STEM4 Building

SEPA Consistency Memo Appendices

Appendix A

Geotechnical Engineering Services

Bothell STEM 4 Building
UW Bothell and Cascadia College
Bothell, Washington

for

UW Bothell and Cascadia College

November 19, 2018

GeoEngineers
Earth Science + Technology

Geotechnical Engineering Services

Bothell STEM 4 Building
UW Bothell and Cascadia College
Bothell, Washington

for
UW Bothell and Cascadia College

November 19, 2018

GeoEngineers

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Geotechnical Engineering Services

Bothell STEM 4 Building
UW Bothell and Cascadia College
Bothell, Washington

File No. 00183-120-02

November 19, 2018

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EXECUTIVE SUMMARY

This report contains the results of our geotechnical engineering services for use in preliminary design of the proposed Bothell Science, Technology, Engineering and Math (STEM) 4 Building project for UW Bothell and Cascadia College in Bothell, Washington. The project consists of constructing either one larger building or two smaller buildings on the hillslope between The Center for Global Learning & The Arts (CC3) and Discovery Hall (UW3), and east of the Truly House.

Subsurface Conditions

The subsurface conditions were evaluated by drilling eleven borings (GEI-4 through GEI-14) at the project site. Three borings (GEI-1 through GEI-3) were previously drilled on the south side of the site for a previous UW4 building concept. The subsurface soil conditions generally consist of the following:

Soils

Topsoil. Topsoil was observed in all of the borings and generally consisted of loose dark brown sandy silt and silty sand and typically ranges from 2 to 6 inches thick.

Fill. Fill consisting of loose to medium dense silty sand with gravel or soft to medium stiff silt with variable sand was observed in borings GEI-4, GEI-11 and GEI-14 to depths ranging between about 3½ and 4½ feet.

Glacial Till. Weathered glacial till was observed below the topsoil in all of the borings except GEI-10, GEI-11, GEI-13 and GEI-14. The weathered till extends about 4½ to 8 feet deep and consists of brown medium dense to dense silty sand and/or very stiff to hard sandy silt with varying gravel and cobble content. Dense to very dense relatively unweathered glacial till was observed below the weathered till or fill in all of the borings completed except for GEI-11. The unweathered glacial till generally consists of gray silty sand or sandy silt with variable gravel and cobbles. The glacial till deposits are about 50 feet thick on the west side of the site and decreases in thickness to about 6 feet along the east side of the site. The glacial till also pinches out to the north.

Transitional Bed Deposits. Transitional bed deposits were observed below the glacial till in the southern half of the site. The transitional bed deposits were observed 9½ to 28 feet below the existing ground surface. The transitional bed deposits typically consist of dense to very dense sand with silt and gravel. In GEI-14, glaciolacustrine deposits were encountered below the transitional bed deposits, which suggests that the glaciolacustrine deposits dive down to the south at a relatively steep declination.

Glaciolacustrine Deposits. Glaciolacustrine deposits generally consist of stiff to hard gray silt/clay and were observed below the glacial till in the northern portion of the site and are interpreted to dive below the transitional bed deposits to the south. The glaciolacustrine deposits were observed as shallow as 4½ feet below ground surface at the north end of the site and up to 33 feet below ground surface in GEI-14 near the center of the site. The borings terminated in the glaciolacustrine deposits, where encountered.

Groundwater Conditions

Groundwater measured in five monitoring wells installed at the site indicate the groundwater ranges from about Elevation 65 to 84½ feet across the site. Artesian groundwater conditions have been encountered in previous projects completed on the campus and should be expected. Perched groundwater is typical within the native glacial deposits and should be expected within permeable layers within the native glacial deposits, especially the transitional bed deposits, and at the contact with the overlying fill and looser native soils during wet weather.

Earthquake Engineering

The site is classified as Site Class D, in accordance with the 2015 International Building Code (IBC).

Excavation Considerations

Excavations for the building(s) may require cuts up to 15 feet deep. These cuts can be made as temporary open cut slopes or using temporary shoring, depending on site constraints. Temporary unsupported cut slopes more than 4 feet high may be inclined at 1½H:1V (horizontal to vertical) maximum steepness in the fill, weathered till, transitional bed deposits, and glaciolacustrine deposits. Excavations made in the dense to very dense glacial till may be made at 1H:1V maximum steepness.

Structural Fill

On-site weathered till and glacial till soils should be suitable for use as structural fill in areas outside of the building(s) footprint provided the work is accomplished during the normally dry season (June through September) and that the soil can be properly moisture conditioned and compacted.

Imported gravel borrow should be planned for use as structural fill under the building footprint(s) and within a 1H:1V influence zone projected down from the edges of the foundations. Imported gravel borrow should also be used as structural fill during the wet season (October through May) and in wet weather.

Temporary Dewatering

Temporary dewatering may be required to deal with perched water and/or surface water entering excavations, and for excavations where the planned finish floor elevation is near or below the measured groundwater. Perched or surface water entering excavations can likely be addressed by drainage ditches and sump pumps. Well points and/or larger sump pumps will be required to accomplish excavations below the groundwater table and likely for the lower level of the building(s).

Shallow Foundations

The building(s) can be supported on conventional spread and mat footings bearing on undisturbed native soils or on structural fill extending to undisturbed native soils. We recommend a preliminary allowable bearing pressure of 8,000 pounds per square foot (psf) for shallow foundations bearing on the very dense glacial till and transitional bed deposits. Foundations will generally need to extend about 4½ feet below the existing ground surface to achieve 8,000 psf design bearing pressure where glacial till is present. Foundations supported on undisturbed stiff to hard glaciolacustrine deposits may be designed using an allowable bearing pressure of 4,000 psf. Foundations supported on structural fill consisting of imported gravel borrow and overlying medium dense to very dense glacial soils or foundations supported on undisturbed medium dense to dense native glacial soils may be designed using an allowable bearing pressure of 3,000 psf. These allowable soil bearing pressures apply to the total of dead and long-term live loads and may be increased by up to one-third for wind or seismic loads. These allowable soil bearing pressures are net values.

Perimeter footing drains should be included in the design of the building(s).

Lateral foundation loads may be resisted by passive resistance on the sides of the footings and by friction on the base of the footings. For footings supported and surrounded by either dense native soils or compacted structural fill, a coefficient of friction of 0.35 and a passive resistance of 350 pounds per cubic foot (pcf) may be used.

Slab-on-Grade Floors

We recommend that all topsoil, fill and looser native soils be removed below the building floor slabs and be replaced with structural fill. A subgrade modulus of 100 pounds per cubic inch (pci) may be used for design of the slabs-on-grade for the building(s). Concrete slabs-on-grade should be supported on a 6-inch-thick capillary break layer overlain by a vapor retarder.

Below-Grade Walls and Retaining Walls

Below-grade walls should be provided with a free draining drainage layer and footing drain pipes. For below-grade walls constructed either neat against the dense native soils, or backfilled with compacted structural fill, we recommend the following equivalent fluid weights for walls having horizontal backfill:

- allowable passive – 350 pcf
- active – 35 pcf
- at rest – 55 pcf

Underslab Drainage Considerations

Underslab drainage should be provided below floors that are cut into the hillslope. Because the planned lower finish floor elevation may be constructed in soils with significant groundwater, a more robust underslab drainage system is recommended to prevent the buildup of hydrostatic uplift pressures.

Pavements

New hot-mix asphalt (HMA) pavement sections for surface parking should consist of at least 3 inches HMA over 4 inches of base course in car parking areas and 4 inches HMA over 6 inches of base course in areas exposed to truck traffic areas.

This Executive Summary should be used only in the context of the full report for which it is intended.

1.0 INTRODUCTION

This report presents the results of our geotechnical engineering services for the proposed Bothell Science, Technology, Engineering and Math (STEM) 4 Building project for UW Bothell and Cascadia College in Bothell, Washington. The site for the proposed STEM 4 building is shown relative to existing campus buildings and other physical features on the Vicinity Map and Site Plan, Figures 1 and 2, respectively.

1.1. Project Description

The Bothell STEM 4 building will be consisted of either one large building or two smaller buildings on the hillslope between Discovery Hall (UW3) and The Center for Global Learning & The Arts (CC3), and east of the Truly House. The location of the building footprint(s) have not been determined at this time. The building(s) may consist of four levels with a mechanical penthouse. The lower floor levels will be stepped into the hillslope with the lowest finish floor level at a similar elevation as the Crescent Walk on the east of the site.

1.2. Scope of Services

The purpose of our services is to evaluate soil and groundwater conditions as a basis for developing design criteria for the geotechnical aspects of the proposed STEM building(s). Our services were performed in general accordance with scope of services outlined in our Consultant Services Agreement No. 2018-267A(1), dated August 6, 2018, and Amendment Number One, dated September 17, 2018.

2.0 FIELD EXPLORATIONS AND LABORATORY TESTING

2.1. Field Explorations

The subsurface soil and groundwater conditions were evaluated by reviewing existing geotechnical information in the project vicinity and drilling eleven geotechnical borings (GEI-4 through GEI-14). The borings were completed on September 5 through September 7 and September 20, 2018, and were completed to depths ranging from 35¼ to 36½ feet below the existing ground surface. The borings were completed using track-mounted, continuous-flight, hollow-stem auger drilling equipment. Two-inch-diameter monitoring wells were installed in borings GEI-4, GEI-6, GEI-10, GEI-11 and GEI-14 to observe groundwater conditions.

The approximate locations of the explorations are shown on Figure 2. Descriptions of the field exploration program and the boring logs are presented in Appendix A.

2.2. Laboratory Testing

Soil samples were obtained during the exploration program and taken to our laboratory for further evaluation. Selected samples were tested for the determination of moisture content, fines content (material passing the U.S. No. 200 sieve), Atterberg Limits (plasticity characteristics) and sieve analysis tests. A description of the laboratory testing and the test results are presented in Appendix B.

2.3. Previous Studies

GeoEngineers previously conducted geotechnical and geologic services for design and construction of the existing UW Bothell/Cascadia College Co-located Campus including existing buildings and site work. The results of our previous geotechnical services are summarized in the following documents:

- "Geotechnical Engineering Services, Phase 4 STEM Building, University of Washington, Bothell, Washington," dated May 24, 2016.
- "Geotechnical Engineering Services, UW Bothell Phase 3 Science & Academic Building, Bothell, Washington," dated May 2, 2011.
- "Geotechnical Engineering Services, The Center for Global Learning and the Arts, Cascadia Community College, Bothell, Washington," dated September 21, 2006.
- "Report, Geotechnical Engineering Services, UWB/CCC Co-Located Campus, Phase 2a Design Development, Bothell, Washington," dated June 25, 1999.
- "Report, Geotechnical Engineering Services, UWB/CCC Co-Located Campus Phase 1 Design Development, Uplands Development and Off-site Improvements, Bothell, Washington," dated May 5, 1998.
- "Report, Geotechnical Engineering Services, UWB/CCC Co-Located Campus, Phase 1 Design Development, Lowland Stream and Wetlands, Bothell, Washington," dated May 4, 1998.

The approximate locations of relevant explorations completed for the studies listed above are shown on Figure 2. Logs of the relevant explorations are also included in Appendix C, Exploration Logs from Previous Studies.

3.0 SITE DESCRIPTION

3.1. Site Geology

Our review of the geologic map for the area (Minard 1985) and our previous geotechnical reports for the campus indicates that the proposed building site is underlain by varied sequence of dense to very dense glacial till, dense transition bed deposits, and stiff to hard glaciolacustrine deposits at relatively shallow depths.

Glacial till was observed in most of the explorations completed at the site. Glacial till commonly consists of a very compact, poorly sorted, non-stratified mixture of clay, silt, sand, gravel and cobbles. Glacial till commonly appears gray or blue on a fresh surface, while weathered glacial till may be brown to yellow in color. Till may include cobbles and large boulders.

Transitional bed deposits are also mapped in the project vicinity and were observed underlying the glacial till in some explorations completed on the southern side of the project site. Transitional bed deposits are glacially consolidated deposits commonly consisting of interbedded stiff to hard clay, silt, and sand.

Glaciolacustrine deposits were observed underlying the glacial till in some of the explorations completed in the northern portion of the site. Glaciolacustrine deposits are glacially consolidated deposits commonly consisting of stiff to hard clay/silt.

3.2. Surface Conditions

The proposed Bothell STEM 4 Building project is located on the hillslope between the CC3 building and the UW3 building. The ground surface in the project area slopes down from west to east from approximately Elevation 122 feet at top of the slope to about Elevation 76 feet at the base of the slope. Vegetation generally consists of tall grass, shrubs and large conifer and deciduous trees. The east side of the site is bounded by the Crescent Walk located west of the campus library. Numerous underground utilities associated with the library and campus development are located between the planned STEM building site and the existing campus buildings.

3.3. Subsurface Conditions

Several soil units were encountered in the explorations including topsoil, fill, weathered and unweathered glacial till, transitional bed deposits and glaciolacustrine deposits. Interpreted subsurface soil conditions are illustrated in Cross Sections A-A' and B-B' in Figures 3 and 4. Cross Section A-A' is cut east-west at the center of the site and Cross Section B-B' is cut north-south. Observed subsurface soil conditions are summarized below:

Topsoil. Topsoil was observed in all of the borings and generally consisted of loose dark brown sandy silt and silty sand and typically ranges from 2 to 6 inches thick.

Fill. Fill consisting of loose to medium dense silty sand with gravel or soft to medium stiff silt with variable sand and debris was observed in borings GEI-4, GEI-11 and GEI-14 to depths ranging between about 3½ and 4½ feet.

Glacial Till. Weathered glacial till was observed below the topsoil in all of the borings except GEI-10, GEI-11, GEI-13 and GEI-14. The weathered till extends about 4½ to 8 feet deep and consists of brown medium dense to dense silty sand and/or very stiff to hard sandy silt with varying gravel and cobble content. Dense to very dense relatively unweathered glacial till was observed below the weathered till or fill in all of the borings completed except for GEI-11. The unweathered glacial till generally consists of gray silty sand or sandy silt with variable gravel and cobbles. The glacial till deposits are about 50 feet thick on the west side of the site and decreases in thickness to about 6 feet along the east side of the site. The glacial till also pinches out to the north.

Transitional Bed Deposits. Transitional bed deposits were observed below the glacial till in the southern half of the site. The transitional bed deposits were observed 9½ to 28 feet below the existing ground surface. The transitional bed deposits typically consist of dense to very dense sand with silt and gravel. In GEI-14, glaciolacustrine deposits were encountered below the transitional bed deposits, which suggests that the glaciolacustrine deposits dive down to the south at a relatively steep declination.

Glaciolacustrine Deposits. Glaciolacustrine deposits generally consist of stiff to hard gray silt/clay and were observed below the glacial till in the northern portion of the site and are interpreted to dive below the transitional bed deposits to the south. The glaciolacustrine deposits were observed as shallow as 4½ feet below ground surface at the north end of the site and up to 33 feet below ground surface in GEI-14 near the center of the site. The borings terminated in the glaciolacustrine deposits, where encountered.

3.4. Groundwater Conditions

Groundwater is present within the transitional bed deposits in the southern portion of the site and is interpreted to be under artesian pressure. Perched groundwater also exists above and within permeable layers of the glaciolacustrine deposits. Measurements indicate that the groundwater ranges from Elevation 65 to 84¼ feet across the site. Transitional bed deposits were not encountered in the northern portion of the site and monitoring wells were screened within the glaciolacustrine deposits. Artesian conditions have been encountered in previous projects on the campus, especially within the transitional bed deposits and should be expected at the site. Perched groundwater is typical within and overlying the glacial till deposits and should be expected within permeable layers within the till deposits.

