>
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<td>2 Protection Plate (FR-WHI)</td>
<td>K1062-4BE-34&quot;-FIT TO EDGE GUARD</td>
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<td>2 Wall Stop</td>
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<tr>
<td>1 Astragal x Gasket</td>
<td>357SS X S88D</td>
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<td>1 Gasket</td>
<td>S88D (HEAD &amp; JAMBS)</td>
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### SET #U-3C

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<td>1 Mortise Cylinder</td>
<td>5361QC X CC (VERIFY CAM)</td>
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<tr>
<td>1 Permanent Core</td>
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<tr>
<td>1 Closer (PULL)</td>
<td>DC6200</td>
<td>689 CR</td>
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<td>K1062-4BE 16&quot; X 1 1/2&quot; LTDW</td>
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</tr>
<tr>
<td>1 Gasket</td>
<td>S88D (HEAD &amp; JAMBS)</td>
<td>PE</td>
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<td>1 Latch (No lock)</td>
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<td>1 Protection Plate</td>
<td>K1062-4BE 16&quot; X 1 1/2&quot; LTDW</td>
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<tr>
<td>1 Wall Stop</td>
<td>400</td>
<td>US26D RO</td>
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<tr>
<td>1 Gasket</td>
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### SET #U-3E

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<td>2 Flush Bolts</td>
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<tr>
<td>1 Dust Proof Strike</td>
<td>570</td>
<td>US26D RO</td>
</tr>
<tr>
<td>1 Lock (Storeroom)</td>
<td>ML2057 PSA</td>
<td>630 CR</td>
</tr>
<tr>
<td>1 Mortise Cylinder</td>
<td>5361QC X CC (VERIFY CAM)</td>
<td>26D BL</td>
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<tr>
<td>1 Permanent Core</td>
<td>PL2301QC</td>
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<tr>
<td>2 OH Stop (Concealed)</td>
<td>1 SERIES STOP (VERIFY SIZE)</td>
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<td>1 Permanent Core</td>
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<td>1 Wall Stop</td>
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<td>US26D RO</td>
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<tr>
<td>1 Gasket</td>
<td>S88D (HEAD &amp; JAMBS)</td>
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### SET #U-3G

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<tr>
<td>1 Privacy Set</td>
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<tr>
<td>1 Gasket</td>
<td>S88D (HEAD &amp; JAMBS)</td>
<td>PE</td>
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### SET #U-4A

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<td>Door Position Switch</td>
<td>BY ACCESS CONTROL INTEGRATOR</td>
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**NOTE:** ***ELEC ITEM***

<table>
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<th>Item</th>
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<td>Balance of Hardware</td>
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### SET #U-5A

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<td>* Hinge (HD-Full Surface)</td>
<td>I-8500 SERIES</td>
<td>BR</td>
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<tr>
<td>2 Gate Closer</td>
<td>KANT-SLAM</td>
<td>KS</td>
</tr>
<tr>
<td>Door Position Switch</td>
<td>BY ACCESS CONTROL INTEGRATOR</td>
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**NOTE:** ***ELEC ITEM***

**NOTE:** SEQUENCE OF OPERATION: DOOR POSITION SWITCH SEND SIGNAL TO SECURITY MONITORING SYSTEM WHEN DOOR IS OPEN.
### SET #U-5B

<table>
<thead>
<tr>
<th>Item</th>
<th>Specification</th>
<th>Notes</th>
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<tr>
<td>Hinge (HD-Full Surface)</td>
<td>I-8500 SERIES</td>
<td>BR</td>
</tr>
<tr>
<td>Gate Closer</td>
<td>KANT-SLAM</td>
<td>KS</td>
</tr>
<tr>
<td>Door Position Switch</td>
<td>BY ACCESS CONTROL INTEGRATOR</td>
<td>**NOTE: <em><strong>ELEC ITEM</strong></em></td>
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**NOTE:** SEQUENCE OF OPERATION: DOOR POSITION SWITCH SEND SIGNAL TO SECURITY MONITORING SYSTEM WHEN DOOR IS OPEN.

### SET #U-5C

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<td>Hinge (HD-Full Surface)</td>
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<td>BR</td>
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<tr>
<td>EM Lock (FSE-LBM-REX)</td>
<td>ML20905 PSA M91 x M92</td>
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**NOTE:** **ELEC ITEM***

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<tr>
<th>Item</th>
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<tbody>
<tr>
<td>Mortise Cylinder</td>
<td>5361QC X CC (VERIFY CAM)</td>
<td>26D BL</td>
</tr>
<tr>
<td>Permanent Core</td>
<td>PL2301QC</td>
<td>26D BL</td>
</tr>
<tr>
<td>Lock Box (Gate)</td>
<td>K-BXMOR2</td>
<td>KE</td>
</tr>
<tr>
<td>Gate Closer</td>
<td>KANT-SLAM</td>
<td>KS</td>
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<tr>
<td>Power Supply</td>
<td>BPS SERIES</td>
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**NOTE:** **ELEC ITEM***

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<tbody>
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**NOTE:** **ELEC ITEM***

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<tbody>
<tr>
<td>Door Position Switch</td>
<td>BY ACCESS CONTROL INTEGRATOR</td>
<td>**NOTE: <em><strong>ELEC ITEM</strong></em></td>
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<tr>
<td>Card Reader</td>
<td>PROVIDED BY ACCESS CONTROL INTEGRATOR</td>
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**NOTE:** SEQUENCE OF OPERATION: NORMALLY LOCKED FROM EXTERIOR. FREE EGRESS AT ALL TIMES FROM INTERIOR. DOOR POSITION SWITCH (DPS) SIGNALS SECURITY SYSTEM WHEN DOOR IS OPEN. CARD READER MOMENTARILY UNLOCKS EM LOCK AND SHUNTS DPS SIGNAL. REQUEST TO EXIT (REX) SWITCH IN EM LOCK INTERIOR LEVER MOMENTARILY SHUNTS DPS SIGNAL.

### SET #U-6A

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<tr>
<td>Item Description</td>
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<td>Model</td>
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<tr>
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</tr>
<tr>
<td>1 set Auto Flushbolts (HM)</td>
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<td>1842 US26D RO</td>
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<tr>
<td>1 Dust Proof Strike</td>
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<td>570 US26D RO</td>
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<tr>
<td>1 Coordinator</td>
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<td>1600 SERIES PC RO</td>
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<td>1 Lock (Storeroom)</td>
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<td>1 Mortise Cylinder</td>
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<td>5361QC X CC (VERIFY CAM) 26D BL</td>
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<td>1 Permanent Core</td>
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<td>DC6200 689 CR</td>
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<td>2 Protection Plate</td>
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<td>2 Wall Stop</td>
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<tr>
<td>1 Astragal x Gasket</td>
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<td>357SS X S88D PE</td>
</tr>
<tr>
<td>1 Gasket</td>
<td></td>
<td>S88D (HEAD &amp; JAMBS) PE</td>
</tr>
<tr>
<td>1 Door Bottom</td>
<td></td>
<td>234AV PE</td>
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<tr>
<td>1 Threshold</td>
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<td>270A (VERIFY LENGTH) PE</td>
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<tr>
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<td>608 GREY RO</td>
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<td>2 Door Position Switch</td>
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<td>DPS-M-GY SN</td>
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**NOTE: ***ELEC ITEM***

**NOTE: SEQUENCE OF OPERATION:** DOOR POSITION SWITCH SEND SIGNAL TO SECURITY MONITORING SYSTEM WHEN DOOR IS OPEN.
### SET #U-6B

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<thead>
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<td>32D</td>
<td>MC</td>
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<tr>
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<td>CR</td>
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<tr>
<td>1 Permanent Core</td>
<td>PL2301QC</td>
<td>26D</td>
<td>BL</td>
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<tr>
<td>1 Mortise Cylinder</td>
<td>5361QC X CC (VERIFY CAM)</td>
<td>26D</td>
<td>BL</td>
</tr>
<tr>
<td>1 Closer (PULL)</td>
<td>DC6200</td>
<td>689</td>
<td>CR</td>
</tr>
<tr>
<td>1 Protection Plate</td>
<td>K1062-4BE 16&quot; X 1 1/2&quot; LTDW</td>
<td>US32D</td>
<td>RO</td>
</tr>
<tr>
<td>1 Wall Stop</td>
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<td>RO</td>
</tr>
<tr>
<td>1 Gasket</td>
<td>S88D (HEAD &amp; JAMBS)</td>
<td>PE</td>
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<tr>
<td>1 Door Bottom</td>
<td>234AV</td>
<td>PE</td>
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<tr>
<td>1 Threshold</td>
<td>270A (VERIFY LENGTH)</td>
<td>PE</td>
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<tr>
<td>3 Door Silencers</td>
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<td>GREY</td>
<td>RO</td>
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<tr>
<td>1 Door Position Switch</td>
<td>DPS-M-GY</td>
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**NOTE: ***ELEC ITEM*****

**NOTE: SEQUENCE OF OPERATION: DOOR POSITION SWITCH SEND SIGNAL TO SECURITY MONITORING SYSTEM WHEN DOOR IS OPEN.**
### SET #U-6C

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<td>Gasket</td>
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<td>Door Bottom</td>
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<tr>
<td>Threshold</td>
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**NOTE: ***ELEC ITEM***

**NOTE: SEQUENCE OF OPERATION: DOOR POSITION SWITCH SEND SIGNAL TO SECURITY MONITORING SYSTEM WHEN DOOR IS OPEN.**
**SET #U-6D**

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<tr>
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**NOTE: ***ELEC ITEM***

**NOTE: SEQUENCE OF OPERATION: DOOR POSITION SWITCH SEND SIGNAL TO SECURITY MONITORING SYSTEM WHEN DOOR IS OPEN.**

**END OF SECTION**
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PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes specifications for glazing (GL-1, GL-1a, GL-3, GL-3a, GL-4, GL-4a, GL-5):
   1. Curtainwall and Storefront.
   2. Elevator Hoistway glazing

B. Related Sections: The work of the following Sections is related to the work of this Section. Other Sections, not referenced below, may also be related to the proper performance of this work.
   1. Section 05 52 00, Metal Railings: Bolted glass infill panels.
   2. Section 07 42 10, Metal Wall Panels: Glass facing used in Art Metal Panels and light transmitting plastic (polycarbonate sheet) used in Art Metal Panels.
   3. Section 08 11 13, Hollow Metal Doors and Frames
   4. Section 08 44 10, Glazed Aluminum-Framed Storefronts and Curtain Walls
   5. Section 08 56 29, Heat-Resistive Window Wall Systems.

1.02 PERFORMANCE REQUIREMENTS

A. Graffiti-Resistant Plastic Film:
   1. Fire Performance: Surface burning characteristics when tested in accordance ASTM E 84:
      a. Flame Spread: 25, maximum.
      b. Smoke Developed: 450, maximum.
   2. Abrasion Resistance of Surface Coating: Less than five percent increase of transmitted light haze when tested in accordance with ASTM D 1044 using 50 cycles, 500 grams weight, and the CS10F Calbrase Wheel.

1.03 REFERENCES

A. This Section incorporates by reference the latest revisions of the following documents.
   1. American National Standards Institute (ANSI)

   d. ASTM C 1048 - Standard Specification for Heat-Treated Flat Glass--Kind HS, Kind FT Coated and Uncoated Glass.
   e. ASTM C 1172 - Standard Specification for Laminated Architectural Flat Glass.
   g. ASTM D 1044 - Test Method for Resistance of Transparent Plastics to Surface Abrasion
   h. ASTM E 84 - Surface Burning Characteristics of Building Materials
   i. ASTM E 773 - Standard Test Method for Accelerated Weathering of Sealed Insulating Glass Units.
   j. ASTM E 774 - Standard Specification for the Classification of the Durability of Sealed Insulating Glass Units.

3. Glazing Association of North America (GANA)
   a. GANA (GM) - GANA Glazing Manual; Glass Association of North America.
   b. GANA (SM) - FGMA Sealant Manual; Glass Association of North America; 1990.

4. Underwriters Laboratories (UL)
   a. UL 10B: Fire Tests of Door Assemblies; Underwriters Laboratories.

1.04 SUBMITTALS

A. Procedures: Section 01 33 00, Submittal Procedures.
   1. Product Data: For each glass product and glazing material indicated.
   2. Samples: Minimum 12 inches square:
      a. Canopy glass
      b. Graffiti-resistant plastic film applied to 1/4 inch clear glass. Leave 3-inch wide section untreated.
1.05 QUALITY ASSURANCE

A. Glass:

1. Installer Qualifications: A qualified Installer who employs glass Installers for this Project who are certified under the National Glass Association's Certified Glass Installer Program.

2. Safety Glazing Labeling: Where safety glazing labeling is indicated, permanently mark glazing with certification label of the SGCC, another certification agency acceptable to Seattle DPD, or the manufacturer. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.

B. Graffiti-resistant plastic film.

1. Installer Qualifications: All products listed in this section are to be installed by a single Installer with a minimum of 5 years demonstrated experience in installing products of the same type and scope as specified.

a. Provide documentation that the installer is authorized by the Manufacturer to perform Work specified in this Section.

b. Provide a commercial building reference list of 5 properties where the installer has applied window film. This list will include the following information:

1) Name of building.
2) The name and telephone number of a management contact.
3) Type of glass.
4) Type of film.
5) Amount of film installed.
6) Date of completion.

2. Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.

a. Finish areas designated by Project Engineer.

b. Do not proceed with remaining work until workmanship, color, and sheen are approved.

c. Refinish mock-up area as required to produce acceptable work.

PART 2 - PRODUCTS

2.01 GLASS TYPES SUMMARY

A. GL-1: 6mm thick clear tempered safety glass.

B. GL-1a: GL-1 with graffiti-resistant film applied to public side.

C. GL-2: Not Used.
D. GL-3: 9/16-inch thick clear laminated glass.

E. GL-3a: GL-3 with graffiti-resistant film applied to public side.

F. GL-4: Same as GL-3 with frit pattern, described as clear field with 3/4-inch opaque white squares on 1-1/4-inch centers, each direction.

G. GL-4A: Same as GL-4, with graffiti-resistant film applied to public side.

H. GL-5: Tempered glass, 6mm thick, colorless, etched.

2.02 GLASS PRODUCTS, GENERAL

A. Thickness: 1/4 inch unless indicated otherwise.

B. Glass Color: Clear.

C. Strength:

1. Where fully tempered glass is indicated, provide Kind FT heat-treated float glass unless specified otherwise.

2.03 GLASS PRODUCTS

A. Float Glass: ASTM C 1036, Type I, Quality-Q3, Class I (clear) unless otherwise indicated.

B. Tempered Glass: ASTM C 1048; Type I; Quality-Q3; Class I (clear) unless otherwise indicated; of kind and condition indicated.

1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.

2. For uncoated glass, comply with requirements for Condition A.

C. Laminated Glass:

1. ASTM C1172, kind and thickness as scheduled, Class 1 (clear).

   a. Fully tempered: Kind LT.

2. Interlayer Material: 0.06 inch polyvinyl butyral.


3. Laminating Process: Fabricate laminate glass using laminator’s standard heat-plus pressure process to produce glass free from foreign substances and air/glass pockets.


2.04 GLAZING ACCESSORIES

A. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; and complying with AAMA 800 for the following types:

1. AAMA 810.1, Type 1, for glazing applications in which tape acts as the primary sealant.
B. Use sealants that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.

D. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.

E. Spacers: Elastomeric blocks or continuous extrusions of hardness required by glass manufacturer to maintain glass lites in place for installation indicated.

F. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).

2.05 GRAFFITI-RESISTANT PLASTIC FILM

A. Products: Subject to compliance with requirements, provide the following:
   1. "Scratchgard" by ShatterGARD, Inc.
      a. 8351 Roswell Road Suite 391, Atlanta, GA 30350
      b. Voice: (888) 306-7998; Fax: (888) 646-8913
      c. Email: jordan@shattergard.com; Website: http://www.shattergard.com/
   2. Colors: Transparent, clear.
   3. Substitutions: In addition to requirements specified in Section 01 60 00, Product Requirements, provide minimum 8 by 10 inch samples of film mounted to cardboard frames.

2.06 FABRICATION OF GLAZING UNITS

A. Fabricate glazing units in sizes required to fit openings indicated for Contract, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.

B. Clean-cut or flat-grind vertical edges of butt-glazed monolithic lites to produce square edges with slight chamfers at junctions of edges and faces.

C. Exposed glass edges and corners: Grind smooth and polish.

D. Butt jointed glass panels: Grind smooth and polish glass edges.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine framing, glazing channels, and stops, with Installer present, for compliance with the following:
   1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
   2. Presence and functioning of weep systems.
3. Minimum required face and edge clearances.
4. Effective sealing between joints of glass-framing members.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION
A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.
B. Examine glazing units to locate exterior and interior surfaces. Label or mark units as needed so that exterior and interior surfaces are readily identifiable. Do not use materials that will leave visible marks in the completed work.

3.03 GLAZING, GENERAL
A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.
B. Protect glass edges from damage during handling and installation. Remove damaged glass from Contract site and legally dispose of off Contract site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.
C. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.
D. Provide spacers for glass lites where length plus width is larger than 50 inches.
   1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances and to comply with system performance requirements.
   2. Provide 1/8-inch minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.
E. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.
F. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.

3.04 TAPE GLAZING
A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.
B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.
C. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.
D. Do not remove release paper from tape until right before each glazing unit is installed.

E. Apply heel bead of elastomeric sealant.

### 3.05 WINDOW FILM APPLICATION

**A. Preparation:**

1. Clean surfaces thoroughly prior to installation.

2. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

**B. Install film in accordance with manufacturer’s instructions.**

1. Cut film edges neatly and square at a uniform distance of 1/8 inch to 1/16 inch of window sealant. Use new blade tips after three to four cuts.

2. Spray the slip solution, composed of one capful of baby shampoo or dishwashing liquid to one gallon of water, on window glass and adhesive to facilitate proper positioning of film.

3. Apply film to glass and lightly spray film with slip solution.

4. Squeegee from top to bottom of window. Spray slip solution to film and squeegee a second time.

5. Bump film edge with lint-free towel wrapped around edge of a five-way tool.

**C. Upon completion of film application, allow 30 days for moisture from film installation to dry thoroughly, and to allow film to dry flat with no moisture dimples when viewed under normal viewing conditions.**

**D. After application of film, wash film using common window cleaning solutions, including ammonia solutions, 30 days after application. Do not use abrasive type cleaning agents and bristle brushes to avoid scratching film. Use synthetic sponges or soft cloths.**

### 3.06 CLEANING AND PROTECTION

**A. Protect glass from contact with contaminating substances resulting from construction operations. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended in writing by glass manufacturer.**

**B. Remove and replace glass that is broken, chipped, cracked, or abraded or that is damaged from natural causes, accidents, and vandalism, during construction period.**

**C. Wash glass on both exposed surfaces in each area of Contract not more than 4 days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.**

**END OF SECTION**
SECTION 08 91 00
LOUVERS

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes specifications for:
   1. Fixed metal louvers, frames, and accessories.
   2. Blank-off panels for wall louvers.
   3. Bird screens (installed at locations other than louvers)

B. Related Sections:
   1. Section 05 05 14, Fluoropolymer Coatings for Metal.
   2. Section 07 62 00, Sheet Metal Flashing and Trim.
   3. Section 07 92 00, Joint Sealants
   4. Section 08 44 13, Glazed Aluminum-Framed Storefronts and Curtain Walls.
   5. Section 23 33 00, Air Duct Accessories.

1.02 REFERENCES

A. This Section incorporates by reference the latest revisions of the following documents.
   1. Air Movement and Control Association International, Inc. (AMCA)
      a. AMCA 511 Certified Ratings Program for Air Control Devices

1.03 SYSTEM DESCRIPTION

A. System Performance Requirements

   1. Structural Performance: Design, engineer, fabricate, and install exterior metal wall louvers to withstand the effects of loads and stresses from wind and normal thermal movement, without evidencing permanent deformation of louver components including blades, frames, and supports; noise or metal fatigue caused by louver blade rattle or flutter; and permanent damage to fastener and anchors:

      a. Wind Load: Uniform pressures (velocity pressures) indicated on Contract Drawings, acting inwards or outwards.
b. Normal thermal movement is defined as that resulting from the following maximum change (range) in ambient temperature. Base design calculations on actual surface temperatures of metals due to both solar heat gain and night time sky heat loss.

1) Temperature Change (range): 100 degrees. F.

c. Air Performance, Water Penetration, and Air Leakage Ratings: Provide louvers complying with performance requirements indicated as demonstrated by testing manufacturers stock units, of height and width indicated, according to Air Movement and Control Association (AMCA) Standard 500.

1.04 SUBMITTALS

A. Procedures: Section 01 33 00, Submittal Procedures.

B. Product Data: Provide data describing design characteristics, maximum recommended air velocity, design free area, materials and finishes.

C. Shop Drawings: Indicate louver layout plan and elevations, opening and clearance dimensions, tolerances; head, jamb and sill details; blade configuration, screens, blanked out areas required, and frames.

1. Clearly illustrate all elements, including attachment and bracing members, methods employed to assure performance integrity of the exterior enclosure system, and the component's relationship to surrounding work, including dimensional tolerances and bench mark locations to be met.

2. Fully coordinate shop drawings with work of the following sections:

a. Section 07 62 00, Sheet Metal Flashing and Trim.

b. Section 08 44 10, Glazed Aluminum-Framed Storefronts and Curtain Walls.

3. In order to review the coordination of all components of the exterior enclosure system, shop drawings for the above listed Sections shall be submitted to the Resident Engineer simultaneously as part of a fully coordinated submittal package. Any submittal for one or more of the above listed Sections, which is not part of a fully coordinated submittal package will be considered incomplete and will be returned to the Contractor without review.

D. Samples: Submit two samples 2 by 2 inches in size illustrating finish and color of exterior and interior surfaces.

E. Test Reports: Independent Testing Laboratory reports showing compliance with specified performance criteria.

F. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

G. Maintenance Data: Include lubrication schedules, and adjustment requirements.

1.05 QUALITY ASSURANCE

A. Single Source Responsibility: Provide all louvers and vents from a single source.
B. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this Section, with minimum three years of documented experience.

1.06 PROJECT CONDITIONS

A. Coordinate work of this Section with installation of other Sections mentioned above.

B. Coordinate work of this Section with installation of mechanical ductwork and electrical services to motorized devices.

C. Field Measurements: Check actual louver openings by accurate field measurements before fabrication; show recorded measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid delay of the Work. Where field measurements cannot be made without delaying the Work, guarantee opening dimensions and proceed with fabrication of louvers and vents without field measurements. Coordinate wall construction to ensure that actual opening dimensions correspond to guaranteed dimensions.

1.07 WARRANTY

A. Provide 20-year manufacturer warranty against distortion, metal degradation, and failure of connections.

1. Finish: Include coverage against degradation of exterior finish.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Aluminum Extrusions: ASTM B 221, Alloy 6063-T5, T-52, or T6.

B. Fasteners: Use types and sizes to suit unit installation conditions.

1. Use Phillips flat-head screws for exposed fasteners unless otherwise indicated.

2. For fastening aluminum, use aluminum or 300 series stainless-steel fasteners.

3. For fastening galvanized steel, use hot-dip-galvanized steel or 300 series stainless-steel fasteners.

4. For fastening stainless steel, use 300 series stainless-steel fasteners.

5. For color-finished louvers, use fasteners with heads that match color of louvers.

C. Postinstalled Fasteners for Concrete and Masonry: Torque-controlled expansion anchors, made from stainless-steel components, with capability to sustain, without failure, a load equal to 4 times the loads imposed, for concrete, or 6 times the load imposed, for masonry, as determined by testing in accordance with ASTM E 488, conducted by a qualified Independent Testing Laboratory.

D. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

2.02 FABRICATION, GENERAL

A. Assemble louvers in factory to minimize field splicing and assembly. Disassemble units as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.
B. Vertical Assemblies: Where height of louver units exceeds fabrication and handling
limitations, fabricate units to permit field-bolted assembly with close-fitting joints in jambs
and mullions, reinforced with splice plates.

1. Continuous Vertical Assemblies: Fabricate units without interrupting blade-
spacing pattern.

C. Maintain equal louver blade spacing, including separation between blades and frames at
head and sill, to produce uniform appearance.

D. Fabricate frames, including integral sills, to fit in openings of sizes indicated, with
allowances made for fabrication and installation tolerances, adjoining material tolerances,
and perimeter sealant joints.

1. Frame Type: Channel unless otherwise indicated.

E. Include supports, anchorages, and accessories required for complete assembly.

F. Provide vertical mullions of type and at spacings indicated, but not more than
recommended by manufacturer, or 72 inches o.c., whichever is less.

1. Semirecessed Mullions: Where indicated, provide mullions partly recessed
behind louver blades so louver blades appear continuous. Where length of
louver exceeds fabrication and handling limitations, fabricate with interlocking
split mullions and close-fitting blade splices designed to permit expansion and
contraction.

G. Provide subsills made of same material as louvers or extended sills for recessed louvers.

H. Join frame members to each other and to fixed louver blades with fillet welds, threaded
fasteners, or both, as standard with louver manufacturer unless otherwise indicated or
size of louver assembly makes bolted connections between frame members necessary.

2.03 FIXED, EXTRUDED-ALUMINUM LOUVERS

A. 4-Inch Horizontal, Continuous-Line, Drainable-Blade Louver: Drainable-blade louver with
blade gutters (drains) in blades and with semirecessed mullions capable of collecting and
draining water from blades.

1. Basis-of-Design Product: Subject to compliance with requirements, provide
Airolite CB 6744 or comparable product by one of the following:

a. Airolite Company, LLC (The).

b. Construction Specialties, Inc.

c. Ruskin Company; Tomkins PLC.

d. United Enertech Corp.

2. Louver Depth: 4 inches.

3. Frame and Blade Nominal Thickness: Not less than 0.080 inch.

4. Louver Performance Ratings:

a. Free Area: Not less than 8 square feet for 48-inch- wide by 48-inch- high
louver.
b. Point of Beginning Water Penetration: Not less than 1150 feet per minute.

c. Air Performance: Not more than 0.20-inch wg static pressure drop at point of beginning water penetration intake velocity.

B. 6-Inch Horizontal, Continuous-Line, Drainable-Blade Louver: Drainable-blade louver with blade gutters (drains) in rear two-thirds of blades only and with semirecessed mullions capable of collecting and draining water from blades.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Airolite CB 6856 or comparable product by one of the following:

   a. Airolite Company, LLC (The).
   b. Construction Specialties, Inc.
   c. Ruskin Company; Tomkins PLC.
   d. United Enertech Corp.

2. Louver Depth: 6 inches.

3. Frame and Blade Nominal Thickness: Not less than 0.080 inch.

4. Louver Performance Ratings:

   a. Free Area: Not less than 7.9 square feet for 48-inch-wide by 48-inch-high louver.

   b. Point of Beginning Water Penetration: Not less than 1065 feet per minute.

   c. Air Performance: Not more than 0.15-inch wg static pressure drop at point of beginning water penetration intake velocity.

2.04 SCREENS

A. General: Provide screen at each exterior louver.

1. Screen Location for Fixed Louvers: Interior face.

2. Screen location for bird screens at other locations: Per Contract Drawings.

3. Screening Type: Bird screening.

B. Secure screen frames to louver frames with stainless-steel machine screws, spaced a maximum of 6 inches from each corner and at 12 inches o.c.

C. Louver Screen Frames: Fabricate with mitered corners to louver sizes indicated.

1. Metal: Same kind and form of metal as indicated for louver to which screens are attached.

2. Finish: Mill finish unless otherwise indicated.

3. Type:

   a. At louvers: Non-rewirable, U-shaped frames.
b. At other locations: Non-rewirable, L-shaped frames with minimum 1-inch leg for attachment to perimeter of opening.

D. Bird Screening Material: Aluminum, 1/2-inch square mesh, 0.063-inch wire.

2.05 BLANK-OFF PANELS

A. Uninsulated, Blank-Off Panels: Metal sheet attached to back of louver.

1. Aluminum sheet for aluminum louvers, not less than 0.050-inch nominal thickness.
2. Panel Finish: Same type of finish applied to louvers, but black color.
3. Attach blank-off panels with.

B. Insulated, Blank-Off Panels: Laminated panels consisting of insulating core surfaced on back and front with metal sheets and attached to back of louver.

1. Thickness: 2 inches.
2. Metal Facing Sheets: Aluminum sheet, not less than 0.032-inch nominal thickness.
3. Insulating Core: Expanded- or extruded-polystyrene foam.
4. Edge Treatment: Trim perimeter edges of blank-off panels with louver manufacturer's standard channel frames, with corners mitered and with same finish as panels.
5. Seal perimeter joints between panel faces and louver frames with gaskets or sealant.
6. Panel Finish: Same type of finish applied to louvers, but black color.
7. Attach blank-off panels with sheet metal screws.

2.06 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

2.07 ALUMINUM FINISHES

A. Finish louvers after assembly.

B. Exposed Finish: Two-coat fluoropolymer as specified in Section 05 05 14 Fluoropolymer Coatings for Metal.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that prepared openings and flashings are ready to receive work and opening dimensions are as indicated on shop drawings.

B. Verify that field measurements are as indicated.
C. Coordinate shop drawings, diagrams, templates, instructions, and directions for installation of anchorages, which are to be embedded in concrete or masonry construction. Coordinate delivery and schedule of installation of such anchorages to avoid construction delay.

3.02 INSTALLATION

A. Install louver assembly in accordance with manufacturer’s instructions.

B. Install louvers level, plumb, and in proper alignment with adjacent work.

C. Install flashings and align louver assembly to ensure moisture shed from flashings and diversion of moisture to exterior.

D. Secure louver frames in openings with concealed fasteners. Provide ethylene propylene diene M-class rubber (EPDM) or Neoprene washers fitted to screws where required to protect metal surfaces and to make a weather-tight connection.

E. Form closely fitted joints with exposed connections accurately located and secured.

F. Provide perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated. Install concealed gaskets, flashings, joint fillers and insulation as louver installation progresses where required to make louver joints weather-tight. Install perimeter sealant and backing rod in accordance with Section 07 92 00, Joint Sealants.

G. Provide waterproof connection between ductwork, louver screen and louver, and provide positive water drainage to exterior of building.

H. Repair finishes damaged by cutting, welding, soldering, and grinding operations. Restore finishes to that no evidence of corrective work remains. Return items which cannot be refinished in field to shop, and make required alterations and refinish entire unit, or provide new units.

3.03 ADJUSTING AND CLEANING

A. Clean exposed surfaces of louvers and vents that are not protected by temporary covering, to remove fingerprints and soil during construction period. Do not let soil accumulate during construction period.

B. Before final inspection, clean exposed surfaces with water and a mild soap or detergent not harmful to finishes. Thoroughly rinse surfaces and dry.

C. Restore louvers and vents damaged during installation and construction so no evidence remains of corrective work. If results of restoration are unsuccessful, as determined by Architect, remove damaged units and replace with new units.

1. Touch up minor abrasions in finishes with air-dried coating that matches color and gloss of, and is compatible with, factory-applied finish coating.

END OF SECTION
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PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes specifications for providing finishes and colors for the station structural steel, equipment, architectural systems and components, paving materials, interior wall finishes, and other items that are coated or have architectural finishes. The materials are specified in other Sections of these Specifications.

1.02 REFERENCES

A. When a particular manufacturer’s number of description is referenced, it is indicated for the sole purpose of providing an example of the required pattern or color.

1.03 SUBMITTALS

A. General: Refer to Section 01 33 00, Submittal Procedures, for submittal requirements and procedures.

PART 2 - PRODUCTS

2.01 FINISHES

A. General

1. In the following schedules, the materials or objects to receive the finish shall be as described in other Sections

2. All colors indicated shall be confirmed by the Resident Engineer in compliance with Sound Transit approved colors.

3. Where building component Colors are listed as a similar color—all similar colors shall match a single control sample.

PART 3 - EXECUTION

3.01 BUILDING COMPONENT COATING AND COLOR SCHEDULE

A. Schedule attached following this Section.

3.02 ROOM FINISH SCHEDULE

A. Schedule attached following this Section.

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**ROOM FINISH SCHEDULE**

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**ROOM FINISH SCHEDULE**

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**BASEMENT LEVEL 1**

| N5-5B101   | Fan room | *   | *    | WF-1 | WF-1 | *    | WF-1 | *    |
| N5-5B102   | Vestibule | *   | *    | *    | *    | *    | *    |        |
| N5-5B103   | Storage room | *   | *    | *    | *    | *    | *    |        |
| N5-5B104   | Mechanical room | *   | *    | *    | *    | WF-1 | *    |        |
| N5-5B105   | Elevator vestibule | *   | *    | *    | *    | *    | *    |        |
| N5-5B106   | Not Used | -   | -    | -    | -    | -    | -    |        |
| N5-5B107   | Corridor | *   | *    | *    | *    | *    | *    |        |
| N5-5B108   | Smoke exhaust plenum | *   | *    | *    | *    | *    |      | WF-1  |
| N5-5B109   | Unassigned | *   | *    | *    | *    | *    | *    |        |
| N5-5B110   | Smoke exhaust plenum | *   | *    | *    |      | WF-1 | WF-1 | *    |
| N5-5B111   | Electrical Room | *   | *    | *    | *    | *    | *    |        |
| N5-5B112   | Exit Passageway | *   | *    | *    | *    | *    | *    |        |
| N5-5B113   | Smoke exhaust plenum | *   | *    | *    |      | WF-1 | *    | *    |
| N5-5B114   | Electrical Room | *   | *    | *    |      | WF-1 | *    | *    |
| N5-5B115   | Fan room | *   | *    | *    |      | WF-1 | *    |        |
| N5-5B116   | Mechanical room | *   | *    | *    | *    | *    | *    |        |
| N5-5B117   | Smoke exhaust plenum | *   | *    | *    |      | WF-1 | WF-1 | *    |

**BASEMENT LEVEL 2**

| N5-5B201   | Mechanical room | *   | *    | WF-1 | WF-1 | *    | WF-1 | *    |
| N5-5B202   | Vestibule | *   | *    | *    | *    | *    | *    |        |

**BASEMENT LEVEL 3**

| N5-5B301   | Fire valve room | *   | *    | WF-1 | *    | *    | *    | *    |
| N5-5B302   | Plenum | *   | *    | WF-1 | WF-1 | *    | WF-1 | *    |
| N5-5B303   | Maintenance Access Vestibule | *   | *    | *    | *    | WF-1 | *    |        |
| N5-5B304   | Vestibule | *   | *    | *    | *    | *    | *    |        |
| N5-5B305   | Lower mezzanine | *   | *    | *    | *    | *    | *    |        |
| N5-5B306   | Exit Corridor | *   | *    | *    | WF-1 | *    | *    |        |
| N5-5B307   | Elevator lobby | *   | *    | *    | *    | *    | *    |        |
| N5-5B308   | Corridor Vestibule | *   | *    | *    | WF-1 | *    | *    |        |
| N5-5B309   | Corridor | *   | *    | *    | *    | *    | *    |        |
| N5-5B310   | Maintenance Access | *   | *    | *    | *    | *    | *    |        |
| N5-5B311   | Switchgear/TPSS | *   | *    | *    | WF-1 | *    | *    |        |
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**BASEMENT LEVEL 4**

| N5-5B401         |      |      |     | *   |     |     |     |                                           |
| N5-5B402         |      |      |     | *   |     |     |     |                                           |

**PLATFORM LEVEL**

| N5-5P01         |      |      |     |     |     |     | MP  | Refer to drawings for MP type           |
| N5-5P02         |      |      |     |     |     |     |     |                                           |
| N5-5P03         |      |      |     |     |     |     |     |                                           |
| N5-5P04         |      |      |     |     |     |     |     |                                           |
| N5-5P05         |      |      |     |     |     |     |     |                                           |
| N5-5P06         |      |      |     |     |     |     |     |                                           |
| N5-5P07         |      |      |     |     |     |     |     |                                           |
| N5-5P08         |      |      |     |     |     |     |     |                                           |
| N5-5P09         |      |      |     |     |     |     |     |                                           |
| N5-5P10         |      |      |     |     |     |     |     |                                           |
| N5-5P11         |      |      |     |     |     |     |     |                                           |
| N5-5P12         |      |      |     |     |     |     |     |                                           |
| N5-5P13         |      |      |     |     |     |     |     |                                           |
**ROOM FINISH SCHEDULE**

* General Note: Unless otherwise specified, all spaces shall have sealed concrete floor, unfinished CMU or concrete

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SECTION 09 21 16
GYPSUM BOARD ASSEMBLIES

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes specifications for:
   1. Metal stud wall framing.
   2. Metal channel ceiling framing.
   3. Fire-rated wall assemblies.
   4. Gypsum wallboard.
   5. Joint treatment and accessories.
   6. Limited delegated engineering design of framing systems.
      a. Ceiling framing supporting metal strut framing specified in Section 05 43 21, Metal Stud Framing System.

B. Related Sections: The work of the following Sections is related to the work of this Section. Other Sections, not referenced below, may also be related to the proper performance of this work.
   1. Section 05 43 21, Metal Strut Framing System.
   2. Section 06 10 00, Rough Carpentry.
   4. Section 07 21 00, Thermal Insulation.
   5. Section 07 42 53, Cementitious Wall Panels.
   6. Section 07 84 46, Head of Wall Firestopping.
   7. Section 09 30 00, Tiling: Cementitious tile backer board material.

1.02 REFERENCES

A. This Section incorporates by reference the latest revisions of the following documents.

   1. American Society for Testing and Materials International (ASTM)
      a. ASTM C 475 - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board
      b. ASTM C 645 - Standard Specification for Nonstructural Steel Framing Members.


e. ASTM C 1002 - Standard Specification for Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs.


h. ASTM E 413 - Classification for Rating Sound Insulation.

2. Gypsum Association (GA)

a. GA-216 - Application and Finishing of Gypsum Board

b. GA-600 - Fire Resistance Design Manual

3. Underwriters Laboratory (UL)

a. UL (FRD) - Fire Resistance Directory

1.03 SYSTEM DESCRIPTION

A. Assembly Performance Requirements

1. Acoustic Attenuation for Interior Partitions Indicated as Acoustic: For assemblies indicated to have sound transmission class (STC) ratings, provide materials and construction identical to those of assemblies whose STC ratings were classified by an Independent Testing Laboratory as 45-49, in accordance with ASTM E 413, based on tests conducted in accordance with ASTM E 90.

B. Delegated Structural Design: Ceiling framing supporting metal strut framing:

1. Design framing to support metal ceiling system and 250 pounds collateral load at each attached vertical strut for gravity and seismic loading.

1.04 SUBMITTALS

A. Procedures: Section 01 33 00, Submittal Procedures.

B. Shop Drawings: Indicate special details associated with fireproofing, acoustic seals, and other unique details. Show size, gauge, and spacing of studs used to comply with specified requirements for steel framing, and show all control joints as indicated or required in accordance with ASTM C 840.

C. Product Data: Provide data on metal framing, gypsum board, accessories, and joint finishing system.

D. Engineering: Provide manufacturer's data or engineering calculations on spans, deflection, attachment methods, and bracing, and indicate compliance with code.
E. Product Data: Provide manufacturer's data on partition head to structure connectors, showing compliance with requirements.

F. Test Reports: For all stud framing products that do not comply with ASTM C 645 or C 754, provide independent laboratory reports showing maximum stud heights at required spacing and deflections.

1.05 QUALITY ASSURANCE

A. Fire Test Response Characteristics: Where fire-rated gypsum board assemblies are indicated, provide materials and construction identical to those of assemblies tested for fire resistance in accordance with ASTM E 119 by an Independent Testing Laboratory acceptable to the Seattle DPD.

B. Fire Resistance Ratings: As indicated by reference to GA file numbers in GA-600 "Fire Resistance Design Manual" or to design designations in UL "Fire Resistance Directory" or in the listing of another testing and inspecting agency acceptable to Seattle DPD.

C. Single Source Responsibility for Panel Products: Obtain each type of gypsum board and other panel products from a single manufacturer.

D. Single Source Responsibility for Finishing Materials: Obtain finishing materials from the same manufacturer that supplies gypsum board and other panel products.

E. Field Samples: On actual gypsum board assemblies, prepare field samples of at least 100 square feet in surface area for the following applications. Simulate finished lighting conditions for review of in-place unit of work.

1. Wall surfaces indicated to receive non-textured paint finishes.

2. Ceiling surfaces indicated to receive non-textured paint finishes

3. Modify field samples or apply additional samples as required to obtain Resident Engineer's acceptance at no additional cost.

F. Perform in accordance with ASTM C 840.

G. Applicator Qualifications: Company specializing in performing gypsum board application and finishing, with minimum 3 years of documented experience.

H. Coordination: Coordinate work with that of other trades, including but not limited to plumbing, HVAC, Venting, and fire sprinklers, to ensure complete and proper installation of all trades. Include coordination with and provision for design-build trades in base bid pricing.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in original packages, containers, or bundles bearing brand name and identification of manufacturer or supplier.

B. Store materials inside under cover and keep them dry and protected against damage from weather, direct sunlight, surface contamination, corrosion, construction traffic, and other causes. Neatly stack gypsum panels flat to prevent sagging.

C. Handle gypsum board to prevent damage to edges, ends, and surfaces. Do not bend or otherwise damage metal corner beads and trim.
1.07 PROJECT CONDITIONS

A. Environmental Conditions, General: Establish and maintain environmental conditions for applying and finishing gypsum board to comply with ASTM C 840 and with gypsum board manufacturer’s recommendations.

B. Room Temperatures: For non-adhesive attachment of gypsum board to framing, maintain not less than 40 degrees F. For adhesive attachment and finishing of gypsum board, maintain not less than 50 degrees F for 48 hours prior to application and continuously after until thry. Do not exceed 95 degrees F when using temporary heat sources.

C. Ventilation: Ventilate building spaces, to the extent required, for drying joint treatment materials. Avoid drafts during hot dry weather to prevent finishing materials from drying too rapidly.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Metal Framing

1. General: Provide steel framing members complying with the following requirements:

   a. Performance Requirements: Select steel studs and all other members in accordance with the Manufacturer’s standard load tables and following design pressures and deflections:

      1) At stairs and other vertical shafts: 1/360 at 10 pounds per square foot.

      2) At all partitions: 1/360 at 10 pounds per square foot.

      3) At suspended and furred ceilings: 1/240 per 10 pounds per square foot.

   b. Protective Coating: G40 hot-dip galvanized coating in accordance with ASTM A 525.

2. Non-Loadbearing Framing System Components: ASTM C 645; galvanized sheet steel, of size and properties necessary to comply with ASTM C 754 for the conditions indicated.

   a. Exception: The minimum metal thickness and section properties requirements of ASTM C 645 are waived provided steel of 40,000 pounds per square inch minimum yield strength is used, the metal is continuously dimpled, the effective thickness is at least twice the base metal thickness, and maximum stud heights are determined by testing in accordance with ASTM E 72 using assemblies specified by ASTM C 754.

   b. Steel Studs and Runners: ASTM C 645, with flange edges of studs bent back 90 degrees and doubled over to form 3/16-inch-wide minimum lip (return):
1) Thickness: As required to comply with Performance Requirements. Minimum thickness allowable 0.0179 inch (25 gage).

c. Steel Rigid Furring Channels: ASTM C 645, hat-shaped, depth and minimum thickness of base (uncoated) metal as follows:
   1) Depth: 7/8 inch.
   2) Thickness: 0.0179 inch, unless otherwise indicated.

d. Z-Furring Members: Manufacturer’s standard Z-shaped furring members with slotted or non-slotted web, fabricated from steel sheet complying with ASTM A 525 or ASTM A 568; with a minimum base metal (uncoated) thickness of 25 gage at interior non-load bearing locations, face flange of 1-1/4 inch, wall-attachment flange of 7/8 inch, and of depth required to fit insulation thickness indicated.

e. Fasteners for Metal Framing: Provide fasteners of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel framing and furring members securely to substrates involved; complying with the recommendations of gypsum board manufacturers for applications indicated

   a. Strapping: Provide 16 gage by 2 inches width strapping at locations indicated on Contract Drawings.
   b. Backing: Behind all cabinetry and shelving, provide 2 feet by 4 feet wide by 16 gage sheet metal backing inside of walls screwed directly on steel studs before gypsum wallboard is installed. (This is to allow Sound Transit to adjust location of shelving and cabinetry with backing and wallboard already in place.)

4. Typical Framing Components:
   a. Studs: "C" shaped with flat or formed webs.
   b. Runners: U shaped, sized to match studs.
   c. Ceiling Channels: C shaped.
   d. Furring: Hat-shaped sections, minimum depth of 7/8 inch.

5. Framing for Suspended and Furred Wallboard Ceilings: Type and size as specified in ASTM C 754 for spacing required.

6. Partition Head to Structure Connections: Provide track fastened to structure with legs of sufficient length to accommodate deflection, for friction fit of studs cut short.

B. Gypsum Board

b. Edges: Tapered.

2.02 ACCESSORIES

A. Acoustic Insulation: As specified in Section 07 21 00, Thermal Insulation.

B. Acoustic Sealant: Non-hardening, non-skinning, non-sag, non-staining, paintable latex sealant, for use in conjunction with gypsum board, and complying with ASTM C 834 and the following:

1. Acceptable products include:
   a. AC-20 FTR Acoustical and Insulation Sealant, Pecora Corp.
   b. SHEETROCK Acoustical Sealant, United States Gyp Co.

C. Corner Beads, Edge Trim, and Control Joints: Galvanized steel, or plastic, complying with ASTM C 1047. Sheet steel zinc-coated by hot-dip process.

1. Shapes indicated below by reference to Fig. 1 designations in ASTM C 1047:
   a. Provide metal cornerbead on outside corners, unless otherwise indicated on Contract Drawings.
   b. LC-bead with both face and back flanges; face flange formed to receive joint compound. Use LC-beads for edge trim unless otherwise indicated.
   c. L-bead with face flange only; face flange formed to receive joint compound. Use L-bead where indicated.
   d. One-piece control joint formed with V-shaped slot, with removable strip covering slot opening.

D. Joint Materials: ASTM C 475 and as recommended by gypsum board manufacturer for project conditions.

1. Joint Tape, Provide paper reinforcing tape, unless otherwise indicated.

2. Drying-Type Joint Compounds for Gypsum Board: Factory-packaged vinyl-based products complying with the following requirements for formulation and intended use.
   c. Taping compound formulated for embedding tape and for first coat over fasteners and face flanges of trim accessories.
   d. Topping compound formulated for fill (second) and finish (third) coats.

E. Screws: ASTM C 1002; self-drilling type unless otherwise noted. Provide corrosion resistant coated steel drill screws in accordance with manufacturer recommendations at all exterior and wet interior locations.
F. Laminating Adhesive: Special adhesive or joint compound recommended for laminating gypsum panels.

G. Anchorage to Substrate: Corrosion resistant tie wire, nails, screws, fasteners, and other metal supports, of type and size to suit application; to rigidly secure materials in place.

H. Cast-In-Place and Post-installed Anchors in Concrete: Chemical, Expansion, or Cast in place anchors, fabricated from corrosion-resistant materials, with holes or loops for attaching hanger wires, and with capability to sustain, without failure, a load equal to five times that imposed by ceiling construction, as determined from testing accordance with ASTM E 488 conducted by a qualified Independent Testing Laboratory.

I. Powder-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hangers of type indicated, and with capability to sustain, without failure, a load equal to 10 times that imposed by ceiling construction, as determined by testing accordance with ASTM E 1190 conducted by a qualified Independent Testing Laboratory.

J. Wire for Hangers and Ties: ASTM A 641, Class 1 zinc coating, soft temper. 0.1620- inch (8 gage) diameter.

K. Sound Attenuation Blankets: Unfaced mineral-fiber blanket insulation produced by combining mineral fibers of type described below with thermosetting resins to comply with ASTM C 665 for Type I (blankets without membrane facing):
   1. Mineral-Fiber Type: Fibers manufactured from glass or slag.

L. Elastomeric Spray-Applied Membrane:
   1. Firedam Spray by 3M Company
   2. CP 672 Fire Spray by Hilti Construction Chemicals
   3. Metacaulk 1200 and Biostop 750 by Rectorseal

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that project conditions are appropriate for work of this Section to commence. Examine substrates to which gypsum board assemblies attach or abut, installed hollow metal frames, cast-in-anchors, and structural framing with Installer present for compliance with requirements for installation tolerances and other conditions affecting performance of assemblies specified in this Section. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Ceiling Anchorages: Coordinate installation of ceiling suspension systems with installation of overhead structural assemblies to ensure that inserts and other provisions for anchorages to building structure have been installed to receive ceiling hangers that will develop their full strength and at spacing required to support ceilings.
1. Furnish concrete inserts and other devices indicated to other trades for installation well in advance of time needed for coordination with other construction:

3.03 INSTALLATION

A. Metal Framing

1. Metal Framing General: Comply with ASTM C 754 and manufacturer’s instructions, ASTM C 754 and with ASTM C 840 requirements that apply to framing installation.

   a. Install supplementary framing, blocking, and bracing at terminations in gypsum board assemblies to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction. Comply with details indicated and with recommendations of gypsum board manufacturer or, if none available, with "Gypsum Construction Handbook" published by United States Gypsum Co.

   b. Isolate steel framing from building structure at locations indicated to prevent transfer of loading imposed by structural movement. Comply with details shown on Contract Drawings.

      1) Where building structure abuts ceiling perimeter or penetrates ceiling.
      2) Where partition framing and wall furring abut structure except at floor.

         a) Provide slip- or cushioned-type joints as detailed to attain lateral support and avoid axial loading.

      3) Install elastomeric spray-applied sealant and mineral wool packing as required at deflection track accordance with manufacturer’s instructions.

   c. Do not bridge building expansion and control joints with steel framing or furring members. Independently frame both sides of joints with framing or furring members as indicated.

   d. Provide anchorage bracing and support designed to meet seismic requirements of the Seattle Building Code.

2. Suspended Ceilings and Soffits:

   a. Suspend ceiling hangers from building structural members and as follows:

      1) Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or ceiling suspension system. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, counter-splaying, or other equally effective means.

      2) Where width of ducts and other construction within ceiling plenum produces hanger spacing that interfere with the location of hangers required to support standard suspension system
members, install supplemental suspension members and hangers in form of trapezes or equivalent devices. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and requirements of current addition of Seattle Building Code.

3) Secure wire hangers by looping and wire-tying, either directly to structures or to inserts, eyescrews, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause them to deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.

4) Do not connect or suspend steel framing from ducts, pipes or conduit.

b. Sway-brace suspended steel framing with hangers used for support.

c. Install suspended steel framing components in sizes and at spacing indicated but not less than that required by the referenced steel framing installation standard.

1) Wire Hangers: 4 feet on center.

2) Carrying Channels (Main Runners)): 1-1/2 inch, 4 feet on center.

3) Rigid Furring Channels (Furring Members): 16 inches on center.

d. Installation Tolerances: Install steel framing components for suspended ceilings so that cross-furring members or grid suspension members are level to within 1/8 inch in 12 feet as measured both lengthwise on each member and transversely between parallel members.

e. Wire-tie or clip furring members to main runners and to other structural supports as indicated.

f. Grid Suspension System: Attach perimeter wall track or angle where grid suspension system meets vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.

g. Install bracing as required at exterior locations to resist wind uplift.

3. Framing for Walls and Partitions: Space studs at 16 inches on center unless noted otherwise.

a. Install runners (tracks) at floors, ceilings, and structural walls and columns where gypsum board stud assemblies abut other construction.

b. Installation Tolerances: Install each steel framing and furring member so that fastening surfaces do not vary more than 1/8 inch from the plane formed by the faces of adjacent framing.

c. Extend partition framing full height to structural supports or substrates above suspended ceilings, except where partitions are indicated to terminate at suspended ceilings. Cut studs 1/2 inch short of full height. Continue framing over frames for doors and openings and frame around
ducts penetrating partitions above ceiling to provide support for gypsum board.

1) For STC-rated and fire-resistive-rated partitions requiring partitions to extend to the underside of floor/roof slabs and decks or other continuous solid structural surfaces to obtain ratings, install framing around structural and other members extending below floor/roof slabs and decks, as needed, to support gypsum board closures needed to make partitions continuous from floor to underside of solid structure.

d. Install steel studs and furring in sizes and at spacing indicated but not less than that required by the referenced steel framing installation standard to comply with maximum deflection and minimum loading requirements specified:

e. Install steel studs so that flanges point in the same direction and so that leading edges or ends of each gypsum board panel can be attached to open (unsupported) edges of stud flanges first.

f. Frame door openings to comply with details indicated, with GA-219, and with applicable published recommendations of gypsum board manufacturer. Attach vertical studs at jambs with screws either directly to frames or to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.

1) Extend vertical jamb studs through suspended ceilings and attach to underside of floor or roof structure above.

g. Frame openings other than door openings to comply with details indicated or, if none indicated, in same manner as required for door openings. Install framing below sills of openings to match framing required above door heads.

4. Openings: Reinforce openings as required for weight of doors or operable panels, using not less than double studs at jambs.

5. Standard Wall Furring: Install at masonry walls scheduled to receive gypsum board, not more than four inches from floor and ceiling lines and abutting walls. Secure in place on alternate channel flanges at maximum 24 inches on center.

a. Orientation: Horizontal.

6. Blocking: Install blocking for support of toilet accessories and door hardware items. Comply with Section 06 10 00, Rough Carpentry, for wood blocking. Metal backing plates may be used in lieu of wood blocking at Contractor's option.

3.04 APPLICATION

A. Gypsum Board

1. Comply with ASTM C 840 and GA-216. Install to minimize butt end joints, especially in highly visible locations.

2. Single-Layer: Install gypsum board parallel to framing, with ends and edges occurring over firm bearing.

3. Installation on Metal Framing: Use screws for attachment of all gypsum board.
4. Install ceiling board panels across framing to minimize the number of abutting end joints and avoid abutting end joints in the central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member. Do not install water resistant gypsum backing board at ceiling locations.

5. Install wall/partition board panels to minimize the number of abutting end joints or avoid them entirely. Stagger abutting end joints not less than one framing member in alternate courses of board. At stairwells and other high walls, install panels horizontally with end abutting joints over studs and staggered.