Groundwater observations represent conditions observed during drilling and at the time of readings and may not represent the groundwater conditions throughout the year. We anticipate that perched groundwater will exist at the contact between the glacial till and the overlying looser weathered till soils, and within more permeable layers within the native glacial soils. Groundwater seepage is expected to fluctuate as a result of season, precipitation, and other factors.

4.0 CONCLUSIONS AND RECOMMENDATIONS

Based on the results of our field exploration program, laboratory testing, and engineering analysis, we conclude that development of the site can be accomplished as proposed and that shallow foundation support will be suitable for the planned STEM building(s). A summary of primary geotechnical considerations for the site development is provided in the subsequent sections.

4.1. Earthquake Engineering

We evaluated the site for seismic hazards including liquefaction, lateral spreading, fault rupture and earthquake induced landsliding. Our evaluation indicates that the site does not have liquefiable soils present and therefore also has no risk of liquefaction induced lateral spreading. In addition the site has a low risk of fault rupture and earthquake induced landsliding.

4.1.1. 2015 IBC Seismic Design Information

For the site, we recommend the International Building Code (IBC) 2015 parameters for Site Class, short period spectral response acceleration (S_S), 1-second period spectral response acceleration (S_1), and Seismic Coefficients F_A and F_V presented in Table 1.

TABLE 1. IBC SEISMIC PARAMETERS

2015 IBC Parameter	Recommended Value
Site Class	D
Short Period Spectral Response Acceleration, S_S (percent g)	126.8
1-Second Period Spectral Response Acceleration, S_1 (percent g)	49.1
Seismic Coefficient, F_A	1.000
Seismic Coefficient, F_V	1.509

Once the actual building location(s) are determined, the Site Class should be re-evaluated to determine if Site Class D is still appropriate, or if Site Class C may be considered, especially if the building is located on the southern portion of the site where the dense glacial till soils were encountered.

4.1.2. Liquefaction Potential

Liquefaction is a phenomenon where soils experience a rapid loss of internal strength as a consequence of strong ground shaking. Ground settlement, lateral spreading and/or sand boils may result from soil liquefaction. Structures supported on liquefied soils could suffer foundation settlement or lateral movement that could be severely damaging to the structures.

Conditions favorable to liquefaction occur in loose to medium dense, clean to moderately silty sand, which is below the groundwater level. Based on our evaluation of the subsurface conditions observed in the explorations completed at the site, it is our opinion that potentially liquefiable soils are not present below the site.

4.1.3. Ground Rupture

Ground rupture from lateral spreading is associated with liquefaction. Lateral spreading involves lateral displacements of large volumes of liquefied soil, and can occur on near-level ground as blocks of surface soils displace relative to adjacent blocks. In our opinion, ground rupture resulting from lateral spreading at the site is unlikely because potentially liquefiable soils are not present at the site.

Because of the thickness of the Quaternary sediments below the site, which are commonly more than 1,000 feet thick, the potential for surface fault rupture is considered remote.

4.1.4. Landslides

Because dense to very dense/hard glacial till, transitional bed deposits and glaciolacustrine deposits occur at shallow depths, it is our opinion that landsliding as a result of strong ground shaking is unlikely at this site.

4.2. Earthwork

Based on the subsurface soil conditions encountered in the borings, we expect that the soils at the site may be excavated using conventional heavy-duty construction equipment. The materials we encountered are generally loose to medium dense to depths of about 1 to 4½ feet where topsoil and weathered glacial soils were encountered. Below the topsoil and weathered soils, the native soils are generally hard silt/clay and dense to very dense silty sand. Materials within the deeper portions of excavations will require a large excavator to accomplish the excavations. Glacial deposits in the area commonly contain boulders that may be encountered during excavation. Accordingly, the contractor should be prepared to deal with boulders, if encountered.

The onsite soils within the anticipated excavation zone contain a high percentage of fines (material passing the U.S. standard No. 200 sieve) that are moisture-sensitive and susceptible to disturbance, especially when wet. Ideally, earthwork should be undertaken during extended periods of dry weather when the surficial soils will be less susceptible to disturbance and provide better support for construction equipment. Dry weather construction (typically June through September) will help reduce earthwork costs.

If earthwork will occur between October and May, we suggest that a contingency be included in the project schedule and budget to account for increased earthwork difficulties.

Trafficability on the site is not expected to be difficult during dry weather conditions. However, the native soils will be susceptible to disturbance from construction equipment during wet weather conditions. Even in the summer months pumping and rutting of the exposed native lacustrine and transitional bed soils under equipment loads will occur.

4.2.1. Clearing and Site Preparation

All areas to receive fill, structures or pavements should be cleared of vegetation and stripped of topsoil. Clearing should consist of removal of all trees, brush and other vegetation within the designated clearing limits. The topsoil materials could be separated and stockpiled for use in areas to be landscaped. Debris should be removed from the site, but organic materials could be chipped/composted and also reused in landscape areas, if desired.

We anticipate that the depth of stripping will generally be up to 6 inches. Stripping depths may be greater in some areas, particularly where trees and large vegetation have been removed. Actual stripping depths should be determined based on field observations at the time of construction. The organic soils can be stockpiled and used later for landscaping purposes or may be spread over disturbed areas following completion of grading. If spread out, the organic strippings should be in a layer less than 1-foot thick, should not be placed on slopes greater than 3H:1V (horizontal to vertical) and should be track-rolled to a uniformly compacted condition. Materials that cannot be used for landscaping or protection of disturbed areas should be removed from the project site.

Grubbing of the project should consist of removing and disposal of stumps, roots larger than 1-inch-diameter, and matted roots from the designated grubbing areas. Grubbed materials should be completely removed from the project site. All depressions made during the grubbing activities to remove stumps and other materials, should be completely backfilled with properly placed and compacted structural fill.

Care must be taken to minimize softening of the subgrade soils during stripping operations. Areas of exposed subgrade which become disturbed should be compacted to a firm, non-yielding condition, if practical, prior to placing any structural fill necessary to achieve design grades. If this is not practical because the material is too wet, the disturbed material must be aerated and recompacted or excavated and replaced with structural fill.

Construction of the proposed STEM building(s) may require removal of the existing rockery located west of the Crescent Walkway alignment.

All existing utilities should be removed from the building footprint(s) and rerouted if needed. Existing trench backfill should also be removed and replace with structural fill under the building(s). We understand that a deep groundwater interceptor trench was installed near the bottom of the slope during the original campus development. This interceptor trench extends from near the CC3 building south to the existing UW3 building and is located upslope of the Crescent Walk and associated rockery. Existing utility trench backfill under the building footprint(s) should be evaluated during final design such that mitigation measures can be implemented as needed.

4.2.2. Subgrade Preparation

Prior to placing new fills, pavement base course materials or structural fill below on-grade floor slabs, subgrade areas should be proof rolled to locate any soft or pumping soils. Prior to proof rolling, all unsuitable soils should be removed from below building and pavement areas. Proof rolling can be completed using a piece of heavy tire-mounted equipment such as a loaded dump truck. During wet weather, the exposed subgrade areas should be probed to determine the extent of soft soils. If soft or pumping soils are observed, they should be removed and replaced with structural fill.

We recommend that building concrete slabs-on-grade be supported on at least 6 inches of capillary break gravel overlying properly compacted imported structural fill or approved native soil subgrade. Recommendations for subgrade preparation under building foundations is provided in the foundation support section of this report.

If deep pockets of soft or pumping soils are encountered below floor slabs or outside the building footprint, it may be possible to limit the depth of overexcavation by placing a woven geotextile fabric such as Mirafi 500X (or similar material) on the overexcavated subgrade prior to placing structural fill. The geotextile will provide additional support by bridging over the soft material and will help reduce fines contamination into the structural fill. This may be performed under pavement and building floor slab areas depending on actual conditions observed during construction, but it should not occur under future building foundations.

After completing the proof rolling, the subgrade areas should be recompacted to a firm and unyielding condition, if possible. The achievable degree of compaction will depend on when construction is performed. If the work is performed during dry weather conditions, we recommend that all subgrade areas be recompacted to at least 95 percent of the maximum dry density (MDD) in accordance with the American Society for Testing and Materials (ASTM) D 1557 test procedure (modified Proctor). If the work is performed during wet weather conditions, it may not be possible to recompact the subgrade to 95 percent of the MDD. In this case, we recommend that the subgrade be compacted to the extent possible without causing undue weaving or pumping of the subgrade soils.

Subgrade disturbance or deterioration could occur if the subgrade is wet and cannot be dried. If the subgrade deteriorates during proof rolling or compaction, it may become necessary to modify the proof rolling or compaction criteria or methods.

4.2.3. Subgrade Protection

Site soils contain significant fines content (silt/clay) and will be highly sensitive and susceptible to moisture and equipment loads. The contractor should take necessary measures to prevent site subgrade soils from becoming disturbed or unstable. Construction traffic during the wet season should be restricted to specific areas of the site, preferably areas that are surfaced with crushed rock materials not susceptible to wet weather disturbance.

4.2.4. Structural Fill

All fill, whether on-site or imported soil, supporting floor slabs, pavement areas, foundations, or placed against retaining walls or in utility trenches should meet the criteria for structural fill presented below. The suitability of soil for use as structural fill depends on its gradation and moisture content.

Materials

Materials to be placed below the building footprint(s), to backfill below-grade structures, below-grade walls, utility trenches, and paved areas are classified as structural fill for the purpose of this report. Structural fill material quality varies depending upon its use as described below:

1. Structural fill placed below the building foundations (designed for 3,000 psf bearing or less), within the building footprint(s), behind below-grade walls, and within the 1H:1V zone of influence of the building footprint(s) should consist of imported gravel borrow as described in Section 9-03.14(1) of the 2018 Washington State Department of Transportation (WSDOT) Standard Specifications, with the additional restriction that the fines content be limited to no more than 5 percent.
2. Structural fill placed to construct embankment, roadway, and parking areas, to backfill utility trenches, and for general site grading may consist of on-site weathered till and glacial till soils or suitable fill soils provided that the soils are properly conditioned for the required compaction. If needed during dry weather, imported soil should meet the criteria for select borrow as described in Section 9-03.14(2) of the 2018 WSDOT Standard Specifications. On-site soils and imported select borrow will be suitable for use as structural fill during dry weather conditions only and only if properly moisture conditions and compacted. If structural fill is placed during wet weather and/or the wet season (October through May) the structural fill should consist of imported gravel borrow as described in Section 9-03.14(1) of the 2018 WSDOT Standard Specifications, with the additional restriction that the fines content be limited to no more than 5 percent. For planning purposes we recommend that gravel borrow be used throughout the project during wet weather conditions and from October through May.
3. Structural fill placed immediately outside below-grade walls (drainage zone) or around footing drains should consist of washed ⅜-inch to No. 8 pea gravel per Section 9-03.1(4)C Grading No. 8, or conform to Section 9-03.12(4) of the 2018 WSDOT Standard Specifications, as shown on Figure 5, Wall Drainage and Backfill.
4. Structural fill placed as crushed surfacing base course (CSBC) below pavements should conform to Section 9-03.9(3) of the 2018 WSDOT Standard Specifications.
5. Structural fill placed as capillary break below slabs should consist of 1-inch minus clean crushed gravel with negligible sand or silt in conformance with Section 9-03.1(4)C, Grading No. 67 of the 2018 WSDOT Standard Specifications, as shown on Figure 5.

Reuse of On-site Native Soils

Imported gravel borrow should be used for backfill required within the STEM building footprint(s) and within the building influence zone. The on-site weathered till and glacial till soils are expected to be suitable for use as structural fill in areas outside of the building footprint in areas requiring compaction to at least 95 percent of MDD (per ASTM D 1557) provided the work is accomplished during the normally dry season (July through September) and that the soil can be properly moisture conditioned to achieve the specified compaction criteria. Laboratory tests indicate that the moisture content of on-site soils within anticipated areas of cut ranges between about 1 to 33 percent. The optimum moisture content to achieve adequate compaction for the glacial till soils likely ranges from 7 to 9 percent; therefore, the contactor should be prepared to dry the on-site soils as necessary during the dry season.

Transitional bed deposits and glaciolacustrine silt and clay deposits should not be reused as structural fill on the site.

It will be necessary to import gravel borrow to achieve adequate compaction for support of pavement and other areas outside of the building footprint during wet weather construction. For planning purposes the project should include importing all structural fill for wet weather construction where compaction to at least 90 percent of MDD is required. The use of existing on-site glacial till soils as structural fill during wet weather should be planned only for areas requiring compaction to 90 percent of MDD, as long as the soils are properly protected and not placed during periods of precipitation. The contractor should plan to cover all stockpiles with plastic sheeting if to be used as structural fill. The reuse of on-site soils is highly dependent on the skill of the contractor, schedule, and the weather, and we will work with the design team to maximize the reuse of on-site soils during the wet and dry seasons.

Reuse of Existing Concrete Rubble

Existing base course, and Portland cement concrete rubble may be reused as structural fill if properly crushed during demolition. Portland cement concrete rubble and base course materials may be reused as structural fill throughout the project except in landscape areas. For use as structural fill, the concrete rubble should be crushed or otherwise ground up and should meet the gradation requirements for gravel borrow as described in Section 9-03.14(1) of the 2018 WSDOT Standard Specifications. If recycled concrete will be used under pavement areas, we recommend that it meet the gradation requirements for CSBC as described in Section 9-03.9(3) of the 2018 WSDOT Standard Specifications.

Fill Placement and Compaction Criteria

Structural fill should be mechanically compacted to a firm, non-yielding condition. Structural fill should be placed in loose lifts not exceeding 12 inches in thickness when using heavy compactors and 4 inches when using hand operated compactors. The actual thickness will be dependent on the structural fill material used and the type and size of compaction equipment. Each lift should be moisture conditioned to within about 2 percent of the optimum moisture content and compacted to the specified density before placing subsequent lifts. Compaction of all structural fill at the site should be in accordance with the ASTM D 1557 test method. Structural fill should be compacted to the following criteria:

1. Structural fill placed below floor slabs and designated foundations should be compacted to at least 95 percent of the MDD, including all backfill for utility trenches under the building footprint(s).
2. Structural fill placed behind below-grade walls should be compacted to between 90 to 92 percent of the MDD estimated in accordance with ASTM D 1557. Care should be taken when compacting fill near the face of below-grade walls to avoid over-compaction and hence overstressing the walls. Hand operated compactors should be used within 5 feet behind the wall. Wall backfill placed within the building footprint and under floor slabs should be compacted to between 90 to 92 percent of the MDD within 5 feet of the walls and to at least 95 percent of the MDD beyond 5 feet of the walls. The upper 3 feet of fill below floor slab subgrade should also be compacted to at least 95 percent of the MDD. The contractor should keep all heavy construction equipment away from the top of retaining walls a distance equal to half the height of the wall, or at least 5 feet, whichever is greater.
3. Structural fill in new pavement and hardscape areas, including utility trench backfill, should be compacted to at least 90 percent of the MDD, except that the upper 2 feet of fill below final subgrade should be compacted to at least 95 percent of the MDD, as shown on Figure 6, Compaction Criteria for Trench Backfill.
4. Structural fill placed as crushed rock base course below pavements should be compacted to 95 percent of the MDD.

5. Non-structural fill, such as fill placed in landscape areas, should be compacted to at least 90 percent of the MDD.

Weather Considerations

Disturbance of near surface soils should be expected if earthwork is completed during periods of wet weather. During dry weather the soils will: (1) be less susceptible to disturbance, (2) provide better support for construction equipment, and (3) be more likely to meet the required compaction and subgrade preparation criteria.