6. Install gypsum panels with face side out. Do not install imperfect, damaged, or damp panels. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.

7. Locate both edge or end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Position adjoining panels so that tapered edges abut tapered edges, and field-cut edges abut field-cut edges and ends. Do not place tapered edges against cut edges or ends. Stagger vertical joints over different studs on opposite sides of partitions. Avoid joints at corners of framed openings where possible.

8. Attach gypsum panels to steel studs so that the leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.

9. Attach gypsum panels to framing provided at openings and cutouts.

10. Form control joints and expansion joints at locations indicated and as detailed, with space between edges of adjoining gypsum panels, as well as supporting framing behind gypsum panels.

11. Cover both faces, of steel stud partition framing with gypsum panels in concealed spaces except in chase walls that are braced internally.

   a. Except where concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than eight square feet in area.

   b. Fit gypsum panels around ducts, pipes, and conduits.

12. Space fasteners in gypsum panels according to referenced gypsum board application and finishing standard and manufacturer’s recommendations

**B. Trim and Accessories**

1. Control Joints: Place control joints consistent with lines of building spaces and as indicated.

   a. Not more than 30 feet apart on walls and ceilings over 50 feet long.

2. Corner Beads: Install at external corners, using longest practical lengths.

3. Edge Trim: Install at locations where gypsum board abuts dissimilar materials. Install edge trim where edge of gypsum panels would otherwise be exposed or semi-exposed. Provide edge trim type with face flange formed to receive joint compound except where other types are indicated.
a. Install LC-bead where gypsum panels are tightly abutted to other construction and back flange can be attached to framing or supporting substrate.

b. Install L-bead where edge trims can only be installed after gypsum panels are installed

3.05 FINISHES

A. Joint Treatment

1. General: Apply joint treatment at gypsum board joints (both directions); flanges of corner bead, edge trim, and control joints; penetrations; fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration and levels of gypsum board finish indicated.

2. Pre-fill open joints, rounded or beveled edges, and damaged areas using setting-type joint compound.

3. Apply joint tape using setting type compound over gypsum board joints and to trim accessories with concealed face flanges as recommended by trim accessory manufacturer and as required to prevent cracks from developing in joint compound at flange edges.

4. Use drying type compound for additional finishing.

B. Gypsum Board

1. Level 4 gypsum board finish, embed tape in joint compound and apply three separate coats of joint compound over joints, angles, fastener heads, and accessories. Touch up and sand between coats and after last coat as needed to produce a surface free of visual defects and ready for decoration.

   a. Location: Walls and ceilings scheduled to receive flat or eggshell paint finish (if any).

2. Level 5 gypsum board finish: Apply joint treatment specified for Level 4 plus a thin, uniform skim coat of joint compound over entire surface. Use joint compound specified for the finish (third coat) or a product specially formulated for this purpose and acceptable to gypsum board manufacturer. Produce surfaces free of tool marks and ridges ready for decoration of type indicated.

   a. Location: Walls and ceilings scheduled to receive semi-gloss or gloss paint finish.

3. Where Level 2 gypsum board finish is indicated, apply joint compound specified for first coat in addition to embedding coat.

   a. Location: Above finished ceilings concealed from view, for ceiling plenum areas, and where indicated, unless a higher level of finish is required for fire-resistive-rated assemblies and/or sound-rated assemblies.

3.06 FIELD QUALITY CONTROL

A. Tolerances

1. Maximum Variation of Finished Gypsum Board Surface from True Flatness: 1/8 inch in ten feet in any direction.
3.07 CLEANING
   A. Promptly remove all residual joint compound from adjacent surfaces.

3.08 PROTECTION
   A. Provide final protection and maintain conditions, in a manner suitable to Installer that ensures gypsum board assemblies remain without damage or deterioration at time of Completion.

END OF SECTION
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PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes specifications for portland cement plasterwork (stucco) on metal lath in protected unconditioned location.

B. Related Sections: The work of the following Sections is related to the work of this Section. Other Sections, not referenced below, may also be related to the proper performance of this work.

1. Section 09 06 00, Schedules for Finishes
2. Section 09 21 16, Gypsum Drywall Assemblies: Framing and substrate for plasterwork.

1.02 REFERENCES

A. This Section incorporates by reference the latest revisions of the following documents.

1. American Society for Testing and Materials International (ASTM)
   a. ASTM A 641/A 641M: Specification for Zinc-Coated (Galvanized) Carbon Steel Wire
   b. ASTM A 653/A 653M: Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
   c. ASTM C 150: Specification for Portland Cement
   d. ASTM C 206: Specification for Finishing Hydrated Lime
   e. ASTM C 207: Specification for Hydrated Lime for Masonry Purposes
   f. ASTM C 847: Specification for Application of Portland Cement-Based Plaster
   g. ASTM C 926: Specification for Application of Portland Cement-Based Plaster
   h. ASTM C 926: Specification for Application of Portland Cement-Based Plaster
   i. ASTM C 1032: Specification for Woven Wire Plaster Base
   j. ASTM C 1063: Specification for Installation of Lathing and Furring to Receive Interior and Exterior Portland Cement-Based Plaster
   k. ASTM C 1328: Specification for Plastic (Stucco) Cement
1.03 SUBMITTALS
A. Samples for Verification: For each type of finish coat indicated; 12 by 12 inches, and prepared on rigid backing.

1.04 DELIVERY, STORAGE, AND HANDLING
A. Store materials inside under cover and keep them dry and protected against damage from weather, direct sunlight, surface contamination, corrosion, construction traffic, and other causes.

1.05 PROJECT CONDITIONS
A. Comply with ASTM C 926 requirements.
B. Exterior Plasterwork:
   1. Apply and cure plaster to prevent plaster drying out during curing period. Use procedures required by climatic conditions, including moist curing, providing coverings, and providing barriers to deflect wind.
C. Factory-Prepared Finishes: Comply with manufacturer's written recommendations for environmental conditions for applying finishes.

PART 2 - PRODUCTS

2.01 METAL LATH

2.02 ACCESSORIES
A. General: Comply with ASTM C 1063 and coordinate depth of trim and accessories with thicknesses and number of plaster coats required.
B. Metal Accessories:
   2. Casing Beads: Fabricated from zinc-coated (galvanized) steel; square-edged style; with expanded flanges.
   3. Control Joints: Fabricated from zinc-coated (galvanized) steel; one-piece-type, folded pair of unperforated screeds in M-shaped configuration; with perforated flanges and removable protective tape on plaster face of control joint.

2.03 MISCELLANEOUS MATERIALS
A. Water for Mixing: Free of substances capable of affecting plaster set or of damaging plaster, lath, or accessories.
B. Fiber for Base Coat: Alkaline-resistant glass or polypropylene fibers, 1/2 inch long, free of contaminants, manufactured for use in portland cement plaster.
C. Fasteners for Attaching Metal Lath to Substrates: Complying with ASTM C 1063.
D. Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, not less than 0.0475-inch diameter, unless otherwise indicated.

2.04 BASE COAT PLASTER MATERIALS
B. Plastic Cement: ASTM C 1328.
C. Lime: ASTM C 206, Type S; or ASTM C 207, Type S.
D. Sand Aggregate: ASTM C 897.

2.05 FINISH COAT PLASTER MATERIALS
A. Contractor's Option: Site-mix finish coat plaster or ready-mixed finish-coat plaster may be used.
B. Finish Coat Plaster Materials:
   1. Portland Cement: ASTM C 150, Type I or Type II.
   3. Lime: ASTM C 206, Type S; or ASTM C 207, Type S.
   5. Colorants for Job-Mixed Finish Coats: Colorfast mineral pigments that produce finish plaster color specified in Section 09 06 00, Schedules for Finishes. Acceptable manufacturers include:
      a. Bayer Corporation.
      b. Davis Color.
   1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
      b. LaHabra, a brand of ParexLaHabra, Inc.; Exterior Stucco Color Coat.
      c. QUIKCRETE; QUIKCRETE Finish Coat Stucco, No. 1201.
      d. USG Corporation; Oriental Exterior Finish Stucco.
D. Color: In accordance with Section 09 06 00 Schedules for Finishes.

2.06 PLASTER MIXES
A. General: Comply with ASTM C 926 for applications indicated.
1. **Fiber Content:** Add fiber to base-coat mixes after ingredients have mixed at least two minutes. Comply with fiber manufacturer’s written instructions for fiber quantities in mixes, but do not exceed 1 lb of fiber/cu. yd. of cementitious materials.

2. **Installer’s option:** Use either portland cement plaster and lime or use plastic cement plaster and portland cement for cementitious content of base coat mixes.

B. **Base-Coat Mixes for Use over Metal Lath:** Scratch and brown coats for three-coat plasterwork as follows:

1. **Portland Cement Mixes:**
   a. **Scratch Coat:** For cementitious material, mix 1 part portland cement and 3/4 to 1-1/2 parts lime. Use 2-1/2 to 4 parts aggregate per part of cementitious material.
   b. **Brown Coat:** For cementitious material, mix 1 part portland cement and 3/4 to 1-1/2 parts lime. Use 3 to 5 parts aggregate per part of cementitious material, but not less than volume of aggregate used in scratch coat.

2. **Portland and Plastic Cement Mixes:**
   a. **Scratch Coat:** For cementitious material, mix 1 part plastic cement and 1 part portland cement. Use 2-1/2 to 4 parts aggregate per part of cementitious material.
   b. **Brown Coat:** For cementitious material, mix 1 part plastic cement and 1 part portland cement. Use 3 to 5 parts aggregate per part of cementitious material, but not less than volume of aggregate used in scratch coat.

C. **Factory-Prepared Finish-Coat Mixes:** For ready-mixed finish-coat plasters, comply with manufacturer’s written instructions.

**PART 3 - EXECUTION**

3.01 **EXAMINATION**

A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 **PREPARATION**

A. Protect adjacent work from soiling, spattering, moisture deterioration, and other harmful effects caused by plastering.

B. Prepare solid substrates for plaster that are smooth or that do not have the suction capability required to bond with plaster according to ASTM C 926.

3.03 **INSTALLING METAL LATH**

A. Expanded-Metal Lath: Install according to ASTM C 1063.
3.04 INSTALLING ACCESSORIES

A. Install according to ASTM C 1063 and at locations indicated on Contract Drawings.

B. Control Joints: Install control joints at locations indicated on Contract Drawings.

1. As required to delineate plasterwork into areas (panels) of the following maximum sizes:
   a. Vertical Surfaces: 144 sq. ft.
   b. Horizontal and other Nonvertical Surfaces: 100 sq. ft.

2. At distances between control joints of not greater than 18 feet o.c.

3. As required to delineate plasterwork into areas (panels) with length-to-width ratios of not greater than 2-1/2:1.

4. Where control joints occur in surface of construction directly behind plaster.

5. Where plasterwork areas change dimensions, to delineate rectangular-shaped areas (panels) and to relieve the stress that occurs at the corner formed by the dimension change.

3.05 PLASTER APPLICATION

A. General: Comply with ASTM C 926.

1. Do not deviate more than plus or minus 1/4 inch in 10 feet from a true plane in finished plaster surfaces, as measured by a 10-foot straightedge placed on surface.

2. Finish plaster flush with metal frames and other built-in metal items or accessories that act as a plaster ground unless otherwise indicated. Where casing bead does not terminate plaster at metal frame, cut base coat free from metal frame before plaster sets and groove finish coat at junctures with metal.

3. Provide plaster surfaces that are ready to receive field-applied finishes indicated.

B. Base-Coat Mixes for Use over Metal Lath: Scratch and brown coats for three-coat plasterwork; 5/8 to 3/4 inch thick.

C. Plaster Finish Coats: Apply to provide burnished trowel finish to match Resident Engineer's sample.

1. Maintain a wet edge at all times to produce a uniform finish of color and texture matching approved sample and free of cold joints, scaffold lines, shadow lines, and texture variations.

3.06 PLASTER REPAIRS

A. Repair or replace work to eliminate cracks, dents, blisters, buckles, crazing and check cracking, dry outs, efflorescence, sweat outs, and similar defects and where bond to substrate has failed.
3.07 PROTECTION

A. Remove temporary protection and enclosure of other work. Promptly remove plaster from door frames, windows, and other surfaces not indicated to be plastered. Repair floors, walls, and other surfaces stained, marred, or otherwise damaged during plastering.

END OF SECTION
SECTION 09 30 00

TILING

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes specifications for:

1. Tile for floor applications (FT-1, FT-2, FT-3, FT-5).
   a. Includes installation of paver tile furnished by Sound Transit (OFM).

2. Tile for interior and exterior wall applications (WT-1a, WT-1b, WT-2, WT-3, WT-4).

3. Tile backer board.
   a. Cementitious backer board.
   b. Coated glass mat backer board.

4. Non-ceramic trim.

B. Related Sections: The work of the following Sections is related to the work of this Section. Other Sections, not referenced below, may also be related to the proper performance of this work.

1. Section 01 64 00, Owner-Furnished Materials and Equipment

2. Section 07 92 00, Joint Sealants.


4. Section 09 32 19, Mortar-Bed Paver Tiling: Concrete paver tile (FT-4).

5. Section 09 96 23, Graffiti- and Water-Resistant Coatings: Water repellent coating for floor tile

1.02 REFERENCES

A. This Section incorporates by reference the latest revisions of the following documents.

1. American National Standards Institute (ANSI)
d. ANSI A108.11 - American National Standard for Interior Installation of Cementitious Backer Units.


g. ANSI A118.4 - American National Standard Specifications for Latex-Portland Cement Mortar.

h. ANSI A118.7 - American National Standard Specifications for Polymer Modified Cement Grouts for Tile Installation.

i. ANSI A118.9 - American National Standard Specifications for Test Methods and Specifications for Cementitious Backer Units.


a. ASTM D 87 Standard Test Method for Melting Point of Petroleum Wax (Cooling Curve)

b. ASTM C1288 Standard Specification for Discrete Non-Asbestos Fiber-Cement Interior Substrate Sheets

c. ASTM D4397 Standard Specification for Polyethylene Sheeting for Construction, Industrial, and Agricultural Applications

3. Tile Council of North America, Inc. (TCA)

a. TCA (HB) - Handbook for Ceramic Tile Installation;

1.03 DEFINITIONS

A. Module Size: Actual tile size (minor facial dimension as measured in accordance with ASTM C 499) plus joint width indicated.

B. Facial Dimension: Actual tile size (minor facial dimension as measured in accordance with ASTM C 499).

C. Facial Dimension: Nominal tile size as defined in ANSI A137.1.

1.04 SYSTEM DESCRIPTION

A. Performance Requirements

1. Static Coefficient of Friction: For tile installed on walkway surfaces, provide products with the following values as determined by testing identical products in accordance with ASTM C 1028:

a. Level Surfaces: Minimum 0.6 when tested wet or dry.
1.05 SUBMITTALS

A. See Section 01 33 00, Submittal Procedures, for submittal procedures.

B. Product Data: Provide manufacturers’ data sheets on tile, mortar, grout, and accessories. Include instructions for using grouts and adhesives.

C. Shop Drawings: Indicate tile layout. Show locations of each type of tile and tile pattern. Show widths, details, and locations of expansion, contraction, control, and isolation joints in tile substrates and finished tile surfaces.

D. Sample Boards: Mount full-size tile of each type and pattern and apply with specified grout on two plywood panels, minimum 18 by 18 inches in size illustrating pattern, color variations, and grout joint size variations.

E. Manufacturer’s Certificate: Certify that all products meet or exceed specified requirements.

F. Maintenance Data: Include recommended cleaning methods, cleaning materials, stain removal methods, and polishes and waxes.

G. Samples for Verification:
   1. Full-size units of each type and composition of tile and for each color and finish required.
   2. Full-size units of each type of trim and accessory.

H. Product Certificates: For each type of product, signed by product manufacturer.

I. Qualification Data: For Installer.

J. Material Test Reports: For each tile-setting and -grouting product.

1.06 QUALITY ASSURANCE

A. Maintain one copy of TCA Handbook and ANSI A108 Series/A118 Series on site.

B. Manufacturer Qualifications: Company specializing in manufacturing the types of products specified in this section, with minimum five years of documented experience.

C. Installer Qualifications: Company specializing in performing tile installation, with minimum of five years of documented experience.

D. Source Limitations for Tile: Obtain all tile of same type and color or finish from one source or producer.
   1. Obtain tile from same production run and of consistent quality in appearance and physical properties for each contiguous area.

E. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from a single manufacturer and each aggregate from one source or producer.

F. Source Limitations for Other Products: Obtain each of the following products specified in this Section through one source from a single manufacturer for each product:
   1. Joint sealants.
G. Pre-installation Conference: Conduct conference at Contract site to comply with requirements in 01 31 13, Project Coordination.

1.07 MOCK-UP
A. See Section 01 45 00, Quality Control, for general requirements for mock-up.
B. Construct tile mock-up where indicated on the Contract Drawings, incorporating all components in colors and finishes specified for the location.
C. Minimum size of mock-up is indicated on the Contract Drawings.
D. Approved mock-up may remain as part of the Work.

1.08 PRE-INSTALLATION MEETING
A. Convene one week before starting work of this section.

1.09 DELIVERY, STORAGE, AND HANDLING
A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirement in ANSI A137.1 for labeling sealed tile packages.
B. Sound Transit-supplied detectable warning surface tile and sandblast engraved granite pavers will be stored at the following Sound Transit storage facility where they may be picked up by the Contractor upon request to the Resident Engineer:
   1. 3409 C Street, # 6 and # 7, Auburn, Washington
C. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.
D. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.
E. Store liquid latexes and emulsion adhesives in unopened containers and protected from freezing.
F. Handle tile that has temporary protective coating on exposed surfaces to prevent coated surfaces from contacting backs or edges of other units. If coating does contact bonding surfaces of tile, remove coating from bonding surfaces before setting tile.

1.10 PROJECT CONDITIONS
A. Environmental Requirements
   1. Do not install adhesives in an unventilated environment.
   2. Maintain ambient and substrate temperature of 50 degrees F during installation of mortar materials.
   3. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer’s written instructions.
1.11 EXTRA MATERIALS
   A. Furnish extra materials described below that match products installed and that are
      packaged with protective covering for storage and identified with labels describing
      contents.
      
      1. Tile and Trim Units: Furnish quantity of full-size units equal to 3 percent of
         amount installed, for each type, composition, color, pattern, and size indicated.

PART 2 - PRODUCTS

2.01 MANUFACTURERS
   A. In other Part 2 Articles where titles below introduce lists, the following requirements apply
      for product selection:
      
      1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the manufacturers specified.

2.02 MATERIALS - GENERAL
   A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1, “Specifications for Ceramic Tile,” for types, compositions, and other characteristics indicated.
      
      1. For facial dimensions of tile, comply with requirements relating to tile sizes specified in Definitions Article 1.03, herein.
   B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI standards referenced in Article 2.06 below titled, "Setting Mortar and Grouting Materials".
   C. Factory Blending: For tile exhibiting color variations within ranges selected during Sample submittals, blend tile in factory and package so tile units taken from one package show same range in colors as those taken from other packages and match approved Samples.
   D. Factory-Applied Temporary Protective Coating: Where indicated under tile type, protect exposed surfaces of tile against adherence of mortar and grout by pre-coating with continuous film of petroleum paraffin wax, applied hot. Do not coat unexposed tile surfaces.

2.03 TILE
   A. Approved Manufacturers:
      
      6. Substitutions: See Section 01 25 00, Substitution Procedures.
B. Unglazed Ceramic Floor Tiling (FT): Flat tile as follows:

1. FT-1, Product basis-of-design product: Crossville “Graphite” A850
2. FT-2, Product basis-of-design product: Crossville “Ebony” A890
4. Surface: Slip-resistant, with abrasive admixture.
5. Module Size: 12 inch by 12 inch.
7. Face: Plain with cushion edges.

C. Glazed Ceramic Wall Tiling (WT): Flat tile as follows:

1. WT-1 (A & B)
   a. Basis-of-design products
      1) WT-1A Daltile "Modern Dimensions"
      2) WT-1B Daltile "Matte Series"
   b. Composition: Ceramic.
   c. Surface: Smooth, without abrasive admixture.
   d. WT-1A Module Size: 4 by 8 inch
   e. WT-1B Module Size 8 by 8 inch.
   f. Nominal Thickness: 5/16 inch.
   g. Face: Plain with cushion edges.
   h. Color and Finish: To be determined by Resident Engineer.

2. WT-2, Product basis-of-design product: Daltile "Modern Dimensions"
   a. Composition: Ceramic.
   b. Surface: Smooth, without abrasive admixture.
   c. Module Size: 4-1/4 by 8-1/2 inch
   d. Nominal Thickness: 5/16 inch.
   e. Face: Plain with cushion edges.
   f. Color and Finish: (Color Match K111 "Black"); gloss finish.

3. WT-3, Product basis-of-design product: Daltile "Modern Dimensions"
   a. Composition: Ceramic.
   b. Surface: Smooth, without abrasive admixture.
c. Module Size: 4-1/4 by 8-1/2 inch
d. Nominal Thickness: 5/16 inch.
e. Face: Plain with cushion edges.

4. WT-4, Product basis-of-design product: Daltile "Modern Dimensions"
   a. Composition: Ceramic.
   b. Surface: Smooth, without abrasive admixture.
   c. Module Size: 4-1/4 by 8-1/2 inch
d. Nominal Thickness: 5/16 inch.
e. Face: Plain with cushion edges.
f. Color and Finish: (Color Match K111 "Navy"); gloss finish.

2.04 SOUND TRANSIT FURNISHED TILE
A. FT-3: Sandblast Engraved Granite Pavers: 8 inch by 16 inch by 5/8 inch (nominal) sandblast engraved granite pavers. (OFCI)
   1. Pre-sealing: Pre-seal surface of Engraved Granite Pavers products with temporary protective coating prior to delivery to jobsite.
   2. See Section 01 64 00, Owner-Furnished Materials and Equipment.
B. FT-5: Detectable Warning Surface Tile:
   1. Platform Edge Detectable Warning Tile: 12 inch by 12 inch by 3/8 inch (nominal) porcelain tiles with orthogonal truncated domes. (OFCI)
   2. See Section 01 64 00, Owner-Furnished Materials and Equipment.

2.05 PRECAST CONCRETE PAVERS (FT-4)
A. See Section 09 32 19, Mortar-Bed Paver Tiling.

2.06 SETTING MORTAR AND GROUTING MATERIALS
   1. Cleavage Membrane: Asphalt felt, ASTM D 226, Type I (No. 15); or polyethylene sheeting, ASTM D 4397, 4.0 mils thick.
   2. Reinforcing Wire Fabric: Galvanized, welded wire fabric, 2 by 2 inches by 0.062-inch diameter; comply with ASTM A 185 and ASTM A 82 except for minimum wire size.
B. Approved Manufacturers of Latex-Portland Cement Mortar and Polymer-Modified Tile Grout:
   1. Bostik.
2. Custom Building Products.

3. DAP, Inc.

4. LATICRETE International Inc.

5. MAPEI Corporation.

6. Substitutions: See Section 01 25 00, Substitution Procedures.

C. Latex-Portland Cement Mortar (Thin Set/Bond Coat): ANSI A118.4, consisting of the following:

1. Prepackaged dry-mortar mix containing dry, redispersible, ethylene vinyl acetate additive to which only water must be added at Contract site.

2. For wall applications, provide non-sagging mortar that complies with Paragraph F-4.6.1 in addition to the other requirements in ANSI A118.4.

D. Polymer-Modified Tile Grout: ANSI A118.7, color to be manufacturers dark grey as selected by Resident Engineer.

1. Polymer Type: Ethylene vinyl acetate, in dry, redispersible form, prepackaged with other dry ingredients.

   a. Unsanded grout mixture for joints 1/8 inch and narrower.

2.07 ACCESSORY PRODUCTS

A. Elastomeric Sealants

1. General: Provide manufacturer's standard chemically curing, elastomeric sealants of base polymer and characteristics indicated that comply with applicable requirements in Section 07 92 00, Joint Sealants.

2. Colors: Provide colors of exposed sealants to match colors of grout in tile adjoining sealed joints, unless otherwise indicated.

3. Wall: One-Part, Mildew-Resistant Silicone Sealant; ASTM C 920; Type S; Grade NS; Class 25; Uses NT, G, A, and, as applicable to nonporous joint substrates indicated, O; formulated with fungicide, intended for sealing interior ceramic tile joints and other nonporous substrates that are subject to in-service exposures of high humidity and extreme temperatures.

   a. Approved Products:

      1) Dow Corning Corporation; Dow Corning 786.

      2) GE Silicones; Sanitary 1700.

      3) Pecora Corporation; Pecora 898 Sanitary Silicone Sealant.

      4) Tremco, Inc.; Tremsil 600 White.

      5) Substitutions: See Section 01 25 00, Substitution Procedures.

4. Floor: Multipart, Pourable Urethane Sealant for Use T; ASTM C 920; Type M; Grade P; Class 25; Uses T, M, A, and, as applicable to joint substrates indicated, O.
a. Approved Products:

1) Bostik; Chem-Calk 550.
3) Pecora Corporation; NR-200 Urexpan.
4) Tremco, Inc.; THC-900.
5) Substitutions: See Section 01 25 00, Substitution Procedures.

B. Miscellaneous Materials

1. Trowelable Underlayments and Patching Compounds: Latex-modified, portland cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.

2. Temporary Protective Coating: Either product indicated below that is formulated to protect exposed surfaces of tile against adherence of mortar and grout; compatible with tile, mortar, and grout products; and easily removable after grouting is completed without damaging grout or tile.
   a. Petroleum paraffin wax, fully refined and odorless, containing at least 0.5 percent oil with a melting point of 120 to 140 degrees F in accordance with ASTM D 87.
   b. Grout release in form of manufacturer's standard proprietary liquid coating that is specially formulated and recommended for use as temporary protective coating for tile.

3. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.

4. Grout Sealer: Manufacturer's standard silicone product for sealing grout joints that does not change color or appearance of grout.
   a. Available Products:
      1) Bostik; CeramaSeal Grout Sealer.
      3) MAPEI Corporation; KER 004, Keraseal Penetrating Sealer for Unglazed Grout and Tile.
      4) Substitutions: See Section 01 25 00, Substitution Procedures.

C. Trim

1. Non-Ceramic Trim: Brushed stainless steel, style and dimensions to suit application, for setting using tile mortar or adhesive.
   a. Applications: Use in the following locations:
      1) Open edges of wall tile.
2) Borders and other trim as indicated on Contract Drawings.

b. Manufacturer:


2) Ceramic Tool Company.

3) Substitutions: See Section 01 25 00, Substitution Procedures.

D. Tile Backer Board: One of the following

1. Cementitious Backer Board: ANSI A118.9; High density, cementitious, glass fiber reinforced, 1/2 inch thick.

2. Fiber-Cement Underlayment: ASTM C 1288, 1/2 inch thick.

E. Mesh Tape: 2-inch wide self-adhesive fiberglass mesh tape.

F. Cleavage Membrane: Polyethylene sheet, ASTM D 4397, not less than 6 mils thick.

2.08 MIXING MORTARS AND GROUT

A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.

B. Add materials, water, and additives in accurate proportions.

C. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that sub-floor surfaces are smooth and flat within the tolerances specified for that type of work and are ready to receive tile.

B. Verify that wall surfaces are smooth and flat within the tolerances of ANSI 118-A-4.8 specified for that type of work, are dust-free, and are ready to receive tile.

1. Framing members shall be straight, plumb or level, of uniform dimension, and aligned to provide square corners. Maximum variation from required plane shall be 1/4 inch in 10 feet for floor joists, wall studs, and ceiling joists.

C. Verify that sub-floor surfaces are dust-free and free of substances which would impair bonding of setting materials to sub-floor surfaces.

D. Verify that concrete sub-floor surfaces are ready for tile installation by testing for moisture emission rate and alkalinity; obtain instructions if test results are not within the following limits:

1. Moisture emission rate: Not greater than eight pounds per 1000 square feet per 24 hours when tested using calcium chloride moisture test kit for 72 hours.


E. Verify that required floor-mounted fixtures and utilities are in correct locations.
3.02 PREPARATION

A. Protect surrounding work from damage.
B. Vacuum clean surfaces and damp clean.
C. Seal substrate surface cracks with filler. Level existing substrate surfaces to acceptable flatness tolerances.

3.03 INSTALLATION

A. General

1. Install tile and thresholds and grout in accordance with applicable requirements of ANSI A108.1 through A108.13, manufacturer’s instructions, and TCA Handbook recommendations.

2. Lay tile to pattern indicated on Contract Drawings. Do not interrupt tile pattern through openings.

3. Cut and fit tile to penetrations through tile, leaving sealant joint space. Form corners and bases neatly. Align floor and wall joints.

4. Place tile joints uniform in width, subject to variance in tolerance allowed in tile size. Make joints watertight, without voids, cracks, excess mortar, or excess grout.

5. Install non-ceramic trim in accordance with manufacturer’s instructions.

6. Sound tile after setting. Replace hollow sounding units.

7. Keep expansion joints free of adhesive or grout. Apply sealant to joints.

8. Allow tile to set for a minimum of 48 hours prior to grouting.

9. Grout tile joints. Use standard grout unless otherwise indicated.

10. Apply sealant to junction of tile and dissimilar materials and junction of dissimilar planes.

B. Substrate

1. Install tile backer board in strict accordance with ANSI A108.11 and board manufacturer’s instructions, using galvanized roofing nails or corrosion-resistant bugle head drywall screws. Bed fiberglass self-adhesive tape at all joints and corners with material used to set tiles.

C. Cleavage Membrane

1. Install cleavage membrane by laying over structural slab. Lap joints minimum 4 inches. Secure using tape or other means to prevent displacement during mortar bed installation.

3.04 CLEANING

A. On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.
1. Remove latex-portland cement grout residue from tile as soon as possible.

2. Clean grout smears and haze from tile according to tile and grout manufacturer's written instructions, but no sooner than 10 days after installation. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.

3. Remove temporary protective coating by method recommended by coating manufacturer that is acceptable to tile and grout manufacturer. Trap and remove coating to prevent it from clogging drains.

B. When recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors.

3.05 PROTECTION

A. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear.

B. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed.

C. Before final inspection, remove protective coverings and rinse neutral cleaner from tile surfaces.

D. Application of water repellent to floor tile is specified in Section 09 96 23, Graffiti- and Water-Resistant Coatings.

3.06 INTERIOR TILE INSTALLATION SCHEDULE

A. Exterior Floor Installations:
   1. Tile Installation F101: Cement mortar bed (thickset) bonded to concrete; TCA F101 and ANSI A108.1B.
   2. Tile Type: All FT

B. Interior Floor Installations, Concrete Subfloor:
   1. Tile Installation F111: Cement mortar bed (thickset) with cleavage membrane; TCA F111 and ANSI A108.1B.
      a. Tile Type: All FT-
      c. Grout: Polymer-modified sanded grout.

C. Interior Wall Installations, Metal Studs or Furring:
   1. Tile Installation: Thin-set mortar on cementitious backer units or fiber cement underlayment; TCA W244.
a. Tile Type: All WT-.

b. Thin-Set Mortar: Latex- portland cement mortar.

c. Grout: Polymer-modified sanded grout.

D. Interior Wall Installations: Concrete or CMU:


   a. Tile Type: All WT-.

   b. Thin-Set Mortar: Latex- portland cement mortar.

   c. Grout: Polymer-modified sanded grout.

END OF SECTION
PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes specifications precast concrete pavers installed in mortar bed at exterior and interior areas. (FT-4a, FT-4b)

B. Related Sections: The work of the following Sections is related to the work of this Section. Other Sections, not referenced below, may also be related to the proper performance of this work.

1. Section 07 92 00, Joint Sealants.
2. Section 09 06 00, Schedules for Finishes.
3. Section 09 30 00, Tiling.
4. Section 09 96 23, Graffiti- and Water-Resistant Coatings.

1.02 REFERENCES

A. This Section incorporates by reference the latest revisions of the following documents.

1. American Society for Testing and Materials International (ASTM)
   a. ASTM A 185 Specification for Steel Welded Wire, Fabric, Plain for Concrete Reinforcement
   b. ASTM C 33 Concrete Aggregates
   c. ASTM C144 Aggregate for Masonry Mortar
   d. ASTM C 150 Portland Cement
   e. ASTM C 979 Pigments for Integrally colored concrete

2. American Standards Institute (ANSI)
   a. ANSI A108.1B Installation of Ceramic Tile on a Cured Portland Cement Mortar Setting Bed with Dry-Set or Latex Portland Cement Mortar
   b. ANSI A108.10 Installation of Grout in Tilework
   c. ANSI A118.4 Latex Portland Cement Mortar

1.03 SUBMITTALS

A. Procedures: Section 01 33 00, Submittal Procedures.

B. Layout Drawings: Submit layout drawings showing typical installation of pavers, including layout dimensions, field cutting, coordination of lid pavers with underslab vaults and handholds; and other pertinent information.

C. Submit product data for the following products:
   1. Precast Concrete pavers.
   2. Latex additives for use in mortar bed, bond coat, and grout.
   3. Color pigments.
   4. Sealant for expansion joints.

D. Submit additional samples for approval.
   1. Precast Pavers; Submit three sets of precast concrete pavers samples for verification purposes in full size units of each of unit paver indicated in sets for each color, texture and pattern specified, showing full range of variations expected in these characteristics.
   2. Grout: Submit samples of grout.

E. Mortar Bed and Grout Mixes: Submit mix designs for mortar bed and grout, including gradation of sand and amount of color pigments required (grout).

F. Qualification data for firms and persons specified in Article 1.04, herein, to demonstrate their capabilities and experience. Include list of completed projects with project names, addresses, names of architects and owners, plus other information specified.

G. Submit manufacturer's written warranty that each paver type specified and supplied is suitable for supporting vehicular loads.

H. Contract Closeout Submittal: Submit the following at time of Project Closeout in accordance with the provisions in Section 01 77 00, Closeout Procedures, and Section 01 78 23, Operation and Maintenance Data.
   1. Manufacturer’s data on paver, including color pigment, type of aggregates, and finish.
   2. Grout color and mix proportion.

1.04 QUALITY ASSURANCE

A. Manufacturers Qualifications: Minimum of five years experience in the manufacturing of precast concrete units of quality specified.

B. Installer Qualifications: Engage an experienced Installer who has successfully completed unit paver installations similar in material, design, and extent to that indicated for the Contract.

C. Single Source Responsibility: Obtain each color, type and variety of unit pavers, joint materials and setting materials from a single source with resources to provide products and materials of consistent quality in appearance and physical properties without delaying progress of the work.
D. Tolerance:

1. Fabrication Tolerances: Permissible variations in dimensions shall not differ by more than plus or minus 1/16 inch in width, height, length, thickness, concave or convex deflection.

2. Installation Tolerance: Vertical - Do not exceed 1/8 inch in 10 feet in all directions from level or slopes indicated when tested with a 10-foot straightedge.

3. Installation Tolerances: Horizontal – Units shall be installed with the centerline of joints on a 2-foot 0-inch module in both direction along the length and width of the station platforms. Cumulative variances from the 2-foot 0-inch module shall not exceed 1 inch in 190 feet measured in all directions from the centerline of the platform.

E. Acceptability or Appearance: The following list of finish defects shall be considered as unacceptable and shall be replaced with a new unit at no additional cost.

1. Pavers not being within the approved color range
2. Non-uniformity of surface texture.
3. Foreign material embedded in the face.
4. Shrinkage cracks.
5. Ragged or irregular edges. Minor defects incidental to the usual method of manufacturer or slight chipping resulting from handling and delivery may be acceptable to the Resident Engineer provided such defects are minor in scope and do not affect the overall quality and appearance of the work.

F. Field Constructed Mock-Up: Prior to installation of unit pavers, erect mock-ups for each form and pattern of unit pavers required to verify selections made under sample submittals, to match with finish material board sample, and to establish the appearance and workmanship standards required for the project. Grout joints with same type and color of grout to be used in the Work. Mock-up areas shall be a minimum of 100 square feet. Build mock-ups to comply with the following requirements, using materials and same base construction.

1. Locate mock-ups on-site in location and size indicated.
2. Notify Resident Engineer one week in advance of the dates and times when mock-ups will be erected.
3. Demonstrate quality of workmanship that will be produced in final unit of work.
4. Obtain acceptance of mock-ups before start of final unit of work.
5. Retain and maintain mock-ups during construction in undisturbed condition as a standard for judging completed unit of work.
   a. When directed, demolish and remove mock-ups from Project site.
   b. Accepted mock-ups in undisturbed condition at time of substantial completion may become part of completed unit of work.

G. Extra Stock: Furnish extra stock of quantity equal to 0.5 percent of amount installed, in full-size units, for each type, color, size and finish of tile.
1.05 DELIVERY, STORAGE AND HANDLING

A. General: Comply with requirements specified in Section 01 60 00, Product Requirements.

B. Deliver precast pavers on wood pallets, covered with non-staining waterproof membrane; allow air to circulate around precast units.

C. Handle precast units to prevent chipping, breakage, soiling or other damage. Do not use pinch or wrecking bars without protecting edges of precast units with wood or other rigid materials. Lift with wide-belt type slings wherever possible; do not use wire ropes or ropes containing tar or other substances that might cause staining. If required, use wood rollers and provide cushion at end or wood slides.

D. Protect mortar materials and precast units work accessories from weather, moisture, and contamination with foreign materials. Protect liquid components from freezing.

1.06 PROJECT CONDITIONS

A. Review installation procedures, and coordinate with other work, and others whose work will be affected by the precast units work.

B. Cold Weather Protection: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen subgrade or setting beds. Remove and replace unit paver work damaged by frost or freezing.

C. Weather Limitations: Protect unit paver work against freezing when atmospheric temperature is 40 degrees F and falling. Heat materials and provide temporary protection of completed portions of unit paver work. Comply with International Masonry All Weather Council, Guide Specification for Cold Weather Masonry Construction, Section 04200, Article 3.

D. Hot Weather Requirements: Protect unit paver work when temperature and humidity conditions produce excessive evaporation of setting beds and grout. Provide artificial shade and wind breaks and use cooled materials as required. Do not apply mortar to substrates with temperatures of 100 degrees F and above.

PART 2 - PRODUCTS

2.01 PRECAST CONCRETE PAVERS (FT-4)

A. Type and Manufacturer: Wausau Tile “Terra-Pavers” – Type 3 Cotillion FDX, Abbotsford Concrete Products Ltd. “HydralPressed Paving slabs”, or approved equal machine made paver meeting the following requirement:

1. Type FT-4a: Standard paver, sizes 1 and 2
2. Type FT-4b: Ribbed top surface tactile paver, sizes 1 and 2
3. Sizes:
   a. 23-13/16 inches by 23-13/16 inches by 2 inches thick: (Size 1)
   b. 15-13/16 inches by 23-13/16 inches by 2 inches thick: (Size 2)
4. Color: Dark grey to match either of the following:
   a. Wausau Terra Pavers, Type 3, FDX 3008
b. Mutual Materials Hydra-Pressed Paving Slabs, "Texada Charcoal".

5. Finish: Provide manufacturer’s standard light sandblast finish.

6. Edges: Manufacturer’s standard chamfer on top edges (four sides).

B. Method of Fabrication: Fabricated on the Fielding Press or similar method utilizing the wet mix process.

C. Physical Properties:

1. Compressive Strength: Minimum 7,000 psi at 28 days when tested in accordance with ASTM C140.

2. Water Absorption: Maximum of five percent when tested in accordance with ASTM C140.

3. Freeze/Thaw: Pavers shall meet the freeze/thaw tests in accordance with Section 8 of ASTM C67. Specimens when tested shall have no breakage and not greater than one percent loss in dry weight of any individual unit when subjected to 50 cycles of freezing and thawing.

2.02 MATERIAL FOR PAVERS

A. Portland Cement: ASTM C150, Type I. White and gray colors may be required to achieve desired finish color. Use one brand for each type of cement.

B. Aggregates: Normal weight type conforming to ASTM C33, except grading limits shall be as recommended by the paver manufacturer.

C. Color Pigments: Synthetic mineral oxide, sunlight and alkali-fast, conforming to ASTM C979, and certified to be resistant to lime and other alkalis and be compatible with other admixtures that are used in pavers.

2.03 SETTING MATERIALS (MORTAR SET PAVERS)

A. Portland Cement: ASTM C150, Type I or II

B. Sand: Clean, fine sand conforming to ASTM C144.

1. Sand for mortar bed: Uniformly graded from coarse to fine with 100 percent passing the No. 4 sieve and not more than ten percent passing the No. 100 sieve.

2. Sand for grout: Uniformly graded from coarse to fine with not more than 5 percent passing the No. 100 sieve and 100 percent passing the No. 16 sieve.

C. Latex Additive for Mortar Setting Bed: Mapei, Inc. “Planicrete 50”, Laticrete International, Inc. “3701 Latex Additive”, or approved equal latex material which is recommended for use in mortar beds for exterior applications.


F. Color Pigments (Grout): As specified for precast concrete pavers, color to match field paver selected by Resident Engineer.

G. Reinforcing Mesh: ASTM A185, 2 inches by 2 inches by 16/16 gage, galvanized welded wire mesh.

H. Water: Clean and free of deleterious materials that would impair strength or bond.

2.04 MIXES (MORTAR SET)

A. Setting Bed: Proportions shall consist of 1 part portland cement to three parts sand by volume. Measure sand in damp, loose condition. Mix cement and sand with 50 percent latex additive and 50 percent water in accordance with manufacturer’s directions.

B. Bond Coat: Mix 1:1 portland cement/sand gauged with latex additive in accordance with manufacturer’s directions. Mortar shall conform to ANSI A118.4.

C. Grout: Proportions shall consist of one part portland cement, three parts sand by volume, and color pigment. Measure sand in damp, loose condition. Mix cement, sand, and pigments with 100 percent latex additive. Grout complies with ANSI A118.6.

D. Sealant: Sealant and back-up material for expansion joints shall be as specified in Section 07 92 00; Joint Sealants, sealant shall be type “B”.

PART 3 - EXECUTION

3.01 EXAMINATION:

A. Examine areas where installation of precast concrete pavers will occur with Installer present. Verify that substrates and conditions are satisfactory for installation and comply with manufacturer’s requirements and those specified in this Section. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved. Commencement of work constitutes acceptance of conditions.

3.02 PREPARATION

A. Vacuum subbase to remove dirt, dust, debris, and loose particles.

B. Remove substance from concrete substrates that could impair bond of mortar, including wiring and sealing compounds, form oil and laitance.

3.03 INSTALLATION, GENERAL

A. Do not use precast units with chips, cracks, voids, stains, or other defects that might be visible in the finished work. Before setting precast units, examine units for conformance with specified fabrication tolerances and appearance standards; units not meeting requirements shall be rejected.

B. Use power driven masonry saws for cutting of pavers; provide clean, sharp unchipped edges; cut to provide pattern indicated and to fit adjoining work neatly; accurately form corners. All cut pavers that abut other pavers shall have the top edges cut to maintain the 1/4-inch chamfer edges. Use full units without cutting wherever possible.

C. Maintain surface plane for finish pavers not exceeding a tolerance of 1/8 inch in 10 feet when tested with a 10-foot straightedge.
3.04 PAVER INSTALLATION IN MORTAR BED

A. General: Install precast concrete pavers by conventional thick set portland cement mortar method in accordance with ANSI A108.1B and TCA Method F121.

1. Air temperature and relative humidity shall be within the latex additive manufacturer’s established limits when setting precast units.

2. Clean precast units of all surface contaminants prior to setting. Special attention shall be given to backside to remove all bond breaker that may be present as a result of manufacturing process.

3. If recommended by the mortar manufacturer, wet precast units prior to back buttering so the rate of absorption is within manufacturer’s limits.

B. Apply mortar setting bed to uniform thickness to produce a true surface, level in plane or uniformly sloped for drainage as indicated on Contract Drawings; apply setting bed to a minimum thickness of 1-1/4 inches. Center reinforcement within mortar bed.

C. When mortar bed has cured, apply latex portland cement mortar bond coat with a notched trowel leaving uniform ribs or ridges of mortar, unless otherwise recommended by latex additive manufacturer, use a notched trowel which will result in 1/4 inch wide by 3/8-inch high ribs of mortar. Do not apply more mortar that can be covered within 20 minutes or before surface has developed a skin. In all cases, mortar shall be wet and tacky when setting pavers.

1. Back butter each paver unit just prior to setting with same mortar bond coat; unless otherwise recommended by latex additive manufacturer, use a notched trowel, which will result in 1/4-inch high ribs of mortar.

2. Tamp and beat each paver unit to ensure 100 percent full bedding and a true surface, free of air voids. Set and level each unit immediately.

3. Set pavers in pattern as indicated on Contract Drawings with uniform joints of not more than 1/4 inch wide to maintain the 2'-0" module and registration of lid pavers with hard-holes.

D. Joints shall be straight, true and uniform. Remove joint fillers or spacers before mortar has set. Adjust all pavers that are out of line before initial set takes place. Completed work shall be free from hollow sounding areas and loose, cracked, or defective pavers.

E. Grouting: Comply with ANSI A108.10. Allow latex thin-set mortar to cure for a minimum of 3 days prior to grouting. Thoroughly clean joints prior to grouting. Force grout into joints, taking care not to smear grout on adjoining paver units.

1. After initial set of grout, finish joints by tooling to produce a flush polished joint, free from drying cracks.

2. Before grout sets, clean off excess and fill all skips and gaps. Finish grout shall be uniform in color, smooth and without voids, pinholes or low spots.

3. After grouting exterior locations, cover pavers to protect from moisture until latex additives have set to the point where it is no longer water sensitive.

F. Expansion Joint: Locate expansion joints as indicated on Contract Drawings; expansion joints shall extend through setting bed; joints shall be uniform 3/8 inch wide.
1. Premolded joint filler shall be of height required to extend through setting bed to within 1/2 inch from top of paver. Provide removable wood strips on top of premolded filler to provide space for joint filler and sealant.

2. Expansion joints shall be in accordance with TCA Method EJ171. Sealant materials and application shall be part of the work under this Section; refer to Section 07 92 00, Joint Sealants, for materials and application requirements.

3.05 CLEANING

A. Remove mortar and grout during progress of work prior to hardening. Leave finished installation clean and free of cracked, chipped, broken, unbonded or otherwise defective pavers.

1. Remove and replace all defective pavers as directed, or pavers that do not match adjoining pavers as intended.

2. Provide new units to match adjoining units and install in same manner as original units, with same joint treatment to eliminate evidence of replacement.

3. Repoint defective and unsatisfactory joints as required to provide a neat, uniform appearance.

4. Seal with clear water repellent for interior and exterior floor tiles and unit pavers as specified in Section 09 96 23, Graffiti- and Water-Resistant Coatings.

3.06 PROTECTION

A. Provide final protection and maintain condition in a manner acceptable to Resident Engineer, which ensures paver work being without damage or deterioration at time of Final Acceptance.

END OF SECTION
PART 1 - GENERAL

1.01 SUMMARY
A. This Section includes specifications for mineral fiber acoustical lay-in panels and exposed suspension systems for ceilings (ACT-1).
B. Related Sections: The work of the following Sections is related to the work of this Section. Other Sections, not referenced below, may also be related to the proper performance of this work.
   1. Section 09 51 36, Metal Ceilings.
C. Products furnished, but not installed under this Section, include anchors, clips, and other ceiling attachment devices to be cast in concrete at ceilings.

1.02 DEFINITIONS
A. AC: Articulation Class.
B. CAC: Ceiling Attenuation Class.
C. LR: Light Reflectance coefficient.
D. NRC: Noise Reduction Coefficient.
E. CISCA: Ceilings and Interior Systems Construction Association

1.03 REFERENCES
A. This Section incorporates by reference the latest revisions of the following documents.
   1. American Society of Civil Engineers (ASCE)
      a. ASTM A 641, Specification for Zinc-Coated (Galvanized) Carbon Steel Wire
      b. ASTM A 653, Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
      c. ASTM B 633, Specification for Electrodeposited Coatings of Zinc on Iron and Steel
      d. ASTM C 635, Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings

f. ASTM E 488, Test Method for Strength of Anchors in Concrete and Masonry Elements

g. ASTM E 580, Practice for Application of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Requiring Moderate Seismic Restraint

h. ASTM E 795, Practices for Mounting Test Specimens during Sound Absorption Tests

i. ASTM E 1190, Test Methods for Strength of Power-Actuated Fasteners Installed in Structural Members

j. ASTM E 1512, Test Methods for Testing Bond Performance of Bonded Anchors

1.04 SUBMITTALS

A. Procedures: Section 01 33 00, Submittal Procedures.

B. Product Data: For each type of product indicated.

C. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from Installers of the items involved:

1. Ceiling suspension system members.

2. Method of attaching hangers to building structure.
   a. Furnish layouts for cast-in-place anchors, clips, and other ceiling attachment devices whose installation is specified in other Sections.

3. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.


D. Samples for Verification: For each component indicated and for each exposed finish required, prepared on samples of size indicated below.

1. Acoustical Panel: Set of 12-inch square samples of each type, color, pattern, and texture.

2. Exposed Suspension System Members, Moldings, and Trim: Set of 12-inch long samples of each type, finish, and color.

1.05 QUALITY ASSURANCE

A. Source Limitations:

1. Acoustical Ceiling Panel: Obtain each type through one source from a single manufacturer.
2. Suspension System: Obtain each type through one source from a single manufacturer.

B. Source Limitations: Obtain each type of acoustical ceiling panel and supporting suspension system through one source from a single manufacturer.

C. Seismic Standard: Provide acoustical panel ceilings designed and installed to withstand the effects of earthquake motions according to the following:


1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver acoustical panels, suspension system components, and accessories to Contract site in original, unopened packages and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.

B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.

C. Handle acoustical panels carefully to avoid chipping edges or damaging units in any way.

1.07 PROJECT CONDITIONS

A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Contract when occupied for its intended use.

1.08 COORDINATION

A. Coordinate layout and installation of acoustical panels and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

1.09 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Acoustical Ceiling Panels: Full-size panels equal to 2.0 percent of quantity installed.

2. Suspension System Components: Quantity of each exposed component equal to 2.0 percent of quantity installed.

PART 2 - PRODUCTS

2.01 ACOUSTICAL PANEL CEILINGS

A. "ACT-1":

...
1. Lay-in Panels: Armstrong “Ultima Tegular”, Item No. 1912, or approved equal meeting the following:
   b. LR: Not less than 90 percent.
   c. NRC: Not less than 0.70.
   d. Edge/Joint Detail: “Beveled Tegular” (reveal sized to fit flange of exposed suspension system members).
   e. Thickness: 3/4 inch.
   f. Modular Size: 24 by 24 inches.

2. Heavy Duty Exposed Grid Suspension System: Armstrong World Industries “Suprafine”, or approved equal as follows
   a. Narrow-Face, Double-Web, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet, prepainted, electrolytically zinc coated, or hot-dip galvanized according to ASTM A 653, not less than G30 coating designation, with prefinished 9/16-inch- wide metal caps on flanges.
   b. Structural Classification: Heavy-duty system.
   c. End Condition of Cross Runners: Override (stepped) type.
   d. Face Design: Flat cap.
   e. Cap Material: Steel cold-rolled sheet.

2.02 ACOUSTICAL PANELS, GENERAL

A. Manufacturer: Subject to compliance with requirements, provide products of one of the following:
   1. Armstrong World Industries, Inc.
   2. BPB USA.
   3. Ecophon CertainTeed, Inc.
   4. USG Interiors, Inc.

B. Acoustical Panel Standard: Provide manufacturer’s standard panels of configuration indicated that comply with ASTM E 1264 classifications as designated by types, patterns, acoustical ratings, and light reflectance, unless otherwise indicated.
   1. Mounting Method for Measuring NRC: Type E-400; plenum mounting in which face of test specimen is 15-3/4 inches away from test surface in accordance with ASTM E 795.

C. Acoustical Panel Colors and Patterns: Match appearance characteristics indicated for each product type.
2.03 METAL SUSPENSION SYSTEMS, GENERAL

A. Metal Suspension System Standard: Provide manufacturer's standard direct-hung metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable requirements in ASTM C 635.

B. Finishes and Colors, General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes. Provide manufacturer's standard factory-applied finish for type of system indicated.
   1. High-Humidity Finish: Comply with ASTM C 635 requirements for "Coating Classification for Severe Environment Performance" where high-humidity finishes are indicated.

C. Attachment Devices: Size for five times the design load indicated in ASTM C 635, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.
   1. Anchors in Concrete: Anchors of type and material indicated below, with holes or loops for attaching hangers of type indicated and with capability to sustain, without failure, a load equal to five times that imposed by ceiling construction, as determined by testing in accordance with ASTM E 488 or ASTM E 1512 as applicable, conducted by a qualified Independent Testing Laboratory.
      a. Type: Cast-in-place anchors.
      b. Corrosion Protection: Carbon-steel components zinc plated to comply with ASTM B 633, Class Fe/Zn 5 (0.005 mm) for Class SC 1 service condition.
   2. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hangers of type indicated, and with capability to sustain, without failure, load equal to 10 times that imposed by ceiling construction, as determined by testing according to ASTM E 1190, conducted by a qualified Independent Testing Laboratory.

D. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:
   1. Zinc-Coated, Carbon-Steel Wire: ASTM A 641, Class 1 zinc coating, soft temper.
   2. Size: Select wire diameter so its stress at three times hanger design load (ASTM C 635, Table 1, "Direct Hung") will be less than yield stress of wire, but provide not less than 0.106-inch diameter wire.

E. Seismic Stabilizer Bars: Manufacturer's standard perimeter stabilizers designed to accommodate seismic forces.

F. Seismic Struts: Manufacturer's standard compression struts designed to accommodate seismic forces.

G. Seismic Clips: Manufacturer's standard seismic clips designed and spaced to secure acoustical panels in-place.

2.04 METAL EDGE MOLDINGS AND TRIM

A. Manufacturer: Same as suspension system grid members.

B. Roll-Formed, Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that comply with
seismic design requirements; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension system runners.

1. Provide manufacturer’s standard edge moldings that fit acoustical panel edge details and suspension systems indicated and that match width and configuration of exposed runners, unless otherwise indicated.

2. For circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, including structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical panel ceilings.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders, and comply with layout shown on reflected ceiling plans.

3.03 INSTALLATION

A. General: Install acoustical panel ceilings to comply with ASTM C 636 and seismic design requirements indicated, in accordance with manufacturer’s written instructions and CISCA “Ceiling Systems Handbook.”

B. Suspend ceiling hangers from building’s structural members and as follows:

1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.

2. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.

3. Where width of ducts and other construction within ceiling plenum produces hanger spacing that interferes with location of hangers required to support standard suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.

4. Secure wire hangers to ceiling suspension members and to supports above with a minimum of three tight turns. Connect hangers directly either to structures or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.

5. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, postinstalled mechanical or adhesive anchors, or power-actuated fasteners that extend through forms into concrete.
6. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.

7. Do not attach hangers to steel deck tabs.

8. Do not attach hangers to steel roof deck. Attach hangers to structural members.

9. Space hangers not more than 48 inches o.c. along each member supported directly from hangers, unless otherwise indicated; provide hangers not more than 8 inches from ends of each member.

10. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.

C. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers, without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast-in-place or postinstalled anchors.

D. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.

1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.

2. Screw attach moldings to substrate at intervals not more than 16 inches o.c. and not more than 3 inches from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet. Miter corners accurately and connect securely.

3. Do not use exposed fasteners, including pop rivets, on moldings and trim.

E. Install suspension system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

F. Install acoustical panels with undamaged edges and fit accurately into suspension system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide a neat, precise fit.

1. For square-edged panels, install panels with edges fully hidden from view by flanges of suspension system runners and moldings.

2. For reveal-edged panels on suspension system runners, install panels with bottom of reveal in firm contact with top surface of runner flanges.

3. Cut edges of units to match factory formed edges of uncut boards.

4. Paint cut edges of panel remaining exposed after installation; match color of exposed panel surfaces using coating recommended in writing for this purpose by acoustical panel manufacturer.

3.04 FIELD QUALITY CONTROL

A. Tests and Inspections: Testing and inspecting of completed installations of acoustical panel ceiling hangers and anchors and fasteners shall take place in successive stages, in areas of extent and using methods as follows. Do not proceed with installations of acoustical panel ceiling hangers for the next area until test results for previously completed installations of acoustical panel ceiling hangers show compliance with requirements.
1. Extent of Each Test Area: When installation of ceiling suspension systems on each floor has reached 20 percent completion but no panels have been installed.
   
a. Within each test area, testing agency will select one of every ten power-actuated fasteners and postinstalled anchors used to attach hangers to concrete and will test them for 200 lbf of tension; it will also select one of every two postinstalled anchors used to attach bracing wires to concrete and will test them for 440 lbf of tension.
   
b. When testing discovers fasteners and anchors that do not comply with requirements, testing agency will test those anchors not previously tested until twenty pass consecutively and then will resume initial testing frequency.

B. Remove and replace acoustical panel ceiling hangers and anchors and fasteners that do not pass tests and inspections and retest as specified above.

3.05 CLEANING

A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension system members. Comply with manufacturer’s written instructions for cleaning and touchup of minor finish damage. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION
PART 1 - GENERAL

1.01 SUMMARY
   A. This Section includes specifications for plain metal panel ceilings (CLG-3) perforated metal panel ceilings (CLG-4) and expanded metal panel ceilings (CLG-1 and CLG-2)
   B. Related Sections: The work of the following Sections is related to the work of this Section. Other Sections, not referenced below, may also be related to the proper performance of this work.
      1. Section 09 90 00, Painting and Coating.
      2. Divisions 21, 23, and 26 Sections

1.02 REFERENCES
   A. This Section incorporates by reference the latest revisions of the following documents.
      1. American Architectural Manufacturer’s Association (AAMA)
         a. ASTM A 240: Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications
         b. ASTM A 580: Specification for Stainless Steel Wire
         c. ASTM A 591: Specification for Steel Sheet, Electrolytic Zinc-Coated, for Light Coating Weight (Mass) Applications
         d. ASTM A 641: Specification for Zinc-Coated (Galvanized) Carbon Steel Wire
         e. ASTM A 653: Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
         f. ASTM A 666: Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar
         g. ASTM A 1008: Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability
         h. ASTM B 164: Specification for Nickel-Copper Alloy Rod, Bar, and Wire
i. ASTM B 209: Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes

j. ASTM B 633: Specification for Electrodeposited Coatings of Zinc on Iron and Steel

k. ASTM C 553: Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications

l. ASTM C 635: Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings

m. ASTM C 636: Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels

n. ASTM E 84: Test Method for Surface Burning Characteristics of Building Materials

o. ASTM E 488: Test Methods for Strength of Anchors in Concrete and Masonry Elements


3. Ceilings & Interior Systems Construction Association

4. National Association of Architectural Metal Manufacturers (NAAMM)

5. Structural Engineering Institute/American Society of Civil Engineers
   a. SEI/ASCE 7: Minimum Design Loads for Buildings and Other Structures;

1.03 SUBMITTALS

A. Procedures: Section 01 33 00, Submittal Procedures.

B. Product Data: For each type of product indicated.

C. Samples for Verification: For each component indicated and for each exposed finish required, prepared on Samples of size indicated below:

1. Metal Panels: Set of full-size samples of each type, finish, color, pattern, and texture. Show pan edge profile.

2. Exposed Suspension System Members, Moldings and Trim: Set of 12-inch-long Samples of each type, finish, and color.
3. Sound Absorber: Match size of Sample metal pan.

D. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from Installers of the items involved:

1. Ceiling suspension members.
2. Method of attaching hangers to building structure.
3. Furnish layouts for cast-in-place anchors, clips, and other ceiling attachment devices such as light fixtures, sprinklers, and air-distribution components whose installation is specified in other Division 21, 23, and 26 Sections.
   a. of these Contract Specifications.
4. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
5. Ceiling perimeter and penetrations through the ceiling; and trim and moldings.

1.04 QUALITY ASSURANCE

A. Source Limitations:
   1. Acoustical Ceiling Pans: Obtain each type from single source from single manufacturer.
   2. Suspension Systems: Obtain each type from single source from single manufacturer.

B. Source Limitations for Perforated Metal Panel Ceilings: Obtain each combination of perforated metal panels and exposed suspension systems from one source with resources to provide products of consistent quality in appearance, physical properties, and performance.

C. Surface-Burning Characteristics: Complying with ASTM E 84 for Class A materials.

D. Seismic Standard: Provide perforated metal panel ceilings designed and installed to withstand the effects of earthquake motions according to the following:

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver perforated metal panels, suspension system components, and accessories to Project site in original, unopened packages and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.

B. Handle perforated metal panels, suspension system components, and accessories carefully to avoid damaging units and finishes in any way.
1.06 PROJECT CONDITIONS
A. Environmental Limitations: Do not install perforated metal panel ceilings until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Contract when occupied for its intended use.

1.07 COORDINATION
A. Coordinate layout and installation of perforated metal panels and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

1.08 EXTRA MATERIALS
A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Perforated metal panels: Full-size units equal to two percent of quantity installed.
   2. Suspension System Components: Quantity of each grid and exposed molding and trim equal to two percent of quantity installed.

PART 2 - PRODUCTS

2.01 MANUFACTURERS
A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. Armstrong World Industries, Inc.
   2. Ceilings Plus.
   3. Chicago Metallic Corporation.
   6. Steel Ceilings Inc.
   7. USG Interiors, Inc.

2.02 ACOUSTICAL METAL CEILING PANS - GENERAL
A. Sheet Metal Characteristics: For metal components exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, roughness, stains, or discolorations.
   1. Aluminum Sheet: Roll-formed aluminum sheet, complying with ASTM B 209; alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.
   2. Stainless-Steel Sheet: Complying with ASTM A 240/A 240M, Type 304.
B. Sound-Absorbent Fabric Layer: Provide fabric layer, sized to fit concealed surface of pan, and consisting of black, nonwoven, nonflammable, sound-absorbent material with surface-burning characteristics for flame-spread index of 25 or less and smoke-developed index of 50 or less, as determined by testing in accordance with ASTM E 84.

1. Bond fabric layer to panels in the factory with manufacturer's standard nonflammable adhesive.

2.03 EXPANDED METAL PANEL CEILING (CLG-1 AND CLG-2)
A. Expanded Metal Panels: Expanded steel sheet metal with formed sheet metal edge perimeter:

1. Expanded metal pattern: 3/4-inch No.9 regular
2. Metal thickness: 0.134 inch (10 gage).
3. Minimum 0.024 inch thick steel sheet 3/4 inch deep U-edge; tack welded on all sides.
   a. Color, CLG-1: Gray to match PNT-1 (See Section 09 90 00, Painting and Coating)
   b. Color, CLG 2: Black.
B. Suspension Grid: 15/16-inch wide double-web tee system; meeting ASTM C 635, Heavy Duty classification.

1. Finish: "360-degree finish" to match color and gloss of ceiling panels.

2.04 PLAIN METAL PANEL CEILING (CLG-3)
A. Aluminum Pans:

1. Basis of Design Product: Ceilings Plus, "Illusions"

B. Pan Fabrication: Manufacturer's standard units of size, profile, and edge treatment indicated, formed from metal indicated and finished to comply with requirements indicated.

C. Torsion-Spring-Hinged Pans: Designed to be securely retained in preslotted exposed suspension grid by torsion springs.

D. Pan Thickness: Not less than 0.060 inch.

E. Pan Edge Detail: Square.

F. Pan Joint Detail: Butt.

G. Pan Size: As indicated on Contract Drawings.

H. Pan Face Finish: Color coated to match Resident Engineer's sample.

1. Sample: Ceilings Plus "Krylolite" (simulated stainless steel)

2.05 PERFORATED METAL PANEL CEILING (CLG-4)
A. Aluminum Pans:

2. Perforation Pattern: 1/8 by 1-inch rectangular holes at 3/8 by 1-1/4 inch straight centers; equal margins on opposite sides 1 to 2 inches wide.

B. Pan Fabrication: Manufacturer's standard units of size, profile, and edge treatment indicated, formed from metal indicated and finished to comply with requirements indicated.

C. Torsion-Spring-Hinged Pans: Designed to be securely retained in preslotted exposed suspension grid by torsion springs.

D. Pan Thickness: Not less than 0.060 inch.

E. Pan Edge Detail: Square.

F. Pan Joint Detail: Butt.

G. Pan Size: As indicated on Contract Drawings.

H. Pan Face Finish: Color coated to match Resident Engineer's sample.

   1. Sample: Ceilings Plus "Krylolite" (simulated stainless steel)

I. NRC: Not less than 0.75.

2.06 METAL SUSPENSION SYSTEMS

A. Metal Suspension System Standard: Provide manufacturer's standard metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable ASTM C 635 requirements.

B. Suspension Systems: Provide systems complete with carriers, runners, splice sections, connector clips, alignment clips, leveling clips, hangers, molding, trim, retention clips, load-resisting struts, and other suspension components required to support ceiling units and other ceiling-supported construction.

C. Attachment Devices: Size for five times the design load indicated in ASTM C 635, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.

   1. Anchors in Concrete: Anchors of type and material indicated below, with holes or loops for attaching hangers of type indicated and with capability to sustain, without failure, a load equal to five times that imposed by ceiling construction, as determined by testing in accordance with ASTM E 488, conducted by an Independent Testing Laboratory.

      a. Type: Postinstalled expansion anchors.

      b. Corrosion Protection: Stainless-steel components complying with ASTM F 593 and ASTM F 594, Group 1 Alloy 304 or 316 for bolts; Alloy 304 or 316 for anchor.

D. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:


   2. Size: Select wire diameter so its stress at three times the hanger design load indicated in ASTM C 635, Table 1, Direct Hung will be less than yield stress of wire, but provide not less than 0.106-inch-diameter wire.
E. Seismic Stabilizer Bars: Manufacturer’s standard perimeter stabilizers designed to accommodate seismic forces.

F. Seismic Struts: Manufacturer’s standard compression struts designed to accommodate seismic forces.

G. Exposed Metal Edge Moldings and Trim: Provide exposed members as indicated or as required to comply with seismic requirements of Seattle Building Code, to conceal edges of and penetrations through ceiling, to conceal edges of pans and runners, for fixture trim and adapters, for fasciae at changes in ceiling height, and for other conditions; of metal and finish matching perforated metal panel ceiling units, unless otherwise indicated.

H. Suspension System for Torsion-Spring Metal Pans: Provide runners with factory-cut slots fabricated to accept torsion-spring attachment.

2.07 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM’s "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.08 ALUMINUM FINISHES

A. Color-Coated Finish: Manufacturer’s standard powder-coat or baked enamel complying with coating manufacturer’s written instructions for surface preparation, pretreatment, application, baking, and minimum dry film thickness.

2.09 STEEL FINISH

A. Powder Coat: TGIC Polyester meeting performance requirements for gloss and color retention of AAMA 2604.


B. Preparation:

   1. Metal Preparation and Pre-Treatment: Remove organic and inorganic surface soil, grease, oils, and other foreign materials in multi-stage process.

   2. Prepare surfaces using a chemical cleaning and pre-treatment process as recommended by powder coating manufacturer.

C. Application:

   1. Apply coating by electrostatic spray process and bake at temperature and duration as recommended by powder coating manufacturer to ensure maximum adhesion.

   2. Coating shall be smooth and free of holidays, orange peel, sags, pinholes, blisters, or other signs of poor workmanship.

   3. Apply each coating in color to achieve a dry film thickness of 1.5 mils, minimum for first coat primer, and 1.5 to 2.5 mils, minimum for finish coat, not including clear coat
as indicated, adjust to match Resident Engineer’s approved sample for color uniformity and hide.

4. Edges and corners shall receive a dry film thickness equivalent to that of flat surfaces.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, including structural framing to which perforated metal panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of perforated metal panel ceilings.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Measure each ceiling area and establish layout of perforated metal panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width pans at borders, and comply with layout shown on Contract Drawings (reflected ceiling plans) and Coordination Drawings.

3.03 INSTALLATION

A. Install perforated metal panel ceilings to comply with ASTM C 636 and seismic requirements indicated, in accordance with manufacturer’s written instructions and CISCA’s "Ceiling Systems Handbook."

B. Suspend ceiling hangers from building’s structural members and as follows:

1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.

2. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.

3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.

4. Secure wire hangers to ceiling suspension members and to supports above with a minimum of three tight turns. Connect hangers directly either to structures or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.

5. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, postinstalled mechanical or adhesive anchors, or power-actuated fasteners that extend through forms into concrete.
6. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.

7. Do not attach hangers to steel roof deck. Attach hangers to structural members.

8. Space hangers not more than 48 inches o.c. along each member supported directly from hangers unless otherwise indicated; provide hangers not more than 8 inches from ends of each member.

9. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.

C. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers, without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast-in-place or postinstalled anchors.

D. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of perforated metal panels.

1. Screw attach moldings to substrate at intervals not more than 16 inches o.c. and not more than 3 inches from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet. Miter corners accurately and connect securely.

E. Install suspension system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

F. Cut perforated metal panel units for accurate fit at borders and at interruptions and penetrations by other work through ceilings. Stiffen edges of cut units as required to eliminate evidence of buckling or variations in flatness exceeding referenced standards for stretcher-leveled metal sheet.

G. Install perforated metal panels in coordination with suspension system and exposed moldings and trim.

1. Align joints in adjacent courses to form uniform, straight joints parallel to room axis in both directions unless otherwise indicated.

2. Fit adjoining units to form flush, tight joints.

3. Install directionally patterned or textured metal pans in directions indicated.

H. Install hold-down clips where indicated.

3.04 FIELD QUALITY CONTROL

A. Testing Agency: Sound Transit will engage an Independent Testing Laboratory to perform tests and inspections.

B. Tests and Inspections: Testing and inspecting of completed installations of acoustical panel ceiling hangers and anchors and fasteners shall take place in successive stages, in areas of extent and using methods as follows. Do not proceed with installations of acoustical panel ceiling hangers for the next area until test results for previously completed installations of acoustical panel ceiling hangers show compliance with requirements.

1. Extent of Each Test Area: When installation of ceiling suspension systems on each floor has reached 20 percent completion but no panels have been installed.
a. Within each test area, the Independent Testing Laboratory will select one of every postinstalled anchors used to attach hangers to concrete and will test them for 200 lbf of tension; it will also select one of every two postinstalled anchors used to attach bracing wires to concrete and will test them for 440 lbf of tension.

b. When testing discovers fasteners and anchors that do not comply with requirements, the Independent Testing Laboratory will test those anchors not previously tested until twenty pass consecutively and then will resume initial testing frequency.

C. Acoustical panel ceiling hangers and anchors and fasteners will be considered defective if they do not pass tests and inspections.

3.05 CLEANING

A. Clean exposed surfaces of perforated metal panel ceilings, including trim and edge moldings after removing strippable, temporary protective covering, if any. Comply with manufacturer's written instructions for stripping of temporary protective covering, cleaning, and touchup of minor finish damage. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage, including dented and bent units.
PART 1 - GENERAL

1.01 SUMMARY
A. This section includes specifications for resilient wall base.

1.02 REFERENCES
A. This Section incorporates by reference the latest revisions of the following documents.
1. American Society for Testing and Materials International (ASTM)
2. National Fire Protection Association (NFPA)

1.03 SUBMITTALS
A. See Section 01 33 00, Submittal Procedures, for submittal procedures.
B. Product Data: Provide data on specified products, describing physical and performance characteristics; including sizes, patterns and colors available; and installation instructions.
C. Selection Samples: Submit one manufacturer's complete set of color samples for Project Engineer's initial selection.
D. Verification Samples: Submit four samples, at least 12 by 12 inches in size illustrating color and pattern for each resilient flooring product specified.
E. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning, stripping, and re-waxing.

1.04 DELIVERY, STORAGE, AND PROTECTION
A. Protect roll materials from damage by storing on end.

1.05 PROJECT CONDITIONS
A. Environmental Requirements
1. Maintain temperature in storage area between 55 degrees F and 90 degrees F.
2. Store materials for not less than 48 hours prior to installation in area of installation at a temperature of 70 degrees F to achieve temperature stability. Thereafter, maintain conditions above 55 degrees F.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Extra Materials
   1. See Section 01 60 00, Product Requirements, for additional provisions.
   2. Provide 100 lineal feet of base materials of each type and color specified.

B. Base (RB-1)
   1. Resilient Base: ASTM F 1861, Type TS rubber, vulcanized thermoset; top set Style B, Cove, and as follows:
      a. Critical Radiant Flux (CRF): Minimum 0.45 watt per square centimeter, when tested in accordance with ASTM E 648 or NFPA 253.
      b. Height: 4-inch.
      c. Style: Cove.
      d. Thickness: 0.125 inch thick.
      e. Finish: Satin.
      f. Length: Roll.
      g. Color: Solid color to match Johnsonite 55 “Silver Grey”
      h. Accessories: Premolded external corners and end stops. (Do not wrap base around corners.)
      i. Manufacturers:
         4) Substitutions: Not permitted.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive resilient base.
3.02 PREPARATION
A. Apply primer as required to prevent "bleed-through" or interference with adhesion by substances that cannot be removed.

3.03 INSTALLATION
A. Base
1. Fit joints tightly and make vertical. Maintain minimum dimension of 18 inches between joints.
2. Miter internal corners. At external corners, use pre-molded units. At exposed ends, use pre-molded units.
3. Install base on solid backing. Bond tightly to wall and floor surfaces.
4. Scribe and fit to door frames and other interruptions.

3.04 CLEANING
A. Remove excess adhesive from floor, base, and wall surfaces without damage.

END OF SECTION
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PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes specifications for sprayed acoustic insulation (sprayed acoustic treatment).

B. Related Sections: The work of the following Sections is related to the work of this Section. Other Sections, not referenced below, may also be related to the proper performance of this work.

1. Section 07 21 00, Thermal Insulation.

2. Section 07 42 10, Metal Wall Panels: Acoustic liners.

1.02 REFERENCES

A. This Section incorporates by reference the latest revisions of the following documents.

B. American Society for Testing and Materials:

1. American Society for Testing and Materials International (ASTM)
   a. ASTM C 423  Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.
   c. ASTM E 84  Surface Burning Characteristics of Building Materials

1.03 SYSTEM DESCRIPTION

A. Performance Characteristics: Sprayed-on acoustical insulation shall comply with following:

1. Meet "Physical Properties" requirements of ASTM C 1014.

2. Acoustical Performance: Minimum NRC of 0.70, at nominal applied thickness when tested in accordance with ASTM C 423 on solid backing.

B. Minimum Applied Thickness: 1.5 inches (required for low frequency sound absorption).

1.04 SUBMITTALS

A. Procedures: Section 01 33 00, Submittal Procedures.

B. Product Data: Submit manufacturer's brochure on insulation materials, including application instructions and procedures.

C. Samples for Verification: Submit samples of spray-on acoustical insulation in selected color, minimum 1/2-inch thickness by 12 inches square, one showing spray-textured finish and
color to be expected in the finish work, two showing texture back rolled, and three sample with texture tamped. Submit additional samples if required for approval by the Resident Engineer.

1.05 QUALITY ASSURANCE
A. Applicator’s Qualifications: Licensed or approved by insulation manufacturer.
B. Mock-Ups: Minimum 100 square feet in location designated by Resident Engineer

1.06 DELIVERY, STORAGE & HANDLING
A. Deliver materials in unopened containers or packages bearing manufacturer's name, trade name, type. Keep materials off the ground, under cover, and away from damp surfaces. Discard materials exposed to moisture.

1.07 PROJECT CONDITIONS
A. Environmental Conditions: Maintain ambient conditions during installation and for cure period following installation as recommended by manufacturer.
B. Temperature: Maintain a temperature of not less than 40 degrees F for 24 hours before, during and for 24 hours after application of sprayed insulation. If necessary for job progress, provide enclosures with heat to maintain temperature.

1.08 SEQUENCING AND SCHEDULING
A. Coordination: Install clips, hanger supports, and other attachments to the substrate prior to application of insulation material, where their locations can be determined in advance. Delay installation of mechanical and electrical ducts, piping and conduit until insulation application has been completed.

PART 2 - PRODUCTS

2.01 MATERIALS
A. Sprayed Acoustic Insulation Products (SAT-1): Subject to compliance with requirements, provide one of the following.
   2. Isolatek International “Sound Shield”, mineral fiber.
   3. ThermocCon Spray Acoustic Insulation “ThemoCon” cellulose fiber.
   5. Approved equal
B. Color: Medium grey.
C. Bonding Adhesive: Type as recommended and approved by insulation manufacturer for type of substrate.
PART 3 - EXECUTION

3.01 INSPECTION AND PREPARATION

A. General: Verify that surfaces and conditions are acceptable to receive acoustical insulation. Do not proceed with application in areas of discrepancy until all discrepancies have been fully resolved.

B. Verify Following Conditions:

1. Verify that surfaces to receive acoustical insulation are free of oil, grease, or other substances which may impair proper adhesion.

2. Verify clips, hangers, supports, sleeves, and other items required to penetrate insulation are in place.

3. Verify that substrates are not obstructed by ducts, piping, equipment, or other suspended construction which might interfere with application of insulation.

C. Clean surfaces of substances which might be incompatible with or interfere with bond of adhesive and acoustical insulation.

D. Commencement of application indicates acceptance of surface conditions and full responsibility for failure of bond between insulation and substrate.

3.02 APPLICATION

A. Mixing & Application: Mix and apply the bonding adhesive and acoustical insulation in strict accordance with manufacturer’s printed instructions using only approved equipment.

1. Apply bonding adhesive to substrate at rate recommended by manufacturer.

2. If required by manufacturer due to overall thickness, mix insulation with binding adhesive and water to ensure complete and total bonding.

3. Apply insulation over bonding adhesive in two or more passes as necessary to cover with monolithic blanket of uniform density and texture matching approved sample. It is the intent that a sprayed-textured finish with no further treatment will be acceptable. If required, hand tamp insulation to achieve desired results.

B. Mechanically control material and water ratio. Do not retemper material. Complete application in an area before removing equipment and proceeding with further work.

C. Patch insulation which has been damaged by construction operations. Costs for patching damaged insulation shall be borne by the trade causing such damage. All patched areas shall match adjacent area in texture and color.

3.03 CLEAN-UP

A. Cleanup: Clean floors, walls, and other surfaces of overspray and material deposits on a daily basis.

END OF SECTION
SECTION 09 90 00

PAINTING AND COATING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: (PNT-1, PNT-2, PNT-3, PNT-4, PNT-5) In general, the principle items of work include, but are not limited to, the following:

1. Preparation of surfaces.
2. Painting and finishing of all exposed-to-view interior and exterior surfaces, except as otherwise indicated or specified.

B. Field painting of all exposed-to-view metal fabrications, mechanical and electrical items such as pipes, ducts, hangers, conduits, and like items in rooms or areas scheduled to be painted, or where run through existing rooms which are painted.

   a. Field painting of factory finished equipment is not required.

   b. Apply one coat of flat black enamel to all ductwork and lining and to conduit or piping which can be seen through grilles, registers or diffusers, and to speaker enclosures behind speaker cloth; minimum 12 inches from view.

C. Related Sections: The work of the following Sections is related to the work of this Section. Other Sections, not referenced below, may also be related to the proper performance of this work.

1. Section 05 05 14, Fluoropolymer Coatings For Metal.
2. Section 09 06 00, Schedule for Finishes.
3. Section 09 21 16, Gypsum Board Assemblies
4. Section 09 96 00, High-Performance Coatings: (PNT-1H, etc.) Finish designations PNT-# suffixed H require high performance coatings of same colors as PNT-# systems specified in this section.

1.02 DEFINITIONS

A. Exposed Surfaces: The term "exposed surfaces" includes areas visible when permanent or built-in fixtures, covers, grilles, and similar components are in place. Extend painting in these areas as required to maintain the system integrity and provide desired protection.

B. DFM (dry film mils): Minimum thickness, measured in mils, of a coat of paint in the cured state.

C. Gloss Levels: The following terms are used to specify specular gloss of finish coats in accordance with those listed by MPI (Master Painter Institute) when measured in accordance with ASTM D523.
<table>
<thead>
<tr>
<th>Gloss Level</th>
<th>Description</th>
<th>Gloss @ 60 degrees</th>
<th>Sheen @ 85 degrees</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level 1</td>
<td>Traditional matte finish - flat</td>
<td>Maximum 5 units and</td>
<td>Maximum 10 units</td>
</tr>
<tr>
<td>Level 2</td>
<td>High side sheen flat – a ‘velvet-like’ finish</td>
<td>Maximum 10 units and</td>
<td>10-35 units</td>
</tr>
<tr>
<td>Level 3</td>
<td>Traditional ‘eggshell-like’ finish</td>
<td>10-25 units and</td>
<td>10-35 units</td>
</tr>
<tr>
<td>Level 4</td>
<td>‘Satin-like’ finish</td>
<td>20-35 units and</td>
<td>Minimum 35 units</td>
</tr>
<tr>
<td>Level 5</td>
<td>Traditional semi-gloss</td>
<td>35-70 units</td>
<td></td>
</tr>
<tr>
<td>Level 6</td>
<td>Traditional gloss</td>
<td>70-85 units</td>
<td></td>
</tr>
<tr>
<td>Level 7</td>
<td>High gloss</td>
<td>More than 85 units</td>
<td></td>
</tr>
</tbody>
</table>

1.03 SUBMITTALS

A. Procedures: Section 01 33 00, Submittal Procedures.

B. Product Data: Submit complete list of products proposed for use, including technical data on each product to verify compliance; organize list to indicate painting systems to be used with each substrate.

1. Submit paint list with paint manufacturer, paint name, coverage and VOC content listed.

2. Submittal shall contain any proposed revisions to Contract Specifications (for example surface preparation, and method of application) which painting contractor feels are necessary in their execution of the Contract.

3. All proposed revisions must be approved by the Resident Engineer prior to proceeding with the Work.

C. Samples: Using approved paint products, prepare and submit samples of each type of finish, gloss level, and color for approval. Refer to Article 2.04, herein, for requirements. Label samples with color number, product name and date. Provide three samples of each color and sheen.

1. For deep tone or accent colors paint finish applied to drywall or plaster, prepare paint samples on 24-inch square gypsum drywall; drywall shall have Level 5 finish treatment.

2. For all remaining colors, prepare paint samples on 8-1/2 inch by 11-inch heavy, durable non porous paper.

3. Adjustments to the overall sheen in one or more of the colors may be required. Such adjustments (if any) shall be made at no additional cost. Additional samples will be required should adjustments be made.

4. Initial color samples which have been approved are subject to final acceptance at time of field mock-up examination.
D. Contract Closeout Submittal: Include the following at time of Project Closeout:

1. Extra Materials: Coordinate submittal of extra maintenance materials with requirements of Section 01 60 00, Product Requirements and Article 1.07, herein, for quantities and other requirements.

2. Color Mix: Submit color mix formula for each required paint color. Mix formula must be in measured increments of 48ths of an ounce; include the manufacturer's color and number identification, color chip, location list where said colors were applied and paint manufacturer of base.

1.04 QUALITY ASSURANCE

A. Single Source:

1. To the maximum extent practicable, select a single manufacturer to provide all materials required by this Section, using additional manufacturers to provide systems not offered by the selected principal manufacturer.

2. For each individual system, provide primer and other undercoat paint produced by same manufacturer as finish coat. Use only thinners approved by paint manufacturer and use only within recommended limits.

B. Visual Standards: Each distinct area of the finished Work shall be free of variations in color and sheen, runs, sags, holidays, blistering, checking, cracking, scratches and other signs of poor workmanship. Deep tone and accent color walls shall be free from joint banding, flashing, photographing, and uneven appearance.

C. Mockups: Apply benchmark samples of each paint system indicated and each color and finish selected to verify preliminary selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Wall: Provide two samples of at least 100 square feet each (slightly different colors) in each room.

2. Apply benchmark samples after permanent lighting and other environmental services have been activated.

a. If permanent lighting is not operational, provide temporary lighting of same color temperature (degrees K) for Resident Engineer’s evaluation or the samples.

3. Final approval of color selections will be based on benchmark samples.

a. If preliminary color selections are not approved, apply one additional benchmark sample of additional colors selected by Resident Engineer at no added cost to Sound Transit. Include cost of three (first two plus one additional) samples in each space.

1.05 DELIVERY, STORAGE & HANDLING

A. Deliver materials to building in sealed, original, labeled containers bearing manufacturer's name, type of material, brand name, color designation, and instructions for mixing and thinning.

B. Store materials when not in actual use in a place specifically assigned for that purpose which is dry and out of direct sunlight. Store materials in a manner so as not to exceed the manufacturer's temperature limitations.
1.06 PROJECT CONDITIONS

A. Environmental Conditions: Air temperature and substrate temperature and relative humidity shall be within the manufacturer's established limits. Do not apply exterior paint when the following conditions exist, unless requirements of paint manufacturers are more restrictive.

1. Temperature: If surface and ambient temperature is above 90 degrees F, or below 50 degrees F.

2. Weather: Do not apply paint in snow, rain, fog, when excessively windy or during mist; or when relative humidity exceeds 85 percent; or at temperatures less than 5 degrees F above the dew point; or to damp or wet surfaces.

B. Lighting: Do not proceed with work under this section unless adequate lighting is available. Provide lighting level of at least 50 candlepower per square foot, measured mid-height at substrate surface.

C. Ventilation: Provide adequate ventilation as required for the type of paint and cleaning materials used. If necessary, consult paint manufacturer for recommendations.

D. Protection: Protect surrounding areas against damage due to painting operations. At a minimum, surrounding areas shall be covered with polyethylene sheeting and waterproof masking tape. Sound Transit will not be responsible for the Contractor's selection or method of protection.

1. Protective coverings shall be secured against wind and shall be vented to prevent collection of moisture on covered surfaces.

2. Provide "wet paint" signs as required to protect newly painted surfaces.

E. Precautions: Take all precautions to prevent fire; open containers of flammable materials only when needed; keep rubbing cloths and oily rags in tightly closed containers and remove from site daily. Dispose of hazardous materials in accordance with all local, State and Federal regulations.

F. Coordination: Review other sections of herein in which prime paints are to be provided to ensure compatibility of total coating system for various substrates. Notify Resident Engineer in writing of any anticipated problems using specified coating systems with substrates primed by others.

1.07 EXTRA MATERIALS

A. See Section 01 60 00, Product Requirements, for additional provisions.

B. Supply five gallons of each paint type and color; store where directed.

C. Label each container with color and color mix number in addition to the manufacturer's label.

PART 2 - PRODUCTS

2.01 PAINT MATERIALS - GENERAL

A. Manufacturers: Refer to Paint Schedules at end of this Section for manufacturer's product names and paint systems which are included to establish the required level of quality. Additionally the following list of manufacture's are acceptable, contingent upon
meeting level of paint quality indicated in the Paint Schedules, and for which a substitution request is not required.

1. ICI Dulux Paints / Devoe Performance Coatings
2. Benjamin-Moore
4. Parker Paints/Frazee
5. Rodda.
6. Sherwin Williams:
7. Tnemec Company.

B. Paint Grade: Professional grade coatings meeting the equivalent performance requirements listed in the Master Painter Institute Approved Product List and suitable for its intended use.

C. Colors: Each paint color must be accurately mixed to ensure color continuity. No allowance will be granted for mismatched paint of the same color when viewed under normal lighting conditions.

D. Provide primer and finish coats, which are compatible with each other and with prime coats provided under other Sections. Provide barrier coats over incompatible primers or remove and re-prime as required.

E. Tint each undercoat a lighter shade than finish coat so that numbers of coats can be easily discerned. No color mixing will be allowed at the job-site.

F. Thinner: Type as recommended by the paint manufacturer. Use thinner only when recommended by the paint manufacturer, and then only in a quantity as indicated on the label.

G. Primers: Primers, except metal primers and vivid color undercoats, shall be white in color for inspection purposes.

H. Secondary Products: Secondary products not specified by name and required for the job such as shellac, oils, patching compounds, or putty, shall be “best grade” products.

2.02 PRIMERS AND UNDERCOATS

A. Gypsum Board Primer: ICI Dulux Prep + Prime 1040 High Build or approved equal latex primer capable of minimum 4-mil dry film thickness without sags or runs single coat coverage.

2. VOC limit: 100 g/l.
3. DFM: 4 mils.

B. Concrete and Concrete Masonry (CMU) Primer: ICI Devoe Bloxfil 4000 HD Acrylic, Tnemec “Envirofill” Series 130 or approved equal latex masonry filler.

2. VOC limit: 100 g/l.

3. Nominal 8 mils DFM.
   a. Coverage - CMU: 75 s.f. per gallon.
   b. Coverage - Concrete: 100 s.f. per gallon.

C. Anti-Corrosive Metal Primer (Includes Ferrous and Non-Ferrous Metals): ICI Devoe Devflex 4020 PF DTM, Tnemec “Uni-Bond DF” “Series 115”, or approved equal acrylic, rust-inhibitive primer recommended by manufacturer for use on both ferrous and non-ferrous metals.
   1. VOC limit: 91 g/l.
   2. DFM: 2.2 – 3.5 mils.
   3. Adhesion: Minimum rating of 5 when tested in accordance with ASTM D 3359, Method B on all of the following surfaces:
      a. Steel prepared in accordance with SSPC SP-10.
      b. Aluminum prepared in accordance with SSPC SP-1.
      c. Galvanized steel prepared in accordance with SSPC SP-1.

2.03 INTERMEDIATE AND FINISH COATS

A. Latex Flat:
   1. Acceptable products include:
      c. ICI Dulux Life Master 9100
      d. Or approved equal
   2. VOC limit: 20 g/l (with colorants).
   3. DFM: 1.2 mils.

B. Latex Eggshell/Satin:
   1. Acceptable products include:
      c. ICI Dulux Life Master 9300.
      d. Or approved equal
   2. VOC limit: 20 g/l (with colorants).
   3. DFM: 1.4 mils.
C. High-Performance Acrylic Semi-Gloss:
   1. Acceptable products include:
      c. ICI Devoe “Devflex” 4205.
      d. Tnemec “Enduratone” Series 1029.
      e. Or approved equal
   2. VOC limit: 20 g/l (with colorants).
   3. DFM: 1.4 mils.

D. Acrylic Dryfall: Tnemec Series 115 “Uni-Bond DF” or ICI Dulux Uni Grip Aquacrylic Dryfall 1482 -1200 or approved equal self-crosslinking acrylic, multi-substrate dryfall coating recommended by manufacturer for use on various substrates typically encountered with exposed structures.
   1. Sheen: Eggshell (MPI Level 3)
   2. VOC limit: 150 g/l.
   3. DFM: 3.0 mils.

E. High-Build Acrylic: Tnemec Series 156 “Enviro-Crete” or approved equal self-crosslinking waterborne acrylic, sand texture coating.
   1. Sheen: Matte.
   2. VOC limit: 60 g/l.
   3. DFM: 6.0 mils.

F. Sand-Texture Acrylic: Tnemec Series 157 “Enviro-Crete” or approved equal self-crosslinking waterborne acrylic, high-build coating.

G. Waterborne Acrylic Stain: One of the following or approved:
   1. Chemprobe/Tnemec Series 617 "Conformal Stain WB".
   2. United Coatings "Canyon Tone Stain".
   3. Tamms "Aqua Stain".

H. Waterborne Epoxy, Satin:
   1. Acceptable products include:
      a. Kelly Moore “Envir-Poxy” 7100 with flatting agent
      b. Benjamin Moore “Acrylic Epoxy Coating” M43/M44 with flatting agent.
c. Sherwin-Williams "Epo-Plex Multi-Mil Water Based Epoxy (B71-100 Series B71V110 Low Luster Hardener)".

d. ICI Devoe "Tru-Glaze" 4418.

e. Tnemec "H.B. Tneme-Tufcoat" Series 113.

f. Or approved equal

2. Coverage: 4 mils per coat (coatings with less build per coat will require additional coats to achieve required system thickness).

3. VOC limit: 240 g/l (with colorants).

2.04 PAINT COLORS

A. Match the following:

1. PNT-1: Light Gray (actual formula TBD)

2. PNT-2: Ferrari Red

a. Rodda #FS03A482

3. PNT-3: Black or charcoal (actual formula TBD).

4. PNT-4: Concrete Gray

a. WSDOT "Washington Gray"

5. PNT-5: White.

PART 3 - EXECUTION

3.01 EXAMINATION

A. General: Examine surfaces to receive paint finish for conditions that will adversely affect execution, performance, or quality of work and which cannot be put into an acceptable condition through reasonable preparatory work as specified herein.

1. Surfaces which are unfit to receive the work of this section shall be repaired, replaced or re-finished such that they are acceptable and such that the work of this section may be done as specified. It shall be the responsibility of the Contractor to ensure that these provisions are strictly enforced.

2. Commencement of Work constitutes acceptance of surfaces and conditions.

B. Gypsum Wallboard: Inspect wall surfaces of gypsum drywall which are scheduled to receive deep tone and accent paint colors prior to application of paint for signs of defects which could affect the finish appearance such as banding, flashing, or uneven texture.

1. Initial Inspection: Make initial inspection a normal viewing distance (approximately 4 feet) under normal lighting conditions.

2. Inspection after First Coat of Paint: Should defect become visible after first coat of paint has been applied, it shall be the Contractor’s responsibility to have all
such conditions corrected by the drywall Installer/finisher. Any corrected areas shall be re-primed at no additional cost to the Sound Transit.

3. Finish Coats: Application of subsequent coats of paint shall constitute acceptance of the drywall substrate by the painting applicator.

C. Concrete and Masonry:

1. Alkali Content Testing: Test for alkalinity by performing appropriate tests, and neutralize as required for pH reading between 6.8 and 8.0, unless otherwise recommended by paint manufacturer. Test for pH following test method as described in ASTM D4262, utilizing litmus paper.

2. Moisture Content Testing: Test for moisture content by performing appropriate tests. Maximum moisture content shall not exceed 17 percent as determined by a moisture meter, unless otherwise required by paint manufacturer.

3.02 SURFACE PREPARATION (GENERAL)

A. General: Surface preparations and cleaning procedures shall be in strict accordance with the instructions and specifications of the paint manufacturer and with the requirements herein.

B. Removal of Fixtures: Cooperate with other trades and coordinate removal of fixtures, hardware items, and equipment, as required for painting work. Items to be removed on surfaces to be painted include: switch and receptacle plates, escutcheons and like plates, surface-mounted equipment, free-standing equipment which blocks access to painting surfaces, grilles and louvers at duct openings into finished spaces, and other items as required and directed.

C. Painting of Factory-Primed Door Hardware: Prior to painting, mask all operating parts so that item works freely after paint is dry. Remove all excess paint from operating parts and clean and free-up the operation of all parts which do not operate smoothly due to the painting operation.

3.03 SURFACE PREPARATION

A. Uncoated Ferrous Metal: Thoroughly degrease surfaces using solvent (SSPC-SP 1) and remove rust and foreign matter by scraping, sanding, wire brushing, or other abrasion methods as necessary in accordance with SSPC-SP 2 and SSPC-SP 3. Remove pits and clean to bright metal before priming. Apply primer on the same day.

B. Shop-Coated Ferrous Metal: Thoroughly degrease surfaces and clean using solvent (SSPC-SP 1). Remove loose rust, blistered and peeling paint to bare metal by scraping, sanding, wire brushing, or other abrasion methods in accordance with SSPC-SP 2 or SP 3; feather edges of adjacent sound paint. Dull glossy surfaces by scuff-sanding and wipe down. Spot-prime all abraded portions, rust areas, and bare surfaces with specified primer on same day.

C. Galvanized Metal (Unpainted): Clean surfaces, wash and etch, to remove factory films and oily residue as recommended by the paint manufacturer. Responsibility for insuring that the surface is properly prepared rests with the painting Subcontractor. Clean galvanized metal the same day to be painted. If a pretreatment wash primer is recommended by manufacturer, apply pretreatment not more than 8 hours in advance of applying primer.
D. Concrete: Clean surfaces free from dirt, grease, oil, efflorescence, and other foreign substances. Remove mortar droppings, glaze, and scale.

E. Concrete Masonry: Remove all dust and loose mortar by brushing. Neutralize alkali or efflorescence with wash solution recommended by paint manufacturer. Thoroughly clean off resulting crystals with stiff brushes.

F. Gypsum Wallboard: Remove all dust and dirt with a brush; if necessary, clean surfaces using damp rags or sponges. Repair of surface defects and Level of finishing is specified in Section 09 21 16, Gypsum Board Assemblies.

3.04 CLEANING PRIOR TO PAINTING

A. Remove dust and loose deleterious materials from all surfaces before beginning painting operations. Program the cleaning and painting so that dust and other contaminants from the cleaning process will not fall in wet, newly painted surfaces.

3.05 APPLICATION OF PAINT

A. Mixing: Mix paint materials in accordance with the manufacturer's instructions and directions. Mix often enough during application to keep the paint uniform and to ensure complete dispersion of pigment and a uniform composition.

1. Prepare multiple component coatings using all of the contents of the container for each component as packaged by the manufacturer. Mixing of partial kits will not be permitted. Multiple component coatings that have been mixed shall not be used beyond their pot life. Only the components specified and furnished by the manufacturer, including thinner if required, shall be mixed.

B. Application: Apply paint in accordance with the manufacturer's directions. Use techniques best suited for substrate and type of material being applied. Apply using airless spray to greatest extent possible for doors and door frames and other medium to high gloss paints. Brushes and rollers shall be of a type best suited for the type of material being applied.

1. Apply intermediate and finish coats within the manufacturer's recommended top coating time periods.

2. When applying paint to drywall, use a roller nap no greater than 3/8 inch so as to achieve a light stipple finish.

3. If metal doors, and plaster surfaces are not sprayed, finish may be applied with 1/4 inch nap roller. Brush and level out paint applied to metal door frames to achieve a nearly sprayed-on appearance.

C. Apply each coat of paint as a continuous film of uniform thickness, free from holidays, sags, crawls, pinholes, blisters, unevenness in color, or other evidence of poor workmanship. Repaint thin spots or areas missed in the application and allow to dry before applying next coat of paint.

1. Give special attention to ensure that surfaces, such as edges, corners, crevices, welds and exposed fasteners receive a dry film thickness equivalent to that of flat surfaces.

2. Each coat shall be free of dirt, dust, moisture, and other contaminates prior to application of next coat.
D. Allow each coat of paint to thoroughly dry, full thickness of the film, before application of the succeeding coat. Paint is considered dry for recoating when the next coat can be applied without the development of all detrimental film irregularities such as wrinkling, lifting, or loss of adhesion of the previous coat.

E. Coverage for each paint material is specified as either the total minimum dry film thickness in mils, or the spreading rate in square feet per gallon over the surface designated. Actual coverage rate will vary depending upon the texture and porosity of the surface, and climatic conditions.

1. The number of coats specified is the minimum required, irrespective of the coating thickness.

2. In the event the required paint thickness is not achieved, or coating shows through, apply additional coats until the color appearance is uniform and required thickness is obtained. Cost for additional coats to prevent show through shall be borne by the Installer.

3. Do not exceed manufacturer's recommended maximum film build-up per coat (wet mils).

F. Recoat primed and sealed walls and ceilings where there is evidence of suction spots or unsealed areas in first coat to ensure a finish coat with no burn-through or other defects.

G. Sand lightly between coats of enamel to produce an even, smooth finish. Wipe to remove dust before recoating.

H. Make edges of paint adjoining other materials or colors clean and sharp with no overlapping.

I. Do not paint over code-required labels or equipment identification or nomenclature plates.

J. Tops and bottoms of doors shall be finished the same as the faces (primed and two finish coats of paint).

K. Door Frames: Unless otherwise indicated, provide color to match adjacent wall color.

3.06 DAMAGED PAINT SURFACES

A. General: Before final acceptance of the work by the Resident Engineer, repair or re-finish painted surfaces which have been damaged at no additional cost. Refinish whole wall where portion of finish is not acceptable.

B. Areas of chipped, peeled, or abraded paint shall be hand or power sanded, feathering the edges. Prime and finish coat the areas using the same material as originally scheduled. Depending on the extent of repair and its appearance, an overall finish coat may be required by the Resident Engineer to achieve uniform appearance.

3.07 CLEAN-UP

A. General: During the progress of the work, remove from the project all discarded paint materials, rubbish, cans and rags. Leave premises clean and in orderly condition.

B. Cleaning: Upon completion of painting work, clean window glass and other paint-spattered surfaces. Remove spattered paint by proper methods of washing and scraping, using care not to scratch or otherwise damage finished surfaces.
3.08  PAINT SCHEDULE - EXTERIOR SURFACES
A.  Typical Exposed Concrete (other than bridge soffit). Waterborne acrylic stain.
   1.  Primer:  None required.
   2.  Two Finish Coats:  Waterborne acrylic stain.

3.09  PAINT SCHEDULE - INTERIOR SURFACES
A. Paint and Special Coating Designations:
   1.  PNT is used for both paint systems specified in this Section as well as high-
       performance coatings specified in Section 09 96 00, High-Performance Coatings.
   2.  EP designates waterborne epoxy paint system specified in this section.
   4.  Suffix -H following the color numeral indicates High Performance Coating
       specified in Section 09 96 00, High-Performance Coatings.
B.  Exposed Structure (not in "touch zone" within ten feet of walking surface) – Painted
   (includes ductwork, conduit, piping, and miscellaneous metals of structure):  Acrylic
   Dryfall.  Do not paint acoustic insulation.
   1.  Primer:  Metal primer or Acrylic dryfall.
   2.  One Finish Coat:  Acrylic dryfall.
C.  Other Exposed Metal:  Latex Semigloss
   1.  Primer:  Metal primer.
   2.  Two Finish Coats:  Latex Semigloss.
D.  Cementitious Wall Panels, Concrete and CMU:  Sand-texture acrylic
   1.  Primer:  Concrete and concrete masonry primer.
E.  Gypsum Wallboard (typical walls):  Latex eggshell.
   1.  Primer:  Gypsum board primer.
   2.  Two Finish Coats:  Latex Eggshell.
F.  Gypsum Wallboard (typical ceilings):  Latex, Flat.
   1.  Primer:  Gypsum board primer.
   2.  Two Finish Coats:  Latex Flat.
G.  Gypsum Wallboard:  Waterborne Epoxy
   1.  Primer:  Gypsum board primer.
2. Two Finish Coats: Waterborne Epoxy.

END OF SECTION
PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes specifications for special field applied paint coating systems for surfaces to receive high-performance coating (PNT-1H), including the following:

1. Exposed Structural Steel: Exterior.
2. Exposed exterior ferrous metal fabrications.
3. Exposed interior structural steel above grade level in head house.
4. Exterior surface of steel bridge sections.
5. Interior surface of steel bridge sections.
6. Concrete bridge soffit.

B. Related Sections: The work of the following Sections is related to the work of this Section. Other Sections, not referenced below, may also be related to the proper performance of this work.

1. Section 05 05 13, Shop Applied Coatings for Metal.
2. Section 05 05 14, Fluoropolymer Coatings for Metal.
3. Section 05 12 00, Structural Steel Framing.
4. Section 05 12 33, Structural Steel for Bridges.
5. Section 05 50 00, Metal Fabrications.
6. Section 09 90 00, Painting and Coating.

1.02 DEFINITIONS

A. DFM: Dry Film Mils; cured coating thickness measured in mils (1/1000 inch).

1.03 SUBMITTALS

A. Procedures: Section 01 33 00, Submittal Procedures.

B. Product Data: Submit data on coating system, including coating manufacturer's most current technical data sheets on each product showing application procedures, coverage rates and dry mil thicknesses; include additive requirements for Low-Temperature application, where anticipated.

C. Samples: Painting Contractor, Using approved materials, prepare and submit samples of finish coat in each separate color on 12-inch by 12-inch sheet metal, which shall be representative of the in place steel substrates. Label samples with color number, name and
date. Provide samples of each color as indicated using complete coating system by application method proposed for the finish Work. Submit additional samples if required for approval.

1.04 QUALITY ASSURANCE

A. Single Source: The shop applied primer applied in related sections and field applied tie or intermediate, as may be required depending on application method and finish color, and top coating, which constitutes the High Performance Coatings system shall be manufactured by the same manufacturer to ensure undivided responsibility.

B. Applicator's Qualifications: Engage an experienced applicator who has completed paint applications similar in magnitude to that indicated for this Project. Only skilled painters shall be used with 5 years, minimum painting experience and 3 to 5 years, minimum experience using similar opaque aesthetic coating products by similar application methods.

C. Pre-Application Conference: Schedule a Readiness Review Meeting in accordance with Section 01 45 00, Quality Control to review the work approximately 2 weeks prior to scheduled commencement of work. Conference shall be attended by Applicator, authorized representative of coating manufacturer, Resident Engineer, and other representatives directly concerned with the performance of work. The following major considerations shall be reviewed at conference:

1. Inspect shop primed steel for undercutting or all other signs of failure.
2. Inspect concrete surfaces for contamination or other conditions detrimental to coating application.
3. Discuss scaffolding and staging requirements.
4. Review surface preparation and cleaning requirements.
5. Review schedule, sequencing, and time lapse between each separate coat. Discuss re-coat time limits as established by manufacturer.
6. Review methods and materials which are to be used for protection of surrounding buildings and to contain over-spray and falling paint spatter.
7. Discuss environmental conditions, including temperature, relative humidity, wind conditions and sun exposure under which materials may not be applied.
8. Review quality control procedures, which will be employed in determining the daily environmental conditions, containment, and disposal; include a list of those instruments, which will be used.
9. Review forecasted weather conditions, and procedures for coping with unfavorable conditions.

D. Mockup, In Place: Provide a full-size, full-height mockup of an exterior structural column to serve as the standard for the work of this Section. Comply with following:

1. Application of materials shall be performed using same materials, methods, and procedures to be used throughout the balance of the Work.
2. Mock up shall incorporate specified surface preparation, including field touch of welds and abrasions with specified primer, tie/intermediate, as required, and finish top coatings, including Low-Temperature additive as proposed in the finish Work, as applicable.
3. Resident Engineer will direct location and extent of exterior structural steel column to be coated.

4. Notify Resident Engineer in advance of dates and times when mockup is to be completed.

5. Resident Engineer’s review and approval of mock up shall include, but not necessarily be limited to:
   a. Uniformity in color, gloss and hide characteristics of high performance finish.
   b. Applicator’s ability to provide continuous film of uniform thickness, free from surface imperfections which show evidence of poor workmanship or the coating’s inability to be applied in the proposed application method.

6. Obtain Resident Engineer’s approval of mockup before starting High-Performance Coatings.

7. If the Resident Engineer determines that mockup does not meet requirements for accepted appearance, repaint using revised methods acceptable to the Resident Engineer.

8. Approved mockup may become part of the completed Work, if maintained undisturbed at time of Substantial Completion.

1.05 DELIVERY, STORAGE & HANDLING

A. Deliver materials to building in sealed, original, labeled containers bearing manufacturer's name, type of material, brand name, color designation, and instructions for mixing and thinning.

B. Store materials when not in actual use in a place specifically assigned for that purpose which is dry and out of direct sunlight. Store materials in a manner so as not to exceed the manufacturer's temperature limitations.

1.06 PROJECT CONDITIONS

A. Environmental Conditions: Air temperature and substrate temperature and relative humidity shall be within the manufacturer’s established limits. Do not apply paint when the following conditions exist, unless requirements of paint manufacturer are more restrictive.
   1. If surface and ambient temperature is above 90 degrees F, or below 40 degrees F.
   2. If relative humidity is above 85 percent.
   3. During damp and inclement weather or during excessively windy weather.

B. Protection: Protect surrounding areas, buildings, and cars against damage due to cleaning operations and from paint application. Method of protection is at Contractor's option, and must be reviewed with the Resident Engineer prior to starting the Work. Sound Transit will not be responsible for Contractor's selection or method of protection or failure to protect.
   1. Protective coverings shall be secured against wind and shall be vented to prevent collection of moisture on covered surfaces.
   2. Provide "wet paint" signs as required to protect newly painted surfaces.
3. Any portions of the surrounding areas, which are damaged as a result of Contractor's activities, shall be restored, refinished, and replaced to the satisfaction of the Resident Engineer at Contractor's expense.