The wet weather season generally begins in October and continues through May in western Washington; however, periods of wet weather may occur during any month of the year. For earthwork activities during wet weather, we recommend that the following steps be taken:

- The ground surface in and around the work area should be sloped so that surface water is directed away from the work area. The ground surface should be graded so that areas of ponded water do not develop. Measures should be taken by the contractor to prevent surface water from collecting in excavations and trenches. Measures should be implemented to remove surface water from the work area.
- Earthwork activities should not take place during periods of moderate to heavy precipitation.
- Slopes with exposed soils should be covered with plastic sheeting.
- The contractor should take necessary measures to prevent on-site soils and soils to be used as fill from becoming wet or unstable. These measures may include the use of plastic sheeting, sumps with pumps, and grading. The site soils should not be left uncompacted and exposed to moisture. Sealing the surficial soils by rolling with a smooth-drum roller prior to periods of precipitation will help reduce the extent that these soils become wet or unstable.
- The contractor should cover all soil stockpiles that will be used as structural fill with plastic sheeting.
- Construction traffic should be restricted to specific areas of the site, preferably areas that are surfaced with working pad materials not susceptible to wet weather disturbance.
- Construction activities should be scheduled so that the length of time that soils are left exposed to moisture is reduced to the extent practical.

Routing of equipment on the native soils during the wet weather months will be difficult and the subgrade will likely become highly disturbed and rutted. In addition, a significant amount of mud can be produced by routing equipment directly on the glacial soils in wet weather. Therefore, to protect the subgrade soils and to provide an adequate wet weather working surface for the contractor's equipment and labor, we recommend that the contractor protect exposed subgrade soils with crushed gravel or asphalt-treated base (ATB).

4.2.5. Permanent Cut and Fill Slopes

We recommend that permanent slopes be constructed at inclinations of 2H:1V or flatter. Fill slopes should be blended into existing slopes with smooth transitions. To achieve uniform compaction, we recommend that fill slopes be overbuilt slightly and subsequently cut back to expose well-compacted fill.

All fill placed on existing slopes, including structural fill placed under the building, should be benched or keyed into the slope in accordance with Section 2-03.3(14) of the 2018 WSDOT Standard Specifications.

To reduce erosion, newly constructed slopes should be planted or hydroseeded shortly after completion of grading. Until the vegetation is established, some sloughing and raveling of the slopes should be expected. This may necessitate localized repairs and reseeding. Temporary covering, such as clear heavy plastic sheeting, jute fabric, or erosion control blankets (such as American Excelsior Curlex 1 or North American Green SC150) could be used to protect the slopes during periods of rainfall.

4.2.6. Utility Trenches

Trench excavation, pipe bedding, and trench backfilling should be completed using the general procedures described in the 2018 WSDOT Standard Specifications or other suitable procedures specified by the project civil engineer. The native glacial deposits and fill soils encountered at the site are generally of low corrosivity based on our experience in the Puget Sound area and on the campus.

Utility trench backfill should consist of structural fill and should be placed in lifts of 12 inches or less (loose thickness) when using heavy compaction equipment such that adequate compaction can be achieved throughout the lift. The loose lift thickness should not exceed 6 inches when using hand operated equipment. Each lift must be compacted prior to placing the subsequent lift. Prior to compaction, the backfill should be moisture conditioned to within about 2 percent of the optimum moisture content, if necessary. The backfill should be compacted in accordance with the criteria discussed above. Figure 6 illustrates recommended trench compaction criteria under pavement and non-structural areas.

4.2.7. Erosion and Sediment Control

In our opinion, the erosion potential of the on-site soils is low to moderate. Construction activities including stripping and grading will expose soils to the erosional effects of wind and water. The amount and potential impacts of erosion are partly related to the time of year that construction actually occurs. Wet weather construction will increase the amount and extent of erosion and potential sedimentation.

Erosion and sedimentation control measures may be implemented by using a combination of interceptor swales, straw bale barriers, silt fences and straw mulch for temporary erosion protection of exposed soils. All disturbed areas should be finish graded and seeded as soon as practicable to reduce the risk of erosion. Erosion and sedimentation control measures should be installed and maintained in accordance with the requirements of the City of Bothell.

4.3. Excavation Considerations

Excavations are planned for the STEM building and associated underground utilities. Cuts up to 15 feet deep may be required for the STEM building.

Although design of the buildings(s) has not commenced at this time, we anticipate the STEM building(s) will have four levels with concrete slabs-on-grade constructed by stepping up the slope. The lower level will daylight to the east near the Crescent Walk while the second or third level of the building(s) may daylight at the west end of the building. A majority of the excavations can likely be made as temporary open cut slopes depending on site constraints. We anticipate that temporary soil nail shoring or cantilevered soldier piles with lagging can be used to construct the below-grade walls at the transitions from the lower level to the first level, if needed. General recommendations for temporary soldier pile and tieback wall and temporary soil nail wall shoring systems are included in the following sections.

The contractor performing the work has the primary responsibility for protection of workmen and adjacent improvements. In our opinion, the contractor will be in the best position to observe subsurface conditions continuously throughout the construction process and to respond to variable soil and groundwater conditions. Therefore, the contractor should have the primary responsibility for deciding whether or not to use open cut slopes for much of the excavations rather than some form of temporary excavation support, and for establishing the safe inclination of the cut slope. Acceptable slope inclinations for utilities and ancillary excavations should be determined during construction. Because of the diversity of construction techniques and available shoring systems, the design of temporary shoring is most appropriately left up to the contractor proposing to complete the installation. Temporary cut slopes and shoring must comply with the provisions of Title 296 WAC, Part N, "Excavation, Trenching and Shoring."

The excavations will be completed primarily in fill, medium dense to very dense glacial till, dense to very dense and very stiff to hard transitional bed deposits and very stiff to hard glaciolacustrine deposits. The following sub-sections summarize our general excavation recommendations.

4.3.1. Temporary Cut Slopes

For planning purposes, temporary unsupported cut slopes more than 4 feet high may be inclined at 1H:1V maximum steepness within the dense to very dense/very stiff to hard glacial till and transitional bed deposits and 1.5H:1V maximum steepness in the fill, medium dense weathered till, and glaciolacustrine deposits. If conditions allow, temporary cuts made in the dense to very dense till may be included to ¾H:1V, based on observations made during construction by the geotechnical engineer and if groundwater seepage is not encountered. If significant seepage is present on the cut face then the cut slopes may have to be flattened. However, temporary cuts should be discussed with the geotechnical engineer during final design development to evaluate suitable cut slope inclinations for the various portions of the excavation. The contractor should scale slopes cut at 1H:1V or steeper to remove loose materials and cobbles.

The above guidelines assume that surface loads such as traffic, construction equipment, stockpiles or building supplies will be kept away from the top of the cut slopes a sufficient distance so that the stability of the excavation is not affected. We recommend that this distance be at least 5 feet from the top of the cut for temporary cuts made at 1H:1V or flatter, and no closer than a distance equal to one half the height of the slope for cuts made steeper than 1H:1V.

Temporary cut slopes should be planned such that they do not encroach on a 1H:1V influence line projected down from the edges of nearby or planned foundation elements. New footings planned at or near existing grades and in temporary cut slope areas for the lower level should extend through wall backfill and be embedded in native soils.

Water that enters the excavation must be collected and routed away from prepared subgrade areas. We expect that this may be accomplished by installing a system of drainage ditches and sumps along the toe of the cut slopes. Some sloughing and raveling of the cut slopes should be expected. Temporary covering, such as heavy plastic sheeting with appropriate ballast, should be used to protect these slopes during periods of wet weather. Surface water runoff from above cut slopes should be prevented from flowing over the slope face by using berms, drainage ditches, swales or other appropriate methods.

If temporary cut slopes experience excessive sloughing or raveling during construction, it may become necessary to modify the cut slopes to maintain safe working conditions. Slopes experiencing problems can be flattened, regraded to add intermediate slope benches, or additional dewatering can be provided if the poor slope performance is related to groundwater seepage.

4.3.2. Soldier Pile and Tieback Walls

Soldier pile walls consist of steel beams that are concreted into drilled vertical holes located along the wall alignment, typically about 8 feet on center. After excavation to specified elevations, tiebacks are installed, if necessary. Once the tiebacks are installed, the pullout capacity of each tieback is tested, and the tieback is locked off to the soldier pile at or near the design tieback load. Tiebacks typically consist of steel strands or bars that are installed into pre-drilled holes and then either tremie or pressure grouted. Timber lagging is typically installed behind the flanges of the steel beams to retain the soil located between the soldier piles. Geotechnical design recommendations for each of these components of the soldier pile and tieback wall system are presented in the following sections.

Soldier Piles

We recommend that soldier pile walls be designed using the earth pressure diagrams presented in Figure 7, Earth Pressure Diagrams – Temporary Soldier Pile & Tieback Wall. The earth pressures presented in Figure 7 are for full-height cantilever soldier pile walls and for full-height soldier pile walls with a single or multiple levels of tiebacks. The earth pressures presented in Figure 7 represent the estimated loads that will be applied to the wall system for various wall heights.

The earth pressures presented in Figure 7 include the loading from traffic surcharge. Other surcharge loads such as cranes, construction equipment, or construction staging areas should be considered on a case-by-case basis, as shown on Figure 8, Recommended Surcharge Pressures. No seismic pressures have been included in Figure 7 since the walls will be temporary.

We recommend that the embedded portion of the soldier piles be at least 2 feet in diameter and extend a minimum distance of 10 feet below the base of the excavation to resist “kick-out.” The axial capacity of the soldier piles must resist the downward component of the anchor loads and other vertical loads, as appropriate. We recommend using an allowable end bearing value of 40 kips per square foot (ksf) for piles supported on the glacially consolidated soils. The allowable end bearing value should be applied to the base area of the drilled hole into which the soldier pile is concreted. This value includes a factor of safety of about 2.5. The allowable end bearing value assumes that the shaft bottom is cleaned out immediately prior to concrete placement. If necessary, an allowable pile skin friction of 1.5 ksf may be used on the embedded portion of the soldier piles to resist the vertical loads.

Lagging

We recommend that the temporary timber lagging be sized using the procedures outlined in the Federal Highway Administration’s Geotechnical Engineering Circular No. 4. The site soils are best described as competent soils. Table 2 presents recommend lagging thicknesses (roughcut) as a function of soldier pile clear span and depth.

TABLE 2. RECOMMENDED LAGGING THICKNESS

Depth (feet)	Recommended Lagging Thickness (roughcut) for clear spans of:					
	5 feet	6 feet	7 feet	8 feet	9 feet	10 feet
0 to 25	2 inches	3 inches	3 inches	3 inches	4 inches	4 inches
25 to 50	3 inches	3 inches	3 inches	4 inches	4 inches	5 inches

Lagging should be installed promptly after excavation, especially in areas where perched groundwater is present or where clean sand and gravel soils are present and caving soils conditions are likely. The workmanship associated with lagging installation is important for maintaining the integrity of the excavation.

The space behind the lagging should be filled with soil as soon as practicable. Placement of this material will help reduce the risk of voids developing behind the wall and damage to existing improvements located behind the wall.

Material used as backfill in voids located behind the lagging should not cause buildup of hydrostatic pressure behind the wall. Lean concrete or controlled density fill (CDF) are suitable options for use as backfill behind the walls. Lean concrete or CDF will reduce the volume of voids present behind the wall. Based on our experience, the voids between each lean concrete or CDF lift are sufficient for preventing the buildup of hydrostatic pressure behind the wall.

Tiebacks

Tieback anchors can be used for wall heights where cantilever soldier pile walls are not cost-effective. Tieback anchors should extend far enough behind the wall to develop anchorage beyond the “no-load” zone and within a stable soil mass. The anchors should be inclined downward at 15 to 25 degrees below the horizontal. Corrosion protection will not be required for the temporary tiebacks.

Centralizers should be used to keep the tieback in the center of the hole during grouting. Structural grout or concrete should be used to fill the bond zone of the tiebacks. A bond breaker, such as plastic sheathing, should be placed around the portion of the tieback located within the no-load zone if the shoring contractor plans to grout both the bond zone and unbonded zone of the tiebacks in a single stage. If the shoring contractor does not plan to use a bond breaker to isolate the no-load zone, GeoEngineers should be contacted to provide recommendations.

Loose soil and slough should be removed from the holes drilled for tieback anchors prior to installing the tieback. The contractor should take necessary precautions to minimize loss of ground and prevent disturbance to previously installed anchors and existing improvements in the site vicinity. Holes drilled for tiebacks should be grouted/filled promptly to reduce the potential for loss of ground.

Tieback anchors should develop anchorage in the glacial till, transitional bed deposits or glaciolacustrine deposits. We recommend that spacing between tiebacks be at least three times the diameter of the anchor hole to minimize group interaction. We recommend a preliminary design load transfer value between the anchor and soil of 4 kips per foot for glacial till and transition bed deposits and 1.5 kips per foot for fill soils, medium dense weathered till soils, and glaciolacustrine deposits. Higher adhesion values may be developed, depending on the anchor installation technique. The contractor should be given the opportunity to use higher adhesion values by conducting performance tests prior to the start of installing the production tieback anchors.

The tieback anchors should be verification- and proof-tested to confirm that the tiebacks have adequate pullout capacity. The pullout resistance of tiebacks should be designed using a factor of safety of 2. The pullout resistance should be verified by completing at least two successful verification tests in each soil type and a minimum of eight total tests for the project. Each tieback should be proof-tested to 133 percent of the design load. Verification and proof tests should be completed as described in Appendix D, Ground Anchor Load Tests.

The tieback layout and inclination should be checked to confirm that the tiebacks do not interfere with adjacent buried utilities.

Drainage

A suitable drainage system should be installed to prevent the buildup of hydrostatic groundwater pressures behind the soldier pile and lagging wall. It may be necessary to cut weep holes through the lagging in wet areas. Seepage flows at the bottom of the excavation should be contained and controlled. Drainage should be provided for permanent below-grade walls as described below in the "Wall Drainage" section of this report.

Construction Considerations

Temporary casing or drilling fluid may be required to install the soldier piles and possibly the tiebacks where:

- Loose fill is present;
- The native soils do not have adequate cementation or cohesion to prevent caving or raveling; and/or
- Perched groundwater or regional groundwater table is present.

GeoEngineers should be allowed to observe and document the installation and testing of the shoring to verify conformance with the design assumptions and recommendations.

4.3.3. Soil Nail Walls

The soil nail wall system consists of drilling and grouting rows of steel bars or "nails" behind the excavation face as it is excavated and then covering the face with reinforced shotcrete. The placement of soil nails reinforces the soils located behind the excavation face and increases the soil's ability to resist a mass of soil from sliding into the excavation. GeoEngineers should prepare the soil nail design or should be allowed to review the design-build soil nail design to estimate shoring wall deflections and to provide recommendations for additional deflection control measures, as appropriate.

Soil nail walls are typically constructed using the following sequence:

1. Excavate the soil at the wall face to between 1 and 3 feet below the row of soil nails to be installed. Depending upon the soil conditions at the wall face, the excavation may be completed with a vertical cut or with berms (native or fill).
2. Drill, install and grout soil nails.
3. Excavate berm, if present, located within about 3 feet below the elevation of the soil nail.

4. Place drainage strips, steel wire mesh and/or reinforcing bars in front of excavated soil.
5. Install shotcrete and place steel plates and nuts over soil nails.
6. Complete nail pullout capacity testing on approximately 1 out of every 20 nails in an installed row.
7. Repeat steps 2 through 7 for each row of nails located below the completed row.

Soil nails typically consist of #6 to #12 threaded steel bars (¾- to 1½-inch diameter). The steel bars are placed in 4- to 12-inch-diameter holes drilled at angles typically ranging from 10 to 25 degrees below horizontal. Centralizers are used to center the steel bars in the holes. Once the steel bars are installed, the holes are grouted using cement grout or concrete. Post-grout tubes can be installed with the steel bars to increase the bond strength between the grout and the soil. Post-grouting consists of injected grout under high pressure through holes placed in the post-grout tube one to two days after initial grout placement.