PART 2 - PRODUCTS

2.01 COATING MATERIALS

A. Type and Manufacturer: Coating system shall consist of the following materials as manufactured by Tnemec Company, or approved equal. Only one manufacturer's shop primer and coating system shall be used.

1. Touch Up of Steel (Section 05 12 00, Structural Steel Framing and Section 05 50 00, Metal Fabrications): shop priming as specified in Section 05 05 13, Shop Applied Coatings for Metal(moisture-cure aromatic polyurethane, MIO-zinc Primer)

2. Concrete Primer: Waterborne modified polyamine epoxy bonding primer.
   a. Basis of design product: Tnemec 151-1051 "Elasto-Grip FC".

3. Acrylic Intermediate Coat: Self-cross-linking acrylic, recommended by the top coat manufacturer for use over specified primers.
   a. Basis of design product: Tnemec Series 115 "Uni-Bond DF".

   a. Basis of design product: Tnemec Series N69 "Hi-Build Epoxoline II".

5. Acrylic Urethane Top Coat: Waterborne Aliphatic Acrylic Polyurethane", formulated for spray, brush and roller field application creating a Semi-gloss finish.
   a. Basis of design product: Tnemec Series 1081 “Endura-Shield W.B.”.

6. Polyester Polyurethane Top Coat: Chemical and corrosion resistant polyurethane.
   a. Basis of design product: Tnemec Series 291 "CRU".

B. Thinners: Type as supplied or approved by the coating manufacturer. Use thinner only when recommended by the coating manufacturer, and then only in a quantity as indicated on the label.

2.02 COATING SYSTEMS

A. Paint and Special Coating Designations:

1. System type: First 2 or 3 alpha characters.
   a. PNT: Specified in Section 09 90 00, Painting and Coating
   b. HPC: Specified in herein


3. Color: Numeric character at end: See Color Schedule in Section 09 90 00, Painting and Coating.

B. HPC-A-No: Semi-Gloss Urethane for Exposed Steel

2. Intermediate: Acrylic Intermediate; 2.5 DFM

3. Topcoat: Acrylic Urethane; 2.5 DFM

C. HPC-B-#: Semi-Gloss Urethane for Exposed Concrete

1. Primer: Concrete Primer; coverage rate 225 to 250 square feet per gallon.

2. Intermediate: Acrylic Intermediate; 2.5 DFM

3. Topcoat: Acrylic Urethane; 2.5 DFM

D. HPC-C-0: Corrosion-Resistant Urethane for Concealed Steel (Bridge section interiors)


2. Intermediate: Epoxy Intermediate; 4.0 DFM

3. Topcoat: Polyester Urethane; 2.5 DFM

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examination of Exposed Structural Steel to be Painted: Shop priming, including touch-up work required at field connections, burned or abraded portions, welds and bolts is specified in Sections 05 12 00, Structural Steel Framing. Coating applicator shall inspect the primed surfaces. Should inspection reveal any signs of primer failure, corrosion on substrate or conditions detrimental to the performance of this work, such failure and/or conditions shall be immediately reported to the Contractor.

1. It shall be the Contractor's responsibility to see that the surfaces are put into acceptable condition.

2. Coating applicator shall be required to clean surfaces as hereinafter specified to remove all dust, dirt, and other surface contamination. Commencement of work constitutes acceptance of surfaces and conditions.

3.02 SURFACE PREPARATION

A. General: Surface preparations and cleaning procedures shall be in strict accordance with the instructions and specifications of the coating manufacturer and with the requirements herein.

B. Cleaning for Shop Primed Surfaces: Thoroughly clean steel surfaces to remove all surface oils and other contaminants. Clean surfaces using power washing equipment and non-phosphate, biodegradable chemical cleaner.

1. Field test on a small area to determine the most effective method (type of nozzle employed, operating pressure, and distance of nozzle from surface) to achieve maximum cleaning results without damaging or etching the existing primer.

2. After washing with cleaner, power wash surfaces thoroughly with fresh water under high pressure to remove all traces of the chemical cleaner.
C. Cleaning For Galvanized/Galvannealed Surfaces: Thoroughly clean steel surfaces to remove surface oils and other contaminants in accordance with SSPC SP-1 "Solvent Cleaning". Follow manufacturer's additional requirements for the removal of soluble salts as may be required in accordance with SSPC SP-COM.

D. Cleaning and Touch-Up for abraded areas in field erection and fabrication is included under respective referenced Sections.

3.03 APPLICATION OF COATING

A. Mixing: Mix coating materials in accordance with the manufacturer's instructions and directions. Mix often enough during application to keep the coatings uniform and to ensure complete dispersion of pigment and a uniform composition.

1. Prepare multiple component coatings using all of the contents of the container for each component as packaged by the manufacturer. Mixing of partial kits will not be permitted. Multiple component coatings that have been mixed shall not be used beyond their pot life. Only the components specified and furnished by the manufacturer, including thinner if required, shall be mixed.

2. Tie/intermediate coat primer may be thinned for spray applications in accordance with manufacturer's most current printed technical data sheet.

3. Accelerator may be used in tie/intermediate coat and finish coat to enable faster cure time during Low Temperature applications when approved by Resident Engineer; use accelerator type as supplied by the manufacturer, and then only in a quantity as indicated on manufacturer's most current printed technical data sheet.

B. Application Method: Apply both tie/intermediate coat and finish coat in a full application method in accordance with the manufacturer's most current printed technical data sheet. Use techniques best suited for substrate and type of material being applied.

1. Spray Application: Spray painting shall be accomplished with airless spray equipment or conventional spray equipment; pressure settings, application technique, spray tip, mesh filter screens, and mesh tip strainer shall be as recommended by the coating manufacturer for each separate system.

2. Over apply each coat within the manufacturer's recommended recoating time periods. Should time period for application be exceeded, Contractor shall then follow manufacturer's most current printed technical data sheet which may include an additional prime coat or scarification at no additional cost to Sound Transit.

3. When applying paint, overlap each pass 50 percent followed by cross-hatch pattern.

C. Apply each coat of paint as a continuous film of uniform thickness, free from holidays, sags, crawls, pinholes, blisters, unevenness in color, or other evidence of poor workmanship. Repaint thin spots or areas missed in the application and allow to dry before applying next coat of paint. Give special attention to ensure that surfaces, such as edges, corners, crevices, welds and exposed fasteners receive a dry film thickness equivalent to that of flat surfaces.

1. Coverage for paint material is specified as the total minimum dry film thickness (DFT) in mils.

D. Maintain Cure Times: Provide full cure times necessary to resist direct contact with moisture. Comply with manufacturer's requirements based on actual site conditions.
3.04 DAMAGED PAINT SURFACES

A. General: Before final acceptance of the work, repair or re-finish coated surfaces which have been damaged at no additional cost.

B. Areas of chipped, peeled, or abraded coatings shall be hand or power sanded, feathering the edges. Prime and finish coat the areas using the same material as originally scheduled. Depending on the extent of repair and its appearance, an overall finish coat to a natural break point may be required by the Resident Engineer to achieve uniform appearance.

3.05 CLEAN-UP

A. General: During the progress of the work, remove from the project all discarded paint materials, rubbish, cans and rags. Leave premises clean and in orderly condition.

B. Cleaning: Upon completion of painting work, all surfaces which have been damaged or surfaces which have been splattered shall be cleaned, restored, or replaced to the satisfaction of the Resident Engineer at no expense to Sound Transit.

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SECTION 09 96 23
GRAFFITI- AND WATER-RESISTANT COATINGS

PART 1 - GENERAL

1.01 SUMMARY
A. This Section includes specifications for surface preparation and application of the following:
   1. Clear graffiti (GP) protection for exterior surfaces of exterior exposed substrates, including:
      a. Cast-In-Place concrete wall surfaces, both exterior and interior.
      b. Architectural precast concrete wall panels.
   2. Clear water repellent for interior and exterior floor tiles and unit pavers.
   3. Clear water repellent for bridge walking surfaces including stair treads.
B. Related Sections: The work of the following Sections is related to the work of this Section. Other Sections, not referenced below, may also be related to the proper performance of this work.
   1. Section 03 30 00, Cast-in-Place Concrete.
   2. Section 03 45 00, Precast Architectural Concrete.
   3. Section 09 06 00, Schedules for Finishes.
   4. Section 09 30 00, Tiling.
   5. Section 09 32 19, Mortar-Bed Paver Tiling.

1.02 SUBMITTALS
A. Procedures: Section 01 33 00, Submittal Procedures.
B. Product Data: Submit manufacturer's specifications, cleaning and application instructions for each product. Include data substantiating that material is recommended by manufacturer for applications indicated.
C. Installer Certificates: Submit written certifications from treatment manufacturer stating that Applicator complies with requirements specified in Article 1.03, herein.
D. Application Procedures: Submit written description on the following items describing the methods which are being proposed:
   1. Environmental conditions, including temperature, relative humidity, wind conditions and sun exposure under which material may be applied.
   2. Methods and equipment which will be used in application of treatment and graffiti protective materials.
3. Methods and equipment employed to determine moisture content of substrates to be sealed.

4. Methods and equipment employed to perform surface preparation and cleaning.

5. Refer to Article.03, herein, for those forms and inspection reports which the Contractor is required to obtain from the treatment/graffiti protective materials manufacturer's authorized representative.

E. Maintenance Data: Graffiti removal and cleaning instructions, written and video or digital medium showing cleaning procedure, including recommended proprietary products.

1.03 QUALITY ASSURANCE

A. Source Limitations: Obtain graffiti protection materials through one source from a single manufacturer. Provide secondary materials as cleaners recommended by manufacturer of primary materials. Graffiti protection materials shall be completely compatible for use under the stated warranty.

B. Applicator’s Qualifications: Engage an experienced Applicator who employs only persons trained and approved by graffiti protection manufacturer for application of materials and issuance of special warranty.

C. Treatment/Graffiti Manufacturer’s Qualifications and Responsibilities: Firm regularly engaged in manufacturing graffiti protective materials which have been used on similar projects with successful results, and that retains factory-trained, authorized technical representatives who are available for consultation and job-site inspections and assistance at no additional cost. Require the authorized representative to be responsible for the following:

1. Furnish manufacturer's required forms to the Applicator and Resident Engineer which must be completed for issuance of special warranty; return completed documents to the treatment manufacturer.

2. Obtain and forward precast concrete and masonry samples if required by the manufacturer for laboratory evaluation as part of the special warranty program.

3. Attend pre-construction meeting and other meetings as required under related sections.

4. Be present during test area application, as required to determine suitable application to new substrates; review conditions of the substrate, and cleaning procedures included under related Sections, prior to sealing; determine actual coverage rates to be used for issuance of special warranty; and review application techniques and equipment. Notify Resident Engineer, 24 hours in advance of test area application.

5. Be present during first day of full scale treatment application and then for graffiti protection application; thereafter, at various intervals during application to ensure that adequate quality controls procedures are in force and that workmanship techniques employed meet manufacturer’s recommendations. Frequency of job inspections as mutually agreed upon between Applicator, Contractor and Resident Engineer.

6. Review exposed substrates prior to full-scale application of treatment, if required for warranty purposes.
1.04 DELIVERY, STORAGE AND HANDLING

A. Deliver materials to site in sealed, original, labeled containers bearing manufacturer's name, type of material, brand name, and instructions for mixing. Store materials off-ground, and under cover. Conform to all additional recommendations of the manufacturer regarding storage and handling of the materials.

B. The Resident Engineer reserves the right to inspect the containers prior to their opening, to review accompanying bills of lading, and to reject materials in opened containers.

1.05 PROJECT CONDITIONS

A. Weather and Substrate Conditions: Do not proceed with application of graffiti-resistant coatings (except with written recommendation of manufacturer), when the following conditions exist:
   1. Ambient temperature is less than 40 degrees F or above 100 degrees F;
   2. When rain or temperatures below 40 degrees F are predicted for a period of 24 hours, or earlier than three days after surfaces become wet from rainfall or other moisture sources;
   3. When substrate is frozen, or at surface temperature of less than 40 degrees F;
   4. When winds are sufficient to carry airborne chemicals to unprotected surfaces or adjacent properties, or would cause an improper application rate.

B. Protection of Surfaces:
   1. Protect adjoining work from spillage or overspray of graffiti-resistant coatings treatments. Cover adjoining and nearby surfaces of aluminum, glass and planting where there is possibility of graffiti-resistant coatings being deposited on surfaces. Cover surface mounted items.
   2. Clean treatments from unintended surfaces immediately after spillage or overspray. Comply with manufacturer's recommendations for cleaning. Cleaning materials and methods employed shall be such so as not to damage surfaces and permanent finishes.

1.06 EXTRA MATERIALS

A. Maintenance Materials: After completion of work, provide the following amount of extra materials for purposes of cleaning substrates treated with clear graffiti protection. Materials shall match those approved by the GP manufacturer. Package with shelf life and complete instructions for use. Provide following minimum quantities:
   1. One gallon sealed container of cleaner.
   2. One hand held applicator.

PART 2 - PRODUCTS

2.01 CLEAR GRAFFITI PROTECTION AND WATER REPELLENT

A. Graffiti- and Water-Resistant Coating: Water-repellent, penetrating type silicone treatment formulation in solvent carrier, and which produces a “natural” appearance when dry.
2. Active Substance: Silicone RTV.
3. Active Content: Minimum 11 percent by volume.
4. VOC: 250 grams per liter.
5. Acceptable Products:
   b. ProSoCo, Inc. “Blok-Guard & Graffiti Control”.
   c. Professional Products of Kansas, Inc., "Professional Water Sealant & Anti-Graffitiant".

2.02 CLEAR WATER REPELLENT FOR FLOOR TILES, UNIT PAVERS AND BRIDGE DECK.

   A. Silane, Penetrating Water Repellent: Clear, containing 100 percent alkyltrialkoxysilanes; with 600 g/L or less of VOCs when tested in accordance with SCAQMD standards.

   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Degussa Corp; Protectosil Chem-Trete 40-VOC.
      b. PROSOCO, Inc.; SL100.

PART 3 - EXECUTION

3.01 EXAMINATION

   A. General: Employ graffiti- and water-resistant coating manufacturer's authorized technical representative to review all concrete and masonry surfaces after cleaning and prior to application of treatment. Do not proceed with treatment application until unsatisfactory conditions have been corrected in a manner acceptable to manufacturer's technical representative and the Resident Engineer.

   B. Concrete Substrates: All to cure a minimum of 28 days.

3.02 PREPARATION AND CLEANING

   A. General: Surfaces shall be free of dirt, oils, efflorescence, mildew staining, and other contaminants as graffiti in accordance with manufacturer’s prescriptive cleaning instructions for each condition. Do not start application of graffiti- and water-resistant coating until moisture content of substrate is within graffiti- and water-resistant coating manufacturer’s recommendations as determined by moisture meter. Should efflorescence be present at time of graffiti- and water-resistant coating applications, remove by using stiff bristle brushes and water; do not re-apply chemical cleaners.

   1. Where required to remove contaminants, perform cleaning by method acceptable to the graffiti- and water-resistant coating treatment manufacturer, including shotblasting, sandblasting, waterblasting and chemical cleaners.

   B. Coordination with Sealants: Do not apply graffiti- and water-resistant coating until sealants for joints within precast concrete and masonry have been installed and allowed to fully cure.
C. Protection: Protect glass, windows, doors, metal trim and other non-masonry surfaces from contact with graffiti- and water-resistant coating by covering with polyethylene sheeting and waterproof masking tape. Exercise care when installing protection material so as to prevent pin holes or gaps which will allow graffiti- and water-resistant coating to get behind the protective surface.

1. Remove protection material immediately upon completion of an area where the chance of overspray or contact with graffiti- and water-resistant coating protection no longer exists.

2. Immediately remove graffiti- and water-resistant coatings upon contact with metal or glass; use cleaning materials and methods which do not damage surfaces or permanent finishes.

D. Notification Prior to Final Application: Contractor shall notify Resident Engineer, at least 24 hours in advance of performing work to witness final application. Clearly mark panels, which have received test applications.

3.03 TREATMENT APPLICATION - VERTICAL SURFACES

A. Application (General): Apply graffiti- and water-resistant coating in accordance with manufacturer's directions using low pressure (15-25 psi) airless spray equipment to ensure thorough saturation of the exposed architectural (ACIP) and precast concrete. Do not dilute or alter materials. Apply at same coverage rates as determined on test applications to qualify for special warranty, but 150 square feet per gallon, except as determined by test sampling on new substrates:

B. Apply treatment evenly until surfaces are fully wet, starting at the bottom and working up with a 6 to 8 inches rundown below the contact point of the spray pattern, unless otherwise recommended by graffiti- and water-resistant coating manufacturer. Follow manufacturer's recommendations pertaining to type of spray equipment, hoses, and gaskets.

C. Brush out heavy runs and drips if they do not penetrate the surface within a few minutes.

D. At locations where overspray would affect adjacent materials and where not practical for spray applications, apply graffiti- and water-resistant coating using heavily saturated brush or rollers as recommended by the manufacturer.

E. Apply second coat of graffiti- and water-resistant coating after first coat has dried in accordance with manufacturer's directions. Apply material full strength at rate of 200 square feet per gallon.

3.04 WATER REPELLENT APPLICATION - HORIZONTAL SURFACES

A. Apply a heavy-saturation coating of water repellent, on surfaces indicated for treatment, using 15 psi-pressure spray with a fan-type spray nozzle or roller to the point of saturation. Apply coating in dual passes of uniform, overlapping strokes. Remove excess material; do not allow material to puddle beyond saturation. Comply with manufacturer's written instructions for application procedure unless otherwise indicated.

B. Apply a second saturation coating, repeating first application. Apply second coating at right angles to first coating. Comply with manufacturer's written instructions for limitations on drying time between coats and after rainstorm wetting of surfaces between coats. Consult manufacturer's technical representative if written instructions are not applicable to Contract conditions.
3.05 CLEAN-UP

A. Remove and dispose of necessary masking materials following completion of treatment/graffiti protection applications.

B. Clean-up all over spray from adjacent surfaces with cleaner as recommended by the graffiti-resistant coatings manufacturer which will not damage surfaces.

3.06 FIELD QUALITY CONTROL

A. Test Samples (Prior to Finish Work): Perform following test area applications to confirm in place coverage rates and for Resident Engineer’s acceptance.

1. Before applying graffiti- and water-resistant coating, perform the following field evaluation. The cost of the field testing will be the responsibility of the Graffiti- and Water-Resistant Coatings Manufacturer.

2. Prepare a 3-foot by 3-foot area to be sprayed with graffiti-and water-resistant coatings for each substrate. The area will be determined by the Resident Engineer.
   a. Apply the graffiti- and water-resistant coatings treatment in a flooding application, from the bottom up to cause the material to run down 6 to 8 inches below the spray pattern.

B. Spray Test: After first coat of clear graffiti- and water-resistant coating has dried, and before second coat is applied, spray coated surfaces with water.

1. After surfaces have adequately dried, recoat surfaces that show water absorption.

C. Manufacturer’s Field Services:

1. Test Area: Furnish results of test area absorption on each type of substrate. Test results shall determine application rate.

END OF SECTION
SECTION 10 14 53
TRAFFIC SIGNAGE

PART 1 - GENERAL

1.01 SUMMARY
A. This Section includes specifications for furnishing and installing permanent traffic signage, signage removal, signage relocation, and refacing existing signage as indicated.

1.02 REFERENCES
A. This Section incorporates by reference the latest revisions of the following documents. It is a part of this Section as specified and modified. In case of a conflict between the requirements of this Section and those of a listed document, the requirements of this Section shall prevail. Precedence is in the order shown

1. City of Seattle (COS)
   a. Standard Specifications for Road, Bridge, and Municipal Construction
   b. Standard Plans for Municipal Construction
   c. Traffic Control Manual For In-Street Work

2. Washington State Department of Transportation (WSDOT)
   a. Standard Specifications for Road, Bridge, and Municipal Construction

3. Federal Highway Administration (FHWA)
   a. Manual on Uniform Traffic Control Devices (MUTCD)

1.03 SUBMITTALS
A. Procedures: Section 01 33 00, Submittal Procedures.
B. Product Data: Submit to the Resident Engineer for approval, the respective manufacturers’ product data for signage materials.

PART 2 - PRODUCTS

2.01 MATERIALS
A. For roadway signage on roadways and parking areas that will be owned or maintained by jurisdictions other than Sound Transit, use materials that conform to the applicable requirements of the jurisdictional agency’s standard drawings and specifications.

1. All signs, sign posts, and sign post foundations on Montlake Blvd, NE Pacific St, and the main driveways within the UW parking lot will use COS standards and specifications.
2. Special signs such as UW parking permit signs, kiosk signs, and/or gate house signs, etc, are not part of this contract.

PART 3 - EXECUTION

3.01 CONSTRUCTION

A. For roadway signage on streets, roadways and parking areas that will be owned or maintained by jurisdictions other than Sound Transit, the work described in this Section perform Work in accordance with the applicable requirements of the jurisdictional agency’s standard drawings and specifications.

B. Traffic sign, sign post, and post foundation removals will conform to requirements of COS standards and specifications.

C. Traffic sign removals will be performed upon approval from the Resident Engineer. Removal of traffic signs shall not result in a degradation of, or have an adverse affect on, traffic operations.

END OF SECTION
PART 1 - GENERAL

1.01 SUMMARY
A. This Section includes specifications for wall corner guards as detailed or indicated on Contract Drawings.
   1. Surface-mounted stainless steel guards.

1.02 SUBMITTALS
A. Procedures: See Section 01 33 00, Submittal Procedures.
B. Product Data: Indicate physical dimensions, features, anchorage details, and rough-in measurements.

1.03 PROJECT CONDITIONS
A. Coordinate the work with wall or partition sections for installation of concealed blocking or anchor devices.

PART 2 - PRODUCTS

2.01 CORNER GUARDS
A. Stainless Steel Corner Guard - Surface Mounted:
   1. Fabricate from stainless steel sheet, minimum 0.059 inch thick (16 gage) type 430 stainless steel.
   2. Configuration: 90 degree with 1/8 inch radius nose, two-inch wings, height as shown. Exposed edges eased.
   3. Mounting: Adhesive or Tape: Low-odor, low-VOC liquid adhesive or double-faced adhesive foam tape as recommended by corner guard manufacturer.
   4. Finish: Manufacturer’s standard satin; provide adhesive paper to protect finish during construction operations.

PART 3 - EXECUTION

3.01 INSTALLATION
A. Install components in accordance with manufacturer's instructions, level and/or plumb, secured rigidly in position to wall framing members only.
1. Stainless steel corner guards: Apply adhesive or foam tape to back of corner guards and place in position, pressing firmly to wall; remove excess adhesive from around edges and allow to dry a minimum of 24 hours.

END OF SECTION
SECTION 10 28 10
TOILET AND UTILITY ROOM ACCESSORIES

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes specifications for:
   1. Accessories for staff toilet rooms and utility rooms.
   2. Grab bars.

1.02 REFERENCES

A. This Section incorporates by reference the latest revision of the following documents.
      c. ASTM A 653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
      d. ASTM A 666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
   2. General Services Administration (GSA)

1.03 SYSTEM DESCRIPTION

A. Coordination

1. Coordinate the work with the placement of internal wall reinforcement and reinforcement of toilet partitions to receive anchor attachments.

1.04 SUBMITTALS

A. Procedures: Section 01 33 00, Submittal Procedures.
B. Product Data: Provide data on accessories describing size, finish, details of function, attachment methods.

C. Manufacturer’s Installation Instructions: Indicate special procedures and conditions requiring special attention.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Toilet Accessories:


4. Or approved equal.

B. All items of each type to be made by the same manufacturer.

2.02 MATERIALS

A. Accessories - General: Shop assembled, free of dents and scratches and packaged complete with anchors and fittings, steel anchor plates, adapters, and anchor components for installation.

1. Grind welded joints smooth.

2. Fabricate units made of metal sheet of seamless sheets, with flat surfaces.

B. Keys: Provide two keys for each accessory to Sound Transit; master key all lockable accessories.

C. Stainless Steel Sheet: ASTM A 666, Type 304.

D. Stainless Steel Tubing: ASTM A 269, Type 304 or 316.


F. Mirror Glass: Float glass, ASTM C 1036 Type I, Class 1, Quality Q2, with silvering, copper coating, and suitable protective organic coating to copper backing in accordance with GSA CID A-A-3002.

G. Fasteners, Screws, and Bolts: Hot-dip galvanized, tamper-proof, security type.

H. Expansion Shields: Fiber, lead, or rubber as recommended by accessory manufacturer for component and substrate.

2.03 ACCESSORIES

A. Toilet Room
1. **Toilet Paper Dispenser:** Double roll, surface mounted bracket type, satin finished cast aluminum brackets, eccentric-shaped plastic spindle for 1/2 revolution delivery designed to prevent theft of tissue roll.

   a. **Attached Purse Shelf:** 0.03-inch satin finished stainless steel, with rolled or formed edge at front.

2. **Paper Towel Dispenser:** Folded paper type, stainless steel, semi-recessed, with viewing slots on sides as refill indicator.

3. **Waste Receptacle:** Wall-mounted, stainless steel, seamless lower door for access to container, with tumbler lock, reinforced panel full height of door, push-in self-closing top door, continuously welded bottom pan and seamless exposed flanges.

   a. **Liner:** Removable seamless stainless steel receptacle.
   b. **Minimum capacity:** 4 gallons.

4. **Combination Towel Dispenser/Waste Receptacle:** Recessed with projecting waste receptacle, stainless steel; seamless wall flanges, continuous piano hinges, tumbler locks on upper and lower doors.

   a. **Waste receptacle liner:** Reusable, heavy-duty vinyl.
   b. **Towel dispenser capacity:** 700 multifold.
   c. **Waste receptacle capacity:** 12 gallons.

5. **Soap Dispenser:** Liquid soap dispenser, deck-mounted on vanity, with polyethylene container concealed below deck; piston and 4-inch spout of stainless steel with bright polished finish; chrome-plated deck escutcheon.

   a. **Minimum Capacity:** 16 ounces.

6. **Soap Dispenser:** Liquid soap dispenser, wall-mounted, surface, for with stainless steel cover and horizontal stainless steel tank and working parts; push type soap valve, check valve, and window gage refill indicator, tumbler lock.

   a. **Minimum Capacity:** 24 ounces.

7. **Mirrors:** Stainless steel framed, 6 mm thick float glass mirror.

   a. **Size:** as indicated on Contract Drawings.
   b. **Frame:** 0.05-inch angle shapes, with mitered and welded and ground corners, and tamperproof hanging system; No.4 finish.
   c. **Backing:** Full-mirror sized, minimum 0.03-inch galvanized steel sheet and non-absorptive filler material.
   d. **Shelf:** Stainless steel; gage and finish to match mirror frame, turned down edges, welded to frame; 5 inches deep, full width of mirror.

8. **Seat Cover Dispenser:** Stainless steel, surface-mounted, reloading by concealed opening at base, tumbler lock.

   a. **Minimum capacity:** 250 seat covers.
9. Grab Bars: Stainless steel, 1-1/2 inch outside diameter, minimum 0.05-inch wall thickness, non-slip grasping surface finish, concealed flange mounting; 1-1/2 inch clearance between wall and inside of grab bar.
   a. Length and configuration: As indicated on Contract Drawings.

    a. Door: Seamless 0.05-inch door with returned edges and tumbler lock.
    b. Cabinet: Fully welded, 0.03-inch thick sheet.
    c. Operation: 25-cent coin required to operate dispenser. Provide locked coin box, separately keyed.
    d. Identify dispenser slots without using brand names.
    e. Minimum capacity: 30 napkins and 20 tampons.

11. Sanitary Napkin Disposal Unit: Stainless steel, back-to-back partition mounting with adjustable flanges, self-closing door, locking bottom panel with full-length stainless steel piano-type hinge, removable receptacle.
    a. Provide single surface-mounted unit for single fixture rooms and end compartments that do not have shared partition.

B. Utility Room

1. Combination Utility Shelf/Mop and Broom Holder: 0.05-inch thick stainless steel, Type 304, with 1/2-inch returned edges, 0.06-inch steel wall brackets.
   a. Drying rod: Stainless steel, 1/4-inch diameter.
   b. Hooks: Five 0.06-inch stainless steel rag hooks at shelf front.
   c. Mop/broom holders: Three spring-loaded rubber cam holders at shelf front.
   d. Length: Manufacturer’s standard length for number of holders/hooks.

2.04 FINISHES

A. Stainless Steel: No. 4 satin brushed finish, unless otherwise noted.

B. Chrome/Nickel Plating: ASTM B 456, SC 2, satin finish, unless otherwise noted.

C. Baked Enamel: Pretreat to clean condition, apply one coat primer and minimum two coats epoxy baked enamel.

D. Galvanizing for Items Other than Sheet: Comply with ASTM A 123/A 123M; galvanize ferrous metal and fastening devices.

E. Back paint components where contact is made with building finishes to prevent electrolysis.
PART 3 - EXECUTION

3.01 EXAMINATION
   A. Verify existing conditions before starting work.
   B. Verify exact location of accessories for installation.

3.02 PREPARATION
   A. Deliver inserts and rough-in frames to site for timely installation.
   B. Provide templates and rough-in measurements as required.

3.03 INSTALLATION
   A. Install accessories in accordance with manufacturers’ instructions.
   B. Install plumb and level, securely and rigidly anchored to substrate.
   C. Mounting Heights and Locations: As required by accessibility regulations and as indicated on Contract Drawings

END OF SECTION
PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes specifications for:

1. Fire extinguishers.
   a. FE-1: Multipurpose dry chemical for general use, bracket mounted.
   b. FE-2: B-C dry chemical for electrical rooms, bracket mounted.

2. Fire extinguisher cabinets.
   a. FEC-1: Non-rated fully recessed cabinet with FE-1.

3. Accessories.

1.02 REFERENCES

A. This Section incorporates by reference the latest revisions of the following documents.

1. National Fire Protection Association (NFPA)
   a. NFPA 10 - Standard for Portable Fire Extinguishers;

2. Underwriters Laboratories Inc., (UL)
   a. UL (FPED) - Fire Protection Equipment Directory;

1.03 SYSTEM DESCRIPTION

A. Performance Requirements

1. Conform to NFPA 10.

2. Provide extinguishers classified and labeled by Underwriters Laboratories Inc. for the purpose specified and indicated.

1.04 SUBMITTALS

A. Submittal procedures: Section 01 33 00, Submittals Procedures.

B. Product Data: For each type of product indicated. Include rating and classification, material descriptions, dimensions of individual components and profiles, and finishes for fire extinguishers, cabinets, and mounting brackets.

C. Product Schedule: For fire extinguishers. Coordinate final fire extinguisher schedule with fire protection cabinet schedule to ensure proper fit and function.
D. Shop Drawings: Indicate cabinet physical dimensions, rough-in measurements for recessed cabinets, wall bracket mounted measurements, and location.

1.05 QUALITY ASSURANCE

A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."

B. Fire Extinguishers: Listed and labeled for type, rating, and classification by UL or an Independent Testing Laboratory acceptable to the Seattle Fire Department.

C. Coordination: Verify that cabinets are sized to accommodate type and capacity of extinguishers indicated.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Fire Extinguishers
   1. Amerex Corporation.
   2. Ansul Incorporated; Tyco International Ltd.
   4. JL Industries, Inc.
   5. Larsen's Manufacturing Co.
   8. Substitutions: See Section 01 60 00, Product Requirements.

B. Fire Extinguisher Cabinets
   1. JL Industries, Inc.
   2. Larsen's Manufacturing Co.
   4. Strike First Corp. of America.
   5. Substitutions: See Section 01 60 00, Product Requirements.

2.02 EQUIPMENT

A. Fire Extinguishers
   1. Fire Extinguishers - General: Comply with product requirements of NFPA 10 and applicable codes, whichever is more stringent.
      a. Provide extinguishers labeled by Underwriters Laboratories Inc. for the purpose specified and indicated.
2. **FE-1 - Multi-purpose Dry Chemical Type Fire Extinguishers:**
   a. Nominal Size 10 pound.
   b. UL-rated 4A:40B:C or better.
   c. Finish: Red polyester powder coat.

3. **FE-2 - Fire Extinguishers for Electrical Rooms:** BC Dry Chemical Type Fire Extinguishers:
   a. Nominal Size: 5 pounds.
   b. UL-rated 10B:C or better.
   c. Finish: Red polyester powder coat.

### 2.03 MOUNTING BRACKETS

A. Mounting Brackets: Manufacturer's standard galvanized steel, designed to secure fire extinguisher to wall or structure, of sizes required for types and capacities of fire extinguishers indicated.

### 2.04 CABINETS

A. Fire Extinguisher Cabinets

1. Metal: Formed stainless steel sheet; 0.036 inch thick base metal.

2. **FEC-1:** Cabinet Configuration: Fully-recessed type with standard tub, similar to J.L. Industries "Ambassador" Series with flat trim and W style door.
   b. Trim: Flat, 1-1/2 or 1-3/4 inch wide face.

3. **FEC-2:** Cabinet Configuration: Semi-recessed type with fire-rated tub, similar to J.L. Industries "Ambassador" Series with flat trim and W style door.
   b. Trim: 1-1/2 inch projection quarter-round or square return trim.

4. Door: 0.036 inch thick, reinforced for flatness and rigidity; latch. Hinge doors for 180 degree opening with continuous piano hinge.
   a. Lock and handle: Cylinder lock with cam and safety release to permit opening of door with sharp pull; aluminum or zinc plated handle.
      1) J.L. Industries "Saf-T-Lok", Larsens "Larsen Loc" or equivalent.

5. Door Glazing: Glass, clear, 1/8 inch thick tempered. Set in resilient channel gasket glazing.


7. Weld, fill, and grind components smooth.

8. Finish of Cabinet Exterior Trim and Door: No. 4.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine fire extinguishers for proper charging and tagging.

1. Remove and replace damaged, defective, or undercharged fire extinguishers.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Install fire extinguishers and mounting brackets in locations indicated and in compliance with requirements of Seattle Fire Department.

1. Mounting Brackets: 54 inches above finished floor to top of fire extinguisher.

B. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated.

END OF SECTION
PART 1 - GENERAL

1.01 SUMMARY
A. This Section includes specifications for bird deterrent systems to deter birds from landing at station roofs and canopy edges and at other exposed structures at locations indicated on Contract Drawings. System types include:
   1. Pin and wire.
   2. Electric track.
B. Related Sections:
   1. Division 26: Conduit for wiring from power pack to electric track. Power supply for power pack.

1.02 REFERENCES
A. This Section incorporates by reference the latest revisions of the following documents:
   1. American Society for Prevention of Cruelty to Animals (ASPCA)
      a. ASPCA HANDBOOK

1.03 SUBMITTALS
A. Procedures: Section 01 33 00, Submittal Procedures.
B. Manufacturer's descriptive product data.
C. Shop Drawings:
   1. Indicate typical layout in plan and elevation including dimensions and anchoring provisions, type design and spacing for each substrate and condition for track. Show position of track to building edge conditions for viewing angle.
   2. Submit detail drawings of special accessory components not included in manufacturer's product data.
   3. Show orientation and mounting provisions for charger units.
   4. Wiring diagrams and power requirements.
D. Verification Samples:
   1. Pin and wire system:
      a. Wire support posts for approval.
b. Control wire, 6 inches long each.

2. Electric track system:
   a. 24-inch long section of track with couplings.
   b. Each type of exposed mounting hardware

E. Manufacturer’s Installation Instructions: Indicate preparation and installation instructions.

F. Manufacturer’s Certificate: Certify that products meet or exceed specified requirements.

G. Certificate from Seattle DPD indicating approval of system and materials used.

H. Qualification statements for installing mechanics.

1.04 SYSTEM DESCRIPTION

A. Humane pin-and-wire bird deterrent system to deter birds from roosting at edges of facility and creating nuisance and potential health hazard.

B. Low-visibility, bird-shock track system, complete with power pack (charging unit) for producing an intermittent pulse of high voltage, low amperage current to prevent damage to building from bird droppings.

C. ASPCA approval systems.

1.05 QUALITY ASSURANCE

A. Manufacturer qualifications: Company specializing in manufacturing the products specified in this Section with minimum 3 years documented experience.

B. Installer Qualifications: Company completely familiar with installation of products similar to those required for this Contract.

C. Mock-Up

1. Install one pin-and-wire assembly representative of each design required on Contract.

2. Where one design may be used for different penetrating items or in different wall constructions, install one assembly for each different combination.

3. If accepted, mock-up may remain as part of the Work. Remove and replace mock-ups that are not accepted.

1.06 DELIVERY, STORAGE AND HANDLING

A. Store and handle materials to avoid damage to products and injury to Installers.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Post and Wire System:

2. Other acceptable manufacturers and products:

B. Electric Track System:
   2. Other acceptable manufacturers and products:
      a. Hot Foot America, “Electrack A.S”

C. Substitutions: Section 01 25 00, Substitution Procedures.

2.02 PIN AND WIRE SYSTEM COMPONENTS

A. Humane Bird Control Wire Deterrent System
   1. Stainless steel posts with flat base minimum 4 inches by 4 inches for adhesive attachment of system to roof membrane substrate.
   2. Nylon-coated wire.

B. Finish: Natural stainless steel finish.

2.03 ELECTRIC TRACK SYSTEM COMPONENTS

A. Power Pack (Charger)
   1. Input Voltage: 120 Volts AC.
   2. Output Voltage: 7.5KV (+ or -) 2KV, 3 amps (+ or -) 1 amp.
   3. Intermittent DC output.

B. Track System.
   2. Width: 1.5-inch.
   3. Height: 1/4-inch.
   4. Mounting: Non-penetrating, adhesive as recommended by manufacturer.
   5. Lengths: 50-feet standard lengths capable of maintaining design current.
C. Lead-Out Wire:
1. Material: Heavy insulated 14 double gauge copper wires.
3. Height: 3/8-inch.
5. Length: 50-feet standard lengths as required.

D. Mounting Accessories: Type and configuration recommended for weathertight installation.

PART 3 - EXECUTION

3.01 EXAMINATION
A. Verify that installation surfaces are ready to receive architectural bird control. Do not proceed until unsatisfactory conditions have been corrected.

3.02 INSTALLATION
A. Install architectural bird control in accordance with manufacturer's printed instructions.
B. Pin and Wire System:
1. Attach bird wire posts to metal roof surfaces or to roof membrane with adhesive product approved by roofing manufacturer.
2. Install bird wire posts at spacing specified in manufacturer's installation instructions, for uniform appearance and without end-to-end gaps.
3. Install wire and tension springs as specified in manufacturer's installation instructions.
C. Electric Track System:
1. Track System: Install materials neatly, tangent to surface, straight and uniform in appearance, and with uniform clearance from building features in a continuous loop.
2. Install lead-out wire from power pack to track and secure to prevent damage by construction sequencing and building maintenance personnel.
D. Inspect finished installations and make adjustments as necessary.

END OF SECTION
CONTRACT SPECIFICATIONS

SECTION 11 24 23
ROOF SAFETY ANCHORS

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes specifications for roof top safety anchors for roof maintenance and for window washing maintenance.
   1. ("Tie-Offs"): Roof safety anchors consisting of pipe pier with fixed head mounted to structural building frame.

B. Related Sections: The work of the following Sections is related to the work of this Section. Other Sections, not referenced below, may also be related to the proper performance of this work.
   1. Section 05 05 23, Metal Fastenings: General requirements for welding and inspection of welds.
   2. Section 07 54 23, Thermoplastic Polyolefin (TPO) Roofing: Base flashing at anchor assemblies.
   3. Section 07 92 00, Joint Sealants: Coordination for weather sealing roof safety anchors.

1.02 REFERENCES

A. This Section incorporates by reference the latest revisions of the following documents.
   1. American Society for Testing and Materials International (ASTM)
   2. American Welding Society (AWS):
      a. AWS D1.1- Structural Welding Code - Steel.
      b. AWS D1.3 – Specifications for Welding Sheet Steel in Structures.
   3. Occupational and Safety Health Administration (OSHA) Standards:
   4. OSHA Rule on Fall Protection in General Industry (29 CRF 1910, Subpart I).
1.03 SYSTEM DESCRIPTION

A. Design Responsibility: Engage a registered engineer to design all components and all attachments to the building structure to meet the following structural requirements.

B. Structural Performance: Provide safety anchors that have been designed, fabricated and installed to withstand the following loads as demonstrated by calculations prepared by the manufacturer’s design engineer.

1. Roof safety anchor Assemblies: Design anchors and connections to resist 5,000 pounds load pullout force without damage to underlying roof structure, without detachment or fracture of anchor assembly.

2. Provide supplementary plates, attachments and anchors as required to transfer loads to structural frame.

1.04 SUBMITTALS

A. Procedures: Section 01 33 00, Submittal Procedures.

B. Product Data: Submit producer's or manufacturer's specifications for roof safety anchors, including high strength bolts, cables, fittings, anchors, nuts and washers as applicable. Provide manufacturer’s installation instructions, including special procedures for affecting Field Quality Control.

C. Shop Drawings: Submit shop drawings showing, at a minimum, the following information:

1. Roof Plan: Show locations of all roof safety anchor positions.

2. Roof safety anchor Assemblies: Show sizes, height, thicknesses, and type and grade or strength of materials; show type and size of welds.

D. Structural Calculations: Submit structural calculations verifying that roof safety anchors and their connections to the building structure comply with the “Structural Performance” requirements specified. Calculations shall be prepared, stamped and signed by the Sub-Contractor's registered professional structural engineer, licensed in the State of Washington.

E. Certification:

1. Welders and welding procedures: Submit certifications as specified in Section 05 05 23, Metal Fastenings.

2. Submit certified test reports indicating load capacity of roof safety anchors and suspension assemblies, as applicable. Certification stating that roof safety anchors comply with the static and dynamic loading requirements of OSHA and WISHA approved.

3. Submit Installer’s authorization, signed by roof anchor manufacturer.

a. Coordination: Coordinate anchor stud locations and anchor depth limitations with Contract Drawings.
1.05 QUALITY ASSURANCE
A. See Section 05 05 23, Metal Fastenings for requirements for welders, welding procedures, and inspections.

1.06 COORDINATION & SCHEDULING
A. Install roof safety anchors prior to installation of roofing system.

PART 2 - PRODUCTS

2.01 MATERIALS
A. Acceptable Manufactures:
   2. Pro-Bel Enterprises Ltd., Vancouver, BC.
   3. Thaler Metal Industries Ltd.
B. Basis of Design for Roof Safety Anchors: Pro-Bel “Safety Anchor Model No. PB-75ES/WELD”, or approved equal meeting the following:
   1. Steel Pipe: ASTM A53, Schedule 80; minimum 3-1/2 inch diameter.
   2. U-Bar: ASTM A276, Stainless steel Type 304, cold finished with yield strength of 44 Ksi, minimum. U-bar shall be not less than 3/4 inch diameter material with 1-1/2 inch eye opening.
   4. Steel Plate: ASTM A572, Grade 50.
   5. Counter Flashing: Seamless spun 6061-T6 aluminum alloy and temper per ASTM B221.
C. Joint Sealant: Refer to Section 07 92 00, Joint Sealants, for Type F-2 sealant.

2.02 FABRICATION
A. Roof Safety Anchor Assemblies: Steel pipe piers of sizes, thickness, and grade or strength of steel as specified.
   1. Provide pipe in lengths required to maintain 8 inches minimum above top of finished roof assembly. Verify with roofing insulation submittal.
   2. Provide assemblies complete with steel top plate for attachment of U-bar. All joints between sections shall be continuously welded and ground smooth in accordance with AWS Standards.
   3. Anchor assemblies shall be hot-dipped galvanized after fabrication in accordance with Section 05 05 13, Shop-Applied Coatings for Metal.
4. Provide stainless steel “U-shaped” roof safety anchor, minimum 3/4-inch outside diameter; roof safety anchor shall be continuously welded to upper portion of pier as indicated.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify Conditions as satisfactory to receive work of this Section. Do no work until corrections of unsatisfactory conditions are completed. Beginning work constitutes acceptance of existing conditions.

B. Verify layout of roof safety anchors and structural framing is satisfactory for the work to proceed.

C. The manufacturer’s representative shall co-ordinate installation of the work with work of related trades. Where conflicts arise, promptly notify the Resident Engineer for resolution.

3.02 INSTALLATION

A. Layout and install assemblies in accordance with approved shop drawings and manufacturer's recommendations.

B. Co-ordinate installation with work of related trades.

C. Install all work true, level, tightly fitted, and flush with adjacent surfaces as required.

1. Weld anchor base to structural steel framing.

3.03 FIELD QUALITY CONTROL

A. Inspections and Test by the Contractor

1. Visual Inspection:
   a. Conform to ANSI/AWS D1.1.
   b. Visually inspect 100 percent of welds, for both permanent and temporary Work.

2. Quality of welds and standards of acceptance: Conform to ANSI/AWS D1.1.


4. Magnetic Particle Inspection: ASTM E709. Inspect complete and partial joint penetration groove welds and fillet welds as follows:
   a. One out of five (20 percent) of complete joint penetration groove welds of tee and corner joints.
   b. One out of ten (10 percent) of partial joint penetration groove welds and fillet welds.

5. Liquid Penetrant Inspection: ASTM E165. Liquid penetrant inspection may be used for detecting discontinuities that are open to the surface.
6. Repairs: ANSI/AWS D1.1, Section 3.7. Reinspect or retest repaired or corrected welds as specified for the original weld.

B. Inspections and Test: See Section 05 05 23, Metal Fastenings.

END OF SECTION
PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes specifications for Lifeline Fall-Arresting Cable Systems including the designing, furnishing, and installing of a complete fall-arresting lifeline and safety tieback anchor system as defined by OSHA; for safe maintenance access to the wales and struts of the Mezzanine Level, Basement Level 1, and Basement Level 2 as indicated on Drawings and/or provided by design-build supplier.

1.02 REFERENCES

A. This Section incorporates by reference the latest revisions of the following documents.

B. American Institute of Steel Construction (AISC):
   1. AISC S342L, with Supplement No.1 "Load and Resistance Factor Design Specification for Structural Steel Buildings”.
   2. AISI SG-971 Specification for Design of Cold-Formed Steel Structural Members.”

C. American Welding Society (AWS):
   1. AWS D1.1 Structural Welding Code - Steel.

D. American National Standards Institute (ANSI):
   1. ANSI Z 359.1 American National Standard Safety Requirements for Personal Fall Arrest Systems and Components

E. American Society for Testing and Materials International (ASTM):
   1. ASTM A123 Standard Specification for Zinc Coating (Hot-Dip Galvanizing) of Iron and Steel Products

F. Occupational Safety and Health Administration (OSHA):
   1. OSHA 1926.502 Fall Prevention Systems and Criteria and Practices

1.03 SUBMITTALS

A. Procedures: Section 01 33 00, Submittal Procedures

B. Detailed shop drawings showing fabrication for the complete lifeline systems as well as the safety tieback and suspension anchors.
   1. Include layout drawings of each system and anchor in relation to the supporting structure indicating the locations of all components in the system properly labeled for identification.
2. Installation and rigging instructions and all necessary Restrictive and Non-Restrictive Working Usage Notes and General Safety Notes.

3. Indicate welds, both shop and field, using standard welding symbols of ANSI/AWS A2.4. Show the size, length, and type of each weld on drawings.

4. Indicate individual welders' identification on Contract record drawing

C. Design analysis and calculations.

D. Systems Manual including the following:

1. Maintenance Procedures: Including parts list and maintenance requirements for all equipment.


3. Test Certificate: Indicating completion of proof load testing on installed systems.

4. Product certificate: containing the manufacturer's serial number, name and part number of each individual component used in the system; manufacturer's catalog data indicating the sizes, descriptions, capacities, test certifications, and other descriptive data showing sufficient detail that the product complies with the contract requirements.

5. As-Built Drawings: A copy of as-built drawings shall be included in the systems manual. As-built drawings shall include layout drawings of each system and anchor in relation to the supporting structure indicating the locations of all components in the system properly labeled for identification.

E. Manufacturer's Instructions: Manufacturer's instructions indicating the manufacturer's recommended method and sequence of installation for the following: lifeline anchors, safety tieback anchors, energy-absorbing devices, body harnesses, and lifeline cable.

F. Product Data: Material, equipment, and fixture lists. Manufacturer's catalog data indicating the sizes, descriptions, capacities, test certifications, and other descriptive data showing in sufficient detail that the product complies with the contract requirements. Equipment and performance data including but not limited to: lifeline anchors, safety tieback anchors, energy-absorbing devices, body harnesses, lifeline cable.

G. Evidence of Liability Insurance: Provide written documentation in evidence and demonstration of fulfillment of requirements of Article 1.05B, herein below.

1.04 PERFORMANCE REQUIREMENTS

A. Design fall-arresting lifeline and safety tieback anchor system that will allow the user to walk uninterrupted the entire length of the system and provide secure anchorage to arrest a fall by the users in accordance with Contract Documents, standards, and regulations/codes contained. Design system to fully protect the user at all times while in the area of potential fall hazard. Design lifeline system for two simultaneous users. Use safety tieback and suspension anchors that are rated for attachment of a single user. Include all components required to provide a complete and fully operational system.

B. Structural Performance: Provide fall-arresting lifeline and safety tieback anchor system capable of withstanding design loads as required by governing regulations and codes. Where component design loads are specified herein, they represent design minimum requirements. Design the fall arresting lifeline and safety tieback anchor system and
window-washing suspension anchor system as specified herein, and all associated connections to conform to the conditions shown on the Contract Drawings. Ensure that all anchor components conform to proper engineering principles and have been designed by a professional engineer who is legally qualified and registered to practice in the State of Washington where Contract is located and who is experienced in the design of fall arresting and anchoring systems, its application and safety requirements. Sound Transit takes no responsibility for product design, manufacture, delivery and handling, or connection to basic structure. Furnish and install all necessary bracing, ties, anchorage, distribution members, and similar elements in conformance with submitted drawings and calculations.

C. The Engineer retained by the Contractor shall be responsible for verifying that system components are attached in such a manner that their forces cause no distress to the basic structure. Where necessary, provide additional structural elements to safely distribute forces.

D. Locate anchorages to suit suspension equipment used on the building with respect to items such as reach, rigging, spacing, roof edge condition, and similar items.

E. Design all anchor components to provide adequate attachment to the building and suited to current suspended maintenance practices. Ensure compatibility with industry standard equipment.

F. Design system fall-arresting lifeline and safety tieback anchor system to comply with the following structural requirements:

1. Safety Tieback Anchors: designed to allow the user to connect personnel fall arrest equipment and designed with a minimum 2:1 factor of safety.

1.05 QUALITY ASSURANCE

A. Manufacturer: specializing in the design, fabrication and installation of fall-arresting lifeline and safety tieback anchor systems having a minimum of five years documented experience.

B. Insurance: Manufacturer shall carry specific liability insurance (products and completed operations) in the amount of $2,000,000.00 to protect against product/system failure.

C. Welding: executed by certified welders in accordance with AWS requirements.

D. Engineering Responsibility: Preparation of Shop Drawings, design calculations, and other structural data by a qualified professional engineer registered to practice in the State of Washington.

E. Mock-Up Requirement:

1. Provide mock-up of each type of anchor, tie-back, safety anchor or suspension system to the Resident Engineer for approval.

2. If accepted, mock-up shall represent minimum standard for the Work of this section.

3. If accepted, mock-up may remain as part of the Work. Remove and replace mock-ups that are not accepted.

1.06 REGULATORY REQUIREMENTS

A. Comply with the following OSHA regulations:
1. 1910, Subpart D (Walking and Working Surfaces).
2. Appendix C to 1910 Subpart F (Personal Fall Arrest Systems).
3. "OSHA Ruling on Window Cleaning by Bosun's Chair" Memorandum to Regional Administrators from P. K. Clark, Director, Directorate of Compliance Programs.
4. OSHA 1926.502 Fall Prevention Systems and Criteria and Practices.

1.07 MAINTENANCE DATA
A. Submit one copy of system Equipment Manual & Inspection Log Book, with "Initial Inspection - Certification for Use" and "Inspection Sign-Off" forms completed.
B. Submit two copies of a reduced plastic laminated as-built shop drawing showing equipment locations and details. Post this drawing near exits onto the roof.

1.08 DELIVERY, STORAGE, AND HANDLING
A. Deliver materials in manufacturer's original unopened packaging. Store materials in original protective packaging inside a well ventilated area protected from weather, moisture, soiling, abrasion, extreme temperatures, and humidity.

1.09 PROJECT CONDITIONS
A. Field Measurements: Verify actual locations of structural framing and other construction contiguous with lifeline and safety tieback anchor system and window-washing suspension anchor system equipment by field measurements before fabrication and indicate measurements on Shop Drawings.

1.10 COORDINATION
A. Coordinate installation of anchorages for anchor system equipment items and accessories with structural steel fabricator, roofing installer, and other trades that may be affected by the work. For informational purposes, furnish setting drawings, templates, directions for installation of anchorages, or other documentation to the Contract site before impact on other construction and trades.

PART 2 - PRODUCTS

2.01 MANUFACTURERS
A. Accepted Fall-Arresting System Products and Suppliers:
   1. Pro-Bel Ltd., www.pro-bel.com; 1-800-461-0575.
   4. Substitutions: Section 01 25 00, Substitution Procedures.

2.02 MATERIALS
A. Fall-Arresting System
1. All materials shall be new, and completed fall protection system shall be the product of one manufacturer or the manufacturer’s authorized installer regularly engaged in the design and production of such equipment. Provide flexible lifeline and multiple span horizontal cable systems as approved by Resident Engineer.


3. Lifeline supports and anchors: Fabricate supports for additional lifeline support plus safety tieback and suspension anchors from carbon steel with a corrosion resistant finish.

4. Fasteners: The lifeline systems and anchors shall be attached to the supporting structure with appropriate fasteners. The fasteners shall be designed to support a load on the system using the corresponding factor of safety without failure.

5. Horizontal lifeline cable: Marine grade stainless steel wire rope with a minimum breaking strength of 10,000 pounds.

6. Force limiting anchorage posts: Designed to limit load to 2,250 pounds force in the event of a fall and absorb the energy integrally. The body of the anchorage is to deploy in the event of a fall pulling the fixings in shear and preventing damage building structure.