The soils typically are required to have an adequate standup time (to allow placement of the steel wire mesh and/or reinforcing bars to be installed and the shotcrete to be placed). Soils that have short standup times are problematic for soil nailing.

Preliminary Design Recommendations

We recommend the following for preliminary design purposes:

- Vertical elements at approximately 6 feet on center.
- A soil nail grid pattern of about 6 feet by 6 feet. A tighter grid pattern may be necessary where construction-related surcharges are anticipated.
- A soil nail length ranging up to the wall height (but not less than 10 feet), inclined at about 15 to 20 degrees from the horizontal.
- A preliminary allowable load transfer value of 1.5 kip per foot for fill, medium dense weathered till and glaciolacustrine deposits and 4 kips per foot for the glacial till and transitional bed deposits for 6- to 12-inch-diameter nails.
- Strips of drainage material installed behind the shotcrete to relieve hydrostatic pressures. Additional drainage provisions may be necessary if significant groundwater is encountered during the excavation.

The fill at the site, where present, will affect the soil nail design. Typically, the soil nail spacing is tighter or the soil nails are longer, or both, where fill or looser native soils are present compared to where stiff to hard silt and clay or dense to very dense sand and gravel soils are present.

Difficulties associated with face stability and standup time may be experienced during construction in the site soils. The fill soils and medium dense weathered till may have shorter standup times. Some sloughing may occur, especially in the fill, which may result in requiring increased shotcrete volumes.

Contractors experienced in the soil nailing method should be able to mitigate significant spalling and raveling conditions. Contractors should also be prepared to use techniques to address problems that occur because of caving soils. The contractor should be made responsible for the safety of the shoring system.

Testing of selected soil nails should be completed as described in Appendix D.

Drainage

A suitable drainage system should be installed to prevent the buildup of hydrostatic groundwater pressures behind the soil nail walls. Drainage behind soil nail walls typically consists of prefabricated geocomposite drainage strips, such as AmerDrain® 500, installed vertically between the soil nails. The drainage strips are typically a minimum of 16 inches wide and extend the entire height of the wall. Horizontal drainage strips may also be used in areas where perched groundwater is observed, at cold joints in permanent top-down basement wall construction, or for other reasons. We recommend that drainage strips be connected to a tightline pipe installed along the base of the wall and routed to a suitable discharge point as described in the "Wall Drainage" section of this report.

4.4. Temporary Dewatering

The groundwater measured in the monitoring wells installed for the project indicate water levels between Elevation 65 to 84¼ feet across the site. Artesian conditions have been observed in previous projects within the vicinity of the planned building(s). We anticipate planned lower level finish floor elevations may range from 72 to 78 feet, with excavations for utilities and footings likely up to 4 to 8 feet below the finish floor level. Therefore, the contractor should plan for some form of groundwater control at the base of the lower level excavation.

The existing UW3 building was constructed without any special dewatering systems and the contractor was able to control groundwater seepage with a deep network of sump pumps and ditches. The existing south parking garage on the campus and UW3 building were constructed by dewatering the excavation using the permanent underslab drainage system, which consisted of a network of interceptor trenches with drain pipes and backfilled with pea gravel. Groundwater collected in the underslab drainage system was drained by gravity to a nearby catch basin. A similar system may be suitable for the STEM building(s), if conditions are warranted. Refer to the "Slab-on-Grade Floors" section of this report for additional discussion regarding the lower level underdrain system.

The transitional bed deposits consist of interbedded layers of hard silt and very dense fine to medium sand with variable silt content of moderate permeability. The compactness and smaller grain size of the observed sand layers suggest that low to moderate quantities of water may be transmitted through the deposits. Because of the nature of the soils, well points may be needed to effectively dewater the excavation and relieve artesian pressures under the footprint of the lower level; however, it may be possible to effectively dewater the site using sump pumps in deepened trenches, but this must be determined by the contractor.

Based on slug tests completed in a previous project south of the STEM building location, the estimated mean calculated hydraulic conductivity value is approximately 0.001 centimeters per second (2.8 feet per day). This value is typical for the silty sand with gravel and interbedded silt aquifer material observed during drilling. Estimated groundwater flow quantities, based on the planned excavation depth and geometry, and the estimated hydraulic conductivity for varying dewatering depths are summarized in Table 3. Zones or lenses of highly permeable sand and gravel may produce locally higher flow rates, and should be handled during construction as needed.

TABLE 3. ESTIMATED GROUNDWATER SEEPAGE DURING CONSTRUCTION

Dewatering Depth	Estimated Flow Range (gallons per minute, gpm)
Planned Finish Floor	5 to 15
Planned Finish Floor minus 3 feet	10 to 25
Planned Finish Floor minus 6 feet	15 to 40

The temporary dewatering system should be designed to maintain the groundwater level at least 3 feet below the foundation subgrade elevation until such time that the engineer determines that the permanent underslab drainage system is completely constructed, all foundations and underground utilities are installed, and the permanent underslab drainage system is functioning properly. We recommend that well points, if used, be turned off after the permanent drainage and underslab drainage systems have been installed and prior to placing concrete slabs-on-grade to ensure that they function as intended.

In our opinion, the contractor should be responsible for designing and installing the appropriate dewatering system needed to complete the work. Appropriate discharge points should be designated by the contractor. Also, the contractor will need to obtain the necessary discharge permits from the regulatory agencies. We recommend the details of the dewatering system be reviewed by GeoEngineers prior to construction. This will allow us to evaluate if the designs are consistent with the intent of our recommendations, and to provide supplemental recommendations in a timely manner.

Other dewatering issues which must be addressed include disposal of water and backup power. We anticipate that water removed from excavations will be diverted into the existing storm sewer system. A permit will be required to do this. Water sampling prior to and during dewatering will also be required as a part of the permit.

We recommend that a separate line item be included for dewatering in the construction bit documents. This will allow an evaluation of the proposed dewatering scheme separate from the rest of the bid. The following sections discuss well points and sump pumping, two dewatering methods that are anticipated to be the most cost effective for dewatering the lower level of the STEM building excavation.

4.4.1. Well Points

Well points are effective for dewatering all types of soils, whether pumping small amounts of water from silt or large quantities of water from sand and gravel. The volume of water generated by a well point system is typically less than the volume generated by a corresponding system of pumped wells because the well points are generally completed at a shallower depth. Because of the shallower completion depth, the volume of aquifer that contributes water to a well point system is less than for a comparable deep well system.

Well point systems are most suitable for dewatering shallow excavations where the water table must be lowered no more than about 15 feet below ground surface. Multiple well point stages are generally required for greater depths because of the physical limitations of suction lift. Dewatering can be accomplished at depths greater than 15 feet where the excavation can be open cut to permit installation of the well point system below the original grade. This technique increases the depth to which the water table can be lowered with well points.

The well points will likely need to be installed on 4- to 10-foot centers to be effective and as close as possible to the edge of the excavations. The well point screens should be filter packed with graded sand, or sand and fine gravel to improve pumping efficiency and minimize the discharge of turbid water.

4.4.2. Sump Pumping

This dewatering method involves removing water that has seeped into an excavation by pumping from a sump that has been excavated at one or more locations in an excavation. Drainage ditches that lead to the sump are typically excavated along the excavation sidewalls at the base of an excavation. The excavation for the sump and discharge drainage ditches should be backfilled with gravel or crushed rock to reduce the amount of erosion and associated sediment in the water pumped from the sump. In our experience, a slotted casing or perforated 55-gallon drum that is installed in the sump backfill provides a suitable housing for a submersible pump. The contractor may also elect to construct the permanent underslab drainage system during the excavation process in order to help dewater the excavation. The drainage systems should be modified as needed based on excavation conditions.

4.5. Shallow Foundations

We recommend that the proposed STEM building(s) be supported on shallow spread footings founded on the dense to very dense/hard glacial till, transitional bed deposit or glaciolacustrine deposit soils encountered in our borings or on properly compacted structural fill extending down to the dense to very dense/hard glacially consolidated soils. The following recommendations for the building foundations are based on the subsurface conditions observed in the borings and the site survey.

4.5.1. Foundation Design

The building(s) can be supported on conventional spread and mat footings bearing on undisturbed native soils or on structural fill extending to undisturbed native soils. We recommend a preliminary allowable bearing pressure of 8,000 pounds per square foot (psf) for shallow foundations bearing on the very dense glacial till and transitional bed deposits. Foundations will generally need to extend about 4½ feet below the existing ground surface to achieve 8,000 psf design bearing pressure where glacial till is present. Foundations supported on undisturbed stiff to hard glaciolacustrine deposits may be designed using an allowable bearing pressure of 4,000 psf. Foundations supported on structural fill consisting of imported gravel borrow and overlying medium dense to very dense glacial soils or foundations supported on undisturbed medium dense to dense native glacial soils may be designed using an allowable bearing pressure of 3,000 psf. These allowable soil bearing pressures apply to the total of dead and long-term live loads and may be increased by up to one-third for wind or seismic loads. These allowable soil bearing pressures are net values.

Table 4 summarizes the minimum embedment depth below existing grade for an allowable bearing pressure of 8,000 psf on native glacially consolidated soil.

TABLE 4. MINIMUM FOUNDATION EMBEDMENT FOR BEARING SOIL

Boring Number	Glacial Till (8,000 psf)		Glaciolacustrine (4,000 psf)	
	Approximate Depth (feet)	Approximate Elevation (feet)	Approximate Depth (feet)	Approximate Elevation (feet)
GEI-1	10	110	-	-
GEI-2	12	94	-	-
GEI-3	12	83	-	-
GEI-4	7	100	-	-
GEI-5	7	115	-	-
GEI-6	4½	87½	-	-
GEI-7	6½	89	18½	77
GEI-8	-	-	4½	95½
GEI-9	-	-	8	71
GEI-10	3	75	7	71
GEI-11	-	-	5	83
GEI-12	8	108	-	-
GEI-13	3	84	22	65
GEI-14	5	79	-	-

The design frost depth for the Puget Sound area is 12 inches; therefore, we recommend that exterior footings for the building be founded at least 18 inches below lowest adjacent finished grade. Interior footings should be founded at least 12 inches below bottom of slab or adjacent finished grade. Continuous wall footings and individual column footings should have minimum widths of 24 inches.

All footings near below-grade walls should be embedded to a depth that is at least below a 1H:1V line projected up from the bottom of the closest section of wall, otherwise the below-grade walls need to be designed for lateral loads from the footings. In addition, new footings planned for the first and second floor levels and in temporary cut slope areas for the lower and first floor levels, respectively, should extend through wall backfill and be embedded in native soils, unless designed to be supported on structural fill.

Existing fill material should be removed from below building foundations and be replaced with structural fill. Loose/soft or disturbed soils not removed from below footings may result in settlement and potential damage to the foundations.

4.5.2. Foundation Settlement

We estimate that the post-construction settlement of footings founded as recommended above will be about ½ to 1 inch. Differential settlement between comparably loaded column footings or along a 25-foot section of continuous wall footing should be less than ½ inch. We expect most of the footing settlements will occur as loads are applied. Loose or disturbed soils not removed from footing excavations prior to placing concrete will result in additional settlement.

4.5.3. Lateral Resistance

Lateral loads can be resisted by passive resistance on the sides of the footings and by friction on the base of the footings. Passive resistance should be evaluated using an equivalent fluid density of 350 pounds per cubic foot (pcf) where footings are poured neat against native soil or are surrounded by structural fill compacted to at least 95 percent of MDD, as recommended. Resistance to passive pressure should be calculated from the bottom of adjacent floor slabs and paving or below a depth of 1 foot where the adjacent area is unpaved, as appropriate. Frictional resistance can be evaluated using 0.35 for the coefficient of base friction against footings. The above values incorporate a factor of safety of about 1.5.

If soils adjacent to footings are disturbed during construction, the disturbed soils must be recompacted, otherwise the lateral passive resistance value must be reduced.

4.5.4. Footing Drains

We recommend that perimeter footing drains be installed around the building(s). The perimeter drains should be installed at the base of the exterior footings. The perimeter drains should be provided with cleanouts and should consist of at least 4-inch-diameter perforated pipe placed on a 3-inch bed of, and surrounded by, 6 inches of drainage material enclosed in a non-woven geotextile fabric such as Mirafi 140N (or approved equivalent) to prevent fine soil from migrating into the drain material. We recommend that the drainpipe consist of either heavy-wall solid pipe (SDR-35 PVC, or equal) or rigid corrugated smooth interior polyethylene pipe (ADS N-12, or equal). We recommend against using flexible tubing for footing drainpipes. The drainage material should consist of pea gravel or “Gravel Backfill for Drains” per WSDOT standard specifications Section 9-03.12(4), as shown on Figure 5. The perimeter drains should be sloped to drain by gravity, if practicable, to a suitable discharge point, preferably a storm drain. We recommend that the cleanouts be covered, and be placed in flush mounted utility boxes. Water collected in roof downspout lines must not be routed to the footing drain lines.

4.5.5. Construction Considerations

Immediately prior to placing concrete, all debris and loose soils that accumulated in the footing excavations during forming and steel placement must be removed. Debris or loose soils not removed from the footing excavations will result in increased settlement.

If wet weather construction is planned, we recommend that all footing subgrades be protected using a lean concrete mud mat. The mud mat should be placed the same day that the footing subgrade is excavated and approved for foundation support.

We recommend that all completed footing excavations be observed by a representative of our firm prior to placing mud mat, reinforcing steel, and structural concrete. Our representative will confirm that the bearing surface has been prepared in a manner consistent with our recommendations and that the subsurface conditions are as expected.

4.6. Slab-On-Grade Floors

Slab-on-grade floors can be supported on undisturbed medium dense to very dense/very stiff to hard native soils encountered in our borings or on properly compacted structural fill extending down to the soils. A subgrade modulus of 100 per cubic inch (pci) may be used for design of the slabs-on-grade at the site. We recommend that an appropriate capillary break and vapor retarder be installed below the floor slab to reduce the risk of moisture migration through the floor slab. This is especially important since zones of groundwater seepage may be present at the planned floor slab level in more permeable layers within the native soil or in looser soils on top of the native soil.

We recommend that concrete slabs-on-grade be constructed on a gravel layer to provide uniform support and drainage, and to act as a capillary break. The gravel layer below slabs-on-grade should consist of 6 inches of clean crushed gravel, with a maximum particle size of 1 inch and negligible sand or silt, such as WSDOT Standard Specification Section 9-03.1(4)C, AASHTO Grading No. 67, as shown on Figure 5. If prevention of moisture migration through the slab is essential, such as where carpet or floor coverings are used, a vapor retarder such as heavy plastic sheeting or Moist-Stop should be installed between the slab and the gravel layer. We recommend that the plastic sheet be placed over the capillary break layer. The contractor should be made responsible for maintaining the integrity of the vapor barrier during construction. It may also be prudent to apply a sealer to the slab to further retard the migration of moisture through the floor.

4.6.1. Underslab Drainage

Groundwater could accumulate below the slab-on-grade floor(s) because the building(s) will be cut into the hill slope where multiple zones of shallow perched groundwater seepage exists. To help mitigate this condition, we recommend that the building slabs-on-grades for the lower level, the first level and the second level be provided with underslab drainage to collect and discharge groundwater from below the slab. A more robust underslab drainage system is recommended for the lower level, where the finish floor elevation is at or below the groundwater elevation measured in the groundwater monitoring wells (Elevation 65 to 84 feet).

First and Second Levels

Groundwater could accumulate below the slab-on-grade floor(s) because the building will be cut into the hill slope where zones of shallow perched groundwater seepage may exist. To help mitigate this condition, we recommend that the building slabs-on-grades for the first and second levels be provided with under drainage to collect and discharge groundwater from below the slab. This can be accomplished by installing a 4-inch-diameter, heavy-wall perforated collector pipe in a shallow trench placed below the capillary break gravel layer. The trench should measure about 1 foot wide by 1.5 feet deep and should be backfilled with clean pea gravel. The top of the underslab drainage system trenches should coincide with the base of the capillary break layer.

We recommend installing a single under drain collector pipe below the long axis of these areas and connect each end of the drain pipe into the perimeter footing drain pipe. If connected to the footing drain system, the invert of the under-drain pipe should be higher than the invert of the footing drain pipe where they meet.

The collector pipe should be sloped to drain and discharge into the storm water collection system to convey the water off site. The pipe should also incorporate cleanouts, if possible. The cleanouts could be extended through the foundation walls to be accessible from the outside, or could be placed in flush-mounted access boxes cast into the floor slabs.

The drainage pipe should be either machine-slotted or perforated. The slots should be a maximum of ⅛-inch wide with four slots per inch and extend over the lower 60-degree perimeter of the pipe.

Perforated pipe should have two rows of ½-inch holes spaced 120 degrees apart and at 4 inches on-center. The underslab drainage system trenches should be backfilled with pea gravel or "Gravel Backfill for Drains" per WSDOT standard specifications Section 9-03.12(4). The drainage material should be wrapped with non-woven geotextile fabric such as Mirafi 140N (or approved equivalent) to prevent fine soil from migrating into the drain material.

Lower Level

For the STEM building lower level(s), the design team may consider a system similar to the permanent groundwater collection system installed for the South Parking Garage and the UW3 building. For these projects, a subdrain trench was installed along the west side of the excavation and a system of underdrain pipes were installed below the slab.

As a minimum, we recommend that the entire lower level floor slab be underlain by a drainage blanket to intercept groundwater and to dissipate artesian and hydrostatic pressures from under the floor slab. The drainage blanket should be at least 12 inches thick and consist of clean crushed gravel, with a maximum particle size of 1½-inch and negligible sand or silt, such as WSDOT Standard Specification Section 9-03.1(4)C, AASHTO Grading No. 57. The drainage blanket should be placed on undisturbed, very dense transitional bed deposits, glacial till, or glaciolacustrine deposits.

We recommend that perforated underslab drainage pipes be installed longitudinally on roughly 20-foot centers from south to north under the entire lower level floor slab and drainage blanket. The underdrain pipes should be installed between column footings and tie into a collector pipe along the east side of the lower level, if appropriate. If beneficial to the contractor to aid in the dewatering of the excavation, we recommend placing the pipes in trenches that extend about 3 feet below the bottom of adjacent wall and spread footing excavations. The trenches must not compromise the stability of the footings. The underslab drainage pipes should be placed within the backfill material, about 3 inches from the bottom of the drainage layer or trench, and should be sloped at a minimum of 0.25 percent. It will be necessary to modify or the underslab drainage system depending on the actual building design and field conditions.

4.7. Below-Grade Walls and Retaining Walls

4.7.1. Permanent Walls Cast Against Temporary Shoring

Permanent below-grade walls constructed adjacent to temporary shoring walls should be designed for the same earth pressures (including surcharge pressures where applicable) as the adjacent temporary walls, and should also include a seismic load acting over the height of the wall equal to 8H psf, where H is the height of the wall in feet. Other surcharge loads, such as from foundations, construction equipment, or construction staging areas, should be considered on a case-by-case basis, as shown on Figure 8. We can provide the lateral pressures from these surcharge loads as the design progresses.

The soil pressures recommended above assume that wall drains will be installed to prevent the buildup of hydrostatic pressure behind the walls, as described in the "Excavation Considerations," section and tied to permanent drains to remove water to suitable discharge points as described in "Wall Drainage" section.

4.7.2. Other Cast-In-Place Walls

Lateral earth pressures for design of below-grade walls and retaining structures should be evaluated using an equivalent fluid density of 35 pcf provided that the walls will not be restrained against rotation when backfill is placed. If the walls will be restrained from rotation, we recommend using an equivalent fluid density of 55 pcf. Walls are assumed to be restrained if top movement during backfilling is less than H/1000, where H is the wall height. These lateral soil pressures assume that the ground surface behind the wall is horizontal. If the ground surface within five feet of the wall rises at an inclination of 2H:1V or steeper, the walls should be designed for lateral pressures based on equivalent fluid densities of 50 and 80 pcf, respectively, for unrestrained and restrained conditions. These lateral soil pressures do not include the effects of surcharges such as floor loads, traffic loads or other surface loading. Surcharge effects should be included as appropriate. Below-grade walls for the building should also include seismic earth pressures. Seismic earth pressures should be determined using a rectangular distribution of 8H in psf, where H is the wall height.

If vehicles can approach the tops of exterior walls to within ½ the height of the wall, a traffic surcharge should be added to the wall pressure. For car parking areas, the traffic surcharge can be approximated by the equivalent weight of an additional 1 foot of soil backfill (125 psf) behind the wall. For delivery truck parking areas and access driveway areas, the traffic surcharge can be approximated by the equivalent weight of an additional 2 feet (250 psf) of soil backfill behind the wall. Other surcharge loads, such as from foundations, construction equipment, or construction staging areas, should be considered on a case-by-case basis, as shown on Figure 8. Positive drainage should be provided behind below-grade walls and retaining structures as discussed in “Wall Drainage.”

These recommendations assume that all retaining walls will be provided with adequate drainage. The values for soil bearing, frictional resistance and passive resistance presented above for foundation design are applicable to retaining wall design. Walls located in level ground areas should be founded at a depth of 18 inches below the adjacent grade.

4.7.3. Wall Drainage

Permanent Walls Cast Against Temporary Shoring

Drainage behind the permanent below-grade walls cast against temporary shoring is typically provided by strips of drainage material attached to the lagging between the soldier piles and behind the shotcrete facing for soil nail walls. The drainage material strips should be connected to weep pipes that extend through the exterior building wall at the footing elevation. The weep pipes should be connected to the perimeter foundation drains described above in the “Footing Drains” section.

Prefabricated geocomposite drainage material, such as AmerDrain® 500, should be installed vertically between soldier piles for soldier pile walls and behind the shotcrete facing for soil nail walls. For soldier pile shoring walls, the drainage material should be installed on the excavation side of the lagging, with the fabric adjacent to the lagging.

Full wall face coverage is preferable for minimizing spotting and leaking at the face of the permanent wall. However, the use of drainage strips, typically a minimum of 16 inches wide, placed between the soldier piles and behind the shotcrete facing for soil nail walls is generally sufficient for the structural integrity of the wall. If full wall face coverage is planned for soil nail walls, it is typically placed between the temporary and permanent walls. The drainage strips or full wall face coverage should extend the entire height of the wall. If drainage strips are used, additional drainage strips may be necessary in wet areas. Although the use of full wall face coverage will reduce spotting or leaking at the face of the permanent wall, there is still a potential for seepage. If this is a concern, waterproofing should be specified.

Other Cast-In-Place Walls

Positive drainage should be provided behind cast-in-place retaining walls by using free draining wall drainage material with perforated pipes to discharge the collected water, as shown in Figure 5. Wall drainage material may consist of washed ⅜-inch to No. 8 pea gravel per WSDOT 9.03.1(4)C, AASHTO Grading No. 8, or clean gravel (gravel backfill for drains per WSDOT Standard Specification Section 9-03.12(4)) surrounded with a non-woven geotextile fabric such as Mirafi 140N (or approved equivalent). The zone of wall drainage material should be 2 feet wide and should extend from the base of the wall to within 2 feet of the ground surface. The wall drainage material should be covered with 2 feet of less permeable material, such as the on-site silty sand that is properly moisture conditioned and compacted.

A 4-inch-diameter perforated drain pipe should be installed within the free-draining material at the base of each wall. We recommend using either heavy-wall solid pipe (SDR-35 polyvinyl chloride [PVC]) or rigid corrugated polyethylene pipe (ADS N-12, or equal). We recommend against using flexible tubing for the wall drain pipe. The footing drain recommended above in the “Footing Drains” section can be incorporated into the bottom of the drainage zone and used for this purpose.

The pipes should be laid with minimum slopes of one-quarter percent and discharge into the storm water collection system to convey the water off site. The pipe installations should include a cleanout riser with cover located at the upper end of each pipe run. The cleanouts could be placed in flush mounted access boxes. Collected downspout water should be routed to appropriate discharge points in separate pipe systems.

4.7.4. Waterproofing

The recommendations in this section are provided to reduce the potential for buildup of hydrostatic pressures behind below grade walls and hydrostatic uplift forces below the building slab. If no special waterproofing measures are taken, leaks or seepage may occur in localized areas of the below-grade portion of the building, even if the recommended wall drainage and below-slab drainage provisions are constructed. If leaks or seepage is undesirable, below-grade waterproofing should be specified. A waterproofing consultant should be contracted to provide recommendations for below-grade waterproofing for this project.

4.7.5. Other Considerations

Exterior retaining systems used to achieve grade transitions or for landscaping, can be constructed using traditional structural systems such as reinforced concrete, concrete masonry unit (CMU) blocks, or rockeries. Alternatively, retaining walls can consist of reinforced soil and block facing structures. We can provide additional design recommendations for reinforced soil and block facing structures, if requested.

4.8. Surface Water Drainage Considerations

We anticipate shallow groundwater seepage may enter deep excavations depending on the time of year construction takes place, especially in the winter months. However, we expect that this seepage water can be handled by digging interceptor trenches in the excavations and pumping from sumps. The seepage water if not intercepted and removed from the excavations will make it difficult to place and compact structural fill and may destabilize cut slopes.

All paved and landscaped areas should be graded so that surface drainage is directed away from the building(s) to appropriate catch basins.

Water collected in roof downspout lines must not be routed to the footing drain lines or subsurface drain lines. Collected downspout water should be routed to appropriate discharge points in separate pipe systems.

4.9. Infiltration Considerations

Sieve analyses were performed on selected soil samples collected from the borings and test pits that were completed as part of this study. The soil samples typically consisted of native glacial till, transitional bed deposits, and glaciolacustrine deposits. The design infiltration values described below are based on the results of the grain size analyses, the United States. Department of Agriculture (USDA) Textural Triangle, and the Washington State Department of Ecology Storm Water Management Manual (2005). The grain size analyses are presented in Appendix B.

Based on our analysis, it is our opinion that the on-site soils have a very low infiltration capacity. The majority of the soils across the site contain significant fines, which limits the infiltration capacity. The results of the sieve analyses indicated that the fines content (material passing the U.S. No. 200 sieve) typically ranges from 9 to 65 percent. Due to the density and relative impermeability of the glacial till and the high fines content of the silt/clay transitional bed deposits and glaciolacustrine deposits infiltration should be assumed to be negligible when designing the infiltration systems. We recommend an infiltration rate of not more than 0.1 inches per hour be used for design of the infiltration facilities.

Sandy layers within the transitional beds have higher infiltration rates; however these sandy layers are often discontinuous and may be saturated with perched groundwater.

4.10. Pavement Recommendations

4.10.1. Subgrade Preparation

We recommend the subgrade soils in new pavement areas be prepared and evaluated as described in the "Earthwork" section of this report. All new pavement and hardscape areas should be supported on subgrade soils that have been proof rolled or probed as described in the "Clearing and Site Preparation" section of this report. If the exposed subgrade soils are loose or soft, it may be necessary to excavate localized areas and replace them with structural fill or gravel base course. Pavement subgrade conditions should be observed during construction and prior to placing the subbase materials in order to evaluate the presence of zones of unsuitable subgrade soils and the need for overexcavation and replacement of these zones.

4.10.2. New Hot-Mix Asphalt Pavement

In light-duty pavement areas (e.g., automobile parking for surface parking lot), we recommend a pavement section consisting of at least a 3-inch thickness of ½-inch hot-mix asphalt (HMA) per WSDOT Sections 5-04 and 9-03, over a 4-inch thickness of densely compacted CSBC per WSDOT Section

9-03.9(3). In heavy-duty pavement areas (such as driveways, truck traffic lanes, materials delivery), we recommend a pavement section consisting of at least a 4-inch thickness of ½-inch HMA over a 6-inch thickness of densely compacted CSBC.

The base course should be compacted to at least 95 percent of the MDD obtained using ASTM D 1557. We recommend that proof rolling of the subgrade and compacted base course be observed by a representative from our firm prior to paving. Soft or yielding zones observed during proof rolling may require overexcavation and replacement with compacted structural fill.

The pavement sections recommended above are based on our experience. Thicker asphalt sections may be needed based on the actual traffic data, truck and bus loads, and intended use. All paved and landscaped areas should be graded so that surface drainage is directed to appropriate catch basins.

4.10.3. Portland Cement Concrete Pavement

Portland cement concrete (PCC) sections may be considered for areas where concentrated heavy loads may occur. We recommend that these pavements consist of at least 6 inches of PCC over 6 inches of CSBC. A thicker concrete section may be needed based on the actual load data for use of the area. If the concrete pavement will have doweled joints, we recommend that the concrete thickness be increased by an amount equal to the diameter of the dowels. The base course should be compacted to at least 95 percent of the MDD.

We recommend PCC pavements incorporate construction joints and/or crack control joints spaced at maximum distances of 12 feet apart, center-to-center, in both the longitudinal and transverse directions. Crack control joints may be created by placing an insert or groove into the fresh concrete surface during finishing, or by saw cutting the concrete after it has initially set up. We recommend the depth of the crack control joints be approximately one fourth the thickness of the concrete; or about 1½ inches deep for the recommended concrete thickness of 6 inches. We also recommend the crack control joints be sealed with an appropriate sealant to help restrict water infiltration into the joints.

4.10.4. Asphalt-Treated Base

If pavements are constructed during the wet seasons, consideration may be given to covering the areas to be paved with ATB for protection. Light-duty pavement areas should be surfaced with 3 inches of ATB, and heavy-duty pavement areas should be surfaced with 6 inches of ATB. Thicker ATB sections may be needed based on construction equipment loads. Prior to placement of the final pavement sections, we recommend the ATB surface be evaluated and areas of ATB pavement failure be removed and the subgrade repaired. If ATB is used and is serviceable when final pavements are constructed, the CSBC can be eliminated, and the design PCC or asphalt concrete pavement thickness can be placed directly over the ATB.

4.11. Recommended Additional Geotechnical Services

Throughout this report, recommendations are provided where we consider additional geotechnical services to be appropriate. These additional services are summarized below:

- GeoEngineers should be retained to update these preliminary recommendations, as needed, once the location and finished floor elevations of the planned building(s) are determined.

- GeoEngineers should be retained to review the project plans and specifications when complete to confirm that our design recommendations have been implemented as intended.
- During construction, GeoEngineers should observe and evaluate the suitability of the foundation subgrades, observe installation of temporary shoring systems, observe removal of unsuitable soils, evaluate the suitability of floor slab and pavement subgrades, observe installation of subsurface drainage measures, observe and test structural backfill, and provide a summary letter of our construction observation services. The purposes of GeoEngineers construction phase services are to confirm that the subsurface conditions are consistent with those observed in the explorations and other reasons described in Appendix E, Report Limitations and Guidelines for Use.

5.0 LIMITATIONS

We have prepared this report for use by the University of Washington and members of the project team for use in design of this project.

Within the limitations of scope, schedule and budget, our services have been executed in accordance with generally accepted practices in the field of geotechnical engineering in this area at the time this report was prepared. No warranty or other conditions, express or implied, should be understood.

Any electronic form, facsimile or hard copy of the original document (email, text, table, and/or figure), if provided, and any attachments are only a copy of the original document. The original document is stored by GeoEngineers, Inc. and will serve as the official document of record.