7. Swaging: in-line with the anchor point, with a slip indicator.

8. Shock absorber: Limit load in-line shock absorber to 3,000 pounds maximum for multi-span systems and 4,500 pounds maximum for single span systems. Visually display deployment in the event a load such as a fall has occurred on the system.

9. End anchors: 316 stainless steel end anchors with minimum breaking strength of 10,000 pounds.

10. Transfastener/Trolley: 316 stainless steel with a minimum tensile load of 3,600 pounds. Allow for easy pass-through of support points without disconnecting from the system.

11. Tension indicator: Allow the user to physically inspect that the correct cable tension is achieved.

12. Other components including corner assemblies, turnbuckles, and other components: 316L stainless steel.

13. Deceleration device: Provide six appropriate length lanyards that meet or exceed applicable standards of ANSI Z 359.1 and OSHA 1926.104.

14. Harnesses: Provide six full-body harnesses with single back D-ring that meet or exceed applicable standards of ANSI Z 359.1 and OSHA 1926.104.

2.03 SERIAL NUMBERS:

A. On all fall-arresting system components, permanently stamped or engraved, identifying the specific project and system they are used for. Record serial numbers in the system manual.
2.04 FABRICATION
A. Fabricate work true to dimension, square, plumb, level and free from distortion or defects detrimental to appearance and performance.
B. Grind off surplus welding material and ensure exposed internal corners have smooth lines.
C. Fabricate system components of the same material unless otherwise indicated.
D. Fabricate anchoring devices as recommended by the manufacturer to provide adequate support for intended use.

PART 3 - EXECUTION

3.01 EXAMINATION
A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions upon which the work of this Section depends. Report to the Contractor in writing defects in work prepared by other trades and other unsatisfactory site conditions that would cause defective installation of products or cause latent defects in workmanship and function.
   1. Proceed with installation only after unsatisfactory conditions have been corrected.
   2. Commencement of work shall imply acceptance of prepared work.

3.02 INSTALLATION, GENERAL
A. Install equipment in accordance with approved shop drawings and manufacturer’s instructions.
B. Co-ordinate installation with work of related trades.
C. Install all work true, level, tightly fitted, and flush with adjacent surfaces as required.
D. Deform threads of tail end of anchor studs after nuts have been tightened to prevent accidental removal or vandalism.
E. Lifeline systems and anchors: installed by manufacturer’s authorized, trained, and certified personnel.
F. Install anchorage and fasteners in accordance with manufacturer’s recommendations to obtain the allowable working loads published in the product literature and in accordance with these Contract Specifications.
G. Do not load or stress lifeline systems or anchors until all materials and fasteners are properly installed and ready for service.

3.03 FINAL ADJUSTING AND INSPECTION
A. Adjust and leave equipment in proper working order.

3.04 TESTING
A. Test all anchorage systems relying upon chemical adhesive fasteners 100 percent, on site using load cell test apparatus in accordance with manufacturer’s recommendations.
B.  Test using load cell test apparatus in accordance with manufacturer’s recommendations.

3.05 CLEANING
A.  Unless otherwise indicated, clean metals by washing thoroughly with clean water and soap, rinsing with clean water, and drying with soft cloths.

3.06 OPERATOR TRAINING
A.  Provide a minimum of four hours of operator training after system has been installed and proof tested.  Provide training for the users of the system and conduct at the installation site.

3.07 PROTECTION
A.  Protect horizontal maintenance equipment and accessories from damage during construction period with temporary protective coverings approved by manufacturer. Remove protective covering at time of Substantial Completion.

END OF SECTION
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SECTION 11 24 25
WINDOW WASHING EQUIPMENT

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes specifications for:
   1. Electrically powered hoist for window-washer's bosun's chair.
      a. Auxiliary remote control station.
      b. Retractable lifeline.
      a. Retractable lifeline for monorail and adjacent ladder.

B. Related Sections: The work of the following Sections is related to the work of this Section. Other Sections, not referenced below, may also be related to the proper performance of this work.
   1. Section 08 71 00, Door Hardware: Cylinder cores and keys.
   2. Section 11 24 24, Fall-Arresting Systems:
   3. Section 26 05 25, Wire and Cable: Conduit and wiring for hoist and remote control station.

1.02 REFERENCES

A. This Section incorporates by reference the latest revisions of the following documents.
   1. American National Standards Institute (ANSI)
      a. ANSI Z 359.1 Safety Requirements for Personal Fall Arrest Systems and Components

1.03 SUBMITTALS

A. Procedures: Section 01 33 00, Submittal Procedures.

B. Product Data: Submit manufacturer's literature, technical data and installation instructions for each item.
   1. Hoist unit.
   2. Remote control station.
   3. Monorail.
   4. Retractable lifelines.
C. Systems Manual including the following:

1. Maintenance Procedures: Including parts list and maintenance requirements for all equipment.
3. Product certificate: containing the manufacturer’s serial number, name and part number of each individual component used in the system; manufacturer’s catalog data indicating the sizes, descriptions, capacities, test certifications, and other descriptive data showing sufficient detail that the product complies with the contract requirements.

D. Wiring Diagram for remote control station.

PART 2 - PRODUCTS

2.01 ELECTRIC WINDOW WASHING HOIST

A. General: Furnish hoists complete with accessories, controls, power cords and accessories for installation as approved for use the manufacturer.

1. Type: Electric cable hoist with automatic reel for control pendant cable.
2. Capacity: Minimum 400 pounds.
3. Lift: Not less than 65 feet.
4. Cable: Stainless steel, not less than 4000 pound breaking strength.
   a. Termination: Weighted snap hook for attachment of bosun's chair.
5. 60-70 feet per minute lifting speed
7. Accessories:
   a. Weighted locking hook for attachment of bosun's chair.


2.02 REMOTE CONTROL STATION

A. Provide remote control station to permit raising cable and hook to stowed position in ceiling after use and lowering cable and hook to deploy lift for use. Wired type specified, radio (wireless) control is acceptable.

1. Control Station: Standard three-position key switch momentary control.
   a. Exterior type; flush mounted in single gang box.
   b. Lock Cylinders: Provide cylinders specified in 08 71 00 - Door Hardware, and keyed to building keying system.
   c. Keys: Two for each cylinder.

2.03 MONORAIL SYSTEM
A. Aluminum Inverted U-shaped track with two traversing stainless steel trolleys.
   1. Trolley working capacity: 1000 pounds each.
   3. Basis of design manufacturer: Pro-Bel Ltd.

2.04 RETRACTABLE LIFELINES
A. Lifeline for Electric Hoist: Provide fall-arresting retractable lifeline meeting the requirements of ANSI Z 359.1 adjacent to hoist.
   1. Function: Extends and retracts automatically, in the event of a fall it stops the falling worker within inches and limits arresting forces to 900 lbs. or less.
   2. Housing: Cast aluminum or high impact plastic.
   4. Length: Not less than 65 feet.
   5. Cable: Stainless steel, not less than 4000 pound breaking strength.
   6. Provide, shock absorber (if not integral with lifeline), snap hook to attach to worker's harness and tag line to connect lifeline to hoist cable hook.
   7. Basis of design: Miller "Falcon SRL" #MP65SS/65FT with Miller "SofStop Shock Absorber Pack" #928LS/18INYL.

B. Lifeline for Monorail and Adjacent Ladder: Provide fall-arresting retractable lifeline meeting the requirements of ANSI Z 359.1 attached to separate monorail trolley
   1. Function: Extends and retracts automatically, in the event of a fall it stops the falling worker within inches and limits arresting forces to 900 lbs. or less.
   2. Housing: Cast aluminum or high impact plastic.
   4. Length: Not less than 20 feet.
   5. Cable: Synthetic rope, not less than 4000 pound breaking strength.
   6. Provide, shock absorber (if not integral with lifeline), snap hook to attach to worker's harness and tag line to connect lifeline to hoist cable hook.
   7. Basis of design: DBI/Sala L4432.

PART 3 - EXECUTION

3.01 INSTALLATION
A. General: Install all items in accordance with manufacturer's printed instructions.
B. **Clean Up:** After installation and prior to acceptance by the Owner, clean exposed surfaces.

### 3.02 OPERATOR TRAINING

A. Provide a minimum of two hours of operator training after system has been installed and proof tested. Provide training for the users of the system and conduct at the installation site.

**END OF SECTION**
PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes specifications for the coordination and installation of artwork within the station.

B. A wide range of art is included in the construction of the University Link Light Rail, including discrete artworks, artistic enhancements and functional elements of facilities.

C. Artwork installed in this Contract is integrated into the architecture and requires coordination and preparation by the Contractor as itemized herein.

D. Artists are all under contract to Sound Transit.

1.02 DEFINITIONS

A. Artist: The Artist and the Artist’s Subcontractor for fabrication and/or installation.

1.03 SCHEDULING

A. Coordinate artwork installation with the artists through the Resident Engineer.

B. Designate one field engineer whose responsibility is the coordination of the artwork.

C. Upon notification by the Resident Engineer, initiate and lead at least one coordination meeting involving the Contractor designated field engineer and the Resident Engineer. The Resident Engineer will coordinate the inclusion of the artists, architects, and art program administrator. The purpose of the meeting is to coordinate construction schedules, outline procedural issues, and define roles and responsibilities. Provide 2 weeks advance notice for the meeting(s).

D. Provide a task-specific construction schedule to the Resident Engineer and the art program administrator clearly defining requirements for proper coordination of artwork installation. Provide schedule changes that affect artwork coordination as changes occur.

E. Coordinate with work of Section 07 42 10, Metal Wall Panels

PART 2 - PRODUCTS

2.01 COMPONENTS

A. MP-3 as specified in Section 07 42 10, Metal Wall Panels: Perforated metal panels with diffusing polycarbonate layer.

B. Electronic files of artwork for metal panel fabrication as described in Paragraphs 3.03 and 3.04.
PART 3 - EXECUTION

3.01 INSTALLERS

A. Safety

1. On-site Artists and artist’s personnel inspecting the work within the confines of the Contract prior to Final Acceptance of the Contract will comply with the Contractor’s safety program.

   a. Provide a safety orientation/training class and outline safety standards and requirements of the Contract for all artists and artist’s personnel as required.

   b. Artists and Artists’ personnel are responsible for supplying and donning protective attire including proper shoes, hardhat, safety glasses, hearing protection, safety harnesses, gloves, and safety vests as required by the Contractor.

3.02 PREPARATION

A. Contractor Furnished – Contractor Installed Artwork

1. The Contractor coordinates with the Resident Engineer and Artist in developing delivery schedules for artist’s artwork, installation durations, handling, site preparation, providing access to the site, installation, and protection of the artwork after installation.

2. The Contractor reviews all installation details and provisions of the Contract with the Resident Engineer and Artists prior to Contractor’s fabrication/construction of their respective work.

3. The Contractor holds a coordination meeting 2 weeks prior to scheduled installation to discuss unloading, staging, rigging, and hoisting requirements and all other aspects of final artwork installation.

4. The Contractor provides the Resident Engineer with a 12-month and 1-month notice prior to artwork installation. Changes in schedule are coordinated with the Artists through the Resident Engineer.

5. Attachment methods, templates, and all installation details are furnished to the site 1-month prior to installation.

6. The Contractor provides a safe and secure site for storage of the artwork prior to installation should the artwork be delivered to the site as scheduled, and the Contractor is not ready to begin installation. If the artwork is stored off site by the Contractor, the Contractor is responsible for its insured storage and delivery of the artwork to the site at the time of installation. Contractor is liable for damage to the work while in storage or transport under the Contractor’s supervision.

7. Contractor coordinates all adjacent construction to minimize conflicts with artwork installation and minimize potential for subsequent trade damage to installed artwork.

8. Artist and Resident Engineer are present when artwork is installed.
3.03 INSTALLATION

A. Contractor Furnished – Contractor Installed Artwork

1. “The Chamber”

   a. Artist Responsibilities:

      1) Provide electronic drawing files in .DXF format of the artwork for translation and incorporation into the metal panel submittal. All panels receiving perforations are drawn.

      2) Review manufacturer shop drawings of each panel and provide approval to the Resident Engineer.

      3) Be present with the Resident Engineer during installation to verify placement.

   b. Contractor Responsibilities:

      1) Refer to Section 07 42 10, Metal Wall Panels.

      2) Coordinate the transmittal of artist provided electronic drawing files and development of manufacturer’s shop drawings for approval by the Artist and Resident Engineer.

      3) Provide a unique identifier to each panel and indicate position on a layout map.

      4) Provide and install perforated metal panels as detailed in Contract Drawings and in accord with artist provided perforation designs. Provide and install perforated panels with diffuser panels as detailed in the Contract Drawings.

      5) Provide and install lighting fixtures as detailed in the Contract Drawings.

      6) Adjust and aim lighting fixtures at the direction of the Resident Engineer and Artist.

      7) At the conclusion of the work, provide a digital CAD/CAM file of each panel for as-built purposes and future replacement.

3.04 EXAMPLES OF PANEL DESIGN COMPLEXITY

A. The following three images are scaled examples to show the range of complexity of designs that will be provided by the artist. Designs are provided for all panels in electronic format.
1. Example 1

Solid metal panel - typical

Cut outs in metal panel - typical
2. Example 2

- Solid metal panel - typical
- Cut outs in metal panel - typical
3. Example 3

END OF SECTION
SECTION 12 93 00  
SITE FURNISHINGS

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes specifications for furnishing and installing the following:

1. Bicycle racks
2. Benches
3. Newspaper racks
4. Bollards
5. Tree grates
6. Trench drain grates
7. Waste receptacles
8. Lean rails
9. Skateboard deterrents
10. Plant trellis wire mesh panels
11. Edge restraints
12. Tree mulch ring

B. Related section: The Work of the following Sections is related to the work of this Section. Other Sections, not referenced below, may also be related to the proper performance of this Work.

1. Section 01 56 39, Temporary Tree and Plant Protection.
2. Section 01 66 00, Product Storage and Handling Requirements.
3. Section 01 78 23, Operation and Maintenance Data.
4. Section 05 50 00, Metal Fabrications.
5. Section 05 52 00, Metal Railings.
6. Section 05 53 33, Aluminum Grating.
7. Section 09 99 00, Painting and Coating.
8. Section 32 13 13, Concrete Paving.
9. Section 32 90 00, Planting.
1.02 REFERENCES

A. This Section incorporates by reference the latest revisions of the following documents.

B. American Society for Testing and Materials International (ASTM):
   d. ASTM A307-00, Standard Specification for Carbon Steel Bolts and Studs, 60000 PSI Tensile Strength.

1.03 SUBMITTALS

A. Submit the following for approval in accordance with Section 01 33 00, Submittal Procedures, and with the additional requirements as specified for each.

B. Manufactured items:
   1. Manufacturer’s Product Literature: Identify specific product, model, finishes, and features.
   2. Manufacturer’s installation instructions.
   3. Samples of all specified Materials, fasteners, and finishes:
      a. Tree grate: Two 12 inch squares (including typical edge condition).
      b. Trench drain grate: Two 12 inch lengths.
      c. Edge restraint: Two 12 inch lengths.
   4. Shop Drawings:
      b. Include show drawings for all candidates submitted for equivalency status to specified products.

C. Fabricated items:
   1. Samples of all specified Materials, fasteners, and finishes:
      a. Lean rail: Two 12 inch lengths of tube.
      b. Skateboard deterrent: Two 12 inch units.
      c. Plant trellis wire mesh: Two 12 inch squares.
      d. Tree mulch ring: Two 12 inch lengths.
2. **Shop Drawings**: provide details of construction and installation of including materials, dimensions, methods of joining, fastenings and anchoring for:
   
a. All fabricated items including leaning rails, skateboard deterrents, plant trellis wire mesh panels, and tree mulch rings.

b. Obtain approval for minor variations in detail for the purpose of improving fabrication and installation procedures, but not affecting general design for structural stability or size.

3. **Metal fabrication shall be in accordance with Section 05 50 00, Metal Fabrications**.

D. **Weld Certificates**.

### 1.04 DELIVERY, STORAGE, AND HANDLING

A. Refer to Section 01 66 00, Product Storage and Handling Requirements.

B. Deliver products in good condition.

C. Store products to prevent corrosion, deterioration and damage.

D. Handle products to prevent damage.

E. Bent, scratched, or otherwise damaged items are not acceptable.

### 1.05 QUALITY ASSURANCE

A. **Manufacturer's instructions**: Adhere to manufacturer's instructions for product handling, assembly and installation, and maintenance.

B. Manufacturer’s original factory finish must be intact for the installation to be considered satisfactory. On-site touch-up painting or finishing will not be accepted.

C. Inspect surfaces to receive furnishings prior to any installation. Verify accuracy of layout. Insure that surface and grades are complete and meet quality requirements of Contract Documents and the Resident Engineer. If layout, grades and or surface do not meet quality requirements, notify Resident Engineer immediately.

D. Ensure furnishings are plumb, and are centered and aligned with other furnishings or pavement patterns as shown in Contract Documents.

### 1.06 PROJECT CONDITIONS

A. **Field Measurements**: Verify actual locations and dimensions of walls, pavements and other construction contiguous with fabrications by field measurements to ensure that actual dimensions correspond to established dimensions.

B. Provide allowance for trimming and fitting on site.

### 1.07 MOCK-UPS

A. Install the following mock-ups of fabricated items for acceptance by the Resident Engineer:

1. **Lean rail**: Erect one 5 foot section of the lean rail including the footing to illustrate the complete installation of the element.
2. Skateboard deterrent: One installed in section of concrete retaining wall.

3. Plant trellis wire mesh panels: One panel.

4. Tree mulch ring: One, complete with mulch.

B. Do not begin final installation prior to acceptance of mock-up by Resident Engineer.

C. Protect and maintain accepted mock-up as standard of quality for Work of this Section. Accepted mock-ups may be retained as part of final installation

PART 2 - PRODUCTS

2.01 EQUIPMENT

A. General:

1. Comply with Manufacturer’s recommendations. Where these may be in conflict, the more stringent requirements prevail.

2. All products shall be supplied as specified, or accepted equal. Refer to Section 01 25 00, Substitution Procedures for Product Substitution requirements.

B. Bicycle Rack Type 1:

1. Manufacturer: Cora Bike Rack Inc., or accepted equal.


4. Design: Racking design to accommodate all types of bicycles. Allows user to lock both the bicycle frame and wheel.

5. Dimensions:
   b. Height: 34 inches.
   c. Depth: 30 inches.

6. Material and Construction:
   b. Heavy duty high quality steels. Anchor mount.
   d. Color: Manufacturer’s standard black.
   e. Lock support ASTM A36, 3/4 inch H.R. Round bar.

C. Bicycle Rack Type 2:

1. Manufacturer: Dero Bike Rack Co., or accepted equal.


4. Design: Racking design to accommodate all types of bicycles. Allows user to lock both the bicycle frame and wheel.
   b. Floor mounted.
   c. Double-sided.

5. Dimensions:
   a. Length: 88 inches.
   b. Height: 62 inches.
   c. Depth: 56 inches.

6. Material and Construction:
   a. High quality heavy duty steel with anchor mount.
   b. Finish: Powder coat.
   c. Color: Manufacturer’s standard black.

D. Newspaper Racks:
   1. Manufacturer: Rak Systems, Inc., or accepted equal.
   3. Quantity: Provide four Newspaper racks.
   4. Design: Modular, broadsheet, coin-operated news rack.
   5. Model: No. 49B with TK coin mechanism, high security lock, 0.093 door plastic and lock to open paper door.
   7. Newspaper rack base: “Vegas No. 2” as manufactured by Rak Systems, Inc., or accepted equal. Color to be selected from manufacturer’s standard colors. Provide one Newspaper rack base.

E. Bench Type 1:
   1. Manufacturer: Landscape Forms, Inc., or accepted equal.

5. Supports: End supports are type 319 ASTM B 26 aluminum sand castings.

6. Frame: Front seat rail is 1.5 inches outside diameter by 0.12 inch wall normalized 4130 welded steel tubing with type 304 ASTM A 276 stainless steel threaded inserts welded inside each end. Rear seat rail is 1.5 inches outside diameter by 0.12 inch wall ASTM A 513 type 1 steel tubing. Seat panel connections are 0.25 inch by 0.75 inch by 0.80 inch type 304 ASTM A 276 stainless steel flat bar welded to rails. Upper and lower back rails are 6061-T6 or 6005A-T5 ASTM B 211 aluminum extrusions. Upper rail is 1.375 inch diameter. Lower rail is 0.875 inch diameter.

7. Seat and Back Panels: Seat panel is 0.12 inch thick ASTM A 1011 hot rolled pickled and oiled commercial steel type B perforated and formed. Seat panel connections are 0.188 inch by 1 inch by 1.5 inch type 304 ASTM A 276 stainless steel flat bar welded to panel. Back panel is 0.125 inch thick 3003-H14 ASTM B 209 aluminum sheet perforated and formed. Back panel is welded to back rails.

8. Surface Mount Hardware: Plates are 0.375 inch thick 6061-T6511 ASTM B 221 aluminum flat bar. Anchors are 1/2 inch by 4-3/4 inch stainless steel sleeve anchors.


10. Seat Dividers: Type 319 ASTM B 26 aluminum sand castings.

11. Fasteners: All threaded fasteners are stainless steel or Magni 565 coated carbon steel. Seat dividers are attached with nylon shoulder and flat washers to protect the seat panel finish.

12. Mounting Options: May be embedded or surface mounted.

13. Finishes: Finish on metal is Landscape Forms’ Pangard II® finishing process that includes a rust inhibitor and top coat finish of thermosetting polyester powdercoat that is UV, chip and flake resistant.

14. Colors: Manufacturer’s standard black.

15. Installation: Benches are shipped assembled. Install in accordance with the Contract Documents. Stay bench must be installed on a level concrete base at least 5 inches thick for surface mounting and at least 4-1/2 inches thick for embedding.

16. Manufacturer’s warranty: Products to be free from defects in material and/or workmanship for a period of three years from the date of invoice.

F. Bench Type 2:

1. Manufacturer: Forms and Surfaces, or accepted equal.

2. Address: Carpinteria, CA.


5. Dimensions: Modular 20-1/2 inch seat width.
   b. SB-5B: (Typical for all IB Pedestrian Plaza Seating): Backless seats, intermediate armrests, no external armrests, five seat - 17-3/4 inch by 116-1/2 inch by 17-1/2 inch (seat height).

6. Composition and Materials:
   a. Die cast aluminum mounting post: 4.724 inch diameter at the base that tapers to 4.213 inch diameter at the top. Total height shall be 12.795 inches. Aluminum alloy type GA1 Si 12 cu. in accordance with ISO 3522/81 and UNI 5076. Install with neoprene gasket to provide isolation from adjacent materials.
   b. Cylindrical support beam: 3.346 inch diameter extruded aluminum in accordance with UNI 9002.
   c. Die cast aluminum seat, armrests, and connectors: Aluminum alloy type GA1 Si 12 cu. in accordance with ISO 3522/81 and UNI 5076. Seats shall have open slots of 0.50 inch for ventilation and drainage.
   d. Internal tie rod: Tubular carbon steel, 0.118 inch wall thickness, to run the length of the beam assembly.
   e. End caps: Molded black textured plastic, 3 inches in diameter. Caps should conceal the beam end bolt socket heads and washers.
   f. Materials shall fit internal keyways to mate to corresponding pieces to provide a unified, rigid structure.
   g. Finish: Aluminum components to be deburred, fine sandblast with hot dip chromate undercoating and 4 mils polyester powdercoat. Powder coat shall have anti-graffiti properties. Steel components to receive anti-corrosion phosphate/manganese coating.
   h. Color:
      1) Seats and mounting posts: Manufacturer's standard black.
      2) Armrests: Manufacturer's standard silver.

7. Manufacturer's Warranty: Five years material and workmanship.

G. Bollard Type 1:

1. Manufacturer: Creative Pipe, Inc., or accepted equal.

2. Address: P.O. Box 2458, Rancho Mirage, CA 92270-1087, telephone: (800) 644-8467, www.creativepipe.com

3. Model: CBR-6-RB-E-P-FT (fixed).
4. Design: 36 inches tall, round bollard, 6 inches inside diameter, schedule 40 steel pipe, inset reveal, embedded mount, TGIC polyester powder coat, flat top.


6. Manufacturer’s warranty: For a period of one year from the date of receipt and acceptance by the buyer, its bollards will be free from defects in material or workmanship.

H. Bollard Type 2:

1. Manufacturer: Creative Pipe, Inc., or accepted equal.


4. Design: 36 inches tall, Eliminator bollard, 6 inches inside diameter, schedule 40 steel pipe, internally locking removable embedded mounting system, TGIC polyester powder coat, hot-dipped galvanized finish on the flange and hinged hole cover, removable flat cap, internal lifting handle.


6. Manufacturer’s warranty: For a period of one year from the date of receipt and acceptance by the buyer, its bollards will be free from defects in material or workmanship.

I. Tree Grates:

1. Manufacturer: Grating Pacific, or accepted equal.


   a. Refer to Section 05 53 33, Aluminum Grating PART 2 for aluminum, fasteners, and frame materials and fabrication requirements.

   b. Refer to Section 05 50 00, Metal Fabrications 2.01 Materials and 2.02 Fabrication for applicable material and fabrication requirements.


6. Design: Provide four grate panels per tree, two per side of tree unless otherwise illustrated in Contract Documents. Dimensions as shown on Contract Documents. Weld lug attachment to frame, four per panel. Use tamper-resistant screws to attach grates to frame.

J. Trench Drain Grates:

1. Manufacturer: Iron Age Designs, or accepted equal.
2. Address: Iron Age Designs, 2104 SW 152 ND ST #4, Burien, WA 98166, telephone: (206) 276-0925.


5. Finish: Natural.

6. Design: To be used in conjunction with the following drain body types:
   a. ACO H80K, H100K and K100S.
   b. MEADRAIN Shallow Channel System (LZ 80 & LZ 60).

7. Dimensions: No openings greater than 3/8 inch, total thickness 3/4 inch, 5 inch width, 24 inch length segments. Due to casting inconsistencies all dimensions are nominal.

K. Waste Receptacles:

1. Manufacturer: Landscape Forms, or accepted equal.


5. Finish: Powder coat.

6. Color: Manufacturer’s standard black.

L. Lean Rail:


   a. Refer to Section 05 52 00, Metal Railings for applicable design, material, fabrication and installation requirements.

3. Finish:
   a. Galvanized.
   b. Refer to Section 09 99 00, Painting and Coating for material finishes.

4. Dimensions: 2 inch square tube with 1/4 inch radius corners.

M. Skateboard Deterrents:

1. Design: Cast-in-place metals bars with two integral imbeds welded to the base of each unit to prevent lifting from concrete wall. Locate and install per Contract Drawings.

2. Material:
a. Stainless steel.
b. Refer to Section 05 50 00, Metal Fabrications 2.01 Materials and 2.02 Fabrication for applicable material and fabrication requirements.

3. Finish:
   a. Standard mill finish.

4. Dimensions:
   a. Type 1: 1/2 inch thick by 2 inches tall by 12 inches long. Radius all exposed corners 1/2 inch. Ease all exposed edges.
   b. Type 2: 1/2 inch thick by 2 inches tall by 8 inches long. Radius all exposed corners 1/2 inch. Ease all exposed edges.

N. Plant Trellis Wire Mesh Panels:
   1. Material:
      a. Galvanized steel.
      b. Refer to Section 05 50 00, Metal Fabrications 2.01 Materials and 2.02 Fabrication for applicable material and fabrication requirements.
   2. Finish:
      a. Galvanized.
      b. Refer to Section 09 99 00, Painting and Coating for material finishes.
   3. Dimensions:
      a. Refer to Contract Drawings for configuration.
      b. 14 gauge ASTM A641 galvanized steel wire.
      c. Welded wire with 2 inch square pattern.

O. Edge Restraint:
   1. Type 1: Permaloc StructurEdge aluminum edging, 3/16 inch thickness, 2-1/4 inch depth, mill finish, 6063 alloy, or accepted equal.
   2. Type 2: Permaloc PermaStrip aluminum edging, 3/16 inch thickness, 3-1/2 inch depth, mill finish, 6063 alloy, or accepted equal.

P. Tree Mulch Ring:
   1. Material: Galvanized steel.
      a. Refer to Section 05 50 00, Metal Fabrications 2.01 Materials and 2.02 Fabrication for applicable material and fabrication requirements.
   2. Dimensions: 1/2 inch thick bar stock by 3 inch depth by 6 foot radius.
   3. Design: Tree mulch ring is to be fabricated in a maximum of two segments.
4. Installation: Secure to the ground with a minimum of four 10 inch galvanized steel spikes. Segments are to be installed flush with one another and the adjacent finished grade. Install center of ring to match center of tree trunk.

Q. Anchors, Fasteners, Fittings, and Hardware: Stainless steel, or Manufacturer's standard, corrosion-resistant-coated or non-corrodible materials; commercial quality, tamperproof, vandal and theft-resistant, concealed, recessed, and capped or plugged.

2.02 FABRICATION

A. Metal Components: Form to required shapes and sizes with true, level and consistent curves, lines, and angles. Cut, drill and punch metals cleanly and accurately. Remove burrs and sharp or rough areas on exposed surfaces, and ease edges unless otherwise indicated. Separate metals from dissimilar materials to prevent electrolytic action. Cut, reinforce, drill and tap metal fabrications as indicated to receive finish hardware, bolts, and similar items.

B. Welded Connections: Weld connections continuously. Weld solid members with full length, full penetration welds and hollow members with full-circumference welds. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals. Obtain fusion without undercut or overlap. Remove weld flux immediately. At exposed connections, finish surfaces smooth and blended so no roughness or unevenness shows after finishing and welded surface matches contours of adjoining surfaces.

C. Shop Assembly: Preassemble items in the shop to the greatest extent possible to minimize field assembly. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation. Clearly mark units for assembly in the field.

D. Cut, reinforce, drill and tap metal fabrications as indicated to receive finish hardware, bolts, and similar items.

E. Concrete shall be as specified in Section 03 30 00, Cast-In-Place Concrete and Section 32 13 13, Concrete Paving.

2.03 FINISHES

A. Comply with NAAMM's “Metal Finishes Manual for Architecture and Metal Products” for recommendations for applying and designating finishes.

B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of accepted Submittals. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of accepted Submittals and are assembled or installed to minimize contract.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify installation conditions as satisfactory to receive Work of this Section. Do not install until unsatisfactory conditions are corrected. Beginning of installation constitutes acceptance of existing conditions.

B. See Section 01 56 39, Temporary Tree and Plant Protection for guidelines regarding work adjacent existing tree critical root zones.
3.02 INSTALLATION GENERAL
A. Stake location of site furnishings for review of Resident Engineer.
B. Install all manufactured items in accordance with Specifications, Contract Drawings and manufacturer’s directions. Where these may be in conflict, the more stringent requirements govern.
C. Set fabrications accurately in location, alignment and elevation; with edges and surfaces level, plumb, true and free of rack; and measured from established lines and levels. Maximum variation of seats or mounts from level or plumb is 1/16 inch unless otherwise noted.
D. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations.
E. Comply with the following for field welding: Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals. Obtain fusion without undercut or overlap. Remove weld flux immediately. At exposed connections, finish surfaces smooth and blended so no roughness or unevenness shows after finishing and welded surface matches contours of adjoining surfaces.
F. Fastening to in-place construction: Provide fasteners where metal fabrications are required to be fastened to in-place construction.

3.03 INSTALLATION OF MANUFACTURED ITEMS
A. General:
   1. Install in accordance with manufacturer’s specifications.
   2. Includes:
      a. Bicycle racks.
      b. Benches.
      c. Newspaper racks.
      d. Bollards.
      e. Waste receptacles.
      f. Trench drain grates.
      g. Tree grates.
      h. Edge restraints.
   3. Ensure units are plumb, level, and are centered and aligned with adjacent elements and pavement patterns as indicated on the Contract Drawings. Locate as indicated on the Contract Drawings.
   4. Securely anchor units level and square in accordance with manufacturer’s instructions. Install units without damage to shape or finish.
   5. Install with galvanic isolation from surface to which unit is mounted.
B. Newspaper Racks:
1. Inspect newspaper racks to ensure proper door and lock operation.
2. Tag and log keys with appropriate numbers and submit to Resident Engineer.

C. Benches:
1. Field verify site dimensions. Benches cannot extend beyond edges of planting areas into path of travel.

D. Bollards:
1. Install in accordance with manufacturer’s specifications for footing depth and width, using preset anchorage.

E. Waste Receptacles:
1. Align receptacle opening perpendicular to the path of travel, with all openings facing the same direction.

3.04 INSTALLATION OF FABRICATED ITEMS

A. All fabricated items shall be installed consistent with the measured plans provided in the Contract Drawings.

B. Do not start Work prior to approval of shop drawings by the Resident Engineer.

C. Verify dimensions before proceeding with work. Verify measurements at Site.

D. Ensure units are plumb, level, and are centered and aligned with adjacent elements and/or pavement patterns as indicated on the Contract Drawings. Locate as indicated on the Contract Drawings.

E. Securely anchor units level and square in accordance with Contract Drawings. Install units without damage to shape or finish.

F. Provide anchorage to substrates indicated in accordance with Contract Drawings and shop drawing submittals.

G. Special instructions:
1. Lean Rail:
   a. Install lean rail segments along arcs to form consistent line that follows the arc of pavement edges. Sections of lean rail that create variations will be rejected.

2. Trench Drain Grates:
   a. Gaps between adjacent units not to exceed 1/8 inch.

3. Tree Grates:
   a. Cast tree grate frames into the concrete surround, level and flat to prevent rocking and allowing grates to lie flat.
   b. Gaps between adjacent units not to exceed 1/8 inch.
3.05 CLEAN UP

A. Remove all metal, wood, and debris, protective wrappings and coverings, and shipping materials from the project site. Remove all residues, repair all stains, scuffs, abrasions, and marks from the finished product prior to requesting inspection. Fully restore all areas of the site that were impacted by the installation activities.

END OF SECTION
PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes specifications for furnishing and installing and providing preventive maintenance for Geared and Gearless Passenger traction elevators as specified and detailed on the Contract Drawings.

B. Related Sections: The work of the following Sections is related to the work of this Section. Other Sections, not referenced below, may also be related to the proper performance of this work.

1. Section 08 80 00, Glazing.
2. Section 09 96 00, High-Performance Coatings.

C. Related Work Provided Under Other Sections

1. Hoistway and Pit:
   a. Bevel cant not less than 75 degrees from the horizontal on all rear or sidewall ledges and beams that project or recess 2 inches or more into the hoistway. Not required on hoistway divider beams.
   b. Grout around hoistway entrances and sills.
   c. Pit access ladder for each elevator.
   d. Waterproof pit. Dry sump with flush grate and pump.
   e. Seal fireproofing to prevent flaking.

2. Machine Room, Control Room and Machinery Spaces:
   a. Enclosure with access stair with guardrail. Include similar access to overhead machinery space.
   b. Self-closing and locking access door.
   c. Paint walls, ceiling, and floor.
   d. Class ABC fire extinguisher.
   e. Seal fireproofing to prevent flaking.
   f. Fire sprinklers where required.

1.02 REFERENCES

A. This Section incorporates by reference the latest revisions of the following documents.
1. American Society of Mechanical Engineers (ASME)
   a. ASME A17.1 National Safety Code for Elevators and Escalators
   b. ASME A17.2.1 Inspector’s Manual for Electric Elevators
   c. ASME A17.5 Elevator and Escalator Electrical Equipment

   a. ASTM A36 Standard Specification for Carbon Structural Steel
   c. ASTM A568 Standard Specification for Steel, Sheet, Carbon, and High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, General Requirements
   d. ASTM A1008 Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability
   e. ASTM A1011 Standard Specifications for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy with Improved Formability
   f. ASTM B209 Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
   g. ASTM B221 Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles and Tubes

3. National Fire Protection Association (NFPA)
   a. NFPA No. 70 National Electrical Code
   b. NFPA No. 72 National Fire Alarm Code
   d. NFPA No. 130 Standard for Fixed Guideway Transit and Passenger Rail Systems

4. International Building Code (IBC)
   a. IBC Chapter 30 Elevators and Conveying Systems

5. Federal Standard and NAAMM nomenclature

6. American National Standards Institute (ANSI)
   a. ANSI Z97.1 Safety and Glazing Materials used in Building Safety

   a. CPSC 16 CRF Part 1201 Safety Standard for Architectural Glazing Materials

8. Washington Administrative Code (WAC)

9. Occupational Safety & Health Administration (OSHA)
1.03 DEFINITIONS

A. Terms used are defined in the latest edition of the Safety Code for Elevators and Escalators, ASME A17.1.

B. Reference to a device or a part of the equipment applies to the number of devices or parts required to complete the installation.

1.04 SYSTEM DESCRIPTION

A. Related Work Provided Under Other Sections

1. Hoistway and Pit:

a. Clear, plumb, substantially flush hoistway with variations not to exceed 1 inch at any point.

b. Bevel cants not less than 75 degrees from the horizontal on all rear or sidewall ledges and beams that project or recess 4 inches or more into the hoistway. Not required on hoistway divider beams.

c. Divider beams between adjacent elevators at each floor, pit, and overhead. Supports at each floor for car and counterweight guide rail fastening. Intermediate car counterweight guide rail support when floor heights exceed 14 feet 0 inch. Building supports not to deflect more than 1/8 inch under normal conditions, 1/4 inch under seismic conditions.

d. Installation of guide rail bracket supports in concrete. Inserts or embeds, if used, will be furnished under this Section.

e. Wall blockouts and fire rated closure for control and signal fixture boxes that penetrate walls.

f. Cutting and patching walls and floors.

g. Wall pockets and/or structural beams for support of machine, sheave, and dead-end hitch beams. Do not exceed support deflection of 1/1666 of span under static load. Erect from elevator hoistway wall after elevator entrances.

h. Grout around hoistway entrances and sills.

i. Lockable, self-closing, fire-rated pit door.
j. Pit access ladder for each elevator.

k. Structural support for car and counterweight buffer impact loads, guide rail loads, and compensation sheave tie-down upthrust.

l. Waterproof pit. Dry sump with flush grate and pump.

m. Protect open hoistways and entrances during construction in accordance with OSHA Regulations 29 CFR Part 1926.

n. Protect car enclosure, hoistway entrance assemblies, and special metal finishes from damage after installation.

o. Hoistway venting or pressurization to prevent accumulation of smoke and gas as required by Local Building Code.

p. Seal fireproofing to prevent flaking.

2. Machine Room, Control Room and Machinery Spaces:

a. Enclosure with access ship’s ladder or stair with guardrailing. Include similar access to overhead machinery space.

b. Self-closing and locking access door.

c. Ventilation and heating. Maintain minimum temperature of 55 degrees F, maximum 90 degrees F. Maintain maximum 80 percent relative humidity, non-condensing.

d. Paint walls, ceiling, and floor.

e. Class ABC fire extinguisher.

f. Seal fireproofing to prevent flaking.

g. Fire sprinklers where required.

3. Electrical Service, Conductors, and Devices:

a. Lighting and Ground Fault Circuit Interrupter (GFCI) convenience outlets in pit, machine room, and overhead machinery space.

b. Conduit from the closest hoistway of each elevator group or single elevator to the firefighter’s control room and communications distribution cabinet. Coordinate size, number, and location of conduits.

c. Three-phase mainline copper power feeder to terminals of each elevator controller in the machine room with protected, lockable OPEN, disconnect switch.

d. Single-phase copper power feeder to each elevator controller for car lighting and exhaust blower with individual protected, lockable OFF, disconnect switch.

e. Products-of-combustion sensor (NFPA No. 72, Chapter 5-3) in each elevator lobby, for each group of elevators or single elevator and each machine room to initiate firefighters’ return feature. Device at top of hoistway if sprinklered. Provide means for service access from outside the hoistway. Provide
sensor signal wiring from hoistway or machine room connection point to elevator controller terminals.

f. Temporary power and illumination to install, test, and adjust elevator equipment.

g. Means to manually and automatically disconnect power to affected elevator drive unit and controller prior to activation of machine room overhead fire sprinkler system, and/or hoistway overhead fire sprinkler system. Locate manual shut-off means outside bounds of machine room.

h. When sprinklers are provided in the hoistway, identify all electrical equipment, except seismic protective devices, located less than 4 feet 0 inch above the pit floor for use in wet locations. (ANSI/NFPA 70).

i. Power feeders to main control console and firefighters' control panel.

j. Power feeder to elevator Public Address (PA) amplifier in the elevator machine room.

k. Single-phase power feeders to machine room elevator group control monitor with single-phase, protected, lockable OFF, disconnect switch.

B. Review Contract Documents for compatibility with its product prior to bidding. Review structural, architectural, electrical and mechanical, and communication systems documents and elevator specification. Compliance with all provisions of Contract Documents is assumed and required. Sound Transit will not pay for changes to structural, mechanical, electrical, or other systems required to accommodate Contractor's equipment.

1.05 SUBMITTALS

A. Procedures: Section 01 33 00, Submittal Procedures.

1. Within 60 days after Notice to Proceed and before beginning equipment fabrication, submit shop drawings and required material for review. Allow 30 days for response to initial submittal.

B. Scaled or Fully Dimensioned Layout: Plan of pit, hoistway, and machine room indicating equipment arrangement, elevation section of hoistway, details of car enclosures, hoistway entrances, and car/hall signal fixtures.

C. Design Information: Indicate equipment lists, reactions, and design information on layouts.

D. Power Confirmation Sheets: Include motor horsepower, code letter, starting current, full-load running current, and demand factor for applicable motors.

E. Fixtures: Cuts, samples, or shop drawings.

F. Finish Material: Submit 3-inch by 12-inch samples of actual finished material for review of color, pattern, and texture of exposed finishes. Compliance with other requirements is the exclusive responsibility of the Contractor.

G. Acknowledge and/or respond to review comments within seven days of return; promptly incorporate required changes due to inaccurate data or incomplete definition so that delivery and installation schedules are not affected. Revision response time is not justification for equipment delivery or installation delay.

H. Closeout Submittals: Operation and Maintenance Manuals
1. Provide three sets of neatly bound written information necessary for proper maintenance and adjustment of equipment within 30 days following final acceptance. Final retention will be withheld until data is received and reviewed by the Resident Engineer. Include the following as minimums:

a. Printed Instructions: Three sets of neatly bound instructions explaining all operating features.

b. Wiring Diagrams: Three sets of as-installed straight-line wiring diagrams showing the electrical connections of all equipment and all modifications to control circuits. One set of straight-line wiring diagrams shall be reproducible original. Furnish a legend sheet with each set of drawings to provide the following information:

1) Name and symbol of each relay, switch, or other apparatus.

2) Location on drawings, drawing sheet number and area, and location of all contacts.

3) Location of apparatus, whether on controller or on car.

4) Lubricating instructions, including recommended grade of lubricants.

c. Complete software documentation for all installed equipment.

1) Equipment Manufacturer is responsible for upgrades and/or revisions of software during the progress of the Work, warranty period and the term of the ongoing maintenance agreement between Sound Transit and the Contractor.

d. Lubricating instructions, including recommended grade of lubricants.

e. Parts Catalog: Three sets of complete parts catalogs listing all replaceable parts including Manufacturer's identifying numbers and ordering instructions.

f. Diagnostic equipment: Provide all diagnostic test devices complete with instructions, access codes, adjusters’ manuals and set-up manuals for adjustment, diagnosis and troubleshooting of elevator system, and performance of routine safety tests.

1) The elevator installation is a design that can be maintainable by any licensed elevator maintenance company employing journeyman mechanics, without the need to purchase or lease additional diagnostic devices, special tools, or instructions from the original equipment manufacturer.

a) Provide on site capability to diagnose faults to the level of individual circuit boards and individual discreet components for the solid state elevator controller.

b) If the equipment for fault diagnosis is not completely self-contained within the controllers but requires a separate, detachable device, that device is furnished to Sound Transit as part of this installation. Such device is in possession of and become property of Sound Transit.
c) Installed equipment not meeting this requirement are removed and replaced with conforming equipment at no cost to Sound Transit.

d) Provide orientation and training to familiarize Sound Transit operations personnel with the features and operation of the elevator.

e) Provide four sets of neatly tagged keys for all switches and control features properly tagged and marked.

1.06 QUALITY ASSURANCE

A. Comply with most stringent applicable provisions of the Code or Authority specified in Article 1.02, herein, including revisions and changes in effect on date of these Contract Specifications.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver material in Manufacturer’s original, unopened protective packaging.

B. Store material in original protective packaging. Prevent soiling, physical damage, or moisture damage.

C. Protect equipment and exposed finishes from damage and stains during transportation, erection, and construction.

1.08 WARRANTY:

A. Material and workmanship of the installation complies in every respect with Contract Documents. Correct defective material or workmanship that develops within one year from date of final acceptance of work to satisfaction of Resident Engineer at no additional cost, unless due to ordinary wear and tear, or improper use or care by Sound Transit. Perform maintenance in accordance with terms and conditions indicated in the Warranty Preventive Maintenance.

B. Defective is defined to include, but not to be limited to; operation or control system failures, performance below required minimum, excessive wear, unusual deterioration or aging of materials or finishes, unsafe conditions, the need for excessive maintenance, abnormal noise or vibration, and similar unsatisfactory conditions.

C. Make modifications, adjustments, and improvements to meet performance requirements in Parts 2 and 3.

1.09 SYSTEM STARTUP

A. Obtain and pay for permit, license, and inspection fee necessary to complete installation.

B. Perform tests required by The Elevator Section of the City of Seattle Department of Planning and Development as well as tests required by Washington State Labor and Industries. Perform tests in accordance with procedures described in ASME A17.2.1 Inspectors’ Manual for Electric Elevators in the presence of the Resident Engineer.

C. Supply personnel and equipment for demonstration test and final review by Sound Transit, as required in Part 3, Execution, Article 3.06, herein.
1.10 MAINTENANCE

A. Interim Maintenance:

1. When one or more elevators are near completion and ready for service, Sound Transit may accept elevators for interim use and place in service before entire installation of all elevators has been completed and accepted.

2. Temporary acceptance form must be acceptable to Sound Transit and signed prior to use.

3. Provide or pay for temporary hoistway and car enclosures; protect installed equipment and finishes; and pay for all cleaning, repairs, and replacement of materials necessary to restore elevator to as-new condition prior to final Acceptance by the Resident Engineer.

B. Warranty Maintenance:

1. Provide preventive maintenance and 24-hour emergency callback service for one year commencing on date of final Acceptance by Sound Transit. Systematically examine, adjust, clean, and lubricate equipment. Repair or replace defective parts using parts produced by the manufacturer of installed equipment. Maintain elevator machine room, hoistway, and pit in clean condition. Use competent personnel, acceptable to the Resident Engineer, supervised and employed by the Contractor.

2. Contractor shall arrive at property within sixty minutes from time of notification of equipment problem or failure, and shall arrive at property in response to passenger entrapment calls within thirty minutes from time of notification by Sound Transit.

3. Removal of units from beneficial usage for maintenance purposes shall be coordinated with and approved by Sound Transit, unless removal is necessitated for emergency repair or adjustment. Normal preventive maintenance service shall be performed during off-peak operating hours.

4. At least semi-annually or more often if requested, provide summary and review of all callbacks and unit downtime with Sound Transit. The intent of this review is to minimize callbacks by developing consistent communication between the Contractor and Sound Transit relative to callback trends, unit downtime, and their causes.

5. All units shall be available for use an average of 98.7% of property hours of operation over each three-month period during warranty maintenance service. This includes allowance for equipment out of service time as the result of callbacks, scheduled preventive maintenance, and repairs. Contractor’s failure to meet this unit availability provision for two consecutive three-month periods for any single elevator or escalator, or group of units, shall trigger an automatic maintenance audit by Sound Transit. Contractor agrees to expeditiously take corrective action in regard to identified deficiencies. Further, Contractor acknowledges Sound Transit’s right to pass cost of said audit to Contractor.

6. Extend the warranty maintenance period specified in above Article 1.10 B.1, herein, 1 month for each 3-month period in which equipment related failures average more than 0.25 per unit per month.

7. Sound Transit retains the option to delete cost of warranty maintenance from new equipment contract and remit twelve equal installments directly to Contractor during period in which maintenance is being accomplished.
C. Preventive Maintenance Contract:

1. Quote monthly cost for 5-year Preventive Maintenance Agreement commencing on completion of the 1-year period in Article 1.10B.1, herein. Base quotation on present labor and material cost. Price adjustment will be made at Contract commencement date and thereafter as provided in Contract.

1.11 PERMIT, TEST AND INSPECTION

A. Obtain and pay for permit, license, and inspection fee necessary to complete the installation. Installation will be considered complete when the governing authority of Washington State Department of Labor and Industries has issued a permanent operating permit for each elevator.

B. Perform test required by Governing Authority in accordance with procedure described in ASME A17.2, Inspectors’ Manual for Elevators and Escalators, in the presence of Authorized Representative.

C. Supply personnel and equipment for test and final review required by Resident Engineer as indicated in Part 3, Execution, Article 3.06, herein.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Qualified Manufacturers: Alternate Manufacturers must receive approval of Sound Transit at least 10 days prior to bid date.

B. Approved Manufacturers:

1. Fujitec, KONE, Schindler, Thyssen.

2. Geared and Gearless Machines: Manufacturers standard

3. Control Manufacturers: Manufacturers standard controls, MCE, O. Thompson, and Swift/CEC.


2.02 MATERIALS

A. Steel:


B. Stainless Steel: Type 304 or 316 complying with ASTM A167, with standard tempers and hardness required for fabrication, strength and durability. Apply mechanical finish on fabricated work in the locations shown or specified (Federal Standard and NAAMM nomenclature) with texture and reflectivity required to match Resident Engineer’s sample. Protect with adhesive-paper covering.

1. No. 4: Directional polish (satin finish). Graining directions as shown or, if not shown, in longest dimension.

2. Non-directional orbital uniform finish: 80 grit orbital sanding over standard mill plate or shapes to produce a uniform non-directional satin finish with 90 percent of mill marks removed to match Resident Engineers visual sample.

C. Aluminum: Extrusions conforming to ASTM B221; Sheet and plate conforming to ASTM B209.

D. Paint: Clean exposed metal of oil, grease, scale, and other foreign matter and factory paint one shop coat of Manufacturer’s standard rust-resistant primer. After erection, provide one finish coat of industrial enamel paint. Galvanized metal need not be painted. See Section 09 96 00, High Performance Coatings.

E. Prime Finish: Clean all surfaces receiving a baked enamel paint finish of oil, grease, and scale. Apply one coat of rust-resistant mineral paint followed by a filler coat over uneven surfaces. Sand smooth and apply final coat of mineral paint.

F. Baked Enamel Finish: Prime finish in accordance with Article 2.02 E above. Apply and bake two additional coats of enamel in the selected solid color.

1. Glass: Laminated safety glass, minimum 9/16 inch thick, conforming to ANSI Z97.1 and CPSC 16 CFR Part 1201 and Contract Specifications Section 08 80 00, Glazing, Article 2.01, therein

2.03 EQUIPMENT

A. Passenger Elevator Features

1. Number: Elevators 1 and 2, Elevator 3, Elevator 4 as specified and as indicated on the Contract Drawings.

2. Capacity: Elevators 1 and 2: 4,500 pounds, Class A loading; Elevator 3: 4,000 pounds, Class A loading; Elevator 4: 4,500 pounds, Class A loading.

3. Speed: Elevators 1-3: 350 feet per minute (fpm); Elevator 4: 200 feet per minute (fpm).

4. Roping: Manufacturer’s standard roping configuration for an offset machine application for Elevators 1 and 2, and for a machine-room-less traction application for Elevators 3 and 4.

5. Supervisory Control: Elevators 1 and 2: Duplex Selective collective, microprocessor based system; Elevators 3 and 4: Simplex Selective collective microprocessor based system.


8. Stops and Openings: As indicated on the Contract Drawings.
10. Travel: As indicated on the Contract Drawings.
11. Platform Size: Elevators 1 and 2: 8 feet 0 inches wide by 6 feet 8 inches deep front entry; Elevator 3: 8 feet 0 inches wide by 6 feet 9 inches deep front and rear entry; Elevator 4: 6 feet 0 inches wide by 9 feet 4 3/4 inches deep front and rear entry.
12. Minimum Clear Inside Car: Elevators 1 and 2: 7 feet 8 inches wide by 5 feet 11 inch deep; Elevator 3: 7 feet 8 inches wide by 5 feet 7 inches deep; Elevator 4: 5 feet 8 inches wide by 7 feet 11 inches deep
13. Entrance Size: Elevators 1 and 2: 5 feet 0 inches wide by 7 feet high; Elevator 3: 4 feet 0 inches wide by 7 feet high; Elevator 4: 4 feet 0 inches wide by 7 feet high.
15. Door Operation: High speed, heavy duty, door operator, minimum opening speed 2.5 feet per second (fps).
16. Door Protection: Infrared, full screen device, with differential timing and nudging and interrupted beam time.
18. Machine Location: Elevators 1 and 2: Offset at Subgrade Roof level as indicated; Elevators 3 and 4: Located inside shaft in manufacturer’s standard location.
19. Safety: Flexible guide clamp - Type B, car only
20. Guide Rails: Planed steel tees
21. Buffers: Oil
24. Hall pushbutton stations: Elevators 1 and 2: Two hall pushbutton stations at floors Pedestrian Bridge, Grade and Platform. Single hall pushbutton stations at levels Mezzanine and Basement Level 3. Elevators 3 and 4: Single hall pushbutton stations at all floors served for each elevator.
27. Communication System: Emcom Systems IP6000 Full Duplex VoIP hands free telephone with remote keypad and digital display.
28. CCTV System: Pelco C10CH-6 Series Camera, 1/3-inch, High-Resolution, 540 TVL (NTSC/PAL), Compact, 24VDC with transformer.
29. CCTV Housing: Pelco HS1500 enclosure for corner mount or Pelco DF5HD for center ceiling mount.