Please refer to Appendix E for additional information pertaining to use of this report.

6.0 REFERENCES

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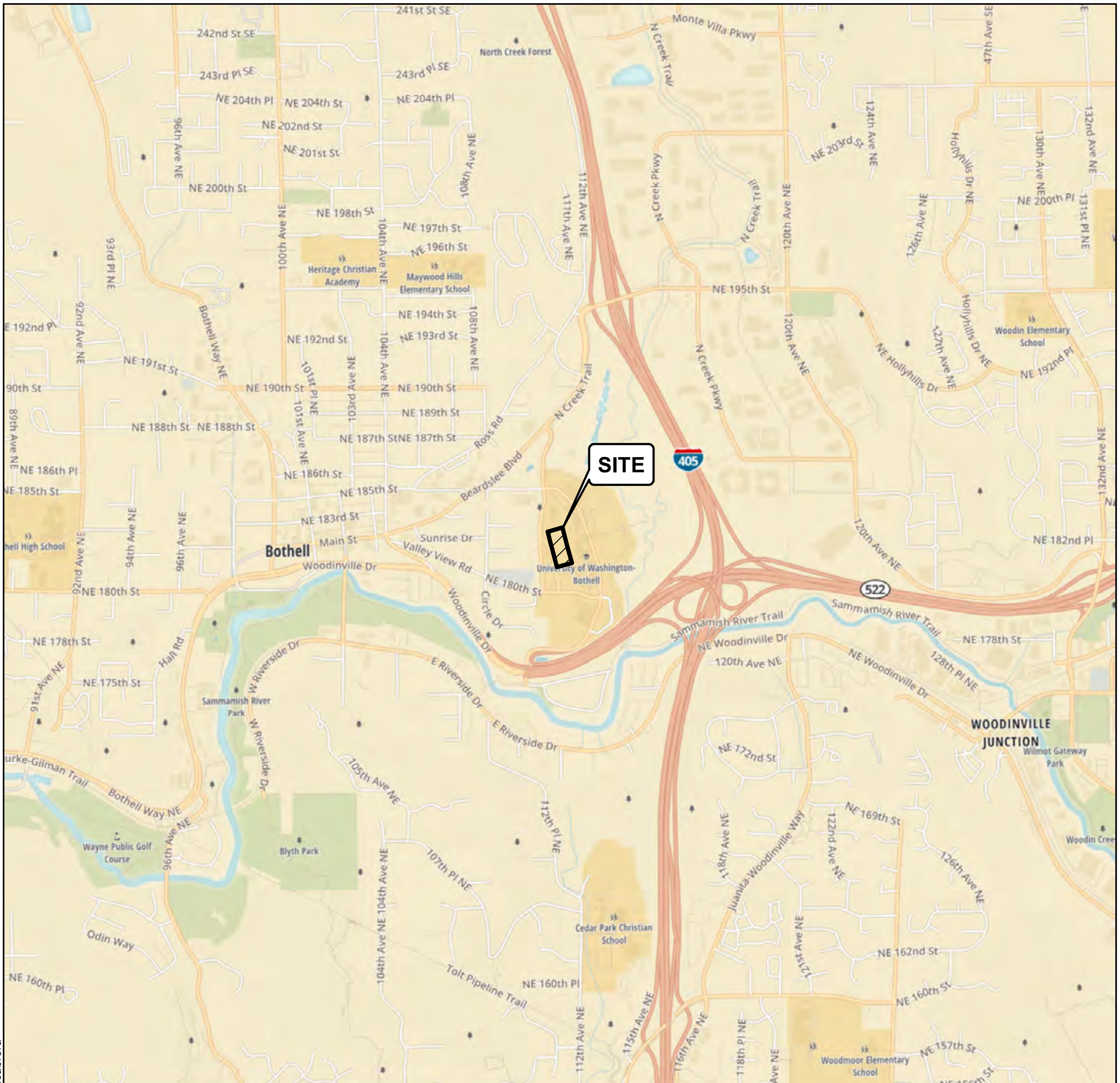
FIGURES



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Feet

Vicinity Map

Cascadia STEM Building (CC4)
Cascadia College Bothell, Washington

GEOENGINEERS

Figure 1

Notes:

1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.

Data Source: Mapbox Open Street Map, 2016

Projection: NAD 1983 UTM Zone 10N

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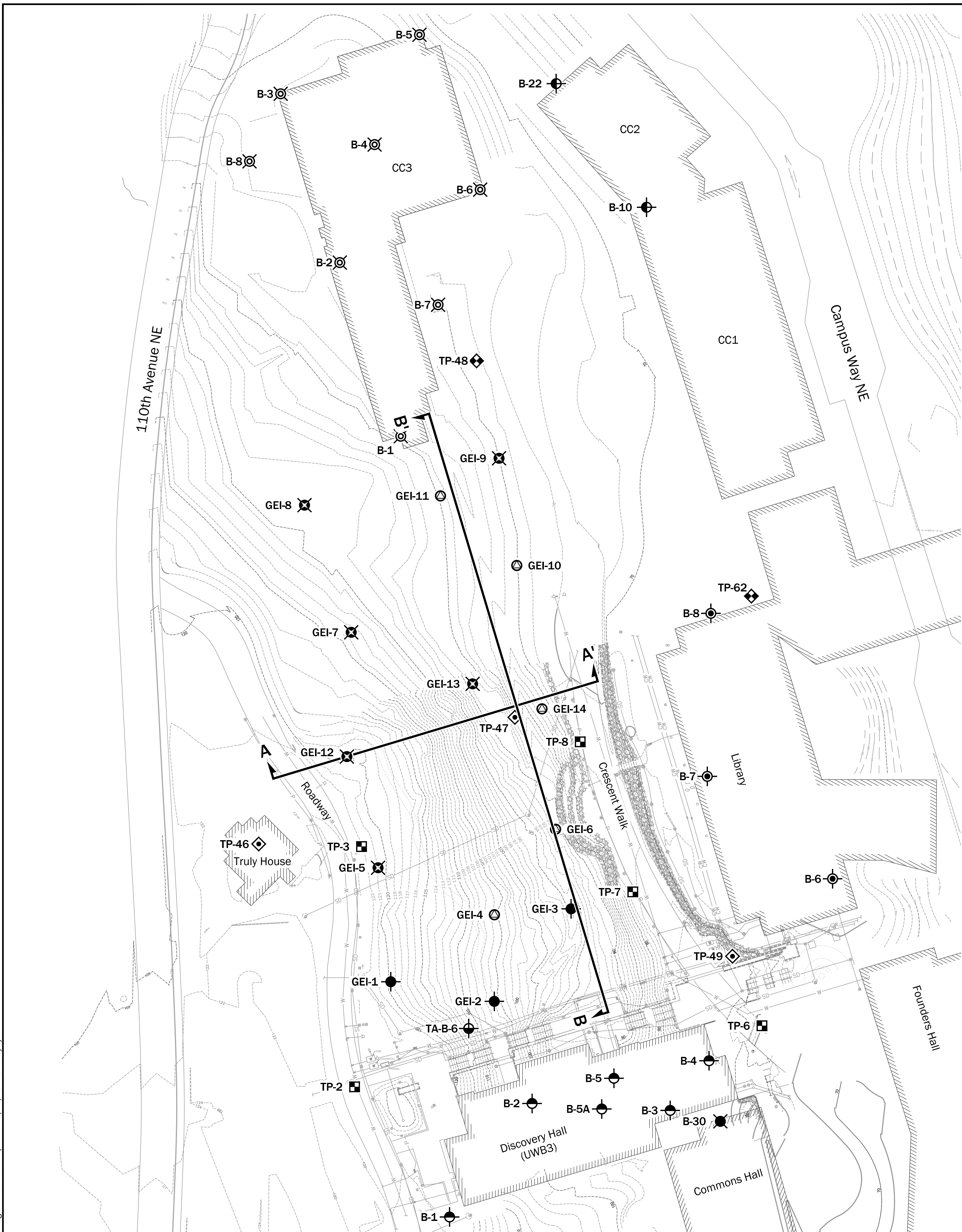

Legend

GEI-12	Boring by GeoEngineers, 2018
GEI-4	Boring with Monitoring Well by GeoEngineers, 2018
GEI-1	Boring by GeoEngineers, 2016
B-1	Boring by GeoEngineers, 2011
TP-2	Test Pit by GeoEngineers, 2011
B-1	Boring by GeoEngineers, 2006
B-30	Boring by GeoEngineers, 1999
TP-48	Test Pit by GeoEngineers, 1999
B-10	Boring by GeoEngineers, 1998 and 1999
B-6	Boring by GeoEngineers, 1997
TP-46	Test Pit by GeoEngineers, 1997
TA-B-6	Boring by Terra Associates, 1996

80 0 80

Feet

Notes:

1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.

Data Source: Site survey by Otak, received 08/27/18.

Projection: WA State Plane, North Zone, NAD83, US Foot

Site Plan

Cascadia STEM Building (CC4)
Cascadia College
Bothell, Washington

GeoEngineers

Figure 2

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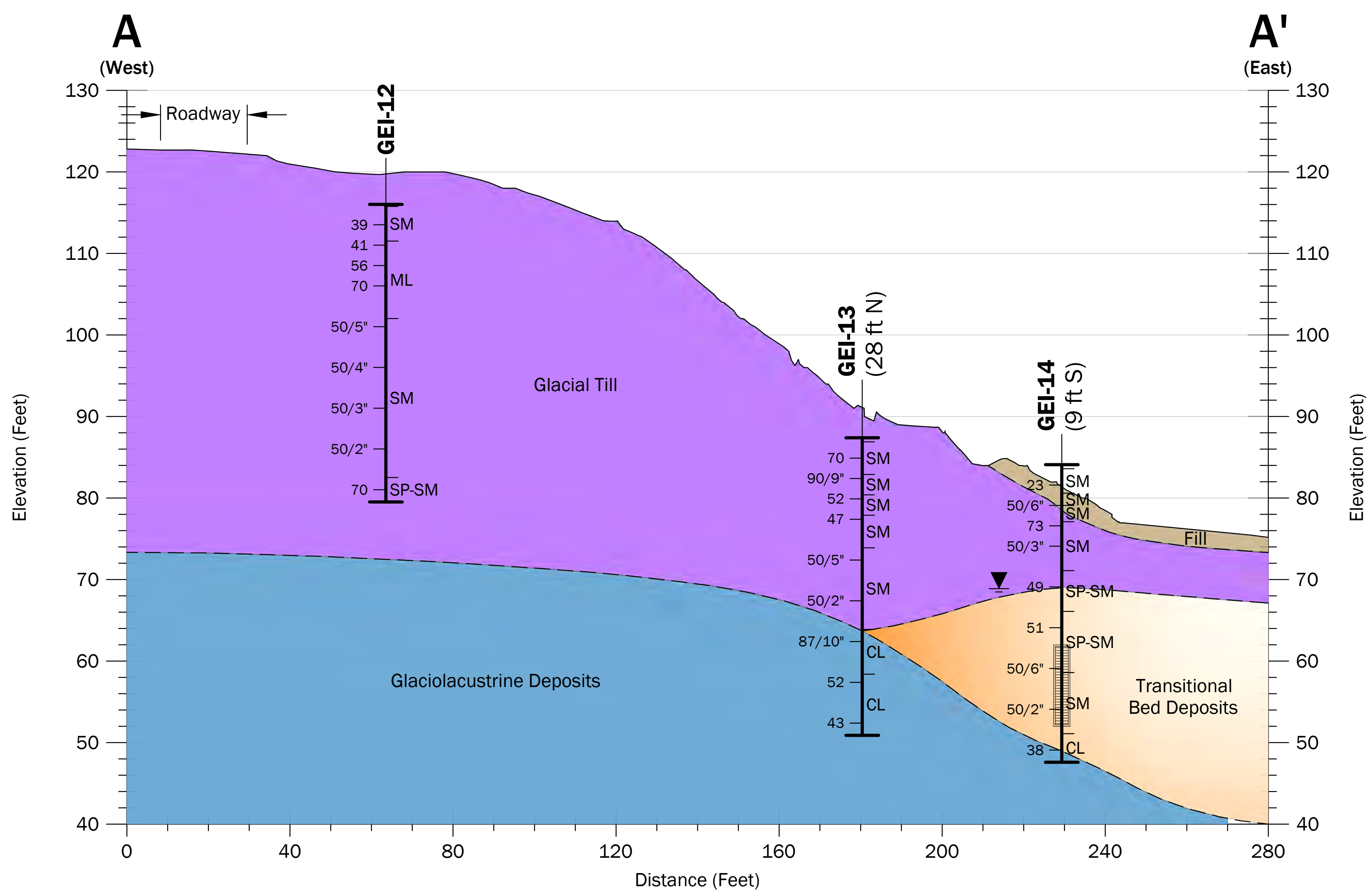


Legend

- Boring ID (Offset)
- Boring
- Inferred Soil Contact
- SM Soil Classification
- Groundwater Measured in Piezometer
- 20 Blow Count
- Well Screen
- Fill
- Glacial Till
- Transitional Bed Deposits
- Glaciolacustrine Deposits

Notes:

1. The subsurface conditions shown are based on interpolation between widely spaced explorations and should be considered approximate; actual subsurface conditions may vary from those shown.
2. This figure is for informational purposes only. It is intended to assist in the identification of features discussed in a related document. Data were compiled from sources as listed in this figure. The data sources do not guarantee these data are accurate or complete. There may have been updates to the data since the publication of this figure. This figure is a copy of a master document. The hard copy is stored by GeoEngineers, Inc. and will serve as the official document of record.

Datum: NGVD 29, unless otherwise noted.

40 0 40
Horizontal Scale in Feet

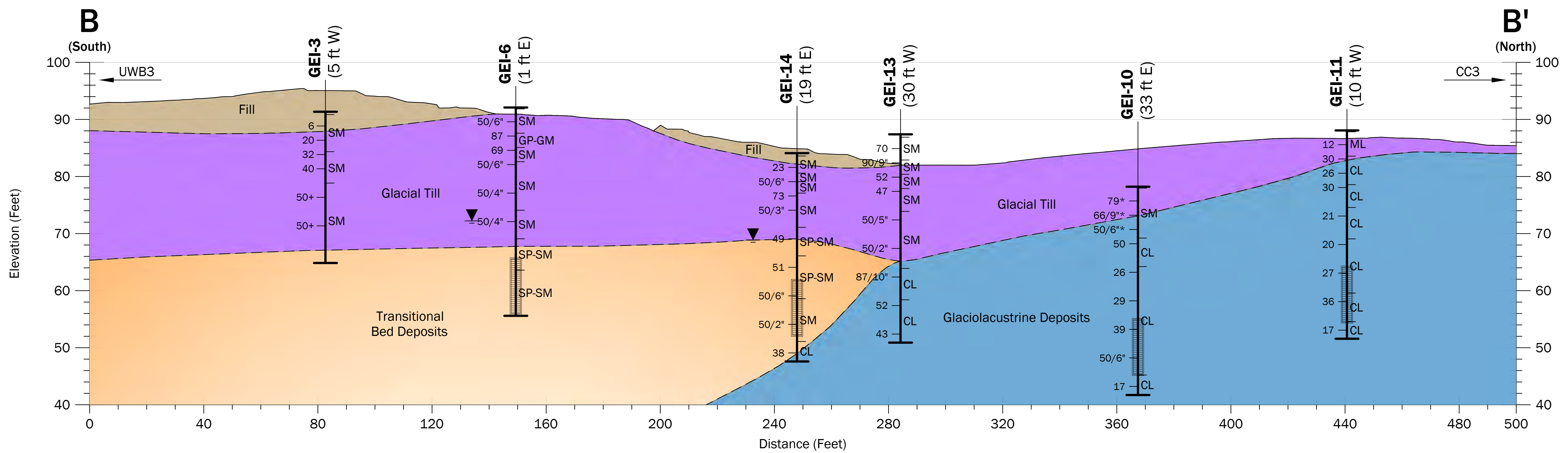
20 0 20
Vertical Scale in Feet
Vertical Exaggeration: 2X

Cross Section A - A'

Cascadia STEM Building (CC4)
Cascadia College
Bothell, Washington

GeoEngineers

Figure 3



Notes:

1. The subsurface conditions shown are based on interpolation between widely spaced explorations and should be considered approximate; actual subsurface conditions may vary from those shown.
2. This figure is for informational purposes only. It is intended to assist in the identification of features discussed in a related document. Data were compiled from sources as listed in this figure. The data sources do not guarantee these data are accurate or complete. There may have been updates to the data since the publication of this figure. This figure is a copy of a master document. The hard copy is stored by GeoEngineers, Inc. and will serve as the official document of record.

Datum: NGVD 29, unless otherwise noted.

Legend

Boring ID (Offset)

- Boring
- Inferred Soil Contact
- Soil Classification
- Groundwater Measured in Piezometer
- Blow Count
- Well Screen
- Fill
- Glacial Till
- Transitional Bed Deposits
- Glaciolacustrine Deposits

Horizontal Scale in Feet (40 0 40)

Vertical Scale in Feet (20 0 20)

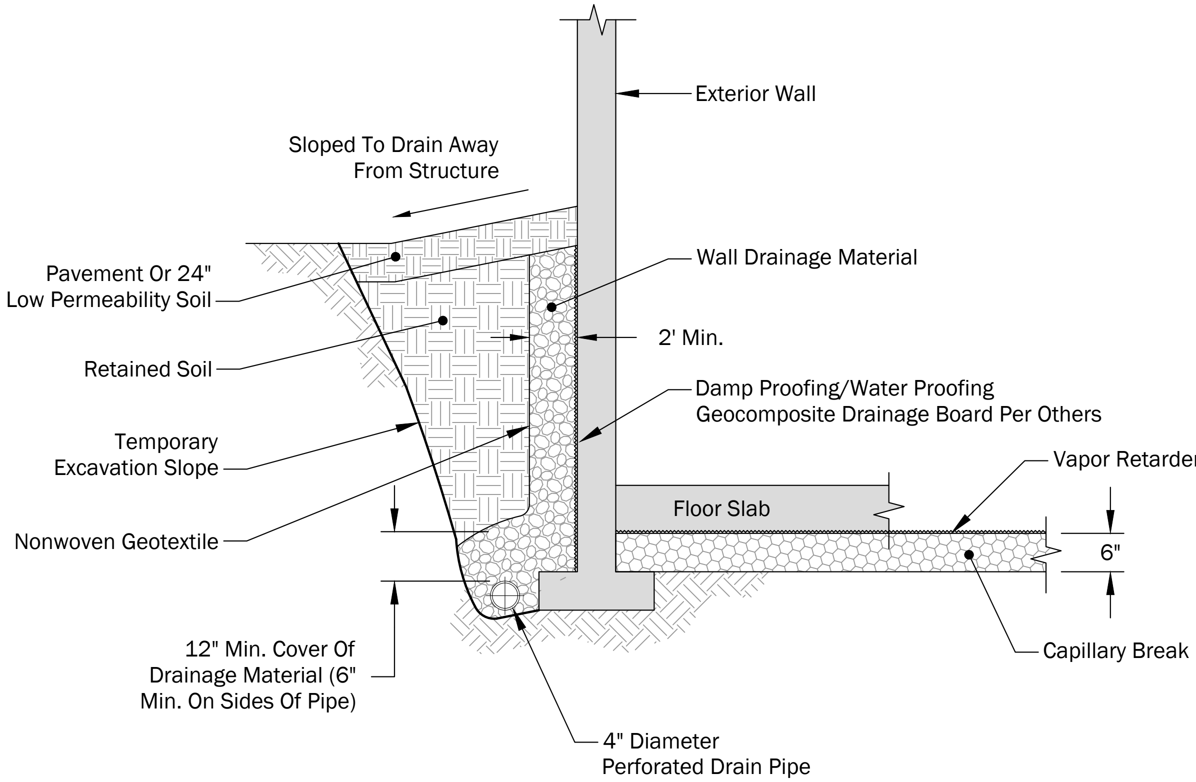
Vertical Exaggeration: 2X

Cross Section B - B'

Cascadia STEM Building (CC4)
Cascadia College
Bothell, Washington

GEOENGINEERS

Figure 4



Not To Scale

Materials:

A. WALL DRAINAGE MATERIAL

May consist of washed 3/8-inch to No.8 pea gravel or conform to Section 9-03.12(4) of the WSDOT Standard Specifications, surrounded with a non-woven geotextile such as Mirafi 140N (or approved equivalent).

B. RETAINED SOIL

Should consist of structural fill, either on-site soil or imported. The backfill should be compacted in loose lifts not exceeding 6 inches within 5' of the wall. Backfill not supporting building floor slabs, sidewalks, or pavement should be compacted to 90 - 92 percent of the maximum dry density, per ASTM D1557. Backfill supporting sidewalks or pavement areas should be compacted to at least 95 percent in the upper two feet. Only hand-operated equipment should be used for compaction within 5 feet of the walls and no heavy equipment should be allowed within 5 feet of the wall.

C. CAPILLARY BREAK

Should consist of 1-inch minus clean crushed rock with neglibile sand or silt per the 2018 WSDOT Specification 9-03.1(4)C, grading No.67.

D. PERFORATED DRAIN PIPE

Should consist of a minimum 4-inch diameter perforated heavy-wall solid pipe (SDR-35 PVC) or rigid corrugated polyethylene pipe (ADS N-12) or equivalent. Drain pipes should be placed with 0.25 percent minimum slopes and discharge to the storm water collection system.

Notes:

1. Thickness/location of permanent wall and slab on grade, and perimeter foundation shown here to depict intent of wall drainage design. Actual thickness/location of these structural elements will vary.

Wall Drainage and Backfill	
Cascadia STEM Building (CC4) Cascadia College Bothell, Washington	
GeoEngineers	Figure 5

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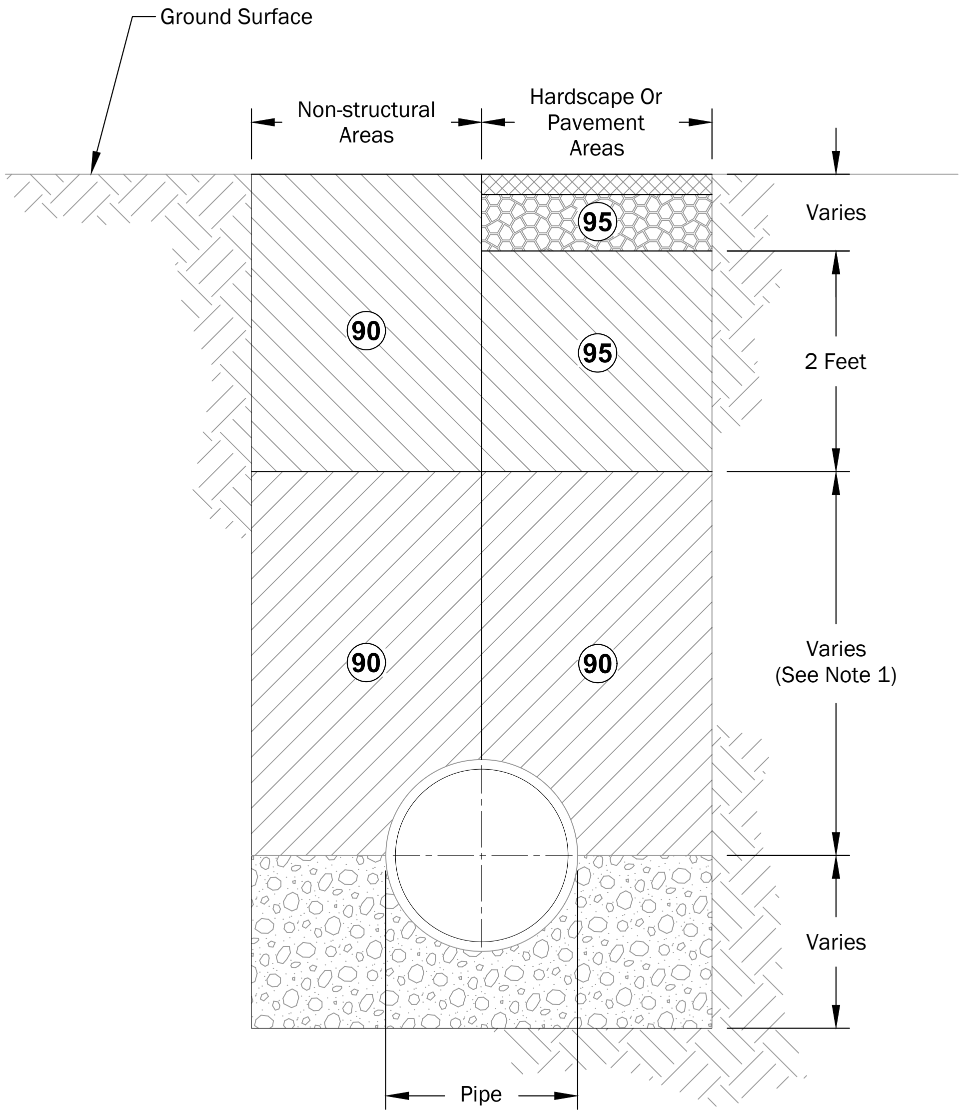

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Legend

95 — Recommended Compaction as a Percentage of Maximum Dry Density, by Test Method ASTM D1557 (Modified Proctor)

Concrete or Asphalt Pavement

Base Course

Trench Backfill

Pipe Bedding

Compaction Criteria for Trench Backfill

Cascadia STEM Building (CC4)
Cascadia College
Bothell, Washington

GeoEngineers

Figure 6

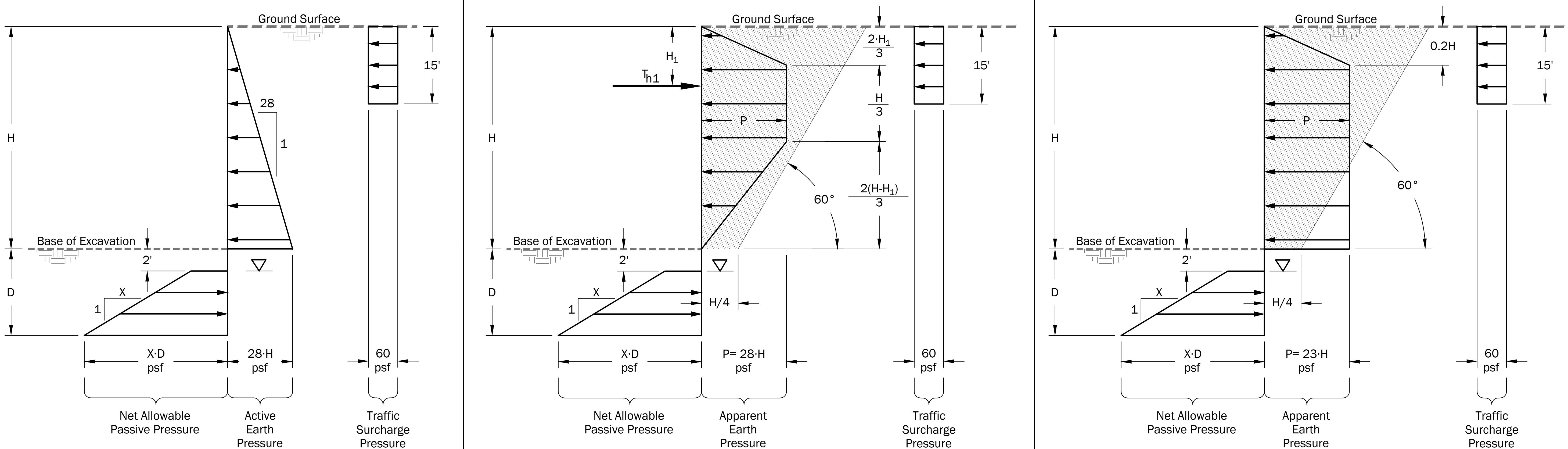
Notes:

1. All backfill under building areas should be compacted to at least 95 percent per ASTM D1557.

Cantilever Soldier Pile

Conventional Soldier Pile Wall with One Level of Tiebacks

Conventional Soldier Pile Wall with Multiple Levels of Tiebacks



Allowable Passive Pressure Factor	X
Below the Water Table	175
Above the Water Table	350

Legend

No Load Zone

H = Height of Excavation, Feet

D = Soldier Pile Embedment Depth, Feet

H_1 = Distance From Ground Surface to Uppermost Tieback, Feet

T_{h1} = Horizontal Load in Uppermost Ground Anchor

P = Maximum Apparent Earth Pressure, Pounds per Square Foot

Notes:

1. Active/apparent earth pressure and traffic surcharge pressure act over the pile spacing above the base of the excavation.
2. Passive earth pressure acts over 2.5 times the concreted diameter of the soldier pile, or the pile spacing, whichever is less.
3. Passive pressure includes a factor of safety of 1.5
4. This pressure diagram is appropriate for temporary soldier pile and tieback walls. If additional surcharge loading (such as from soil stockpiles, excavators, dumptrucks, cranes, or concrete trucks) is anticipated, GeoEngineers should be consulted to provide revised surcharge pressures.