31. Radio Antenna: To be supplied by U830 contractor.

32. Car top inspection station.

33. Firefighters' service, including alternate floor return feature.

34. Standby power transfer (automatic to main floor) with manual override in fire control panel.

35. Accessibility and emergency medical services access and signage.

36. Hinged car return panels arranged for integral car operating panels.

37. Hoistway access switches.

38. Hoistway door unlocking device all floors with keyed escutcheon plugs.

39. Independent service feature.

40. Platform isolation.

41. Load weighing device.

42. Anti nuisance feature.

43. Firefighters' control panel and remote wiring located in Fire Command Center Room.

44. Tamper resistant fasteners for signal fixture faceplates.

45. Sill support angles. For Elevators 1 and 2. Refer to entrance sill details.

46. One year warranty maintenance with 24-hour call back service

47. PA speaker

48. PA amplifier

49. Machine, power conversion unit, and controller sound isolation

50. Seismic devices in accordance with ASME A17.1, Section 2400

51. Pad hooks and vinyl-covered pads

52. Individual floor lock-off switch for Upper Mezzanine and Lower Mezzanine levels in Elevator 2

53. CCTV provisions, all cars

54. Selective door operation

55. Battery pack emergency car lighting. Provide separate constant pressure test button in car service compartment. Illuminate portion of normal car lighting

56. Signage engraving filled with black paint or approved etching process
57. No visible company name or logo
58. Wiring diagrams, operating instructions, and parts ordering information
59. System diagnostic means and instructions
60. Remote electronic brake release to eliminate the need for an access panel for access to machine brakes from outside of hoistway shaft for Elevators 3 and 4.

B. Car, General

1. Car Speed: Plus or minus three percent of Contract speed under all loading conditions.

2. Car Capacity: Safely lower, stop and hold 125 percent of rated load.

3. Car Stopping Zone: Plus or minus 1/4 inch under all loading conditions.

4. Door Opening Time: Elevators 1 and 2: 2.1 seconds from start of opening to fully open. Elevator 3: 1.8 seconds from start of opening to fully open. Elevator 4: 2.6 seconds from start of opening to fully open.

5. Door Closing Time: Elevators 1 and 2: 3.0 seconds from start of closing to fully closed. Elevator 3: 2.8 seconds from start of closing to fully closed. Elevator 4: 4.4 seconds from start of closing to fully closed.

6. Car Floor-to-Floor Performance Time: Elevators 1 and 2: 12.3 seconds from start of doors closing until doors are 3/4 open (1/2 open for side opening doors) and car level and stopped at next successive floor under all loading conditions or travel direction (21 feet-0 inches typical floor height). Elevator 3: 13.1 seconds based on a 28 feet 10 inches typical floor height. Elevator 4: 13.8 seconds based on a 15 feet typical floor height.

7. Car Ride Quality
   a. Horizontal acceleration within car during all riding and door operating conditions. Not more than 20 mg peak to peak in the 1-10 Hertz range.
   b. Acceleration and Deceleration: Smooth constant and not more than 5 feet per second per second with an initial ramp between 0.5 and 0.75 second.
   c. Sustained Jerk: Not more than 8 feet per second per second squared.

8. Airborne Noise: Measured noise level of elevator equipment during operation does not exceed 50 decibels (dBA) in elevator lobbies and 60 dBA inside car under all conditions including door operation and car ventilation exhaust blower on its highest speed.

C. Car Equipment

1. Frame: Welded or bolted, rolled or formed steel channel construction to meet load classification requirements.

2. Safety Device: Type B, flexible guide clamp.
3. Platform: Isolated type, constructed of steel, or steel and wood, which is fireproofed on the underside. Design and construct to accommodate load classification requirements. Minimum Class A construction for all passenger elevators.

4. Guide Shoes: Roller type with three or more spring-dampened, sound-deadening rollers per shoe. Minimum roller diameter 7 inches.

5. Finish Floor Covering: Nominal 1/8-inch rubber floor tile with matching 4-inch cove base and cold welded seams. Norament 925 Lago or approved equal. Color as selected by Resident Engineer from manufacturer’s standard.

6. Sills: One piece nickel silver extrusion with extruded extension between car entrance columns to face of car front return. Extruded extension to match finish of sill.

7. Toe Guard: Minimum 14-gauge stainless steel reinforced and braced to car platform, with flat black finish.

8. Doors: Provide as specified for hoistway entrance doors.

9. Door Hangers: Two-point hanger roller with neoprene roller surface and suspension with eccentric upthrust roller adjustment.

10. Door Track: Bar or formed, cold-drawn removable steel track with smooth roller contact surface.

11. Door Header: Construct of minimum 12-gauge steel, shape to provide stiffening flanges.

12. Door Electrical Contact: Prohibit car operation unless car door is closed within tolerance allowed by Code.

13. Door Clutch: Heavy-duty clutch, linkage arms, drive blocks, and pickup rollers or cams to provide positive, smooth, quiet door operation. Design clutch so car doors can be closed while hoistway doors remain open.

14. Restricted Opening Device: Restrict opening of car doors outside the unlocking zone.

15. Door Operator: High speed, heavy-duty master door operator capable of opening doors at no less than 2.5 fps. Accomplish reversal in no more than two and 1/2 inches of door movement. Open doors automatically when car arrives at a floor. Provide solid state door control with closed loop circuitry to constantly monitor and automatically adjust door operation based upon velocity, position, and motor current. Maintain consistent, quiet, and smooth door operation at all floors regardless of door weight or varying air pressure.

16. Door Control Device:
   a. Infrared Reopening Device: Black, fully enclosed device. Full screen infrared matrix or multiple beams extending vertically along edge of each leading door panel to minimum height of 7 feet above finished floor. The device prevents doors from closing and reverse doors at normal opening speed if beams are obstructed while doors are closing, except during nudging operation. If device fails, provide for automatic shutdown of car at floor level with doors open.
b. **Nudging Operation:** After beams of door control device are obstructed for a predetermined time interval (minimum 20.0 to 25.0 seconds), warning signals sound and doors then attempt to close with a maximum of 2.5 foot-pounds kinetic energy. Activation of the door open button overrides the nudging operation and re-open the doors.

c. **Interrupted Beam Time:** When beams are interrupted during initial door opening, hold door open a minimum of 3.0 seconds. When beams are interrupted after the initial 3.0-second hold open time, reduce time doors remain open to an adjustable time of approximately 1.0 to 1.5 seconds after beams are reestablished.

d. **Differential Door Time:** Provide separately adjustable timers to vary time that doors remain open after stopping in response to calls.

1) **Car Call:** Hold open time adjustable between 3.0 and 5.0 seconds.

2) **Hall Call:** Hold open time adjustable between 5.0 and 8.0 seconds. Use extended hall call time when car responds to coincidental calls.

17. **Car Operating Panel:**

a. One car operating panel at each entrance without faceplates, consisting of a metal box containing vandal resistant operating fixtures mounted behind the car enclosure swing return panels.

b. Suitably identify vandal resistant assemblies including floor buttons, alarm button, door open button, door close button, and emergency stop switch with SCS, Visionmark or Entrada Cast tactile symbols rear mounted. Provide plates in accordance with Local Accessibility Standards including Braille. Locate operating controls no higher than 48 inches above the car floor; no lower than 35 inches for stop device and alarm button.

c. Provide minimum 3/4-inch diameter raised 1/8 inch with square shoulders or flush floor pushbuttons, which illuminate to indicate call registration. Include 5/8-inch high designation of the floors served on face of pushbutton. Provide key switches to activate floor pushbuttons at intermediate levels. Platform, surface and pedestrian bridge levels to have pushbutton only.

d. Provide alarm button at bottom of car operating panel to ring bell located on car, and sound distress signal at control panel. Illuminate button when activated. Provide battery backup for alarm button function.

e. Provide keyed stop switch with markings to show run and stop located in locked car service compartment.

f. Provide door open button to stop and reopen closing doors or hold doors in open position. Button operable only while car is stopped at floor regardless of special operational features, except firefighters’ service.

g. Provide door close button to activate door close cycle. Cycle does not begin until normal door dwell time for a car call has expired except firefighters’ service.
h. Provide firefighters' Phase II key switch with engraved instructions in accordance with Code requirement. Include light jewel, buzzer, and call cancel button.

i. Provide firefighter's telephone jack with bezel matching adjacent controls.

j. Provide seismic indicator jewel.

k. Provide lockable service compartment with recessed flush door. Door material and finish shall match car return panel or car operating panel faceplate. The door contains an integral flush window for displaying the elevator-operating certificate. Inside surface of the door accommodates mounting provisions for certificate.

1) Include the following controls in lockable service cabinet with function and operating positions identified by engraved letters painted black. Service cabinet to be adjacent to hands-free telephone device.

2) Inspection switch.

3) Light switch.

4) 3-speed exhaust blower switch.

5) Independent service switch.

6) Constant pressure test button for battery pack emergency lighting.

7) 120-volt, AC, GFCI protected electrical convenience outlet.

8) Card reader override switch.

9) Stop switch.

   a) Emcom keypad and digital display. Keypad to be wired to hands-free telephone.

l. Provide black paint filled, engraved or approved etched signage with size and style approved by the Resident Engineer as follows:

1) Phase II firefighters' operating instructions on main operating panel above corresponding key switch, with text in accordance with ASME A17.1 211.7(b).

2) Car number over main car operating panel.

3) NO SMOKING over main car operating panel.

4) Car capacity in pounds on service compartment door.

m. Access Card Reader:

1) Install access card reader and connect device to Communications Distribution Cabinet in machine room using four pairs of No. 18 twisted shielded pairs.

n. Communication System:
1) Install Emcom Systems IP6000 VoIP hands-free telephone using fiber optic cable from device to Communications Distribution Cabinet in machine room. Hook up power to device. Install Emcom keypad and digital display in cab operating panel service cabinet and wire to telephone.

o. PA Speakers:
1) Install PA speakers in car canopy with one pair No.16 AWG shielded wiring to PA amplifier in elevator machine room. The PA amplifier receives audio input from the communication distribution cabinet. Messages from the communications system shall take priority over those messages generated by the elevator system. Messages from the elevator system are delayed to accommodate the communications messages, but not cancelled.

18. Car Top Control Station: In accordance with Code. Mount to provide utilization while standing in an upright position.


20. CCTV System:
a. Install CCTV camera, protective housing and transformer and provide power from cab operating panel. Connect camera using fiber optic cable from device to Communications Distribution Cabinet in machine room.

D. Car Enclosure
1. Passenger Elevator: Provide complete car enclosure as specified herein and detailed on the Contract Drawings. Provide the following features.
   b. Canopy: Reinforced 14-gauge furniture steel with lockable, hinged emergency exit. Interior finish white reflective baked enamel.
   c. Front and Rear Return Panels and Integral Entrance Columns: Reinforced 14-gauge non-directional finish stainless steel. Swing entire unit on substantial pivot points (minimum three) for service access to car operating panel(s). Locate pivot points to provide full swing of front return panel without interference with sidewall finish or handrail. Secure in closed position with concealed three-point latching. Provide service compartment with recessed flush cover and cutouts for operating switches.
   d. Transom: Reinforced 14-gauge non-directional finish stainless steel full width of enclosure.
   f. Base: Stainless steel with concealed ventilation cutouts in accordance with the Contract Drawings.
g. Interior Wall Finish: Non-directional finish stainless steel on aluminum honeycomb panels and glass wall panels as detailed in Contract Drawings.

h. Ventilation: Two-speed exhaust blower mounted to car canopy on isolated rubber grommets. Morrison Products, Model AA with diffuser and grille, or approved equal.

i. Lighting: Provide battery standby power for operation. Provide fluorescent fixtures with wiring and hookup. Coordinate with emergency lighting requirements. Provide emergency lighting integral with portion of normal car lighting system. Include required transformer.

j. Suspended Ceiling: Special design as shown in the Contract Drawings.

1) Handrails: 1 ½” diameter satin finish stainless steel tubes.

E. Machine Room Equipment

1. Arrange equipment in spaces shown on Contract Drawings.

2. Elevators 1 and 2: Geared Traction Hoist Machine; Elevators 3 and 4: Gearless Traction Hoist Machine:

   a. Single worm geared or helical geared traction type with AC induction or P.M.S.M. ACV3F motor, brake, gear, drive shaft, deflector sheave, and gear case mounted in proper alignment on an isolated bedplate. Provide bedplate blocking to elevate secondary or deflector sheave above machine room floor.

3. Gearless traction type motor with brake, drive sheave, and deflector sheave mounted in proper alignment on a common, isolated bedplate.

   a. Provide hoist machine mounted direct drive, digital, closed-loop velocity encoder.

   b. Provide machine bedplate mounted deflector sheave A-frame or supporting steel beams and fastenings to mount deflector sheaves to building structure. Provide minimum 16 gauge easily removable sound insulated sheet metal closures in hoistway wall opening around machine.

4. Solid State Power Conversion and Regulation Unit:

   a. Design unit to limit current, suppress noise, and prevent transient voltage feedback into building power supply. Provide internal heat sink cooling fans for the power drive portion of the converter panels. Conform to recommended practice for Emergency and Standby Power Systems for Industrial and Commercial Applications for line harmonics and switching noise.

   b. Isolate unit to minimize noise and vibration transmission. Provide isolation transformers, filter networks, and choke inductors.

   c. Suppress solid-state converter noises, radio frequency interference, and eliminate regenerative voltage transients induced into the mainline feeders or the building standby power generator.
d. Supplement direct-current power for the operation of hoist machine brake, door operator, dispatch processor, and signal fixtures from separate static power supply.

5. Encoder: Direct drive, solid-state, optical, digital type. Update car position at each floor and automatically restore after power loss.

   b. Relay Design: Magnet operated with contacts of design and material to ensure maximum conductivity, long life and reliable operation without overheating or excessive wear. Provide wiping action and means to prevent sticking due to fusion. Contacts carrying high inductive currents are provided with arc deflectors or suppressors.
   c. Shunt Trip: Coordinate controller function and power wiring with Shunt Trip devices where shown on drawings.

d. Microprocessor-Related Hardware:
   1) Provide built-in noise suppression devices, which provide a high level of noise immunity on all solid-state hardware and devices.
   2) Provide power supplies with noise suppression devices.
   3) Isolate inputs from external devices (such as pushbuttons) with isolation modules.
   4) Design control circuits so that one side of power supply is grounded.
   5) Safety circuits shall not be affected by accidental grounding of any part of the system.
   6) System automatically restarts when power is restored.
   7) System memory shall be retained in the event of power failure or disturbance.
   8) Equipment operates properly with a 500 Kiloherz to 1300 Megahertz radio frequency signal, transmitted at a power level of not less than 100 watts Effective Radiated Power (ERP) at a distance of 3 feet.
   9) Provide equipment with Electro Magnetic Interference (EMI) shielding within FCC guidelines.

e. Wiring: CSA labeled copper for factory wiring. Neatly route all wiring interconnections and securely attach wiring connections to studs or terminals.
f. Permanently mark components (relays, fuses, and PC boards) with symbols shown on wiring diagrams.

g. Provide controller or machine mounted auxiliary, lockable off, disconnect if mainline disconnect not in sight of controller and machine.

7. Sleeves and Guards: 4-inch steel angle guards around cable or duct slots through floor slabs or grating. Provide rope and smoke guards for sheaves, cables, and cable slots in machine room and secondary levels. Provide wire mesh infill barriers between hoistway and machine room.


   a. Provide bearing plates, anchors, shelf angles, blocking, and embedments for support and fastening of machine beams or equipment to the building structure.

   b. Isolate machine and overhead sheave beams to eliminate noise and vibration transmission to building structure.

   c. Provide ladders and platforms with handrails and toeboards for overhead sheave access as required.

9. Governor: Centrifugal-type, car and counterweight driven, with pull-through jaws and bi-directional electrical shutdown switches. Provide required auxiliary supports for attachment to building structure.

10. Vibration Isolation: All elevator equipment provided under this Contract, including power conversion unit, controller and their support, are mechanically isolated from the building structure and from electrically induced vibration to minimize the possibility of objectionable noise and vibrations being transmitted to the car, building structure, or occupied areas of building.

11. Sound Isolation:

   a. Noise level relating to elevator equipment and its operation does not exceed 80 dBA in the machine room.

   b. Take all dBA readings 3 feet off the floor and 3 feet from the equipment.

12. Remote Monitoring Terminal Cabinet: Provide an interface for remote monitoring and control of each car by the Central Control System. Provide a single cabinet with terminal blocks with interfacing to all elevator controllers in the machine room.

   a. Cabinet is NEMA 12.

   b. Terminal blocks accept No.14 AWG.

   c. Receive the following dry contact inputs to effect the following control actions for each car.

      1) Phase 1 Recall - Home.

      2) Phase 1 Recall – Alternate floor (one contact per floor).

      3) Access control permissive.
d. Provide normally open dry contacts for each of the following status items for each car:

1) Elevator door closed.
2) Elevator warning alarm.
3) Passenger alarm pushbutton.
4) Elevator at floor (one contact per floor)
5) Normal/Fire Operations.

F. Hoistway Equipment

1. Guide Rails: Minimum 15 pounds per foot or heavier, planed steel T-sections of suitable size and weight for the application, structural support spacing, car weight, counterweight, and seismic reactions, with brackets for attachment to building structure. Provide car rail backing and intermediate counterweight tie brackets to meet Code requirements.

2. Buffers, Car, and Counterweight: Oil type with blocking and support channels. Provide switch on buffer to limit car speed if buffer is compressed. Provide buffer access ladder and platform.

3. Sheaves: Machined grooves with sealed bearings. Provide mounting means to machine beams, machine bedplate, and car and counterweight structural members.

4. Counterweight: Steel frame with metal filler weights, guided by 5-inch roller guide shoes.

5. Counterweight Guard: Metal guard in pit.

6. Governor Rope and Encoder Pit-Tensioning Sheave: Mount sheave and frame on pit floor support frame or guide rail. Provide with guides or pivot point to enable free vertical movement and proper tension of cable/tape.

7. Hoist and Governor Ropes:
   a. 8 by 19 or 8 by 25 Seale construction, traction steel type. Fasten with staggered length, adjustable, spring isolated shackles.
   b. Governor rope to suit manufacturer's specification.

8. Terminal Stopping: Provide normal, final and emergency terminal speed limiting devices. Provide ability to bypass final limit while in inspection mode on car top to properly access and maintain the overhead sheaves, beams and governors. There will be no secondary platform or access panels provided for service to the overhead area.

9. Electrical Wiring and Wiring Connections:
   a. Conductors and Connections: Copper throughout with individual wires coded and connections on identified studs or terminal blocks. Use no splices or similar connections in wiring except at terminal blocks, control compartments, junction boxes, or condulets. Provide 10 percent spare conductors throughout. Run spare wires from car connection points to individual elevator controllers in the machine room. Provide four pairs of
spare shielded communication wires in addition to those required to connect specified items. Tag spares in machine room.

b. Conduit: Painted or galvanized steel conduit and duct. Conduit size, 1/2 inch minimum. Flexible conduit not to exceed 36 inches in length. Flexible heavy-duty service cord may be used between fixed car wiring and car door switches for door protective devices.

c. Traveling Cables: Type ET flame and moisture-resistant outer cover. Prevent traveling cable from rubbing or chafing against hoistway or equipment within hoistway.

d. Communications System Wiring: Include Communications Systems wiring within traveling cable from car to controller to Communications Distribution Cabinet. Connect from each car controller in machine room, route to and terminate to separate Communication Distribution Cabinet within machine room. Wiring to be as follows:

1) CCTV cables: two RG-6 coaxial cables and two-pair single mode fiber optic cables.
2) Access Card Reader: Four - No. 18 twisted shielded pairs.
3) Emergency Telephone and Passenger Emergency Telephone: 1 pair single mode fiber optic cables.
4) Radio Antenna: one super flex 75-ohm coaxial cable.

e. Auxiliary Wiring: Connect in each car controller in machine room, route to and terminate to devices

1) Smoke sensors: one pair 16 AWG.
2) Paging speaker: one pair 16 AWG.

10. Entrance Equipment:

a. Door Hangers: Two-point hanger roller with neoprene roller surface and suspension with eccentric upthrust roller adjustment.

b. Door Tracks: Bar or formed, cold-drawn removable steel tracks with smooth roller contact surface.

c. Door Interlocks: Operable without retiring cam. Paint interlocks flat black.

d. Door Closers: Spring, spirator, or jamb/strut mounted counterweight type. Design and adjust to ensure the smooth quiet mechanical close of doors.

e. Floor Numbers: Stencil paint 4-inch high floor designations in contrasting color on inside face of hoistway doors at each landing and adjacent to the leading edge of the door.

G. Equipment furnished by Sound Transit, installed under this Section:

1. Radio antennas.
2. Product of combustion sensors.

H. Seismic Operations and Equipment
1. Provide design, components and operation in accordance with governing code. Provide dual counterweight derailment sensing wires vertically each side of counterweight the entire height of travel. The counterweight frame is equipped with four derailment rings. A dual axis seismic switch is provided that will activate at no less than 0.15 times gravity in the vertical or horizontal directions. A minimum of one seismic switch is provided per single or group of elevators. Counterweight retainer plates are bolted; welded plates are not acceptable.

2.04 COMPONENTS

A. Hoistway Entrances

1. Complete entrances bearing UL fire labels.

2. Frames: Satin finish stainless steel at all floors. Standard bolted head to jamb connection assemblies fabricated from not less than 14-gauge material. Permanently attach rear mounted Arabic floor designation plates, centerline at 60 inches above finished floor, on both sides of jambs existing. Provide main egress landing plates with Star designation. Braille indications shall be below Arabic floor designation.

3. Door Panels: 16-gauge non-directional finish stainless steel, sandwich construction without binder angles. Glass-paneled doors at levels detailed in Contract Drawings. Provide leading edges of center-opening doors with rubber astragals. Provide a minimum of two gibs per panel; one at leading and one at trailing edge with gibs in the sill groove entire length of travel. Provide 9/16-inch thick laminated tempered glass approximately 1 foot by 5 feet in each panel.

4. Sight Guards: 14-gauge, same material and finish as hoistway entrance door panels. Construct without sharp edges.


6. Sill Supports: Structural or formed steel designed to support door sill based upon car loading classification. Grout under the sill. Five-inch by 5-inch by 1/2-inch cold-rolled structural steel angle, extend full width of hoistway. Fasten to building structure at maximum 18 inches on center. For elevators 1 and 2, see non-standard details for sill supports at suspended floor slabs.


8. Struts and Headers: Provide for vertical support of entrances and related material.

9. Provide door open bumpers on entrances equipped with vertical struts.

B. Hall Control Stations

1. Pushbuttons: Provide one riser with flush-mounted faceplates. Two risers for Elevators 1 and 2 at levels Pedestrian Bridge, Grade and Platform. Include pushbuttons for each direction of travel, which illuminate to indicate call registration. Include approved engraved message and pictorial representation prohibiting use of elevator during fire or other emergency situation as part of faceplate. Pushbutton design matches car operating panel pushbuttons. Provide vandal resistant pushbutton and light assemblies.
2. Hoistway Door Unlocking Device: Provide unlocking device with locking escutcheon plug in door panel at all floors with finish to match adjacent surface.


4. Faceplate Material and Finish:
   a. Hall Pushbutton Station: Satin finish stainless steel.

C. Signals

1. Hall Lantern: Provide at each entrance to indicate travel direction of arriving car. Locate as detailed on Contract Drawings. Illuminate up or down lights and sound tone twice for down direction travel prior to car arrival at floor. Sound level to be adjustable from 20 to 80 dBA measured at 5 feet in front of hall pushbutton and 3 feet off floor. Illuminate light until the car doors start to close. Provide advanced hall lantern notification to comply with ADA hall call notification time. Minimum 2 and 1/2 inches in the smallest dimension, arrow lenses with faceplates. Provide vandal resistant lantern and light assemblies consisting of series of dots or lines for maximum visibility.

2. Car Position Indicator: Alpha-numeric digital indicator containing floor designations and direction arrows a minimum of 1/2 inch high to indicate floor served and direction of car travel. Locate fixture in each car operating panel. When a car leaves or passes a floor, illuminate indication representing position of car in hoistway. Illuminate proper direction arrow to indicate direction of travel. Provide vandal resistant indicator and light assemblies.

3. Lobby Position Indicator: Alpha-numeric digital indicator containing floor designations and direction arrows a minimum of 1/2 inch high to indicate floor served and direction of car travel. Locate fixture integral with hall lanterns at Plaza level. When a car leaves or passes a floor, illuminate indication representing position of car in hoistway. Illuminate proper direction arrow to indicate direction of travel. Provide vandal resistant indicator and light assemblies.

4. Faceplate Material and Finish:

5. Floor Passing Tone: Provide an audible tone of no less than 20 dbA and frequency of no higher than 1500 Hertz, to sound as the car passes or stops at a floor served.

6. Voice Synthesizer: Provide electronic device with easily re-programmable message and voice to announce car direction, floor, and emergency exiting instructions.

7. Card reader override: Provide conduit and wiring to control panel. Fixtures are located as directed by the Resident Engineer. Coordinate size and location.

8. Fire Fighters' Control Panel: Locate in building Fire Command Center Room. Furnish and install panel as specified and all applicable wiring from each elevator.
shaft to the fire panel. Fixture faceplate, No. 4 brushed finish stainless steel, including the following features:

a. Car position and direction indicator (digital-readout or color SVGA display type). Identify position indicator with car number.

b. Indicator showing operating status of car.

c. Wiring to panel. Conduit from closest elevator hoistway of each group by others.

d. Manual car standby power selection switch and power status indicator.

e. Firefighter’s telephone jack.

f. Two position fire fighter’s emergency return switches and indicators with engraved instructions filled with red epoxy enamel paint.

9. Firefighters’ Key Box: Flush-mounted box with lockable hinged cover. Engrave instructions for use on cover in accordance with Local Fire Authority requirements.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Before installing equipment, examine hoistway and machine room areas. Verify that no irregularities exist that affect execution of work specified.

B. Do not proceed with installation until work in place conforms to Contract requirements.

3.02 INSTALLATION

A. Install all equipment in accordance with Manufacturer’s instructions, referenced Codes, these Contract Specifications and approved submittals.

B. Install machine room equipment with clearances in accordance with referenced Codes and these Contract Specifications.

C. Install all equipment so it may be easily removed for maintenance and repair.

D. Install all equipment for ease of maintenance.

E. Install all equipment to afford maximum accessibility, safety, and continuity of operation.

F. Replace or refurbish all material to meet performance requirements outlined in this specification prior to station operation. There will be an extended period of time from the point that the elevators are installed to the final acceptance and station normal operation.

G. Remove oil, grease, scale, and other foreign matter from the following equipment and apply one coat of field-applied machinery enamel.

1. All exposed equipment and metal work installed as part of this work that does not have architectural finish.

3. Neatly touch up damaged factory-painted surfaces with original paint and color. Protect machine-finish surfaces against corrosion.

H. Operation

1. Group Automatic:

   a. Approved microprocessor-based, group dispatch, car and motion control systems as follows including, as a minimum, the features described hereafter:

      1) Fujitec Millennium II
      2) KONE KCM831
      3) MCE IMC
      4) Schindler Miconic VX
      5) Swift Futura
      6) Thompson Microflite Ultra
      7) Thyssen TAC 50

   b. Operate cars as a group, capable of balancing service and providing continuity of group operation with one or more cars removed from the system.

   c. Register service calls on cars from pushbuttons located at each floor and in each car. Slow down, and automatically stop cars at landings corresponding to registered calls. Make stops at successive floors for each direction of travel irrespective of order in which calls are registered except when bypassing hall calls to balance and improve overall service; stop only one car in response to particular hall call. Assign hall calls to specific cars, and continually review and modify these assignments to improve service. Simultaneous to initiation of slow down of a car for a hall call, cancel that call. Render hall pushbutton ineffective until car doors begin to close after passenger transfer. Cancel car calls in the same manner. Give priority to coincidental car and hall calls in car assignment.

   d. Operate system to meet changing traffic conditions on a service demand basis. Include provisions for handling traffic, which may be heavier in either direction, intermittent or very light. As traffic demands change, automatically and continually modify group and individual car assignment to provide the most-effective means to handling traffic conditions. Assign hall calls to individual cars, continually review and update assignments; provide means to sense long-wait hall calls and preferentially serve them; give priority to coincidental car and hall calls in hall call assignment and accomplish direction reversal without closing and reopening doors.

   e. Use easily re-programmable system software. Design basic algorithm to optimize service based on equalizing system’s response to registered hall calls and equalizing passenger trip time to shortest possible time.

   f. Required Features:
1) Dispatch Protection: Backup dispatching shall function in the same manner as the primary dispatching.

2) Delayed Car Removal: Automatically remove delayed car from group operation.

3) Position Sensing: Reset car position when passing or stopping at each landing.

4) Hall Pushbutton Failure: Multiple power sources and separate fusing for pushbutton risers.

5) Duplicate communication link: All group and individual car computers.

2. Other Items:

a. Load Weighing: Provide means for weighing car passenger load. Design control system to provide dispatching at main floor in advance of normal intervals when car fills to capacity. Provide hall call by-pass when the car is filled to preset percentage of rated capacity and traveling in down direction. (Field adjustment range: 10 percent to 100 percent.)

b. Anti-Nuisance Feature: If car loading relative to weight is not commensurate with registered car calls, cancel car calls. Systems employing either load weighing or door protective device for activation of this feature are acceptable.

c. Independent Service: Provide controls for operation of each car from its pushbuttons only. Close doors by constant pressure on desired destination floor button or door close button. Open doors automatically upon arrival at selected floor.

d. Car-to-Street or Lobby Feature: Provide the means for automatic return to the Street or Lobby level. Return car nonstop after answering pre-registered car calls, and park with doors open until the car is returned to normal operation.

e. Firefighters’ Service: Provide equipment and operation in accordance with Code requirements.

f. Automatic Car Stopping Zone: Stop car within 1/4 inch above or below the landing sill. Avoid overtravel or undertravel, and maintain stopping accuracy regardless of load in car, direction of travel, distance between landings, and rope slippage or stretch.

g. Motion Control: Microprocessor based AC variable-voltage, variable frequency with digitally encoded closed-loop velocity feedback suitable for operation specified and capable of providing smooth, comfortable car acceleration, retardation, and dynamic braking. Limit the difference in car speed between full load and no load to not more than plus or minus 3 percent of the Contract speed.

h. Door Operation: Automatically open doors when car arrives at main floor whether car call has been registered or not.

i. Standby Lighting and Alarm: Car mounted battery unit with solid-state charger to operate alarm bell and car emergency lighting. Battery to be
rechargeable with minimum five-year life expectancy. Coordinate location of light fixture with the Resident Engineer. Provide constant-pressure test button in service compartment of car operating panel.

j. Alternate Power Transfer: Upon loss of normal power, adequate alternate power shall be supplied via the normal electrical feeders to simultaneously start and run all cars in each group and single cars at rated car speed and load.

1) Automatically return one car at a time, in each group, car, nonstop to Surface level and Elevator 4 to Mezzanine level, open doors for approximately 3.0 seconds, close doors, and park out-of-service. During return operation, car and hall call pushbuttons are rendered inoperative. As each car parks, the system immediately selects the next car until all cars in a group have returned to the designated floor. If a car fails to start or return within 30 seconds, the system automatically selects next car in the group to automatically return. When all cars in a group have returned to the designated floor, all cars in each group are designated for automatic operation.

2) Provide separate key-operated group rotary switch in the firefighters' control panel.

3) Switch labeled ALTERNATE POWER OVERRIDE with positions marked AUTO and appropriate car numbers. The key is same as that used for firefighters' Phase I and II switch, key removable in AUTO position only.

4) Switch overrides automatic return and automatic selection functions, and causes the manually selected car to operate. Manual selection causes car to start and proceed to designated floor and open and close its doors before stand-by power is transferred to the next selected car.

5) Provide ALTERNATE POWER indicator lights (one per car) in firefighters' control panel. Indicator light illuminates only when corresponding car is selected to automatically or manually operate on standby power.

6) Successive Starting: When normal power is restored or there has been a power interruption, individual cars in each bank shall restart at 5-second intervals.

3.03 FIELD QUALITY CONTROL

A. Work at jobsite will be checked during course of installation. Full cooperation with the Resident Engineer is mandatory. Accomplish corrective work required prior to performing further installation.

B. Have Code Authority acceptance inspection performed and complete corrective work.

3.04 ADJUSTING

A. Install rails plumb and align vertically with tolerance of 1/16 inch in 100 feet. Secure joints without gaps and file all irregularities to a smooth surface.
B. Static balance car to equalize pressure of guide shoes on guide rails.

C. Lubricate all equipment in accordance with Manufacturer’s instructions.

D. Adjust motors, power conversion unit, brake, controllers, leveling switches, limit switches, stopping switches, door operators, interlocks, and safety devices to achieve required performance levels.

3.05 CLEANING

A. Keep work areas orderly and free from debris during progress of Contract. Remove packaging materials on a daily basis.

B. Remove all loose materials and filings resulting from work.

C. Clean machine room equipment and floor.

D. Clean hoistways, car, car enclosure, entrances, and operating and signal fixtures.

3.06 DEMONSTRATION

A. General: Furnish labor, materials, and equipment necessary for tests. Notify the Resident Engineer 5 days in advance when ready for final review of unit or group. Final acceptance of installation will be made only after all field-quality control reviews have been completed, identified deficiencies have been corrected, all Sound Transit’s information and certificates have been received, and the following items have been completed to satisfaction of Sound Transit:

1. Workmanship and equipment comply with these Contract Specifications.

2. Contract speed, capacity, floor-to-floor, and door performance comply with these Contract Specifications.

3. Performance of following are satisfactory:
   a. Starting, accelerating, running
   b. Decelerating, stopping accuracy
   c. Door operation and closing force
   d. Equipment noise levels
   e. Signal fixture utility
   f. Overall ride quality
   g. Performance of door control devices
   h. Operations of special security operation and floor lock-off provisions.

4. Test Results:
   a. In all test conditions, obtain specified speed, performance times, stopping accuracy without re-leveling, and ride quality to satisfaction of the Resident Engineer,
b. Temperature rise in motor windings limited to 122 degrees F above ambient. A full-capacity, one-hour running test, stopping at each floor for 10 seconds in up and down directions, may be required.

B. Performance Guarantee: Should tests reveal defects, poor workmanship, variance or noncompliance with requirements of specified Codes and ordinances, or variance or noncompliance with the requirements of these Specifications, complete corrective work to satisfaction of the Resident Engineer at no cost:

1. Replace equipment that does not meet Code or these Specifications requirements.

2. Perform work and furnish labor, materials, and equipment necessary to meet specified operation and performance.

3. Perform and assume cost for retesting required by The Elevator Section of the City of Seattle Department of Planning and Development, the Washington State Department of Labor and Industries Elevator Section, or the Resident Engineer to verify specified operation and performance.

C. Field Review Scheduling: Schedule progress and final equipment reviews with the Resident Engineer. Reply promptly, in writing, to corrective work indicated on the Resident Engineer’s progress and final review reports, indicating status, schedule for completion, and questions.

END OF SECTION
PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes specifications for furnishing and installing escalators as specified and as detailed on the Contract Drawings, including preventive maintenance as described herein.

B. Related Sections: The work of the following Sections is related to the work of this Section. Other Sections, not referenced below, may also be related to the proper performance of this work.
   1. Section 05 05 23, Metal Fastenings
   2. Section 26 05 33, Raceways and Boxes for Electrical Systems.

1.02 REFERENCES

A. This Section incorporates by reference the latest revisions of the following documents.
   1. American Society of Mechanical Engineers (ASME):
      a. ASME A17.1 Safety Code for Elevators and Escalators
      b. ASME A17.2.3 Guide for Inspection of Elevators, Escalators and Moving Walks
      c. ASME A17.5 Elevator and Escalator Electrical Equipment
      a. ASTM A36 Standard Specification for Carbon Structural Steel
      c. ASTM A568 Standard Specification for Steel, Sheet, Carbon, and High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, General Requirements
      d. ASTM A1008 Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability
      e. ASTM A1011 Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy with Improved Formability
      f. ASTM B209 Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
g. ASTM B221 Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles and Tubes

   a. NFPA 70 National Electrical Code
   c. NFPA 130 Standard for Fixed Guideway Transit and Passenger Rail Systems

4. National Electrical Manufacturers Association (NEMA):

5. Seattle Building Code (SBC)

   a. ANSI/AWS D1.1 Structural Welding Code-Steel
   b. ANSI/AWS A2.4 Standard Symbols for Welding, Brazing, and Nondestructive Examination

7. Occupational Safety & Health Administration (OSHA):
   a. 29 CFR Part 1926, Safety and Health Regulations for Construction

   a. 28 CFR Part 36. ADA Standards for Accessible Design

   a. AMP 555-92. Code of Standard Practice For the Architectural Metal Industry

1.03 DEFINITIONS
A. Terms used are defined in the latest edition of ASME A17.1, Safety Code for Elevators and Escalators.

B. Reference to a single device or part of the equipment applies to the full number of devices or parts required to complete the installation as shown in Contract Drawings and Specifications.

1.04 SYSTEM DESCRIPTION
A. Related Work Specified Elsewhere:
   1. Wellway and Pit:
      a. Clear, plumb, wellway with variations not to exceed 1 inch at any point.
      b. Floor pockets and/or structural beams for support of escalator truss at each end and at intermediate locations as shown on the Contract
Drawings. Support beam deflection shall not exceed 1/1666 of span under static load.

c. Fire resistive enclosure of escalator truss including ends, sides, and bottom in ceiling plenum.

d. Patching and finishing around escalator landing plates after installation.

e. Cladding and finishing of exposed truss surfaces.

f. Waterproof pit. Sump pit with flush grate and pump or indirect waste drain.

g. Protect open wellways during construction in accordance with OSHA regulations.

h. Protect escalator truss, steps, landing plates, balustrades, handrails, and special metal finishes from damage.

i. Venting or other means to prevent accumulation of smoke and gas in escalator truss as required by Local Building Code.

j. Fire sprinklers in accordance with local Code requirements with protective guards.

2. Electrical Service, Conductors, and Devices:

   a. Light with guard and Ground Fault Circuit Interrupter (GFCI) convenience outlet in each pit and machine room space.

   b. Three-phase mainline copper power feeder to terminals of each escalator controller in the machine room space with protected, lockable OFF, disconnect switch.

   c. Temporary power and illumination to install, test, and adjust escalator equipment.

   d. Single phase copper power feeder to each lower end escalator pit for truss heater with individual protected, lockable OFF, disconnect switch located in machine room space.

   e. Single phase copper power feeder to each lower end and upper end escalator pit for under handrail lighting with individual protected, lockable OFF, disconnect switch located in machine room space.

B. Review all Contract Drawings. Comply with all provisions of Contract Documents. Sound Transit will not pay for changes to structural, mechanical, electrical, or other systems to accommodate Manufacturer’s equipment.

1.05 SUBMITTALS

A. Procedures: Section 01 33 00, Submittal Procedures.

   1. Within 60 days of Notice to Proceed and before beginning equipment fabrication, submit shop drawings and required material for review as outlined Section 01 33 00, Submittal Procedures. Allow 30 days for response to initial Submittal.
B. Fully Dimensioned Layout: Plan of pit, wellway, indicating equipment arrangement and elevation section of wellway.

C. Design Information: Indicate equipment lists, reactions, and design information on layouts.

D. Power Confirmation Sheets: Include motor horsepower, code letter, starting current, full-load running current, and demand factor for applicable motors.

E. Finish Material: Submit 3-inch by 12-inch samples or 12-inch lengths of actual finished material for review of color, pattern and texture by Resident Engineer. Compliance with other requirements is the exclusive responsibility of the Contractor.

F. Manufacturer’s specifications and installation instructions for complete system and for each component part of product used in system. Include listing and description of performance and operating characteristics, indicating how actual escalator will be modified from requirements and how differences exceed minimum requirements. Include maximum dynamic and static loads imposed on building structure at points of support for Work and maximum and minimum power demands.

G. Manufacturer’s literature including configuration drawings to be used to cross reference, locate, and identify hardware, components, and systems submitted. Submit drawings that affect work by others within 30 days after Notice to Proceed (NTP). Indicate manufacturer’s unit assembly number or components part number as it appears in submitted literature. If component or subsystem is furnished by Subcontractor, indicate name of Subcontractor and Subcontractor’s part number, component, or subsystem identification number. Configuration drawings include:

1. Truss drawings: Facsimile outline of escalator truss in plan and profile.
3. Balustrade Section: Vertical section taken completely through balustrade and truss midway between working points.
4. Escalator cladding: Vertical section taken completely through escalator cladding, handrail and decking at mid-flight at upper and lower deck where handrail and decking are level or parallel to floor.
5. Manufacturer’s requirements for supports, cladding, connections, and tolerances.
6. Modifications to adjacent finishes affected by manufacturer’s configuration.
7. Escalator seismic support details.

H. Manufacturer’s literature and configuration drawings indicating sufficient information to determine compliance with applicable codes.

I. Shop drawings including information and dimensions to manufacture and install escalators; to scale and include:

1. Location of lower and upper working points, proposed attachment for escalator truss to entrance structure, intermediate support details, thermal expansion joint, load reactions, rated capacity and speed, handrail details, and machine room space and access.
2. Location of major mechanical and electrical components within truss, electric interface connections, and drainage connections.
3. Electrical layouts showing location of truss lighting, light switches, light fixtures, maintenance receptacles, and safety devices.

4. Schematic and electrical wiring diagrams of power distribution and control systems, including wiring of safety devices and interface connections for remote surveillance for each typical escalator, or group of escalators.

5. Location of operating panel in upper and lower-end balustrades - Show following items:
   a. Stop button;
   b. Start and direction selection switch.

6. Show location of following items:
   a. Hand and finger guards;
   b. Guards at ceiling and intersections;
   c. Passenger instruction signs;
   d. Balustrade lighting
   e. Emergency stop buttons; and
   f. Direction selection switches.

7. Modifications of details, dimensions, and configuration for elements to accommodate selected products for Work of this Section.

8. Test Procedures.

9. Certificates and Test Reports - Written certified reports for required tests, recording dates performed, test method, test results, interpretation of results, and recommended action. Include Certificate and Test Reports for following:
   a. Manufacturer’s certificate of rated load test;
   b. Contractor’s standard field test and data report;
   c. Certificate of inspection by the agency having jurisdiction;
   d. Operating permit issued by the agency having jurisdiction; and
   e. Manufacturer’s product data.

10. Maintenance Program - Detailed maintenance program, showing functions to be performed and schedule of frequency, not less than 90 days before acceptance tests and final Acceptance.

11. Welder certifications and qualified welding procedures and necessary documentation, as required in Section 05 05 23, Metal Fastenings, for review and acceptance.

J. Acknowledge and respond to drawing comments within 15 days of return; promptly incorporate required changes due to inaccurate data or incomplete definition so that delivery and installation schedules are not affected. Revision response time is not justification for equipment delivery or installation delay.
K. Closeout Submittals: Operations and Maintenance Manuals

1. Provide three sets of neatly bound written information necessary for proper maintenance and adjustment of equipment within 30 days following Final Acceptance. Final retention will be withheld until data is received by Sound Transit and reviewed by the Resident Engineer. Include the following as minimums:

   a. Straight-line wiring diagram of as-installed escalator circuits, with index of location and function of components. Provide one set reproducible master. Mount installation wiring diagrams on panels, racked, or similarly protected, in escalator machine room space. Provide remaining set rolled and in a protective drawing tube. Maintain with addition of all subsequent changes. These diagrams are Sound Transit's property.

   b. Lubrication instructions, including recommended grade of lubricants.

   c. Parts catalogs for all replaceable parts including ordering forms and instructions.

   d. Keys for all switches and control features.

2. Diagnostic test device complete with access codes, adjusters manuals, and set-up manuals for adjustment.

1.06 QUALITY ASSURANCE

A. Compliance with Regulatory Agency: Comply with most-stringent applicable provisions of the Code or Authority outlined in Article 1.02, herein, including revisions and changes in effect on date of these Contract Specifications.

1.07 DELIVERY, STORAGE, AND HANDLING

A. When escalator manufacturing process is complete and facility access is complete, deliver escalators and equipment to Work site in manufacturer's unopened protective packaging.

B. Transport, handle, and store materials in manner to ensure preservation of material quality and fitness for incorporation in Work. Store material in a manner to facilitate inspection and prevent damage.

C. Erection equipment is subject to review and acceptance by the Resident Engineer upon delivery to Work site. If equipment is deemed by the Resident Engineer to be unacceptable or hazardous to personnel and property, promptly bring to acceptable condition, or remove from Work site. Obtain approval from the Resident Engineer for use of heavy moving and erection equipment supported by station structures prior to use.

D. Protect equipment and exposed finishes during transportation, erection, and construction.

1.08 WARRANTY

A. Material and workmanship of the installation shall comply in every respect with Contract Documents. Correct defective material or workmanship that develops within one year from date of final acceptance of Work to the satisfaction of the Resident Engineer at no additional cost, unless due to ordinary wear and tear, or improper use or care by Sound Transit. Perform maintenance in accordance with terms and conditions indicated in Warranty Preventive Maintenance.
B. Defective is defined to include, but not limited to; operation or control system failures, performance below required minimum, excessive wear, unusual deterioration or aging of materials or finishes, unsafe conditions, the need for excessive maintenance, abnormal noise or vibration, and similar unsatisfactory conditions.

C. Make modifications, adjustments, and improvements to meet performance requirements specified in Parts 2, Products and 3, Execution, herein.

1.09 SYSTEM STARTUP

A. Obtain and pay for permit, license, and inspection fee necessary to complete the installation.

B. Perform test required by Governing Authority in accordance with procedure described in ASME A17.2.3 Guide for Inspection of Elevators, Escalators, and Moving Walks in the presence of the Resident Engineer.

C. Supply personnel and equipment for test and final review required by the Resident Engineer, as specified in Part 3, Execution, herein.

1.10 MAINTENANCE

A. Interim:

1. When one or more escalators are near completion and declared ready for service, Sound Transit may accept escalators for interim use and place in service before entire installation of all escalators has been completed and accepted.

2. During this period, Sound Transit may pay a mutually agreed amount per escalator for preventive maintenance.

3. Temporary acceptance form must be acceptable to Sound Transit and signed by the Resident Engineer prior to use of escalators.

4. Protect installed equipment and finishes; and perform or arrange to pay for all cleaning, repairs, and replacement of materials necessary to restore escalator to as-new condition prior to Final Acceptance by Sound Transit.

B. Warranty Maintenance:

1. Provide preventive maintenance and 24-hour emergency call-back service for one year commencing on date of final Acceptance by Sound Transit. Systematically examine, adjust, clean, and lubricate all equipment. Repair or replace defective parts using parts produced by the manufacturer of installed equipment. Maintain machine room space, wellway, and pit in clean condition.

2. Use competent personnel acceptable to the Resident Engineer.

3. Contractor shall arrive at property within sixty (60) minutes from time of notification of equipment problem or failure.

4. Removal of units from beneficial usage for maintenance purposes shall be coordinated with and approved by Sound Transit, unless removal is necessitated for emergency repair or adjustment. Normal preventive maintenance service shall be performed during off-peak operating hours.
5. At least semi-annually or more often if requested, provide summary and review of all callbacks and unit downtime with Sound Transit. The intent of this review is to minimize callbacks by developing consistent communication between the Contractor and Sound Transit relative to callback trends, unit downtime, and their causes.

6. All units shall be available for use an average of 98.7% of property hours of operation over each three month period during warranty maintenance service. This includes allowance for equipment out of service time as the result of callbacks, scheduled preventive maintenance, and repairs. Contractor’s failure to meet this unit availability provision for two consecutive three-month periods for any single elevator or escalator, or group of units, shall trigger an automatic maintenance audit by Sound Transit. Contractor agrees to expeditiously take corrective action in regard to identified deficiencies. Further, Contractor acknowledges Sound Transit’s right to pass cost of said audit to Contractor.

7. Sound Transit retains the option to delete cost of warranty maintenance from new equipment contract and remit twelve equal installments directly to Contractor during period in which maintenance work is being accomplished.

C. Preventive Maintenance Contract: Quote monthly cost for five-year preventive maintenance contract commencing on completion of the one year period in Article 1.10 B above. Submit quote based upon terms and conditions of the preventive maintenance contract furnished with these Contract Specifications. Base on present value. Price adjustment will be made at Contract commencement date and thereafter as provided in Contract.

1.11 PERMIT, TEST AND INSPECTION

A. Obtain and pay for permit, license, and inspection fee necessary to complete the installation. Installation will be considered complete when the governing authority of Washington State Department of Labor and Industries has issued a permanent operating permit for each elevator.

B. Perform test required by Governing Authority in accordance with procedure described in ASME A17.2, Inspectors’ Manual for Elevators and Escalators, in the presence of Authorized Representative.

C. Supply personnel and equipment for test and final review required by Resident Engineer, as indicated in Part 3, Execution.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Qualified Manufacturers: Alternate Manufacturers must receive approval of Sound Transit at least 5 days prior to bid date.

B. Approved Manufacturers:

1. Fujitec
2. KONE
3. Schindler

4. Thyssen Krupp

2.02 MATERIALS

A. Steel:


B. Stainless Steel: Type 304 complying with ASTM A167, with standard tempers and hardness required for fabrication, strength and durability. Apply mechanical finish on fabricated work in the locations shown or specified, (Federal Standard and NAAMM nomenclature), with texture and reflectivity required to match Resident Engineer’s sample. Protect with adhesive-paper covering.

1. No. 4: Bright directional polish (satin finish). Graining directions as shown or, if not shown, in longest dimension.

C. Aluminum: Extrusions conforming to ASTM B221; sheet and plate conforming to ASTM B209.

D. Paint: Clean exposed metal of oil, grease, scale, and other foreign matter and factory paint one shop coat of manufacturer’s standard rust-resistant primer. After erection, provide one finish coat of industrial enamel paint. Galvanized metal need not be painted.

E. Prime Finish: Clean all surfaces receiving a baked enamel finish of oil, grease, scale, and other foreign matter. Apply one coat of rust-resistant mineral paint followed by a filler coat over uneven surfaces. Sand smooth and apply final coat of mineral paint.

F. Baked Enamel: Prime in accordance with Article 2.02 E above. Apply and bake three additional coats of enamel in the selected solid color.

G. All equipment and metalwork installed as a part of this Work, which does not have special architectural finish and which is exposed in the wellway, shall be thoroughly cleaned of oil, grease, scale, and other foreign matter and given one coat of field-applied machinery enamel. Damaged factory-painted surfaces shall be neatly touched up with original paint and color.

H. All natural metals shall be stretcher-leveled, re-squared sheets. The grain of belting shall run in the direction of the longest dimension. A satin finish shall be provided by first removing tool-and-die marks and then finishing with No. 80, 100, and 120-grit sanding belts. All surfaces shall be smooth and without waves.

2.03 EQUIPMENT

A. Escalator Features

1. Number: Escalators 1-13 as specified and detailed on the Contract Drawings

2. Size: 48 inches wide (40 inch step)
3. Speed: 100 feet per minute (fpm)
4. Rise: As shown on Contract Drawings
5. Floors Served: As specified and detailed on the Contract Drawings
6. Angle of Inclination: 30 Degrees
7. Operation: Reversible
8. Drive Motor Gear box: Worm helical
10. Deck Configuration: High
11. Deck Finish: Satin finish Stainless steel
12. Molding and Trim: Match deck finish
13. Skirt Panels: Satin finish Stainless steel
14. Handrail Color: Black with white inserts
15. Step Tread and Riser: Cleated and meshed with adjacent step with tread demarcation inserts, tread sides and nosing
16. Demarcation Color: Yellow
17. Power Supply: 480 Volts, three-phase, 60 hertz
18. Additional Features:
   a. Step demarcation lighting
   b. Emergency stop buttons
   c. Caution signs at each lading
   d. Floor intersection guards
   e. Truss extensions
   f. Truss and combplate heater
   g. Balustrade LED type lighting
   h. Combplate lighting
   i. Fault finder mounted in inner deck or at stop switch location
   j. Intermediate supports located as detailed
   k. Power supply provided as detailed in the Contract Drawings. Provide a junction box and conduit as needed based on a power supply located at the lower end of the escalator.
   l. Anti-slide devices on decks when the outer edge of the deck is 8 inches or greater from the edge of the handrail, or on adjacent escalators when
the unobstructed distance between the edge of facing handrails is 12 inches or greater. Anti-slide devices to be a minimum 2 inches diameter by 1 inch height stainless steel with concealed mounting.

19. Performance
   a. Step Speed: Unit shall be capable of operating at Contract speed under all loading conditions in either direction of travel.
   b. Handrail Speed: Consistent with step speed.

20. Operation
   a. Each unit shall be capable of operating smoothly and quietly at rated speed with synchronized step and handrail operation and speed in either direction of travel.

21. Seismic Features
   a. Provide slip joints pinned and as designed by a Structural Engineer registered in the State of Washington. Provide sliding assembly based on manufacturers’ standard and approved by Sound Transit.
   b. Provide seismic switch to disable escalator if a seismic event occurs. Locate beneath soffit at lower end, or other approved remote location, outside of truss.

B. Machine Room Equipment
   1. Driving Machine: Worm geared or helical spur gear reduction unit coupled directly to drive motor.
   2. Fault Finder: Provide fault-locating instrumentation to monitor supply voltage, drive unit, wheels, drive chains, step chains, safety circuits, emergency brake lubrication oil, up thrust switch, handrail entry, broken handrail, skirt switch, top and bottom step chain, or step-link switch, comb plate, under/over speed switch, low lubricant level indication, and emergency stop switch. Permanently install fault-finding equipment at each escalator. Provide display to indicate trouble code in outer deck at readily visible location. Design to resist vandalism.
   4. Brake Operation: Safely decelerate, stop, and hold rated load in accordance with Code requirements. Brakes: Not to stop escalator operating in the down direction at a rate not greater than 3 feet/second/second.
   5. Controller: Wire to identify terminal block studs. Identifying symbols or letters identical to those on wiring diagrams permanently marked adjacent to each component on the controller. Enclose all components in steel cabinet removable from machine room for ease of access to switches and wiring. Provide mainline circuit breaker and means to protect against overload and single phasing.
   6. Step Drive Assembly: Direct or indirect drive. Machine sprockets at each side over which step chains or step chain rollers: pass and transmit motion from machine to steps. If indirect chain drive is used between machine and drive
sprocket, provide emergency brake on drive assembly to automatically set if drive chain fails. Provide roller-type sealed bearings.

7. **Stop Switch**: Conform to Code

8. **Remote monitoring Interface Terminal Cabinet (ITC)**: Provide an interface for remote monitoring and control of each escalator by the Building Management System (BMS). Provide a single cabinet with a terminal strip in the escalator pit.

   a. **Cabinet**: NEMA 12.

   b. **Terminal blocks**: Accept No. 14 AWG.

   c. **Receive the following dry contact inputs to effect the following control actions for each escalator:**

      1) **Remote Emergency Stop**

   d. **Provide normally open dry contacts for each of the following status items for each escalator:**

      1) Escalator Running/Off
      2) Escalator Traveling Up/Down
      3) Escalator Fail
      4) Escalator Emergency Stop Button
      5) Seismic operation
      6) Truss heater
      7) Pit high water level

   e. **Remote monitoring Interface Terminal Cabinet Diagram**
### Interface Terminal Cabinet - Terminal Strip

<table>
<thead>
<tr>
<th>Term Block Label</th>
<th>Type</th>
<th>Operation</th>
<th>Dry Contact Function</th>
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<tbody>
<tr>
<td>S1A</td>
<td>Status</td>
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<td>Not Running</td>
</tr>
<tr>
<td>S1B</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>S2A</td>
<td>Status</td>
<td>Maintained</td>
<td>Traveling Up</td>
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<tr>
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<td></td>
</tr>
<tr>
<td>S3A</td>
<td>Alarm</td>
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<td>Failed</td>
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<tr>
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<td>Status</td>
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<td>S4B</td>
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<tr>
<td>S5A</td>
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<td>Maintained</td>
<td>Truss Heater</td>
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<td>Pit High Water Level</td>
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</tr>
<tr>
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</table>

C. Wellway Equipment

1. **Truss**: Steel truss to safely carry entire load of escalator, including all components, full-capacity load and weight of exterior truss, and balustrade covering material. Exterior cladding material, according to design. Weight, 10 psf. Provide factor of safety according to Code. Provide clearly identified exterior cladding support attachment locations on exposed sides and bottom of the entire length of truss. Provide fire resistant galvanized sheet metal exterior cladding at manufacturer’s factory.

2. **Truss Extensions**: Provide truss extensions at upper or lower landings as required or as shown in Contract Drawings. End support locations will not be adjusted to accommodate Installer’s equipment.

3. **Noise and Vibration Control**: Provide sound isolation within truss as required to limit noise levels relating to escalator equipment and its operation to no more than 60 Decibels (dBA), measured 3 feet above escalator at any point of its length.

4. **Drip Pans**: Minimum 14-gauge galvanized metal drip pans of oil-tight construction beneath pit, machine room, and trusses. Ensure drip pan is of sufficient strength to withstand the weight of maintenance personnel. Ensure pan extends full inside length and it’s wide enough to collect oil drips and dirt droppings; slope to drain. Provide suitable drains with grease trap at base of each oil pan with removable access plate to sump and pump.

5. **Step Tracks**: Construct from steel. Bolt sections of track, including transitions, to facilitate maintenance and replacement if required. Factory install and align track sections, including transitions, to ensure smooth, quiet operation of running gear under all conditions. Form a fully independent assembly consisting of the individual track section, together with transition section, step chain tension carriage, main drive shaft and handrail drive shaft.
6. Electrical Wiring:
   a. Conductors: Copper throughout with individual wires coded and all connections identified on studs or terminal blocks. Type SO cable may be utilized for wiring conducting 30 Volts or less, in accordance with NEC 620-621.
   b. Conductors: 31 Volts rms or greater. Provide conduit, junction boxes, connections, and mounting means in accordance with requirements of Section 26 05 33, Raceways and Boxes for Electrical Systems. Provide painted or galvanized steel or aluminum conduit. Conduit size minimum 3/8 inch. Do not use flexible conduit exceeding 18 inches in length.

7. Step Chains: Steel links with hardened pins connecting adjacent steps and engaging drive sprockets. Provide synthetic composition roller assemblies with sealed bearings. Provide escalator design that permits chain inspection and operation while unit is running with steps removed.

8. Step Chain Tension Carriage: Spring tensioning device to take up chain slack and maintain constant tension.

9. Step Assembly: Single piece die-cast aluminum, fastened to the step chain axles. Ensure step rollers have sealed bearings and are tired with synthetic composition material. Provide cleated treads and risers. Cover the underside of Steps with sound-deadening material. Ensure steps are removable from unit without disassembly of balustrade or decking. Provide renewable yellow step demarcation inserts on trailing edge of each step tread and both sides of each step tread.

10. Safety Devices: Provide step, skirt, handrail, and other safety devices to function according to Code.
    a. Broken step chain;
    b. Broken drive chain;
    c. Skirt obstruction;
    d. Reversal stop;
    e. Step up-thrust;
    f. Handrail speed;
    g. Missing step;
    h. Step level;
    i. Handrail entry;
    j. Combplate impact; and
    k. Step demarcation lights.

2.04 COMPONENTS
   A. Handrails
1. Design handrails for outdoor use. Construct handrails of moisture-resistant laminated non-wicking synthetic fabric with molded rubber or neoprene cover properly vulcanized to ensure strong, smooth splice, and operate on formed guides except when in contact with driving sheaves. Reinforce handrail with full width stainless steel tape not less than 1.75 inches by 0.02 inch thick, or stainless steel wire tension member 1.75 inches wide by 0.02 inch thick. Color of handrails: black with white dots.

2. Provide handrail drive of traction type having tension device; apply one coat of zinc chromate primer and one coat of aluminum enamel. Drive handrails from main drive of each escalator connected to escalator so handrail will operate at same speed as escalator steps. Provide handrail wheels of ball or roller bearings with ample means for lubrication.

B. Balustrade


2. Balustrade Lighting: LED type light fixtures


4. Deck Boards: Reinforced 14-gauge metal. Abut all deck section to one another to provide a smooth surface-to-surface connection with butt joint transition, top and bottom, and horizontal to inclined sections.

5. Finishes:
   a. Interior Panels: Satin finish stainless steel reinforced vertical panels with section joints vertical to escalator incline, flush inclined panel from skirt to handrail guide above.

6. Trim and Moldings: manufacturer’s standard finish.

7. Floor Intersection Guards: Provide clear plexiglass intersection guards at floor penetrations as required according to Code.

8. Extended Newels: Align newels of adjacent escalators at upper and lower landings.

C. Landings

1. Flat Steps: Provide upper and lower landings with three flat steps.

2. Combplates: Aluminum or other alloy provided with non-slip surface. Provide removable comb sections. Apply yellow powder coat finish. Provide combplate lighting in skirt panel on both sides of units at both upper and lower landings.
3. Landing Plates: Aluminum or other alloy with non-slip surface. Extend plates from combplates to equipment access plates at upper and lower ends. Extend plates full width of truss.

4. Equipment Access Plates: Aluminum or other alloy with non-slip surface. Provide removable access plates to provide for entry into equipment spaces at upper and lower ends. Cover entire truss openings with plates. Match access plate to material and finish of adjacent landing plates. Provide landing plate and access floor plate without visible manufacturers name or logo.

D. Signal and Control Fixtures

1. Provide upper and lower newel or stanchion-mounted operating stations. Mount on right side when facing unit. Match deck finish. Identify Function and operating positions of switches and buttons with engraved characters that are readily visible from a standing position. Include the following at each station:

   a. Red emergency stop button. Cover the button with a transparent cover that can be readily lifted or pushed aside. When the cover is moved, ensure an audible warning signal is activated. Ensure the signal has a minimum sound intensity of 80 dBA at the button location. Engrave the cover EMERGENCY STOP; MOVE COVER or equivalent legend (for example LIFT COVER); and PUSH BUTTON. EMERGENCY STOP in letters not less than 1/2 inch high. Engrave other required wording in letters not less than 3/16 inch high. Ensure the cover is self-resetting.

   b. Key switch to start unit.

   c. Key directional control switch.

2.05 ACCESSORIES

A. Signs

1. Landing Signs: Provide caution signs at top and bottom landings according to Code, engraved plate with material and finish to match decking.

B. Key box

1. Provide a keybox with hooks suitable for storing all escalator keys. Locate within Fire Command Center room.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Site Verification of Conditions

1. Prior to beginning the installation of equipment, examine wellway and pit areas. Verify that no irregularities exist that would affect quality of execution of work specified.

2. Do not proceed with installation until work in place conforms to Contract requirements.
3.02 INSTALLATION

A. Install all equipment in accordance with Manufacturer’s instructions, referenced codes, Contract Specifications, and approved Submittals.

B. Install all equipment for ease of maintenance.

C. Install all equipment to afford maximum accessibility, safety, and continuity of operation.

D. Replace or refurbish all material to meet performance requirements outlined in these Contract Specifications prior to station turnover for normal operation. There will be an extended period of time from the point that the escalators are installed to the final acceptance and station normal operation.

E. Remove oil, grease scale, and other foreign matter from the following equipment and apply one coat of field-applied machinery enamel.
   1. All exposed equipment and metal work installed as part of this work that does not have architectural finish.
   3. Neatly touch up damaged factory-painted surfaces with original paint and color. Protect machine-finish surfaces against corrosion.

F. Coordinate access and escalator work with work of other trades for proper time and sequence to avoid construction delays. Use benchmarks, lines, and levels designated by Contractor to ensure dimensional coordination of Work.

G. Warp finish floor to level with the escalator floor plates but do not lay floor around escalator openings until escalator has been installed. Coordinate as required for installation.

H. The rough opening provided in the Contract Drawings is designed to accommodate variances in dimensions, support locations, and details that may vary by manufacturer. It is the responsibility of the Contractor to coordinate the final design and engineering of the selected escalators to fit the rough opening and to adjust the extent of adjacent finishes, at no additional cost to Sound Transit. Obtain approval for adjustments to details and finishes from the Resident Engineer.

I. Inspect site and verify embedded items are provided and correctly installed.

J. In event of notice of delay for access to Work, site storage at Contractor’s facility will be required.

3.03 FIELD QUALITY CONTROL

A. Work at the jobsite will be checked during the course of installation. Full cooperation with the Resident Engineer is mandatory. Accomplish corrective work required prior to performing further installation.

B. Have The Elevator Section of the City of Seattle Department of Planning and Development and Washington Station Department of Labor and Industries acceptance inspection performed and complete corrective work.
3.04 ADJUSTING

A. Track alignment: Re-align factory installed tracks if required to ensure continuous four-point contact with step and chain rollers. Secure joints without gaps and file irregularities to a smooth surface.

B. Lubricate all equipment in accordance with Manufacturer’s instructions.

C. Adjust motors, brakes, controllers, stopping switches, and safety devices to achieve required performance levels.

D. Adjust brakes and controlled descent devices to stop escalator with variable load without toppling passengers. Drive machine brakes shall stop the down running escalator at a rate no greater than 3 feet/second/second.

E. Adjust handrail speed to coincide with step speed.

3.05 CLEANING

A. Keep work areas orderly and free from debris during progress of Contract. Remove packaging materials on a daily basis.

B. Remove all loose materials and filings resulting from work.

C. Clean machine room equipment, truss interior, and pit.

D. Clean balustrades, deck boards, skirt panels, operating and signal fixtures, and trim.

E. Before Substantial Completion, remove all protective coverings and wrapping.

3.06 DEMONSTRATION

A. General: Furnish labor, materials, and equipment necessary for tests. Notify Resident Engineer five days in advance when ready for final review of each escalator unit or group. Final Acceptance of installation will be made only after all field quality control reviews have been completed, identified deficiencies have been corrected, all Sound Transit’s information and certificates have been received, and the following items have been completed to satisfaction of the Resident Engineer.

1. Workmanship and equipment: comply with these Contract Specifications.

2. Contract speed and performance comply with these Contract Specifications.

3. Performance of following is satisfactory:

a. Starting and running

b. Controlled descent

c. Stopping

d. Equipment noise levels

e. Signal and operating devices

f. Overall ride quality

g. Handrail speed
h. Safety devices

4. Test Results:
   a. In all test conditions, obtain specified speed, handrail speed, controlled
descent performance, stopping, ride quality, and operation noise levels
to satisfaction of the Resident Engineer.
   b. Temperature rise in windings limited to 50 degrees C above ambient.

B. Personnel, Equipment, and Instruments: Furnish personnel, equipment, and instruments
to perform required tests. The following instruments may be necessary to complete the
tests:
   1. Multi-meter.
   2. 500-volt Megger.
   3. Alternating current voltmeter and ammeter.
   4. Celsius-calibrated thermometers (two minimum).
   5. Precision tachometer.
   7. Test weights for noise test.

C. Operating Tests:
   1. Overspeed Protection Device: Test by operating at rated speed, tripping
overspeed device manually.
   3. Broken Drive Chain Devices: Test by operating at rated speed, tripping broken
chain device manually.
   4. Insulation-Resistance Test: Test safety circuit and motor winding circuit at 500
volts. Minimum resistance to ground: 1 megohm.
   5. Running Test: Submit certified copy of type test based on Item 320.6 of
ASME A17.2.3 - Guide for Inspection of Elevators, Escalators and Moving Walks.
   6. Demonstrate functionality of all remote monitoring and control terminations at
ITC.

D. Performance Guarantee: Should these tests reveal defects, poor workmanship,
variance, or noncompliance with requirements of specified Codes and ordinances, or
variance or noncompliance with the requirements of these Contract Specifications,
complete corrections to satisfaction of the Resident Engineer at no cost:
   1. Replace all equipment that does not meet Code or the requirements of these
Contract Specifications.
   2. Perform work and furnish labor, materials, and equipment necessary to meet
specified operation and performance.
3. Perform and assume cost for retesting required by Governing Code Authority and Sound Transit to verify specified operation and/or performance.

E. Field Review Scheduling: Schedule progress and final equipment reviews with the Resident Engineer. Reply promptly, in writing, to corrective work indicated on the Resident Engineer’s progress and final review reports, indicating status, schedule for completion, and questions, diagnosis, and troubleshooting of escalator system.

END OF SECTION
1.01 SUMMARY

A. This Section includes specifications for piping materials, mechanical sleeve seals, sleeves, escutcheons, grout, fire suppression demolition, concrete bases, and supports and anchorages, and common installation instructions for piping systems.

B. Related Sections: The work of the following Sections is related to the work of this Section. Other Sections, not referenced below, may also be related to the proper performance of this work.

1. Section 02 41 00, Demolition.
2. Section 03 05 15, Portland Cement Concrete.
3. Section 05 50 00, Metal Fabrications.
4. Section 07 84 00, Firestopping.
5. Section 22 05 00, Common Work Results for Plumbing.

1.02 REFERENCES

A. This Section incorporates by reference the latest revisions of the following documents.

1. American Society of Mechanical Engineers (ASME)
   a. ASME B1.20.1 Pipe Threads, General Purpose (Inch)
   b. ASME B16.21 Nonmetallic Flat Gaskets for Pipe Flanges
   c. ASME B31.1 Power Piping and Process Piping SET

   a. ASTM A53 Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
   b. ASTM B32 Standard Specification for Solder Metal
   c. ASTM B813 Standard Specification for Liquid and Paste Fluxes for Soldering of Copper and Copper Alloy Tube
   d. ASTM B828 Standard Practice for Making Capillary Joints By Soldering of Copper and Copper Alloy Tube and Fittings
   e. ASTM C1107 Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink)

3. American Welding Society
a. AWS A5.8 Specification for Filler Metals for Brazing and Bronze Welding
b. AWS D1.1 Structural Welding Code Steel
c. AWS D10.12 Guide for Welding Mild Steel Pipe

1.03 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in chases.

E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

1.04 SUBMITTALS

A. Procedures: Section 01 33 00, Submittal Procedures.

B. Welding certificates.

1.05 QUALITY ASSURANCE

A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."

B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."


2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

C. All equipment and component assemblies furnished and installed on the fire suppression system shall be UL listed and FM approved for its specific use.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Pipe, Tube and Fittings

1. Refer to individual Division 21, Fire Suppression, piping Sections for pipe, tube, and fitting materials and joining methods.
2. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

B. Joining Material

1. Refer to individual Section 21 10 00 Water-Based Fire-Suppression System for special joining materials not listed below.

2. Pipe-Flange Gasket Materials: ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated.


4. Brazing Filler Metals: AWS A5.8, BCuP Series or BAg1, unless otherwise indicated.


C. Mechanical Sleeve Seals

1. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.

2. Sealing Elements: EPDM interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.

3. Pressure Plates: Stainless steel. Include two for each sealing element.

4. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

D. Sleeves

1. Galvanized-Steel Sheet: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

2. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.

3. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

4. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.
   a. Underdeck Clamp: Clamping ring with set screws.

E. Escutcheons

1. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.

2. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome-plated finish.

3. One-Piece, Cast-Brass Type: With set screw.
4. Split-Casting, Cast-Brass Type: With concealed hinge and set screw.

F. Grout
   1. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.
      b. Design Mix: 5000-psi, 28-day compressive strength.
      c. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.01 ERECTION
   A. Metal Supports and Anchorages
      1. Refer to Section 05 50 00, Metal Fabrications, for structural steel.
      2. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor fire suppression materials and equipment.
      3. Field Welding: Comply with AWS D1.1.

   B. Wood Supports and Anchorages
      1. Cut, fit, and place wood grounds, nailers, blocking, and anchorages to support, and anchor fire suppression materials and equipment.
      2. Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.
      3. Attach to substrates as required to support applied loads.

3.02 INSTALLATION
   A. Piping Systems
      1. Install piping according to the following requirements and as indicated.
      2. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
      3. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.
4. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

5. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

6. Install piping to permit valve servicing.

7. Install piping at indicated slopes.

8. Install piping free of sags and bends.

9. Install fittings for changes in direction and branch connections.

10. Install piping to allow application of insulation.

11. Select system components with pressure rating equal to or greater than system operating pressure.

12. Install escutcheons for penetrations of walls, ceilings, and floors.

13. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.


   a. Install steel pipe for sleeves smaller than 6 inches in diameter.

   b. Install cast-iron "wall pipes" for sleeves 6 inches and larger in diameter.

   c. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

15. Underground, Exterior-Wall Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

   a. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

16. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Section 07 84 00, Firestopping, for materials.

17. Verify final equipment locations for roughing-in.

18. Refer to equipment specifications in other Sections herein for roughing-in requirements.
3.03 APPLICATION

A. Grouting

1. Mix and install grout for fire suppression equipment base bearing surfaces, pump and other equipment base plates, and anchors.
2. Clean surfaces that will come into contact with grout.
3. Provide forms as required for placement of grout.
4. Avoid air entrapment during placement of grout.
5. Place grout, completely filling equipment bases.
6. Place grout on concrete bases and provide smooth bearing surface for equipment.
7. Place grout around anchors.
8. Cure placed grout. In accordance with manufacture recommendations.

3.04 CONSTRUCTION

A. Piping Joints

1. Join pipe and fittings according to the following requirements and Division 21, Fire Suppression, Sections specifying piping systems.
2. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
3. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
6. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
   a. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
   b. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.
7. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 “Quality Assurance” Article.
   a. Do not use pipe sections that have cracked or open welds.
8. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

B. Concrete Bases

1. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to the seismic performance requirements of Section 21 10 00, Water-Based Fire-Suppression Systems. The requirements of Section 21 10 00 shall take precedent.

   a. Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit.

   b. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated or required by seismic design analysis, install dowel rods on 18-inch centers around the full perimeter of the base.

   c. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.

   d. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

   e. Install anchor bolts to elevations required for proper attachment to supported equipment.

   f. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

   g. Use 3000-psi, 28-day compressive-strength concrete and reinforcement as specified in Section 03 05 15, Portland Cement Concrete.

END OF SECTION
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SECTION 21 05 13
COMMON MOTOR REQUIREMENTS FOR FIRE SUPPRESSION EQUIPMENT

PART 1 - GENERAL

1.01 SUMMARY
A. Section includes general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on ac power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

1.02 REFERENCES
A. This Section incorporates by reference the latest revisions of the following documents.
   1. National Electrical Manufacturers Association (NEMA)
      a. NEMA MG-1 Motors and Generators, Includes Errata and Revision 1

1.03 COORDINATION
A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:
   1. Motor controllers.
   2. Torque, speed, and horsepower requirements of the load.
   3. Ratings and characteristics of supply circuit and required control sequence.
   4. Ambient and environmental conditions of installation location.

PART 2 - PRODUCTS

2.01 GENERAL MOTOR REQUIREMENTS
A. Comply with requirements in this Section except when stricter requirements are specified in fire suppression equipment schedules or Sections.
B. Comply with NEMA MG 1 unless otherwise indicated.

2.02 MOTOR CHARACTERISTICS
A. Duty: Continuous duty at ambient temperature of 104 degrees F and at altitude of 3300 feet above sea level.
B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.
2.03 POLYPHASE MOTORS

A. Description: NEMA MG 1, Design B, medium induction motor.
B. Efficiency: Energy efficient, as defined in NEMA MG 1.
C. Service Factor: 1.15.
D. Multispeed Motors: Variable torque.
   1. For motors with 2:1 speed ratio, consequent pole, single winding.
   2. For motors with other than 2:1 speed ratio, separate winding for each speed.
F. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.
G. Temperature Rise: Match insulation rating.
H. Insulation: Class F.
I. Code Letter Designation:
   1. Motors 15 HP and Larger: NEMA starting Code F or Code G.
   2. Motors Smaller than 15 HP: Manufacturer's standard starting characteristic.
J. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

2.04 POLYPHASE MOTORS WITH ADDITIONAL REQUIREMENTS

A. Motors Used with Reduced-Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.
B. Motors Used with Variable Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.
   1. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width modulated inverters.
   2. Energy- and Premium-Efficient Motors: Class B temperature rise; Class F insulation.
   3. Inverter-Duty Motors: Class F temperature rise; Class H insulation.
   4. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.

2.05 SINGLE-PHASE MOTORS

A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:
   1. Permanent-split capacitor.
2. Split phase.
3. Capacitor start, inductor run.
4. Capacitor start, capacitor run.

B. Multispeed Motors: Variable-torque, permanent-split-capacitor type.

C. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.

D. Motors 1/20 HP and Smaller: Shaded-pole type.

E. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

PART 3 - EXECUTION (NOT USED)

END OF SECTION
PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes heat tracing with the following electric heating cables:
   1. Self-regulating, parallel resistance.

B. Related Sections: The work of the following Sections is related to the work of this Section. Other Sections, not referenced below, may also be related to the proper performance of this work.
   1. Section 21 07 00, Fire Suppression Systems Insulation.
   2. Section 26 05 26, Grounding and Bonding for Electrical Systems.
   3. Section 26 05 25, Wire and Cable.

1.02 REFERENCES

A. This Section incorporates by reference the latest revisions of the following documents.
   1. National Electrical Manufacturers Association (NEMA)
      a. NEMA 3R Raintight, Sleet Resistant - Outdoor
   2. Institute of Electrical and Electronics Engineers (IEEE)

1.03 SUBMITTALS

A. Procedures: Section 01 33 00, Submittal Procedures.

B. Product Data: Include rated capacities, operating characteristics, furnished specialties, and accessories for each type of product indicated.
   1. Schedule heating capacity, length of cable, spacing, and electrical power requirement for each electric heating cable required.

C. Shop Drawings: For electric heating cable. Include plans, sections, details, and attachments to other work.

D. Field quality-control test reports.

E. Operation and Maintenance Data: For electric heating cables to include in operation and maintenance manuals.
F. Warranty: Special warranty specified herein.

1.04 QUALITY ASSURANCE

A. Heat Trace Cables: UL Listed for use on Fire Protection System Piping.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by an Independent Testing Laboratory acceptable to Seattle Electrical Inspector marked for intended use.

1.05 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace electric heating cable that fails in materials or workmanship within specified warranty period.

1. Warranty Period: Ten years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 SELF-REGULATING, PARALLEL-RESISTANCE HEATING CABLES

A. Basis-of-Design Product: Subject to compliance with requirements, provide Thermon FLX Self Regulating Heating Cable and Thermon GPT-3 Freeze Protection Thermostat or a comparable product by one of the following:

1. Chromalox, Inc.; Wiegard Industrial Division; Emerson Electric Company.


3. Raychem; a division of Tyco Thermal Controls.

B. Heating Element: Pair of parallel No. 16 AWG, nickel-coated stranded copper bus wires embedded in crosslinked conductive polymer core, which varies heat output in response to temperature along its length. Terminate with waterproof, factory-assembled non-heating leads with connectors at one end, and seal the opposite end watertight. Cable shall be capable of crossing over itself once without overheating.

C. Electrical Insulating Jacket: Flame-retardant polyolefin.

D. Cable Cover: Tinned-copper braid, and polyolefin outer jacket with UV inhibitor.

E. Maximum Operating Temperature (Power On): 150 degrees F.

F. Maximum Exposure Temperature (Power Off): 185 degrees F.

G. Maximum Operating Temperature: 300 degrees F.

H. Capacities and Characteristics:


3. Number of Parallel Cables: 1

4. Volts: 277 V.
5. Phase: 1
6. Hertz: 60 Hz.
7. Maximum Circuit Length for 0 degrees F Start-up Temperature: 649 ft.

2.02 CONTROLS

A. Heater Trace Circuit Controller: Automatic electronic controller with input for remote temperature sensor input, internal ground fault protection, and monitoring functions for each heat trace circuit.

1. Control Range: 41 deg F to 77 degrees F adjustable, with 2 degrees F dead band.
2. Electrical Supply: 277 V, 1 phase, 60 hertz; 2-pole contact for 30 amps maximum load.
3. GFI Protection: 30, 60, 90, or 120 mA selectable with automatic reset.
4. Monitoring Functions: Power-on self-check, heater operation, GFI protection and ground leakage current tested every 24 hours, temperature sensor operation, and contactor operation.
5. Alarm Relay: Single-throw double-pole 1 amp class 2 contact.
6. Indicators: Lights mounted on enclosure for normal power, call for heat, ground fault occurrence, or a failure of the monitored functions.
7. Enclosure: NEMA 3R.

B. Remote temperature sensor: Resistance Temperature Detector (RTD) for directly sensing pipe-wall temperature at beginning and end of each heat trace circuit.

2.03 ACCESSORIES

A. Cable Installation Accessories: Pipe-mounted non-metallic heat trace power circuit connection box, Fiberglass tape, heat-conductive putty, cable ties, silicone end seals and splice kits, and installation clips all furnished by manufacturer, or as recommended in writing by manufacturer.

2.04 RTD EXTENSION WIRE

A. For extending RTD signal leads; Silver-plated copper wire with Teflon or PVC insulation and jacket; 2 or 3 conductors as required by Heat Trace Circuit Controller manufacturer.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine surfaces and substrates to receive electric heating cables for compliance with requirements for installation tolerances and other conditions affecting performance.

1. Ensure surfaces and pipes in contact with electric heating cables are free of burrs and sharp protrusions.
2. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Install electric heating cable across expansion joints according to manufacturer's written recommendations using slack cable to allow movement without damage to cable.

B. Install electric heating cables after piping has been tested and before insulation is installed.

C. Install electric heating cables according to IEEE 515.1.

D. Install insulation over piping with electric cables according to Section 21 07 00, Fire Suppression Systems Insulation.

E. Set field-adjustable switches and circuit-breaker trip ranges.

F. Protect installed heating cables, including non-heating leads, from damage.

3.03 CONNECTIONS

A. Ground equipment according to Section 26 05 26, Grounding and Bonding for Electrical Systems.

B. Connect wiring according to Section 26 05 25, Wire and Cable.

3.04 FIELD QUALITY CONTROL

A. Testing: Perform tests after cable installation but before application of coverings such as insulation, wall or ceiling construction, or concrete.

1. Test cables for electrical continuity and insulation integrity before energizing.

2. Test cables to verify rating and power input. Energize and measure voltage and current simultaneously.

B. Repeat tests for continuity, insulation resistance, and input power after applying thermal insulation on pipe-mounting cables.

C. Remove and replace malfunctioning units and retest as specified above.

END OF SECTION
CONTRACT SPECIFICATIONS

SECTION 21 07 00
FIRE SUPPRESSION SYSTEMS INSULATION

PART 1 - GENERAL

1.01 SUMMARY
A. This Section includes specifications for:
   1. Insulation Materials:
      a. Mineral fiber.
   2. Insulating cements.
   3. Adhesives.
   5. Lagging adhesives.
   7. Factory-applied jackets.
   8. Field-applied jackets.
  10. Securements.

1.02 REFERENCES
A. This Section incorporates by reference the latest revisions of the following documents.
   1. American Society for Testing and Materials International (ASTM)
      b. ASTM A240 Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications
      c. ASTM B209 Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
      f. ASTM C547 Standard Specification for Mineral Fiber Pipe Insulation
g. ASTM C795 Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel

h. ASTM C871 Standard Test Methods for Chemical Analysis of Thermal Insulation Materials for Leachable Chloride, Fluoride, Silicate, and Sodium Ions

i. ASTM C921 Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation

j. ASTM C1136 Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation

k. ASTM D1644 Standard Test Methods for Nonvolatile Content of Varnishes

l. ASTM E84 Standard Test Method for Surface Burning Characteristics of Building Materials

m. ASTM F1249 Standard Test Method for Water Vapor Transmission Rate Through Plastic Film and Sheeting Using a Modulated Infrared Sensor

2. Military Specifications

a. MIL-A-3316C, Adhesives, Fire-resistant, Thermal Insulation

b. MIL-C-19565C, Coating Compounds, Thermal Insulation, Fire- and Water-Resistant, Vapor Barrier

1.03 SUBMITTALS

A. Procedures: Section 01 33 00, Submittal Procedures.

B. Product Data: For each type of product indicated. Include thermal conductivity, thickness, and jackets (both factory and field applied, if any).

C. Shop Drawings:

1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.

2. Detail attachment and covering of heat tracing inside insulation.

3. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.

4. Detail removable insulation at piping specialties and equipment connections.

5. Detail application of field-applied jackets.

D. Qualification Data: For qualified Installer

E. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.

F. Field quality-control reports.
1.04 QUALITY ASSURANCE

A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.

B. Fire-Test-Response Characteristics: Insulation and related materials shall have fire-test-response characteristics indicated, as determined by testing identical products in accordance with ASTM E84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, and cement material containers, with appropriate markings of applicable Independent Testing Laboratory.

1. Insulation Installed In Tunnels: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.06 COORDINATION

A. Coordinate size and location of supports, hangers, and insulation shields.

B. Coordinate clearance requirements with piping Installer for piping insulation application and equipment Installer for equipment insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

C. Coordinate with the installation and testing of heat tracing system.

1.07 SCHEDULING

A. Schedule insulation application after pressure testing systems and, where required, after installing and testing of the heat tracing. Insulation application may begin on segments that have satisfactory test results.

PART 2 - PRODUCTS

2.01 INSULATION MATERIALS

A. Products shall not contain asbestos, lead, mercury, or mercury compounds.

B. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C871.

C. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C795.

D. Mineral-Fiber, Preformed Pipe Insulation:

1. Products: Subject to compliance with requirements, provide one of the following:
   a. Johns Manville; Micro-Lok.
   b. Knauf Insulation; 1000 (Pipe Insulation).
c. Owens Corning; Fiberglas Pipe Insulation.

2. Type I, 850 degrees F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C547, Type I, Grade A, with factory-applied all-service jacket (ASJ) and self-sealing lap (SSL). Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

2.02 INSULATING CEMENTS


1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
   a. Insulco, Division of MFS, Inc.; Triple I.

B. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C449/C449M.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
   a. Insulco, Division of MFS, Inc.; SmoothKote.
   c. Rock Wool Manufacturing Company; Delta One Shot.

2.03 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.

B. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

1. Products: Subject to compliance with requirements, provide one of the following:
   a. Childers Products, Division of ITW; CP-82.
   c. ITW TACC, Division of Illinois Tool Works; S-90/80.
   d. Marathon Industries, Inc.; 225.
   e. Mon-Eco Industries, Inc.; 22-25.

2.04 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-C-19565C, Type II.

B. Vapor-Barrier Mastic: Solvent based; suitable for outdoor use on below ambient services.

1. Products: Subject to compliance with requirements, provide one of the following:
2. Water-Vapor Permeance: ASTM F1249, 0.05 perm at 30-mil dry film thickness.

3. Service Temperature Range: Minus 50 to plus 220 degrees F.

4. Solids Content: ASTM D1644, 33 percent by volume and 46 percent by weight.


C. Breather Mastic: Water based; suitable for indoor and outdoor use on above ambient services.

1. Products: Subject to compliance with requirements, provide one of the following:
   
a. Childers Products, Division of ITW; CP-10.

   b. Foster Products Corporation, H. B. Fuller Company; 35-00.

   c. ITW TACC, Division of Illinois Tool Works; CB-05/15.


   e. Mon-Eco Industries, Inc.; 55-50.

   f. Vimasco Corporation; WC-1/WC-5.

2. Water-Vapor Permeance: ASTM F1249, 3 perms at 0.0625-inch dry film thickness.

3. Service Temperature Range: Minus 20 to plus 200 degrees F.

4. Solids Content: 63 percent by volume and 73 percent by weight.


2.05 LAGGING ADHESIVES

A. Description: Comply with MIL-A-3316C Class I, Grade A and shall be compatible with insulation materials, jackets, and substrates.

1. Products: Subject to compliance with requirements, provide one of the following:

   a. Childers Products, Division of ITW; CP-52.

   b. Foster Products Corporation, H. B. Fuller Company; 81-42.

   c. Marathon Industries, Inc.; 130.

   d. Mon-Eco Industries, Inc.; 11-30.

   e. Vimasco Corporation; 136.
2. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over equipment and pipe insulation.

3. Service Temperature Range: Minus 50 to plus 180 degrees F.


2.06 SEALANTS

A. FSK and Metal Jacket Flashing Sealants:

1. Products: Subject to compliance with requirements, provide one of the following:
   a. Childers Products, Division of ITW; CP-76-8.
   b. Foster Products Corporation, H. B. Fuller Company; 95-44.
   c. Marathon Industries, Inc.; 405.
   d. Mon-Eco Industries, Inc.; 44-05.
   e. Vimasco Corporation; 750.

2. Materials shall be compatible with insulation materials, jackets, and substrates.

3. Fire- and water-resistant, flexible, elastomeric sealant.

4. Service Temperature Range: Minus 40 to plus 250 degrees F.

5. Color: Aluminum.

B. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
   a. Childers Products, Division of ITW; CP-76.

2. Materials shall be compatible with insulation materials, jackets, and substrates.

3. Fire- and water-resistant, flexible, elastomeric sealant.

4. Service Temperature Range: Minus 40 to plus 250 degrees F.


2.07 FACTORY-APPLIED JACKETS

A. When factory-applied jackets are indicated, comply with the following:

1. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C1136, Type I.

2.08 FIELD-APPLIED JACKETS

A. Field-applied jackets shall comply with ASTM C921, Type I, unless otherwise indicated.

B. Metal Jacket:
1. **Products:** Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
   
   a. Pabco-Childers Metals, Division of ITW; Metal Jacketing Systems.
   
   b. RPR Products, Inc.; Insul-Mate.

2. **Aluminum Jacket:** Comply with ASTM B209, Alloy 3003, 3005, 3105 or 5005, Temper H-14.
   
   a. Sheet and roll stock ready for shop or field sizing.
   
   b. Smooth finish and minimum thickness of 0.020 inch.
   
   c. Moisture Barrier for Outdoor Applications: 3-mil-thick, polysurlyn heat laminated to the metal jacketing.
   
   d. Factory-Fabricated Fitting Covers:
      
      1) Same material, finish, and thickness as jacket.
      
      2) Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.
      
      3) Tee covers.
      
      4) Flange and union covers.
      
      5) End caps.
      
      6) Beveled collars.
      
      7) Valve covers.
      
      8) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

### 2.09 TAPES

**A. ASJ Tape:** White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C1136.

1. **Products:** Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
   
   a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0835.
   
   b. Compac Corp.; 104 and 105.
   
   c. Ideal Tape Co., Inc., an American Biltrite Company; 428 AWF ASJ.
   
   d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.

2. **Width:** 3 inches.

3. **Thickness:** 11.5 mils.

4. **Adhesion:** 90 ounces force/inch in width.
5. Elongation: 2 percent.

6. Tensile Strength: 40 lbf/inch in width.

7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

B. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
   a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0800.
   b. Compac Corp.; 120.
   c. Ideal Tape Co., Inc., an American Biltrite Company; 488 AWF.
   d. Venture Tape; 3520 CW.

2. Width: 2 inches.

3. Thickness: 3.7 mils.


5. Elongation: 5 percent.

6. Tensile Strength: 34 lbf/inch in width.

2.10 SECUREMENTS

A. Bands:

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
   a. Pabco-Childers Metals Corporation; Bands.
   b. RPR Products, Inc.; Bands.

2. Stainless Steel: ASTM A167 or ASTM A240/A240M, Type 304 or Type 316; 0.015 inch thick, 3/4 inch wide with wing seal.

3. Aluminum: ASTM B209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 3/4 inch wide with wing seal.

B. Staples: Outward-clinching insulation staples, nominal 3/4-inch wide, stainless steel or Monel.

C. Wire: 0.062-inch soft-annealed, stainless steel.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   b. Pabco-Childers Metals Corporation.
PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.

1. Verify that systems and equipment to be insulated have been tested and are free of defects.
2. Verify that surfaces to be insulated are clean and dry.
3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

B. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.

C. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.03 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment and piping including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of equipment and pipe system as specified herein or shown on the Contract Drawings.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

F. Keep insulation materials dry during application and finishing.

G. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

H. Install insulation with least number of joints practical.

I. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
1. Install insulation continuously through hangers and around anchor attachments.

2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.

3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.

4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

J. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

K. Install insulation with factory-applied jackets as follows:
   1. Draw jacket tight and smooth.
   2. Cover circumferential joints with 3-inch-wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
   3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches o.c.
   4. Cover joints and seams with tape as recommended by insulation material manufacturer to maintain vapor seal.
   5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.

L. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

M. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

N. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

3.04 PENETRATIONS

A. Insulation Installation at Tunnel Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.

3.05 MINERAL-FIBER INSULATION INSTALLATION

A. Insulation Installation on Straight Pipes and Tubes:
   1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and applicable insulation joint sealant.

3. For insulation with factory-applied jackets on above ambient surfaces, secure laps with outward clinched staples at 6 inches o.c.

4. For insulation with factory-applied jackets on below ambient surfaces, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.

2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.

3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.

4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available.

2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of same material as straight segments of pipe insulation when available.

2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.

3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.

4. Install insulation to flanges as specified for flange insulation application.

3.06 FIELD-APPLIED JACKET INSTALLATION

A. Install metal jackets with a 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.

3.07 FIELD QUALITY CONTROL

A. Testing Agency: Engage an Independent Testing Laboratory to perform tests and inspections.
B. Perform tests and inspections.

C. Tests and Inspections:

1. Inspect pipe, fittings, strainers, and valves, randomly selected by Resident Engineer, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to three locations of straight pipe, three locations of coupled fittings, two locations of flanges and one valve location.

D. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

END OF SECTION
SECTION 21 10 00
WATER-BASED FIRE-SUPPRESSION SYSTEMS

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes the following fire-suppression systems in or connected to the Station.
   1. Automatic wet-type, Class 1 standpipe system for the stairwells
   2. Completion of the Automatic wet-type Class 1 standpipe system for the connecting tunnels.
   3. Wet-pipe sprinkler systems
   4. Dry pipe sprinkler systems
   5. Pre-action sprinkler systems.

B. This section includes engineering requirements for hydraulic calculations and fire-suppression systems supports.

C. Related Sections: The work of the following Sections is related to the work of this Section. Other Sections, not referenced below, may also be related to the proper performance of this work.
   1. Section 09 90 00, Painting and Coating
   2. Section 10 44 00, Fire Protection Specialties.
   3. Section 21 05 00, Common Work Results for Fire Suppression.
   4. Section 22 11 16, Domestic Water Piping.
   5. Section 22 11 19, Domestic Water Piping Specialties.
   6. Section 22 14 13, Facility Storm Drainage Piping.
   7. Section 26 05 25, Wire and Cable.
   8. Section 26 05 26, Grounding and Bonding for Electrical Systems.
   9. Section 28 31 00, Fire Detection and Alarm.

1.02 REFERENCES

A. This Section incorporates by reference the latest revisions of the following documents.
   1. American National Standards Institute (ANSI)
      a. B16.3 Malleable Iron Threaded Fittings
b. B16.5 Pipe Flanges and Flanged Fittings

c. B16.21 Nonmetallic Flat Gaskets for Pipe Flanges

d. B31.1 Power Piping

2. American Society of Mechanical Engineers International (ASME)
   a. Boiler and Pressure Vessel Code (BPVC), Section IX, Welding and Brazing Qualifications

3. American Society for Testing and Materials International (ASTM)
   a. ASTM A53 Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
   b. ASTM A105 Standard Specification for Carbon Steel Forgings for Piping Applications
   c. ASTM A106 Standard Specification for Seamless Carbon Steel Pipe for High-Temperature Service
   d. ASTM A123 Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
   e. ASTM A183 Standard Specification for Carbon Steel Track Bolts and Nuts
   f. ASTM A307 Standard Specification for Carbon Steel Bolts and Studs, 60000 PSI Tensile Strength
   g. ASTM A536 Standard Specification for Ductile Iron Castings
   h. ASTM A563 Standard Specification for Carbons and Alloy Steel Nuts
   i. ASTM A780 Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings
   j. ASTM B16 Standard Specification for Free-Cutting Brass Rod, Bar and Shapes for Use in Screw Machines
   k. ASTM B633 Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel

4. City of Seattle (COS):
   a. Seattle Fire Code (International Fire Code with Seattle Amendments and all applicable Administrative Rules)

5. Manufacturers Standardization Society for the Valve and Fittings Industry
   a. MSS SP-58 Pipe Hangers and Supports – Materials, Design and Manufacture
   b. MSS SP-69 Pipe Hangers and Supports – Selection and Applications
   c. MSS SP-89 Pipe Hangers and Supports – Fabrications and Installation Practices
6. National Fire Protection Association (NFPA)
   a. NFPA 13 Standard for Installation of Sprinkler Systems
   b. NFPA 14 Installation of Standpipe and Hose Systems
   c. NFPA 25 Inspection Testing & Maintenance of Water based Fire Protection Systems
   d. NFPA 130 Standard for Fixed Guideway Transit and Passenger Rail

1.03 SYSTEM DESCRIPTIONS

A. Combined Standpipe and Sprinkler System: Fire-suppression system with both standpipe and sprinkler systems. Sprinkler system is supplied from standpipe system.

B. Automatic Wet-Type, Class 1 Standpipe System: Having Seattle Fire Department compatible 2-1/2 inch hose connections on the supply valves provided for use by the fire department only

C. Sprinkler System: Descriptions of the various types of sprinkler systems listed herein are as defined in NFPA 13.

1.04 PERFORMANCE REQUIREMENTS

A. Fire-suppression standpipe system design shall provide for the following:
   1. Minimum Residual Pressure at Each Hose-Connection Outlet: 100 psig.
   2. Unless Otherwise Indicated, the Following Is maximum acceptable Residual Pressure at nominal flow through each Hose-Connection Outlet: 175 psig.

B. Fire-suppression sprinkler system design shall provide for the following:
   1. Margin of Safety for available pressure at design water flow conditions: A 10 psi reserve "cushion between the available water supply pressure and hydraulically calculated pressure at system design demand, is required.
   2. Sprinkler Occupancy Hazard Classifications: Indicated on the Contract Drawings in matrix form for each type of sprinkler system. Any areas not specifically identified on the Contract Drawings shall comply with the following:
      a. Building Service Areas: Ordinary Hazard, Group 1.
      b. Electrical Equipment Rooms: Ordinary Hazard, Group 1.
      c. General Storage Areas: Ordinary Hazard, Group 1.
      d. Mechanical Equipment Rooms: Ordinary Hazard, Group 1.
      e. Platform Areas: Ordinary Hazard Group 2
      f. Public Areas: Ordinary Hazard Group 1

3. Minimum Density for Automatic-Sprinkler Piping Design: As Indicated on the Contract Drawings in matrix form for each type of sprinkler system. Any areas not specifically identified on the drawings shall comply with the following:
a. Ordinary-Hazard, Group 1 Occupancy: 0.15 gpm/sq.ft. over the most remote 1500 sq. ft.

b. Ordinary-Hazard, Group 2 Occupancy: 0.20 gpm/sq. ft. over the most remote 1500 sq. ft.

c. Extra Hazard Group 1 Occupancy: 0.30 gpm/sq.ft over the most remote 2500 sq. ft.

d. For dry pipe and double interlock preaction systems, the area of sprinkler operation shall be increased by 30 percent without revising the density.

4. Maximum Protection Area per Sprinkler:

a. Office Spaces: 120 sq. ft.

b. Storage Areas: 130 sq. ft.

c. Mechanical Equipment Rooms: 130 sq. ft.

d. Electrical Equipment Rooms: 130 sq. ft.

e. Other Areas: According to NFPA 13 recommendations, unless otherwise indicated.

5. Total Combined Hose-Stream Demand Requirement: According to NFPA 13, unless otherwise indicated:

a. Ordinary-Hazard Occupancies: 250 gpm for 60 to 90 minutes.

C. Seismic Performance: Fire-suppression piping and support system shall be capable of withstanding the effects of earthquake motions determined according to NFPA 13 and ASCE 7, "Minimum Design Loads for Buildings and Other Structures": Section 9, "Earthquake Loads."

D. Pressure Transient Loading: Fire-suppression piping and support systems at the platform level shall be capable of withstanding a transient pressure load of 0.10 pounds per square inch.

1.05 PROJECT COORDINATION

A. See Section 01 31 13, Project Coordination and Section 21 05 00, Common Work Results for Fire Suppression, for requirements.

1.06 SUBMITTALS

A. Procedures: Section 01 33 00, Submittal Procedures.

B. All product data, shop drawings, and calculations required by this section shall be approved by the Seattle Fire Department.

C. Product Data: For each type of equipment/product, pipe, valve, pipe hanger, anchorage device and support system component.

D. Certified Test Reports: Submit certified test reports on the Contractor's Material and Test Certificate for Aboveground Piping as shown in NFPA 13
E. Hydraulic Calculations: Submit hydraulic calculations for review prior to fabrication of all of the systems, signed and sealed by the qualified professional fire protection engineer registered in the State of Washington.

1. Complete hydraulic agent flow calculations from a UL listed computer calculation program. Calculation sheets must include the software licenses name and the UL listing number for verification.

2. Hydraulic calculations shall include information from Hydrant flow test data acceptable to the Seattle Fire Department.

3. Arrange with Seattle Public Utilities for hydrant flow test to be witnessed by Sound Transit and the Seattle Fire Department and submit complete Fire Hydrant flow test report.

F. Shop Drawings, and Manufacturers' product data including piping, fittings, valves, couplings, fire department connections, piping supports, maintenance data, and recommended spare parts. Show complete system in shop drawings, including construction phasing.

1. Include design calculations for pipe supports and indicate size and characteristics of component and fabrication details.

G. Pipeline layout drawings together with standard details.

1. Field installation layout drawings drawn to no less than 1/8”=1'-0” scale, prepared in accordance with NFPA 13 showing all sprinkler systems in plan view and including all accessories such as alarm valves, flow switches, drain valves and test connections.

H. Fire-Suppression Systems Support and Seismic Design Submittal: For pipe supports and seismic-restraint details to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional structural engineer registered in the State of Washington responsible for their preparation.

1. Design Calculations: Calculate the seismic forces acting on the standpipe system(s) installed in this Contract and the sprinkler systems in the platform and station.

2. Design Analysis: The pipe supports are not detailed on the Contract Drawings. Submit detailed calculations for the design of the supports including seismic bracing.

3. Seismic-Restraint and Support Details: Indicate fabrication and arrangement. Detail attachments of restraints to the restrained items and to the structure. Show attachment locations, methods, and spacing. Identify components, list their strengths, and indicate directions and values of forces transmitted to the structure during seismic events.

   a. Pre-approval and Evaluation Documentation: For seismic restraints devices selected. Documentation shall be prepared by an agency acceptable to Seattle Department of Planning and Development, showing maximum ratings of restraint items and the basis for approval (tests or calculations).

I. Operation and Maintenance Manuals: Section 01 78 23, Operation and Maintenance Data. In addition to these requirements include manufacturer's installation and
maintenance data for all fire suppression equipment/products furnished under this specification.

J. Welding Certificates.

K. Welding report interpreting weld radiographs to the Resident Engineer without recommendations.

1.07 QUALITY ASSURANCE

A. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
   1. Comply with provisions in ASME B31.1 "Power Piping Code"
   2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

B. Employ shop and field welders and/or welding operators and welding procedures qualified in accordance with the requirements of Section IX of the ASME Boiler and Pressure Vessel Code.

C. Employ a licensed fire protection installer to install and test the standpipe and sprinkler systems.

D. Engineering Responsibility: Preparation of working plans, calculations, and field test reports by a fire protection engineer registered in the State of Washington

E. Seismic Design Engineering Responsibility: Preparation of working plans and calculations by a structural engineer registered in the State of Washington

F. Verify materials are clearly marked with the manufacturer's name, nameplate data or stamp, rating, and ASTM conformance number, as applicable.
   1. Use only fire protection system components and equipment that is Underwriters Laboratories (UL) Listed and labeled and Factory Mutual (FM) approved for use in fire protection systems. All piping materials shall as a minimum conform to the requirements of NFPA 13.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. If acceptable manufacturers are not listed in this section, refer to the Articles describing each specific product type.

B. If it complies with these Contract Specifications and is UL listed and FM approved, for at least a 175 psig working pressure, except when higher pressure ratings are specified for the different piping components under their individual descriptions, one of the following pipe fitting manufacturers will be acceptable:
   1. Screwed piping fittings, Class 150, ANSI B16.3 screwed malleable iron Class 125, ANSI B16.4 cast iron, or Class 150 ductile iron:
      a. Grinnell
      b. Star Products, Inc.
c. Ward

2. Welding fittings ANSI B16.9 made of ASTM 234 Grade WPA or WPB steel with wall thickness identical to pipe in which installed:
   a. Babcock & Wilcox
   b. Grinnell
   c. Ladish
   d. Taylor Forge
   e. Tube-Line
   f. Tube-Turn
   g. Weld Bend

3. Flanges, Class 150, ANSI B16.5, raised face, forged steel, screwed or welding neck type where specified and/or required:
   a. Grinnell
   b. Ladish
   c. National Flange
   d. Taylor Forge
   e. Weld Bend

C. Weld fittings shall be UL listed and FM approved, factory made and shall be full line size. If it complies with these Contract Specifications, one of the following weld fitting manufacturers will be acceptable:

1. Branch pipes more than one size smaller than the diameter of the main pipe:
   a. Bonney Forge "Weldolet" or "Threadolet" ANSI B16.9
   b. Grinnell Forged Steel Weldolet or Threadolet ANSI B16.9
   c. "Weldolet", "Threadolet" and Merit fittings and shaped nipples shall have a wall thickness as required by the ANSI B31.1.0 and ANSI 36.10 Code and shall be suitable for the working pressure and temperature of the pipe to which they connect.

2. For branch sizes 3 inches and smaller shaped nipple welding fittings with factory beveled ends:
   a. Allied Type T-1 and T-2
   b. Grinnell
   c. Tube Forgings
   d. Tube-Turn
   e. Wheeling
f. Do not make any branches by burning a hole in the main and welding in the branch line.

D. If it complies with these Contract Specifications and is UL listed and FM approved, one of the following pipe hanger and support manufacturers will be acceptable:

1. B-Line
2. Grinnell
3. Hilti
4. Michigan Hanger
5. PHD
6. Tolco

E. At the Contractor’s option, grooved style couplings and fittings may be used in lieu of welded or screwed joints specified hereinbefore as follows:

1. For Sprinkler Loop and Branch Piping: Use Victaulic Style 005 or Grinnell 7400 UL listed, painted ductile iron couplings for roll groove on Schedule 10 and higher steel pipe. Pipe couplings to 8 inches in size shall be listed for a minimum of 300 psig working pressure.

2. For the Sprinkler Main Piping and the Stairwell Standpipe system: Use Victaulic Style 07 “Zero Flex”, or Gruvlok 7401 couplings with roll groove on Schedule 10 pipe or rolled or cut grooves on Schedule 40 pipe. Couplings to 8 inches size shall be listed for a minimum 450 psig working pressure.

3. For the Tunnel Standpipe System: Use only Victaulic Style 07 or Gruvlok 7401 couplings with roll or cut grooves on schedule 40 pipe. Victaulic Style 77 flexible couplings are acceptable only where added flexibility is necessary. Use with hot dip galvanized pipe where exposed in the unconditioned platform areas.

4. Fittings for the Standpipe & Sprinkler systems: UL listed, FM approved painted ductile iron Victaulic or Gruvlok standard grooved fittings or Victaulic “Firelock” fittings compatible for use with the specified coupling and of pressure rating at least equal to that of the connected grooved coupling. Victaulic Style 920 mechanical tees are acceptable for use on Schedule 40 sprinkler branch piping. Fittings for use on the galvanized tunnel standpipe system are to be furnished hot dip galvanized from the factory.

5. Additional Requirements: Grooved fitting manufacturer shall be ISO 9001 approved.

a. Pipe grooves shall be made by a tool manufactured by the grooved coupling/fitting company. The manufacturer shall provide a certified letter with the Shop Drawing stating that the roll or cut grooving machine and fittings will provide a system complying with the pressure class and piping materials herein specified. Manufacturers groove depth control tool shall be used for field and shop grooving of piping. Manufacturer’s hole cutting tool shall be used in lieu of burning a hole in the piping. Gaskets shall be UL listed for the service and working pressure of the systems. Adapter flanges, reducing couplings and outlet couplings shall not be allowed. Couplings and fittings installed throughout the project
shall be the product of one manufacturer. Roll grooving shall not be acceptable for galvanized dry pipe systems.

F. If it complies with these Contract Specifications and is UL listed and FM approved, one of the following flange gasket manufacturers will be acceptable:
   1. Crane
   2. Dallas Gasket
   3. Garlock

G. If it complies with these Contract Specifications and is UL listed and FM approved, check valves manufactured by one of the following manufacturers will be acceptable:
   1. Crane
   2. Grinnell
   3. Kennedy
   4. Mueller
   5. Nibco
   6. Victaulic
   7. Viking

H. If it complies with these Contract Specifications and is UL listed and FM approved, gate valves manufactured by one of the following manufacturers will be acceptable:
   1. Mueller
   2. Crane
   3. Croker
   4. Fairbanks
   5. Grinnell
   6. Jenkins
   7. Kennedy
   8. Milwaukee
   9. Nibco
   10. Viking
   11. Walworth

I. If it complies with these Contract Specifications and is UL listed and FM approved, butterfly valves manufactured by one of the following manufacturers will be acceptable:
   1. Grinnell
2. Jenkins
3. Milwaukee
4. Nibco
5. Victaulic

J. If it complies with these Contract Specifications and is UL listed and FM approved, floor control valves manufactured by one of the following manufacturers will be acceptable:
   1. Croker
   2. Elkhart “Pressure-Matic”
   3. Guardian
   4. Potter-Roemer
   5. Standard "Pressuretrol"
   6. Zurn

K. If it complies with these Contract Specifications, specialty valves such as alarm check valves, deluge, dry pipe valves and double interlocked preaction sprinkler systems (or single interlocked preaction sprinkler system) manufactured by one of the following manufacturers will be acceptable:
   1. Tyco
   2. Victaulic
   3. Grinnell
   4. Notifier
   5. Reliable Sprinkler Company
   6. Viking Corp

2.02 STEEL PIPE & FITTINGS

A. Piping 4 inches and smaller shall be ASTM A 53, ASTM A 135 or ASTM A 795 black steel for all wet pipe systems as specified herein. Dry pipe and pre action systems shall be galvanized. Pipe shall be manufactured in the United States.

B. Piping 6 inches and larger shall be ASTM A 53, Grade B, ASTM A 135 or ASTM A 795 black steel Type “S” (seamless), Type “F” (furnace-butt welded) or Type “E” (electric resistance welded). Electric resistance welded pipe shall be fully normalized at the seams after welding. Pipe shall be manufactured in the United States.

C. Pipe wall thickness shall be in accordance with ANSI B36.10, current edition and shall be as follows:
   1. For the standpipe systems:
      a. Schedule 40, hot-dip galvanized for the tunnel standpipe system
      b. Schedule 10 or Schedule 40, black steel painted for the stairwell system
2. For 175 psig wet loop and branch pipe of the sprinkler systems:
   a. 1 inch through 2 inches: Schedule 40
   b. 2-1/2 through 6 inches: Schedule 10 or Schedule 40

3. For the 175 psig wet feed mains to the sprinkler systems:
   a. 2-1/2 through 6 inches: Schedule 10 or Schedule 40

4. For 175 psig on all dry pipe systems including pre-action systems:
   a. Schedule 40
   b. Piping shall be galvanized in accordance with ASTM A123

D. Fire protection systems utilizing Schedule 40 pipe to be of threaded below 2 inches in size, and of butt welded or cut or roll groove construction above 2 inches in size. Do not use roll groove construction on dry pipe systems. Shop welds on sub assemblies of pipe to be hot dip galvanized after fabrication.

E. Flanges are required for servicing and/or removal of equipment for repair in butt welded systems. Schedule 10 pipe to be joined by roll grooved fittings only.

F. At each joint the flanges to have matching flat faces or raised faces, and the flanges shall be identified in configuration and pressure rating. Steel flanges shall have a medium tool finish and shall have either flat or raised faces. When 150 lb. steel flanges are connected to 125 lb. cast iron or 300 lb. ductile iron flanges valves or fittings, the steel flanges shall be flat face medium finish. Grooved flange adapters shall be Victaulic 741 or Gruvlok Fig. 7012 using flange washers to join to the rubber faced serrated flanged components or raised faced flanges. Serrated flanges or raised face flanges shall use a full face red rubber gasket between the grooved flange washer and the flange to provide an acceptable sealing surface.

G. Screw joints to be made up with approved pipe joint compound. Screw threads are to be in accordance with American Pipe Thread Standards.

H. Flange gasket material to be as specified herein and must also be suitable for the service and pressure class intended.
   1. Gaskets to be 1/16 inch thick for all pipe sizes 10 inch and smaller; and 1/8 inch thick for all pipe sizes 12 inch and larger. Gaskets shall be ring type between raised face flanges and full face type between flat face flanges with punched bolt holes and pipe opening.
   2. Gaskets to be compressed non-asbestos with a nonstick clean surface and factory applied parting agent applied to both sides of the gasket.
   3. Gaskets to contain no asbestos.

I. Flange bolting materials for flanges in service at 399 degrees F or below to be carbon steel ASTM A 307 Grade B hexagon head bolts and nuts. Cap screws utilized with flanged butterfly valves shall be ASTM A 307 Grade B cap screws with hexagon heads. Flange bolt thread lubricant shall be an antiseize compound. Thread lubricant designed for temperatures up to 1000 degrees F, shall be Crane Antiseize Thread Compound or approved equal. Where the configuration or arrangement of flanges prevent the installation of machine bolts, stud bolts are an acceptable alternate.
2.03 DUCTILE-IRON PIPE AND FITTINGS

A. Limit use restrained mechanical joint ductile iron pipe or mechanical joint sleeve to extending the 8-inch and 10-inch underground water supplies from just outside the building to a few feet inside the building. Use grooved end ductile iron pipe to extend the pipe aboveground to the backflow preventer in the South Fire Services Room inside the building.

B. Mechanical-Joint, Ductile-Iron Pipe: AWWA C151 cement lined, Class 53 with mechanical-joint bell end and plain end.
   1. Mechanical-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern.
   2. Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray-iron restraining glands, rubber gasket, and stainless steel bolts and nuts.

C. Grooved-End, Ductile-Iron Pipe: AWWA C151 cement lined Class 53, with factory- or field-formed, radius-cut-grooved ends according to AWWA C606.
   1. Grooved-Joint Piping Systems:
      a. Manufacturers:
         1) Victaulic Co. of America.
         2) Gruvlok from Anvil International Inc.
      b. Grooved-End Fittings: ASTM A 536, ductile-iron casting with OD matching AWWA ductile-iron-pipe OD.
      c. Grooved-End-Pipe Couplings: AWWA C606, gasketed fitting matching ductile-iron-pipe OD. Include ductile-iron housing with keys matching ductile-iron-pipe and fitting grooves, prelubricated rubber gasket with center leg, and steel bolts and nuts. Coupling shall be rated for 350 psig minimum working pressure.
      d. Grooved-End Transition Coupling: UL and FM approved ductile iron coupling for connecting grooved end IPS steel pipe, valves or fittings to grooved end AWWA ductile iron pipe. Furnish complete with flush seal gasket. Coupling shall be rated for 350 psig minimum working pressure.
      e. Grooved-End Transition Flange Adapter: UL 213, gasketed fitting with key for ductile-iron-pipe dimensions designed for direct connection of flanged components into a radius grooved AWWA ductile iron piping system. Include flange-type, ductile-iron housing with rubber gasket listed for use with housing and complete with steel bolts and nuts.

2.04 SPRINKLER SPECIALTY FITTINGS

A. Sprinkler specialty fittings shall be UL listed or FM approved, with 175-psig minimum working-pressure rating, and made of materials compatible with piping.

B. Sprinkler Drain and Alarm Test Fittings: Cast- or ductile-iron body; with threaded or locking-lug inlet and outlet, test valve, and orifice and sight glass.
   1. Manufacturers:
C. Sprinkler Branch-Line Test Fittings: Brass body with threaded inlet, capped drain outlet, and threaded outlet for sprinkler.

1. Manufacturers:
   b. Fire-End and Croker Corp.
   c. Potter-Roemer; Fire-Protection Div.

D. Sprinkler Inspector's Test Fitting: Cast- or ductile-iron housing with threaded inlet and drain outlet and sight glass.

1. Manufacturers:
   a. AGF Manufacturing Co.
   b. Central Sprinkler Corp.
   c. G/J Innovations, Inc.
   d. Triple R Specialty of Ajax, Inc.

E. Drop-Nipple Fittings: UL 1474, adjustable with threaded inlet and outlet, and seals.

1. Manufacturers:
   a. CECA, LLC.
   b. Merit.

2.05 LISTED FIRE-PROTECTION VALVES

A. Valves shall be UL listed or FM approved, with minimum pressure rating as specified below. If pressure rating is not specified minimum acceptable rating is 175 psig

B. Ball Valves 2-inch NPS and smaller: Provide ball valves for drain service and where show on the Contrace Drawings of size as indicated. Where low point drains are not indicated, provide a minimum size drain and ball valve as required by NFPA 13 and 14 respectively for the Sprinkler and Standpipe systems


   b. Ball valve: UL Listed and FM approved and rated for 600 psi water-oil-gas (WOG)
1) Where used for other than drain service provide Indicating Type Ball Valves: UL 1091, with integral indicating device and ends matching connecting piping. Indicator: Provide with pre-wired, single-circuit, supervisory switch suitable for installation in a 115 V-AC electrical system.

c. Manufacturers:
1) Global Safety Products, Inc.
2) Milwaukee Valve Company.
3) Watts Regulator

C. Butterfly Valves 2-1/2-inch NPS and larger: Lug type with grooved ends. Designed for fire protection service with grooved ends, polyphenylene sulfide blend coated ductile iron body. Disc shall be ductile iron conforming to ASTM A536 with electrolysis nickel coating conforming to ASTM B-733. Furnish with nitrile (Grade T) seat conforming to ASTM D2000. Use only valves UL Listed for minimum 300 psi service in fire protection systems. Furnish valve with gear operated actuator and hand wheel. Actuator shall have bronze traveling nut on a steel lead screw contained in a ductile iron housing. Valve shall have a black alkyd enamel coating. Furnish complete with two single-pole double-throw (SPDT) supervisory switches factory wired to junction box.UL 1091.

a. Manufacturers:
1) McWane, Inc.; Kennedy Valve Div.
2) Mueller Company.
3) NIBCO.
4) Pratt, Henry Company.
5) Victaulic Co. of America.

D. Check Valves NPS 2 and Larger: UL 312, swing type, cast-iron body with flanged or grooved ends.

1. Manufacturers: As listed in Article 2.01, herein

E. Gate Valves: UL 262, OS&Y type.

1. NPS 2 and Smaller: Gate valves up to and including 2 inch size Kennedy Figure 66, 175 psig cold water, UL listed, bronze body, bronze trim, single disc, outside screw and yoke, screwed bonnet valves with seats of bronze, screwed ends.

a. Other Acceptable Manufacturers:
1) Crane Co.; Crane Valve Group; Crane Valves.
2) Hammond Valve.
3) NIBCO.

2. NPS 2-1/2 and Larger: Gate valves 2-1/2-inch through 10-inch, Kennedy Figure 4068, 175 psig cold water, UL listed and approved iron body, outside screw and
yoke bolted bonnet valves with double or single disc, Class 125 ANSI B16.1 flanged ends, bronze trim, bronze seats.

a. Other Acceptable Manufacturers: As listed in Article 2.01, herein.

2.06 SPECIALTY VALVES

A. Dry Pipe System:

   1. Dry Pipe Valves:

      a. Dry pipe and pre action valves shall be equal to Victaulic NXT with low pressure regulator (or approved equal) to reduce water delivery time.

      b. Provide where indicated a dry pipe valve equipped to give a signal upon operation, complete with standard trimmings, including water and air pressure gauges, test by-pass and necessary piping, fittings and accessories required for a complete installation. All dry piping to be Schedule 40 galvanized pipe. Do not use roll groove fittings on dry pipe systems.

      c. Arrange all dry pipe systems so that they can be fully drained.

      d. Provide pressure alarm switch. Electric connection to the Fire Alarm Panel will be by Division 26, Electrical.

      e. Provide a low air pressure trouble switch. Field electric connection will be by Section 28 31 00, Fire Detection and Alarm. Switch will alarm at the Fire Alarm Panel. Coordinate switch requirements with the work provided in 28 31 00.

   2. Dry Pipe Compressors: Dry pipe system air compressors shall be furnished. Compressors shall be sized to fill the piping system to the required pressure in 30 minutes. Each compressor shall be automatically controlled by a factory mounted pressure switch. In addition, provide a separate low pressure switch with set point lower than the operating switch to provide a trouble signal to the Fire Alarm Panel. Coordinate switch requirements with the work provided in Section 28 31 00, Fire Detection and Alarm. Compressor electrical requirements shall be suitable for the voltage provided. The Contractor shall provide the following data with his bid proposal:

      a. Location of each dry pipe air compressor.

      b. Motor horsepower and voltage requirements for each air compressor.

B. Alarm Check Valves: UL 193, designed for horizontal or vertical installation, with bronze grooved seat with O-ring seals, single-hinge pin, and latch design. Include trim sets for bypass, drain, electrical sprinkler alarm switch, pressure gages, retarding chamber, and fill-line attachment with strainer.

   a. Drip Cup Assembly: Pipe drain without valves and separate from main drain piping.

   b. Drip Cup Assembly: Pipe drain with check valve to main drain piping.

C. Automatic Drain Valves: UL 1726, NPS 3/4, ball-check device, straight or angle pattern with threaded ends. Valve is used to drain low point of system between fire department connection and swing check valve. Seals automatically under pressure
1. Manufacturers:
   a. AFAC Inc.
   b. Grinnell Fire Protection.
   c. Potter Roemer

2.07 SPRINKLERS

A. Sprinklers shall be UL listed or FMG approved, with 175-psig minimum pressure rating.

B. Manufacturers:
   1. AFAC Inc.
   2. Central Sprinkler Corp.
   3. Firematic Sprinkler Devices, Inc.
   5. Grinnell Fire Protection.
   6. Reliable Automatic Sprinkler Co., Inc.
   7. Star Sprinkler Inc.
   9. Victaulic Co. of America.
   10. Viking Corp.

C. Automatic Sprinklers: With heat-responsive element complying with the following:
   1. UL 199, for nonresidential applications.
   2. UL 1767, for early-suppression, fast-response applications.

D. Sprinkler Types and Categories: Nominal 1/2-inch orifice for "Ordinary" temperature classification rating, unless otherwise indicated or required by application.

E. Sprinkler types, features, and options as follows:
   1. Concealed ceiling sprinklers, including cover plate.
   2. Flush ceiling sprinklers, including escutcheon.
   3. Pendent sprinklers.
   4. Quick-response sprinklers.
   5. Recessed sprinklers, including escutcheon.
   7. Upright sprinklers.
F. Sprinkler Finishes: Chrome plated, bronze, and painted.

G. Special Coatings: Wax, lead, and corrosion-resistant paint.

H. Sprinkler Escutcheons: Materials, types, and finishes for the following sprinkler mounting applications. Escutcheons for concealed, flush, and recessed-type sprinklers are specified with sprinklers.
   1. Ceiling Mounting: Chrome-plated steel, one piece, flat.
   2. Sidewall Mounting: Chrome-plated steel, one piece, flat.

I. Sprinkler Guards: Wire-cage type, including fastening device for attaching to sprinkler.

2.08 FIRE HOSE OUTLET VALVES
A. These valves are for use by the Fire Department and are installed on the standpipe system(s).
   1. 2-1/2 inch angle type cast brass; with a rough chrome plated finish, and valve rated to 300 psi. Furnish with red hand wheel, female National Pipe Taper (NPT) inlet and the Seattle Fire Department compatible male hose thread outlet.
      a. Verify that valve is UL Listed and FM approved and furnish complete with brass cap and chain. Use fire hose valves of Elkhart Brass Model No. U-25-25 or approved equal by Kidde Fire Fighting or the Waterous Company.

2.09 FIRE DEPARTMENT CONNECTIONS
A. Manufacturers:
   1. AFAC Inc.
   2. Central Sprinkler Corp.
   4. Fire-End and Croker Corp.
   5. Fire Protection Products, Inc.
   8. Potter-Roemer; Fire-Protection Div.
   9. Reliable Automatic Sprinkler Co., Inc.
   10. United Brass Works, Inc.

B. Wall-Type, Fire Department Connection: UL 405, 175-psig minimum pressure rating; with corrosion-resistant-metal body with brass chrome plated inlets, brass wall chrome plated escutcheon plate, brass chrome lugged caps with gaskets and brass chains, and brass lugged swivel connections. Include inlets with threads according to NFPA 1963 and matching the Seattle Fire Department threads, outlet with pipe threads, extension pipe nipples for each inlet, check devices or clappers for inlets, and escutcheon plate with...
raised letters at least 1-inch in size with marking similar to "CH STATION AUTO SPKR & STANDPIPE." for two of four flush FDCs and "SOUTH TUNNEL STANDPIPE" and "NORTH TUNNEL STANDPIPE" respectively for the other two.

1. Type: Flush, with four inlets and square or rectangular escutcheon plate and with 6 inch outlet connection orientation as shown on the Contract Drawings


2.10 ALARM DEVICES

A. Alarm-device types shall match piping and equipment connections.

B. Water-Motor-Operated Alarm: UL 753, mechanical-operation type with pelton-wheel operator with shaft length, bearings, and sleeve to suit wall construction and 10-inch-diameter, cast-aluminum alarm gong with red-enamel factory finish. Include NPS 3/4 inlet and NPS 1 drain connections.

1. Manufacturers:
   a. AFAC Inc.
   b. Central Sprinkler Corp.
   c. Firematic Sprinkler Devices, Inc.
   d. Globe Fire Sprinkler Corporation.
   e. Grinnell Fire Protection.
   f. Reliable Automatic Sprinkler Co., Inc.
   g. Star Sprinkler Inc.
   h. Viking Corp.

C. Water-Flow Indicator: UL 346, electrical-supervision, paddle-operated-type, water-flow detector with 250-psig pressure rating and designed for horizontal or vertical installation. Include two single-pole, double-throw circuit switches for isolated alarm and auxiliary contacts, 7 A, 125-V ac and 0.25 A, 24-V dc; complete with factory-set, field-adjustable retard element to prevent false signals and tamperproof cover that sends signal if removed.

1. Manufacturers:
   a. ADT Security Services, Inc.
   b. Grinnell Fire Protection.
   c. ITT McDonnell & Miller
   d. Potter Electric Signal Company.
   e. System Sensor.
   f. Viking Corp.
   g. Watts Industries, Inc.; Water Products Div.
D. Valve Supervisory Switch: UL 753, electrical, single-pole, double-throw switch with normally closed contacts. Include design that signals controlled valve is in other than fully open position.

1. Manufacturers:
   a. McWane, Inc.; Kennedy Valve Div.
   b. Potter Electric Signal Company.
   c. System Sensor.

2.11 PRESSURE GAGES
A. Manufacturers:
   1. AGF Manufacturing Co.
   2. AMETEK, Inc.; U.S. Gauge.
   5. Marsh Bellofram.
   6. WIKA Instrument Corporation.
B. Description: UL 393, 3-1/2- to 4-1/2-inch diameter, dial pressure gage with range of 0 to 250 psig minimum.
   1. Water System Piping: Include caption "WATER" or "AIR/WATER" on dial face.
   2. Air System Piping: Include retard feature and caption "AIR" or "AIR/WATER" on dial face.

PART 3 - EXECUTION

3.01 PIPING APPLICATIONS, GENERAL
A. Flanges, flanged fittings, unions, nipples, and transition and special fittings with finish and pressure ratings same as or higher than the specified products pressure rating may be used in aboveground applications shown on the Contract Drawings, subject to approval by the Resident Engineer.
B. Piping between Fire Department Connections and Check Valves: Galvanized, Schedule 40 steel pipe with grooved ends; grooved-end fittings; grooved-end-pipe couplings; and grooved joints.
C. Underground Service-Entrance Piping: Ductile-iron, mechanical-joint pipe and fittings and restrained joints.
D. Underground Service-Entrance Piping: Ductile-iron, grooved-end pipe and fittings; grooved-end-pipe couplings; and grooved joints.
3.02 STANDPIPE SYSTEM PIPING APPLICATIONS

A. Threaded-end, black or galvanized, standard-weight steel pipe; cast- or malleable-iron threaded fittings; and threaded joints.

B. Grooved-end, black or galvanized, standard-weight steel pipe with square-cut- or roll-grooved ends; grooved-end fittings; grooved-end-pipe couplings; and grooved joints.

3.03 SPRINKLER SYSTEM PIPING APPLICATIONS

A. NPS 1-1/2 and Smaller: Threaded-end, black or galvanized, standard-weight steel pipe; cast- or malleable-iron threaded fittings; and threaded joints.

B. NPS 1-1/2 and Smaller: Plain-end, black or galvanized, standard-weight steel pipe; locking-lug fittings; and twist-locked joints.

C. NPS 2 and Larger: Threaded-end, black or galvanized, standard-weight steel pipe; cast- or malleable-iron threaded fittings; and threaded joints.

D. NPS 2 and Larger: Grooved-end, black or galvanized, standard-weight steel pipe; grooved-end fittings; grooved-end-pipe couplings; and grooved joints.

3.04 VALVE APPLICATIONS

A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:

1. Listed Fire-Protection Valves: UL listed and FMG approved for applications where required by NFPA 13 and NFPA 14.
   a. Shutoff Duty: Use butterfly or gate valves.

2. Unlisted General-Duty Valves: For applications where UL-listed and FMG-approved valves are not required by NFPA 13 and NFPA 14.
   a. Shutoff Duty: Use butterfly or gate valves.
   b. Throttling Duty: Use globe valves.

3.05 SERVICE ENTRANCE PIPING

A. Connect to the two 8-inch below-ground water sources just outside building as shown on the Contract Drawings.

B. Install supervised shutoff valve and pressure gage in each feed ahead of common tee connection, to allow for independent servicing of each water feed for the fire protection system.

C. For the buried pipe entrance(s) into the building, provide adequately sized galvanized sleeve cast in place in the wall and seal annual space between pipe and sleeve using “Link Seals”. Coordinate with the information on mechanical sleeve seals under “Part 2-Products” of Section 21 05 00, Common Work Results for Fire Suppression.

3.06 STANDPIPE COMPONENT INSTALLATION

A. Install the standpipe systems as indicated, in accordance with requirements of NFPA 14.
B. Install standpipe piping so that it can be thoroughly drained and, where practicable, arranged to drain at the main drain valves.

C. Install pressure gages at top of each standpipe riser in the stairwells.

D. Valve accessibility for operation and servicing is required. Install valves as indicated and with no stems located below the horizontal position.

E. Provide escutcheon plates at finished surfaces where exposed piping passes through floors, walls, and ceilings. Fasten escutcheons to pipe or pipe coverings.

F. Install seismic restraints on piping. Comply with requirements in NFPA 13 for seismic-restraint device materials and installation and the approved "Seismic restraint and support detail" plans submitted in accordance with the paragraph titled "Submittals".

G. Install listed fire-protection valves, trim and drain valves, specialty valves and trim, controls, and specialties according to NFPA 14, the Seattle Fire Department and the approved pipeline layout drawings submitted in accordance with the paragraph titled "Submittals".

H. Connect to the existing capped tunnel standpipe mains provided under the U230 and U 220 contracts.

3.07 SPRINKLER PIPING INSTALLATION

A. Refer to Section 21 05 00, Common Work Results for Fire Suppression, for basic piping installation.

B. Locations and Arrangements: Contract Drawing Plans, Schematics, and Diagrams indicate general location and arrangement of piping. Install piping as indicated, to implement the esthetic intent of the Contract Drawings as far as practical.

1. Deviations from approved Contractor developed working plans for piping will require written approval from the Seattle Fire Department. File written approval with Resident Engineer before deviating from approved working plans.

2. Exposed piping shall be installed as nearly as possible parallel to or at right angles to the column lines of the building. Springing or forcing piping into place will not be permitted. Install piping in such a manner as to prevent strain on the equipment.

C. Install unions adjacent to each valve in pipes NPS 2 and smaller. Unions are not required on flanged devices or in piping installations using grooved joints.

D. Install flanges or flange adapters on valves, apparatus, and equipment having NPS 2-1/2 and larger connections.

E. Install listed fire-protection shutoff valves supervised-open, located to control sources of water supply except from fire department connections. Install permanent identification signs indicating portion of system controlled by each valve.

F. Furnish and install all sleeves and fire proofing as required when penetrating inside walls and floors.

G. Install "Inspector's Test Connections" in sprinkler system piping, complete with shutoff valve, sized and located according to NFPA 13.
H. Install sprinkler piping with drains for complete system drainage. Carefully grade piping so as to eliminate traps and pockets. Where traps cannot be avoided provide drains.

I. Install ball drip valves to drain piping between fire department connections and check valves. Drain to floor drain or outside building.

J. Install alarm devices and flow switches in piping systems as indicated on the Contract Drawings.

K. Alarm Check Valves: Install in vertical position for proper direction of flow, including bypass check valve and retarding chamber drain-line connection.

L. Install pressure gages on riser or feed main and at each sprinkler test connection. Include pressure gages with connection not less than NPS 1/4 and with soft metal seated globe valve, arranged for draining pipe between gage and valve. Install gages to permit removal, and install where they will not be subject to freezing.

M. Coordinate the installation of pipes, hangers, valves and all other items of the fire protection system with the work of all other trades so that all components will be installed to avoid conflicts and provide for proper servicing and maintenance of mechanical and electrical equipment in the ceiling plenums and equipment rooms.

3.08 HANGER AND SUPPORT INSTALLATION:

A. Pipe hanger and support installation of the pre-engineered pipe hanger and seismic restraint system shall conform to the following:

1. Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure or the tunnel structure.

2. Design and space supports as indicated in NFPA 13. Comply with NFPA 13 for hanger material selection. Install additional supports at concentrated loads, including valves, flanges, guides, strainers, and expansion joints, and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms.

3. Install expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer’s written instructions.

4. Install hangers and supports and seismic bracing in accordance with NFPA 13, complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.

5. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of flexible couplings, expansion loops, expansion bends, and similar units.

6. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

7. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.9, "Building Services Piping," are not exceeded.
8. All hangers and associated hardware in the unconditioned platform areas shall be hot-dip galvanized

3.09 CONSTRUCTION

A. Welding

1. Shop fabricate all major piping assemblies.

2. Field welding, in general, is not permitted. In specific cases and only with the approval of the Resident Engineer may the Contractor be allowed to field weld. Submit request to field weld with sufficient proof that no other method is feasible.

3. All welds shall have 100 percent penetration and smooth lines of fusion on the exterior and interior. Do not exceed 1/16-inch weld reinforcement.

4. Examine welds in accordance with the requirements of ANSI/ASW D1.1, Section 6, Parts A and B, and ASTM E94 and ASTM E1032, as applicable. In addition, examine by radiography 100 percent of the welds that are embedded in concrete or buried and examine fully by random radiography a minimum of 10 percent of all remaining circumferential butt welds.

B. Repair of Galvanized Surfaces:

1. Clean welds, bolted connections, field cut grooved pipe, and abraded areas such as rolled grooves on galvanized pipe and apply galvanizing-repair paint in accordance with Section 05 05 13, Shop-Applied Coating for Metal.

3.10 SPRINKLER APPLICATIONS

A. Drawings indicate sprinkler types to be used. Where specific types are not indicated, use the following sprinkler types, in accordance with NFPA 13, Seattle Fire Department, and approved shop drawings and pipeline layout drawing submitted in accordance with paragraph titled “Submittals”:

1. Rooms without Ceilings: Upright sprinklers.

2. Rooms with Suspended Ceilings: Pendent sprinklers.


4. Sprinkler Finishes:

a. Upright, Pendent, and Sidewall Sprinklers: Chrome plated in finished spaces exposed to view; rough bronze in unfinished spaces not exposed to view; wax coated where exposed to acids, chemicals, or other corrosive fumes.

b. Concealed Sprinklers: Rough brass, with factory-painted white cover plate.

c. Flush Sprinklers: Bright chrome, with painted white escutcheon.

d. Recessed Sprinklers: Bright chrome, with bright chrome escutcheon.

e. Residential Sprinklers: Dull chrome.
3.11 SPRINKLER INSTALLATION
A. Install sprinklers in suspended ceilings in center of narrow dimension of acoustical ceiling panels and tiles. Architectural sensitive areas are shown on Contract Drawings including but not limited to the Architectural reflected ceiling plans.
B. Do not install pendant or sidewall, wet-type sprinklers in areas subject to freezing. Use dry-type sprinklers with water supply from heated space.

3.12 HOSE-CONNECTION INSTALLATION
A. Install hose connections adjacent to standpipes, unless otherwise indicated.
B. Install freestanding hose connections for access and minimum passage restriction.
C. Install hose-connection valves with flow-restricting device, unless otherwise indicated.
D. Install wall-mounting-type hose connections in cabinets. Include pipe escutcheons, with finish matching valves, inside cabinet where water-supply piping penetrates cabinet. Install valves at angle required for connection of fire hose. Refer to Section 10 44 00, Fire Protection Specialties, for cabinets.

3.13 FIRE DEPARTMENT CONNECTION INSTALLATION
A. Install wall-type, fire department connections in vertical wall.
B. Install ball drip valve at each check valve for fire department connection.

3.14 CONNECTIONS
A. Drawings indicate general arrangement of piping, fittings, and specialties.
B. Install piping adjacent to equipment to allow service and maintenance.
C. Connect water-supply piping to fire-suppression piping. Include backflow preventer between potable-water piping and fire-suppression piping. Refer to Section 22 11 19, Domestic Water Piping Specialties, for backflow preventers.
D. Install ball drip valves at each check valve for fire department connection. Drain to floor drain or outside building.
E. Connect piping to specialty valves, hose valves, specialties, fire department connections, and accessories.
F. Electrical Connections: Power wiring is specified in Section 26 05 25, Wire and Cable.
G. Connect alarm devices to fire alarm.
H. Ground equipment according to Section 26 05 26, Grounding and Bonding for Electrical Systems.
I. Connect wiring according to Section 26 05 25, Wire and Cable.

3.15 LABELING AND IDENTIFICATION
A. Comply with the requirements of Section 22 05 50, Mechanical Identification, and install labeling and pipe markers on equipment and piping according to requirements in NFPA 13 and NFPA 14. In case of conflict the requirements of NFPA 13 & 14 will govern
respectively for the Sprinkler & Standpipe systems unless otherwise allowed by the Seattle Fire Department.

1. Identify fire hose cabinets with lettering not less than 2 inches high.

3.16 PAINTING

A. Prepare piping system to be free from grease, oil, rust and scale, and make ready for the application of paint as specified in Section 09 90 00, Painting and Coating. Provide protective covering to keep paint away from the sprinkler heads; protective covering shall be removed under Section 09 90 00.

3.17 FIELD QUALITY CONTROL

A. Flushing of Piping: Underground mains and lead in connections to system risers shall be completely flushed before connection is made to sprinkler and standpipe piping. The minimum rate of flow shall not be less than that indicated in NFPA 13. All flushing water shall be disposed off in a manner acceptable to the Resident Engineer.

B. Testing (General)

1. Perform 100 percent visual inspection of all field welds.

2. Test installed systems and products hydrostatically, using testing instruments calibrated by an Independent Testing Laboratory in accordance with Section 01 45 00, Quality Control, and flush after removal of testing equipment in accordance with applicable requirements of NFPA 13 & NFPA 14 respectively. Repair leaks and retest repaired parts of both the existing and new sections of the systems. Repair damages resulting from the system's failure during the test at no additional cost to Sound Transit.

a. Test standpipe hydrostatically for 2 hours without loss in pressure, using the most convenient outlet connection. The test pressures for the standpipe system are as follows:

1) The stairwell standpipe system shall be tested with a 225 psig reading at the high point of the system.

2) The new section of the Tunnel Standpipe system(s) at Capitol Hill extending from the isolation valve(s) in the fire services room(s) up to the existing isolation valves at the first cross passage(s) on either side of the station, are to be tested with a 225 psig reading at the high point of each of the two tested sections.

3) Retest the existing tunnel standpipe from Capitol Hill Station to Cross Passage No. 11: with a 280 psi reading at the low point of the this tested section.

4) Retest the existing tunnel standpipe from Cross Passage No. 11 to Cross Passage No. 15: with a 330 psi reading at the low point of this tested section.

5) Retest the existing tunnel standpipe from Cross Passage No. 15 to the existing isolation valves at the south end of the University of Washington Station: with a 370 psi reading at the low point of this tested section.
6) Retest the existing tunnel standpipe from Cross Passage No. 5 to the Pine Street Stub tunnel with a 290 psi reading at the low point of this tested section.

b. Test all sprinkler system piping and appurtenances subject to system working pressure using a minimum 225 psig test pressure that shall be maintained without loss for 2 hours.

c. In addition to the hydrostatic tests the dry and preactions system are to be subjected to an air pressure leakage test for 24 hours using 40 psig air with less than 1-1/2 psi loss over the test period.

d. Contractor shall provide and dispose of the quantity of water necessary for testing. Refer to Section 01 57 24, Temporary Site Water Discharge, for testing water disposal requirements.

3. Conduct stairwell and tunnel standpipe system flow test(s) in accordance with NFPA 14 including but not limited to the following:

a. Tunnel system demand testing shall conducted by flowing water simultaneously from the existing fire hose outlets N04-FHV-01 and N04-FHV-02, and at all additional fire hose outlets required by the Seattle Fire Department.

b. Flow 250 gpm from each of the two most remote hose valves in the stairwell to verify residual pressure(s) without pumper truck assist.

4. Furnish items used in testing

a. Calibrate pressure gages.

b. Use testing instruments calibrated by an Independent Testing Laboratory accordance with Section 00 45 00, Quality Control.

C. Perform tests in the presence of the Resident Engineer and Seattle Fire Department. Give 48-hour notice prior to test and notify the Seattle Fire Department and Seattle Public Utilities. The Resident Engineer will review certificates and test reports, and will inspect the standpipe system to verify conformance with NFPA 14.

END OF SECTION
PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes specifications for clean-agent extinguishing systems and the following:
   1. Piping and piping specialties.
   2. Extinguishing-agent containers.
   3. Extinguishing agent.
   5. Control and alarm panels.
   6. Accessories.
   7. Connection devices for and wiring between system components.
   8. Connection devices for power and integration into building's fire alarm system.

B. Related Sections: The work of the following Sections is related to the work of this Section. Other Sections, not referenced below, may also be related to the proper performance of this work.
   1. Section 21 05 00, Common Work Results for Fire Suppression.
   2. Section 22 05 29, Hangers and Supports For Plumbing Piping And Equipment.
   3. Section 23 05 29, Hangers and Supports For HVAC Piping And Equipment.
   4. Section 28 31 00, Fire Detection and Alarm.

1.02 REFERENCES

A. This Section incorporates by reference the latest revisions of the following documents.
   1. American Society of Mechanical Engineers (ASME)
      a. B16.5 Pipe Flanges and Flanged Fittings
      b. B16.11 Forged Fittings, Socket-Welding and Threaded
      c. B16.21 Nonmetallic Flat Gaskets for Pipe Flanges
      d. B16.22 Wrought Copper and Copper Alloy Solder Joint Pressure Fittings
      e. B16.24 Cast Copper Alloy Pipe Flanges and Flanged Fittings
f. B18.2.1 Square and Hex Bolts and Screws, Inch Series

g. B31.1 Power Piping

   b. ASTM A53 Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
   c. ASTM A106 Standard Specification for Seamless Carbon Steel Pipe for High-Temperature Service
   d. ASTM A536 Standard Specification for Ductile Iron Castings
   e. ASTM A563 Standard Specification for Carbon and Alloy Steel Nuts
   f. ASTM B88 Standard Specification for Seamless Copper Water Tube

3. American Welding Society (AWA)
   a. AWS A5.8 Standard Specification for Filler Metal for Brazing and Braze Welding
   b. AWS D10.12 Guide for Welding Mild Steel Pipe

4. American Water Works Association (AWWA)
   a. AWWA C606 Grooved and Shouldered Joints

5. City of Seattle (COS):
   a. Seattle Fire Code (International Fire Code with Seattle Amendments)

6. National Fire Protection Association (NFPA)
   a. NFPA 13 Standard for Installation of Sprinkler Systems
   b. NFPA 70 National Electric Code
   c. NFPA 72 National Fire Alarm Code
   d. NFPA 2001 Standard on Clean Agent Fire Extinguishing Systems

7. National Electrical Manufacturers Association (NEMA)
   a. NEMA 1CS6 Industrial Controls and Systems: Enclosures

8. Underwriters Laboratories Inc.
   a. UL 213 Standard for Safety Rubber Gasketed Fittings for Fire Protection Service
   b. UL 268 Standard for Safety Smoke Detectors for Fire Alarm Signaling Systems
1.03 DEFINITIONS

1.04 SYSTEM DESCRIPTION
A. Clean-agent fire-extinguishing system shall be an engineered system for total flooding of the hazard area including the room cavity below the ceiling.

1.05 PERFORMANCE REQUIREMENTS
A. Design clean-agent extinguishing system and obtain approval from the Seattle Fire Department. Design system for Class A, B, or C fires as appropriate for areas being protected and include safety factor. Use clean agent indicated and in concentration suitable for normally occupied areas.

B. Performance Requirements: Discharge HFC 227ea within 10 seconds and maintain 7.1 percent concentration by volume at 70 degrees F for 10-minute holding time in hazard areas.

1. HFC 227ea concentration in hazard areas greater than 9.0 percent immediately after discharge or less than 5.8 percent throughout holding time will not be accepted without written authorization from Sound Transit and the Seattle Fire Department.

2. System Capabilities: Minimum 620-psig calculated working pressure and 360-psig initial charging pressure.

C. Cross-Zoned Detection: Devices located in two separate zones. Sound alarm on activating single-detection device, and discharge extinguishing agent on actuating single-detection device in other zone.

D. System Operating Sequence: As follows:

1. Actuating First Detector: Visual indication on annunciator panel, energize audible alarm and visual alarms (slow pulse), shut down air-conditioning and ventilating systems serving protected area, close HVAC fire/smoke dampers serving the protected area, close doors in protected area, and send signal to fire alarm system.

2. Actuating Second Detector: Visual indication on annunciator panel, energize audible and visual alarms (fast pulse), shut down power to protected equipment, start time delay for extinguishing-agent discharge for 30 seconds, and discharge extinguishing agent. On agent discharge, release preaction valve to allow water to fill sprinkler system.

3. Extinguishing-agent discharge will operate audible alarms and strobe lights inside and outside the protected area.

E. System Operating Sequence: System shall be cross-zoned, air-sampling detectors and photoelectric detectors reporting to a fully programmable microprocessor-based control panel programmed to operate as follows:

1. If one photoelectric detector and air-sampling detector reaches the third detection level (Fire 1), agent discharge will be initiated as described for the third detection level (Fire 1) below.
F. Manual stations shall immediately discharge extinguishing agent when activated.

G. Operating abort switches will delay extinguishing-agent discharge while being activated, and switches must be reset to prevent agent discharge. Release of hand pressure on the switch will cause agent discharge if the time delay has expired.

H. EPO: Will terminate power to protected equipment immediately on actuation.

I. Low-Agent Pressure Switch: Initiate trouble alarm if sensing less than set pressure.

J. Seismic Performance: Fire-suppression piping and containers shall be capable of withstanding the effects of earthquake motions determined according to ASCE 7, "Minimum Design Loads for Buildings and Other Structures": Section 9, "Earthquake Loads."

1.06 PROJECT COORDINATION

A. See Section 01 31 13, Project Coordination, and Section 21 05 00, Common Work Results for Fire Suppression, for requirements.

1.07 SUBMITTALS

A. Product Data: For the following:
   1. Extinguishing-agent containers.
   2. Extinguishing agent.
   3. Discharge nozzles.
   4. Control panels.
   5. Detection devices.
   7. Switches.
   8. Alarm devices.
   9. Pipe hangers and supports, including seismic restraints.

B. Shop Drawings: Signed and sealed by a qualified professional engineer. Include design calculations. Include the following for hazard-area enclosure, drawn to scale:
   1. Plans, elevations, sections, details, and attachments to other work. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
   2. Wiring Diagrams: Power, signal, and control wiring.
   3. Design Calculations: For weight, volume, and concentration of extinguishing agent required for each hazard area.
   4. Reflected Ceiling Plans: Show ceiling penetrations, ceiling-mounted items, and the following:
      a. Extinguishing-agent containers, piping, discharge nozzles, detectors, and accessories.
b. Method of attaching hangers to building structure.

c. Other ceiling-mounted items including light fixtures, diffusers, grilles, speakers, sprinklers, and access panels.

5. Occupied Work Area Plans: Show the following:

a. Controls and alarms.

b. Extinguishing-agent containers, piping and discharge nozzles if mounted in space, detectors, and accessories.

c. Equipment and furnishings.

C. Permit Approved Drawings: Working plans, prepared according to NFPA 2001, that have been approved by the Seattle Fire Department. Include design calculations.

D. Field quality-control test reports.

E. Maintenance Data: For components to include in maintenance manuals.

1.08 QUALITY ASSURANCE

A. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice the State of Washington and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of clean-agent extinguishing systems that are similar to those indicated for this Project in material, design, and extent.

B. Product Options: Drawings indicate size, profiles, and dimensional requirements of clean-agent extinguishing systems and are based on the specific system indicated. Refer to Section 01 66 00, Product Storage and Handling Requirements.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by an Independent Testing Laboratory acceptable to Seattle Fire Marshal, and marked for intended use.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. In other Part 2 articles were titles below introduce lists, the following requirements apply to product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.02 PIPING MATERIALS

A. Refer to Part 3 piping applications Article retained for applications of pipe, tube, fitting, and joining materials.
B. Piping, Valves, and Discharge Nozzles: Comply with types and standards listed in NFPA 2001, Section "Distribution," for charging pressure of system.

2.03 PIPE AND FITTINGS

A. Steel Pipe: ASTM A 53/A 53M, Type S, Grade B or ASTM A 106, Grade B; Schedule 40, or Schedule 80, seamless steel pipe.
   1. Threaded Fittings:
      b. Flanges and Flanged Fittings: ASME B16.5, Class 300, unless Class 600 is indicated.
   2. Forged-Steel Welding Fittings: ASME B16.11, Class 3000, socket pattern.
   3. Grooved-End Fittings: FMG approved and NRTL listed, ASTM A 47/A 47M malleable iron or ASTM A 536 ductile iron, with dimensions matching steel pipe and ends factory grooved according to AWWA C606.

B. Plain-End, Hard Copper Tube: ASTM B 88, Type K, water tube, drawn temper.

C. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
   1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch maximum thickness, unless thickness or specific material is indicated.

D. Flange Bolts and Nuts: ASME B18.2.1, carbon steel.

E. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing.

F. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

G. Steel, Keyed Couplings: UL 213, AWWA C606, approved or listed for halon or clean-agent service, and matching steel-pipe dimensions. Include ASTM A 536, ductile-iron housing, rubber gasket, and steel bolts and nuts.

2.04 VALVES

A. General: Brass; suitable for intended operation.

B. Container Valves: With rupture disc or solenoid and manual-release lever, capable of immediate and total agent discharge and suitable for intended flow capacity.

C. Valves in Sections of Closed Piping and Manifolds: Fabricate to prevent entrapment of liquid, or install valve and separate pressure relief device.

D. Valves in Manifolds: Check valve; installed to prevent loss of extinguishing agent when container is removed from manifold.
2.05 EXTINGUISHING-AGENT CONTAINERS
A. Description: Steel tanks complying with ASME Boiler and Pressure Vessel Code: Section VIII, for unfired pressure vessels. Include minimum working-pressure rating that matches system charging pressure, valve, pressure switch, and pressure gage.
   1. Finish: Red, enamel or epoxy paint.
   2. Manifold: Fabricate with valves, pressure switches, selector switch, and connections for main- and reserve-supply banks of multiple storage containers.
   3. Storage-Tank Brackets: Factory- or field-fabricated retaining brackets consisting of steel straps and channels; suitable for container support, maintenance, and tank refilling or replacement.

2.06 FIRE-EXTINGUISHING CLEAN AGENT
A. Clean Agent: HFC 227ea, heptafluoropropane.
   1. Available Manufacturers:
      a. Cerberus Pyrotronics.
      b. Chemetron Fire Systems.
      c. Fike Corporation.
      d. Kidde-Fenwal, Inc.
      e. Modular Protection Corp.

2.07 DISCHARGE NOZZLES
A. Equipment manufacturer's standard one-piece brass or aluminum alloy of type, discharge pattern, and capacity required for application.

2.08 CONTROL PANELS
A. Description: FMG approved or NRTL listed, including equipment and features required for testing, supervising, and operating fire-extinguishing system.
   B. Power Requirements: 120/240-V ac; with electrical contacts for connection to system components and fire alarm system, and transformer or rectifier as needed to produce power at voltage required for accessories and alarm devices.
   C. Enclosure: NEMA ICS 6, Type 1, enameled-steel cabinet.
      1. Mounting: Surface.
   D. Supervised Circuits: Separate circuits for each independent hazard area.
      1. Detection circuits equal to the required number of zones, or addressable devices assigned to the required number of zones.
      3. Alarm circuit.
5. Abort circuit.
6. EPO circuit.

E. Provide the following control-panel features:
1. Electrical contacts for shutting down fans, activating dampers, and operating system electrical devices.
2. Storage container, low-pressure indicator.
3. Service disconnect to interrupt system operation for maintenance with visual status indication on the annunciator panel.

F. Annunciator Panel: Graphic type showing protected, hazard-area plans and locations of detectors, abort, EPO, and manual stations. Include lamps to indicate device-initiating alarm, electrical contacts for connection to control panel, and stainless-steel or aluminum enclosure.

G. Standby Power: Lead-acid or nickel-cadmium batteries with capacity to operate system for 72 hours and alarm for minimum of 15 minutes. Include automatic battery charger, with varying charging rate between trickle and high depending on battery voltage, that is capable of maintaining batteries fully charged. Include manual voltage control, dc voltmeter, dc ammeter, electrical contacts for connection to control panel, and suitable enclosure.

2.09 DETECTION DEVICES

A. Description: Comply with NFPA 2001 and NFPA 72, and include the following types:

1. Ionization Detectors: Comply with UL 268, dual-chamber type, having sampling and referencing chambers, with smoke-sensing element.
2. Photoelectric Detectors: Comply with UL 268, consisting of LED light source and silicon photodiode receiving element.
   a. Pipe Network: CPVC tubing connects control unit with calibrated sampling holes.
   b. Smoke Detector: Particle-counting type with continuous laser beam. Sensitivity adjustable to a minimum of four preset values.
   c. Sample Transport Fan: Centrifugal type, creating a minimum static pressure of 0.05-inch wg at all sampling ports.
   d. Control Unit: Multizone unit as indicated on Drawings. Provides same system power supply, supervision, and alarm features as specified for the control panel plus separate trouble indication for airflow and detector problems.
   e. Signals to the Central Fire Alarm Control Panel: Any type of local system trouble is reported to the central fire alarm control panel as a composite “trouble” signal. Alarms on each system zone are individually reported to the central fire alarm control panel as separately identified zones.
2.10 MANUAL STATIONS
A. General Description: Surface FMG approved or NRTL listed, with clear plastic hinged cover, 120-V ac or low voltage compatible with controls. Include contacts for connection to control panel.

B. Manual Release: "MANUAL RELEASE" caption, and red finish. Unit can manually discharge extinguishing agent with operating device that remains engaged until unlocked.

C. Abort Switch: "ABORT" caption, momentary contact, with green finish.

D. EPO Switch: "EPO" caption, with yellow finish.

2.11 SWITCHES
A. Description: FMG approved or NRTL listed, where available, 120-V ac or low voltage compatible with controls. Include contacts for connection to control panel.

1. Low-Agent Pressure Switches: Pneumatic operation.

2. Power Transfer Switches: Key-operation selector, for transfer of release circuit signal from main supply to reserve supply.

3. Door Closers: Magnetic retaining and release device or electrical interlock to cause the door operator to drive the door closed.

2.12 ALARM DEVICES
A. Description: FMG approved or NRTL listed, low voltage, and surface mounting, unless otherwise indicated.

B. Bells: Minimum 6-inch diameter.

C. Horns: 90 to 94 dBA.

D. Strobe Lights: Translucent lens, with "FIRE" or similar caption.

2.13 ELECTRICAL POWER AND WIRING
A. Electrical power, wiring, and devices are specified in Division 26.

PART 3 - EXECUTION

3.01 EXAMINATION
A. Examine areas and conditions, with Installer present, for compliance with hazard-area leakage requirements, installation tolerances, and other conditions affecting work performance.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PIPING APPLICATIONS
A. Flanged pipe and fittings and flanged joints may be used to connect to specialties and accessories and where required for maintenance.
B. Fittings Working Pressure: 620 psig minimum.
C. Flanged Joints: Class 300 minimum.
D. NPS 2 and Smaller: Schedule 40, steel pipe; malleable-iron threaded fittings; and threaded joints.
E. NPS 2-1/2 and NPS 3: Schedule 40, steel pipe; steel, grooved-end fittings; steel, keyed couplings; and grooved joints.
F. NPS 4 and Larger: Schedule 40, steel pipe; steel, grooved-end fittings; steel, keyed couplings; and grooved joints.

3.03 CLEAN-AGENT EXTINGUISHING PIPING INSTALLATION
A. Install clean-agent extinguishing piping and other components level and plumb and according to manufacturers' written instructions.
B. Refer to Section 21 05 00, Common Work Results for Fire Suppression, for basic pipe installation and joint construction.
C. Grooved Piping Joints: Groove pipe ends according to AWWA C606 dimensions. Assemble grooved-end steel pipe and steel, grooved-end fittings with steel, keyed couplings and lubricant according to manufacturer's written instructions.
D. Install extinguishing-agent containers anchored to substrate.
E. Install pipe and fittings, valves, and discharge nozzles according to requirements listed in NFPA 2001, Section "Distribution," and in ASME B31.1.
   1. Install valves designed to prevent entrapment of liquid or install pressure relief devices in valved sections of piping systems.
   2. Support piping using supports and methods according to NFPA 13 and Section 22 05 29, Hangers and Supports for Plumbing Piping And Equipment, and Section 23 05 29, Hangers and Supports for HVAC Piping and Equipment.
   3. Install seismic restraints for extinguishing-agent containers and piping systems.
   4. Install control panels, detection system components, alarms, and accessories, complying with requirements of NFPA 2001, Section "Detection, Actuation, and Control Systems," as required for supervised system application.

3.04 CONNECTIONS
A. Drawings indicate general arrangement of piping, fittings, and specialties.
B. Install piping adjacent to extinguishing-agent containers to allow service and maintenance.
C. Connect electrical devices to control panel and to building's fire alarm system. Electrical power, wiring, and devices are specified in Section 28 31 00, Fire Detection and Alarm.

3.05 LABELING
A. Install labeling on piping, extinguishing-agent containers, other equipment, and panels according to NFPA 2001.
B. Install signs at entry doors for protected areas to warn occupants that they are entering a room protected with a clean-agent fire extinguishing system.

C. Install signs at entry doors to advise persons outside the room the meaning of the bell(s), and strobe light(s) outside the protected space.

3.06 FIELD QUALITY CONTROL

A. Comply with operating instructions and procedures of NFPA 2001, Section "Approval of Installations." Include the following tests and inspections to demonstrate compliance with requirements:

1. Check mechanical items.
2. Inspect extinguishing-agent containers and extinguishing agent, and check mountings for adequate anchoring to substrate.
3. Check electrical systems.
5. Perform functional pre-discharge test.
7. Check remote monitoring operations.
8. Check control-panel primary power source.
9. Perform "puff" test on piping system, using nitrogen.

B. Perform field-acceptance tests of each clean-agent extinguishing system when installation is complete. Perform system testing only after hazard-area enclosure construction has been completed and openings sealed. Comply with operating instructions and procedures of NFPA 2001, Section "Approval of Installations." Include the following to demonstrate compliance with requirements:

1. Perform functional predischarge test.
2. Perform system functional operational test.
3. Check remote monitoring operations.
4. Check control-panel primary power source.
5. Perform "puff" test on piping system, using nitrogen.

C. Correct malfunctioning equipment, then retest to demonstrate compliance. Replace equipment that cannot be corrected or does not perform as specified and indicated, then retest to demonstrate compliance. Repeat procedure until satisfactory results are obtained.

1. Report test results promptly and in writing to Resident Engineer and Seattle Fire Department and the Seattle Building authorities having jurisdiction.

D. Perform the following field tests and inspections and prepare test reports:
1. After installing clean-agent extinguishing piping system and after electrical
   circuitry has been energized, test for compliance with requirements.

2. Perform each electrical test and visual and mechanical inspection stated in
   NETA ATS, Sections "Inspection and Test Procedures" and "System Function
   Tests." Certify compliance with test parameters.

3. Leak Test: After installation, charge system and test for leaks. Repair leaks and
   retest until no leaks exist.

4. Operational Test: After electrical circuitry has been energized, start units to
   confirm proper motor rotation and unit operation. Remove malfunctioning units,
   replace with new units, and retest.

5. Test and adjust controls and safeties. Replace damaged and malfunctioning
   controls and equipment.

E. Remove and replace malfunctioning units and retest as specified above.

3.07 CLEANING

A. Each pipe section shall be cleaned internally after preparation and before assembly by
   means of swabbing, using a suitable nonflammable cleaner. Pipe network shall be free
   of particulate matter and oil residue before installing nozzles or discharge devices.

3.08 SYSTEM FILLING

A. Preparation:
   1. Verify that piping system installation is completed and cleaned.
   2. Check for complete enclosure integrity.
   3. Check operation of ventilation and exhaust systems.

B. Filling Procedures:
   1. Fill extinguishing-agent containers with extinguishing agent and pressurize to
      indicated charging pressure.
   2. Install filled extinguishing-agent containers.
   3. Energize circuits.
   4. Adjust operating controls.

3.09 DEMONSTRATION

A. Train Sound Transit's maintenance personnel to adjust, operate, and maintain clean-
   agent extinguishing systems.

END OF SECTION