Not To Scale

Earth Pressure Diagrams - Temporary Soldier Pile & Tieback Wall

Cascadia STEM Building (CC4)
Cascadia College
Bothell, Washington

GEOENGINEERS

Figure 7

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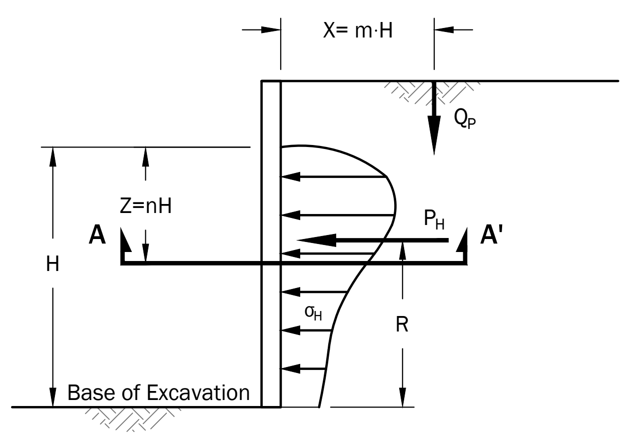
Lateral Earth Pressure from Point Load, Q_P (Spread Footing)



For $m \le 0.4$

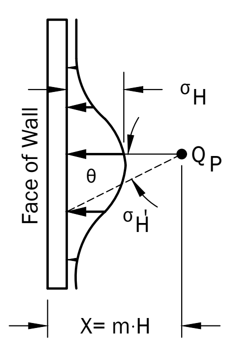
$$\sigma_H = \frac{0.28 Q_P n^2}{H^2(0.16+n^2)^3}$$

For $m > 0.4$

$$\sigma_H = \frac{1.77 Q_P m^2 n^2}{H^2(m^2+n^2)^3}$$

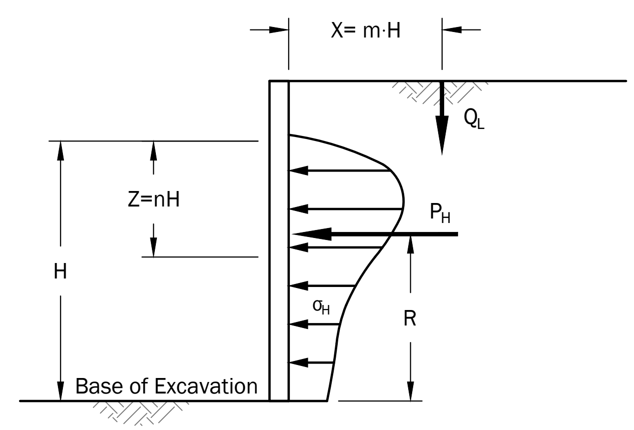
$$\sigma'_H = \sigma \, COS^2(1.1\theta)$$

m	$P_H\left(\frac{H}{Q_P}\right)$	R
0.2	0.78	0.59H
0.4	0.78	0.59H
0.6	0.45	0.48H



Section A-A'
Pressures from Point Load Q_P

Lateral Earth Pressure from Line Load, Q_L (Continuous Wall Footing)



For $m \le 0.4$

$$\sigma_H = \frac{0.2n \cdot Q_L}{H(0.16+n^2)^2}$$

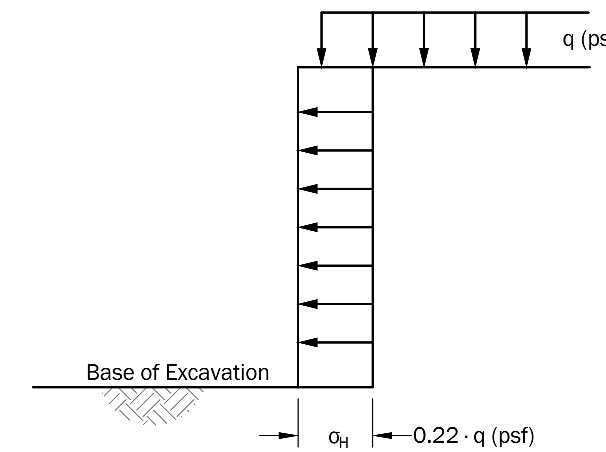
For $m > 0.4$

$$\sigma_H = \frac{1.28 m^2 n Q_L}{H(m^2+n^2)^2}$$

Resultant $P_H = \frac{0.64 Q_L}{(m^2+1)}$

m	R
0.1	0.60H
0.3	0.60H
0.5	0.56H
0.7	0.48H

Uniform Surcharges, q (Floor Loads, Large Foundation Elements or Traffic Loads)



σ_H = Lateral Surcharge Pressure from Uniform Surcharge

Definitions:

- Q_P = Point load in pounds
- Q_L = Line load in pounds/foot
- H = Excavation height below footing, feet
- σ_H = Lateral earth pressure from surcharge, psf
- q = Surcharge pressure in psf
- θ = Radians
- σ'_H = Distribution of σ_H in plan view
- P_H = Resultant lateral force acting on wall, pounds
- R = Distance from base of excavation to resultant lateral force, feet
- X = Resultant lateral force acting on wall, pounds
- Z = Depth of σ_H to be evaluated below the bottom of Q_P or Q_L
- m = Ratio of X to H
- n = Ratio of Z to H

Notes:
1. Procedures for estimating surcharge pressures shown above are based on Manual 7.02 Naval Facilities Engineering Command, September 1986 (NAVFAC DM 7.02).
2. See report text for where surcharge pressures are appropriate.

Not To Scale

Recommended Surcharge Pressure

Cascadia STEM Building (CC4)
Cascadia College
Bothell, Washington

GEOENGINEERS

Figure 8

APPENDICIES

APPENDIX A
Field Explorations

APPENDIX A
FIELD EXPLORATIONS

Subsurface soil and groundwater conditions were evaluated by drilling eleven borings (GEI-4 through GEI-14) at the approximate locations shown on Figure 2. Monitoring wells were installed in borings GEI-4, GEI-6, GEI-10, GEI-11 and GEI-14 to evaluate groundwater levels. Locations of the explorations were determined in the field by tape measuring distances from the exploration locations to existing site features such as sidewalks, fences, parking lot curbs, and buildings. Ground surface elevations were interpolated from a site topographic map prepared by Otak, Inc. and are shown on the exploration logs.

Borings

Eleven borings (GEI-4 through GEI-14) were drilled on September 5 through September 7 and September 20, 2018 to depths ranging from 35¼ to 36½ feet below the existing ground surface. The borings were drilled by Holocene Drilling, Inc. of Puyallup, Washington and Advance Drill Technologies, Inc. of Snohomish, Washington, using track-mounted drill rigs equipped with auto-hammers. The borings were advanced using 3½- and 4½-inch inside diameter hollow-stem augers. Drilling services were subcontracted to GeoEngineers and the borings were advanced under the full-time observation of a representative from our firm.

The soils encountered in the borings were typically sampled at 2½ to 5-foot vertical intervals with a 2-inch-outside-diameter split-barrel standard penetration test (SPT) sampler. The samples were obtained by driving the sampler 18 inches into the soil with a 140-pound auto-hammer free-falling 30 inches. The number of blows required for each 6 inches of penetration is recorded. The blow count ("N-value") of the soil is calculated as the number of blows required for the final 12 inches of penetration. This resistance, or N-value, provides a measure of the relative density of granular soils and the relative consistency of cohesive soils. Where very dense soil conditions preclude driving the full 18 inches, the penetration resistance for the partial penetration is entered on the logs. The blow counts are shown on the boring logs at the respective sample depths.

The borings were logged by a geologist or geotechnical engineer from our firm who identified the boring locations, classified the soils encountered, obtained representative soil samples and maintained a detailed log of each boring. The soils encountered during boring operations were visually classified in the field in general accordance with the Unified Soil Classification System (USCS), ASTM D 2488, and the system described on Figure A-1. Representative soil samples were obtained from the borings, logged, placed in plastic bags, and transported to our laboratory in Redmond, Washington. The field classifications were checked in our laboratory.

In addition, pertinent information including soil sample depth, stratigraphy, and groundwater were recorded. Groundwater levels were estimated by observing soil samples and the drill rods. The drilling operation was also monitored for indication of various drilling conditions, such as hard and soft drilling. At completion of drilling, the borings were backfilled in accordance with the procedures of the Washington State Department of Ecology.

Summary boring logs are presented on Figures A-2 through A-12. A key to the symbols and terms used on the logs are included on Figure A-1. These logs are based on our interpretation of the field and laboratory data and indicate the various types of soils encountered. They also indicate the approximate depths at which the soils or their characteristics change, although the change may be gradual. If a change occurred between samples in the borings, it was interpreted.

Monitoring Wells

Groundwater monitoring wells were installed in borings GEI-4, GEI-6, GEI-10, GEI-11 and GEI-14. The monitoring wells were constructed using 2-inch-diameter polyvinyl chloride (PVC) casing. The depth to which the casing was installed was selected based on our understanding of subsurface soil and groundwater conditions encountered during drilling. The lower portion of the casing was slotted to allow entry of water into the casing. Medium sand was placed in the borehole annulus surrounding the slotted portion of the casing. A bentonite seal was placed above the slotted portion of the casing. The monitoring well was protected by installing flush-mount steel monuments set in concrete. Completion details for the monitoring wells are shown on Figures A-2, A-4, A-8, A-9 and A-12.

Groundwater Measurements

Groundwater levels in the monitoring wells were measured on September 7 and September 20, 2018.

SOIL CLASSIFICATION CHART

MAJOR DIVISIONS			SYMBOLS GRAPH	SYMBOLS LETTER	TYPICAL DESCRIPTIONS
COARSE GRAINED SOILS MORE THAN 50% RETAINED ON NO. 200 SIEVE	GRAVEL AND GRAVELLY SOILS MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	CLEAN GRAVELS (LITTLE OR NO FINES)		GW	WELL-GRADED GRAVELS, GRAVEL - SAND MIXTURES
				GP	POORLY-GRADED GRAVELS, GRAVEL - SAND MIXTURES
		GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)		GM	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES
				GC	CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES
	SAND AND SANDY SOILS MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE	CLEAN SANDS (LITTLE OR NO FINES)		SW	WELL-GRADED SANDS, GRAVELLY SANDS
				SP	POORLY-GRADED SANDS, GRAVELLY SAND
		SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)		SM	SILTY SANDS, SAND - SILT MIXTURES
				SC	CLAYEY SANDS, SAND - CLAY MIXTURES
FINE GRAINED SOILS MORE THAN 50% PASSING NO. 200 SIEVE	SILTS AND CLAYS	LIQUID LIMIT LESS THAN 50		ML	INORGANIC SILTS, ROCK FLOUR, CLAYEY SILTS WITH SLIGHT PLASTICITY
				CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
				OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS	LIQUID LIMIT GREATER THAN 50		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS SILTY SOILS
				CH	INORGANIC CLAYS OF HIGH PLASTICITY
				OH	ORGANIC CLAYS AND SILTS OF MEDIUM TO HIGH PLASTICITY
HIGHLY ORGANIC SOILS				PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

NOTE: Multiple symbols are used to indicate borderline or dual soil classifications

ADDITIONAL MATERIAL SYMBOLS

SYMBOLS GRAPH	SYMBOLS LETTER	TYPICAL DESCRIPTIONS
	AC	Asphalt Concrete
	CC	Cement Concrete
	CR	Crushed Rock/ Quarry Spalls
	SOD	Sod/Forest Duff
	TS	Topsoil

Groundwater Contact

Measured groundwater level in exploration, well, or piezometer

Measured free product in well or piezometer

Graphic Log Contact

Distinct contact between soil strata

Approximate contact between soil strata

Material Description Contact

Contact between geologic units

Contact between soil of the same geologic unit

Sampler Symbol Descriptions

- 2.4-inch I.D. split barrel
- Standard Penetration Test (SPT)
- Shelby tube
- Piston
- Direct-Push
- Bulk or grab
- Continuous Coring

Blowcount is recorded for driven samplers as the number of blows required to advance sampler 12 inches (or distance noted). See exploration log for hammer weight and drop.

"P" indicates sampler pushed using the weight of the drill rig.

"WOH" indicates sampler pushed using the weight of the hammer.

Laboratory / Field Tests

%F	Percent fines
%G	Percent gravel
AL	Atterberg limits
CA	Chemical analysis
CP	Laboratory compaction test
CS	Consolidation test
DD	Dry density
DS	Direct shear
HA	Hydrometer analysis
MC	Moisture content
MD	Moisture content and dry density
Mohs	Mohs hardness scale
OC	Organic content
PM	Permeability or hydraulic conductivity
PI	Plasticity index
PP	Pocket penetrometer
SA	Sieve analysis
TX	Triaxial compression
UC	Unconfined compression
VS	Vane shear

Sheen Classification

NS	No Visible Sheen
SS	Slight Sheen
MS	Moderate Sheen
HS	Heavy Sheen

NOTE: The reader must refer to the discussion in the report text and the logs of explorations for a proper understanding of subsurface conditions. Descriptions on the logs apply only at the specific exploration locations and at the time the explorations were made; they are not warranted to be representative of subsurface conditions at other locations or times.

Key to Exploration Logs

GeoEngineers

Figure A-1

Drilled	Start	End	Total Depth (ft)	Logged By	Checked By	Driller	Drilling Method
	9/5/2018	9/5/2018	35.5	PEB	CWM	Holocene Drilling, Inc.	Hollow-stem Auger

Hammer Data	Autohammer 140 (lbs) / 30 (in) Drop	Drilling Equipment	Diedrich D50
Surface Elevation (ft) / Vertical Datum	107.1 / NGVD29	Top of Casing Elevation (ft)	106.65
Easting (X) / Northing (Y)	1306194 / 279975	Horizontal Datum	WA State Plane North NAD83 (feet)

DOE Well I.D.: BLH 148
A 2 (in) well was installed on 9/5/2018 to a depth of 35 (ft).

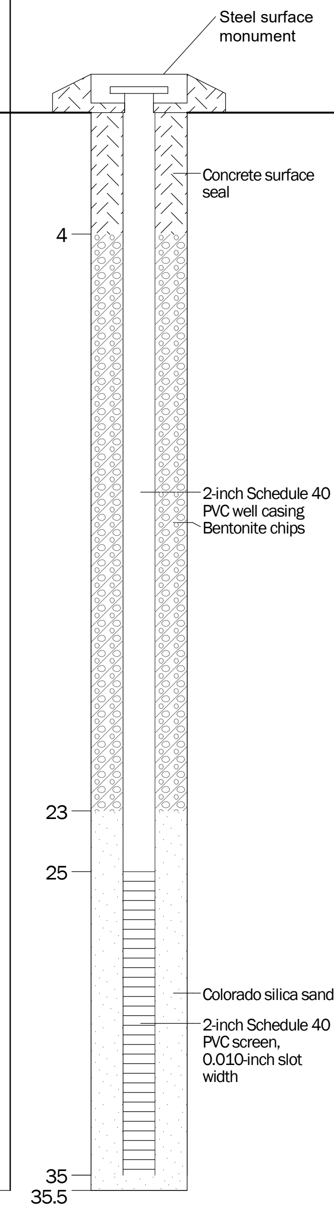
Groundwater Date Measured	Depth to Water (ft)	Elevation (ft)
10/31/2018	33.10	73.55

Notes:

FIELD DATA

Recovered (in)	Blows/foot	Sample Name / Testing	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)
			TS	2 to 3 inches of topsoil		
			SM	Brown silty fine to medium sand, roots (very dense, moist) (fill)		
6	52	1 / MC			12	
			SM	Brown/gray silty fine sand with gravel, slight oxidation staining (very dense, moist) (weathered glacial till)		
18	60	2 / SA			8	44
			SM	Gray/brown silty fine to medium sand with gravel (very dense, moist) (glacial till)		
18	82	3 / MC			8	
12	50/6"	4 / SA			7	35
1	50/6"	5 / MC			1	
			SP-SM	Gray fine to coarse sand with silt and gravel (very dense, moist)		
11	50/5"	6 / %F			4	8
			SM	Gray silty fine to coarse sand with gravel (very dense, moist)		
4	50/4"	7				
				Fine to medium sand		
5	50/5"	8				
4	50/6"	9				

WELL LOG



Note: See Figure A-1 for explanation of symbols.
Coordinates Data Source: Horizontal approximated based on Topographic Survey. Vertical based on Site-specific survey.

Date:11/5/18 Path:\\GEOENGINEERS.COM\WAN\PROJECTS\10\10600003\GINT\1060000300.GPJ DBLibrary/Library:GEOENGINEERS_DF_STD_US_JUNE_2017.GLB/GEI8_GEOTECH_WELL_%F

Log of Boring with Monitoring Well GEI-4

GeoEngineers

Project: Cascadia STEM Building (CC4)
Project Location: Cascadia College, Bothell, Washington
Project Number: 10600-003-00

Figure A-2
Sheet 1 of 1

Drilled	Start 9/5/2018	End 9/5/2018	Total Depth (ft) 35.25	Logged By PEB / Checked By CWM	Driller Holocene Drilling, Inc.	Drilling Method Hollow-stem Auger

Surface Elevation (ft) 122.19 / Vertical Datum NGVD29	Hammer Data: Autohammer 140 (lbs) / 30 (in) Drop	Drilling Equipment: Diedrich D50
Easting (X) 1306098 / Northing (Y) 280014	System Datum: WA State Plane North NAD83 (feet)	Groundwater not observed at time of exploration

Notes:

Elevation (feet)	Depth (feet)	Interval	Recovered (in)	Blows/foot	Collected Sample	Sample Name / Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
	0							TS	2 to 3 inches of topsoil			
120								ML	Gray/brown sandy silt with occasional gravel, roots, moderate oxidation staining (medium dense, moist) (weathered glacial till)			
			0	13		1						
	5		18	21		2 SA				14	55	
115			6	50/6"		3 %F		ML	Gray/brown sandy silt with occasional gravel (very dense, moist) (glacial till)	10	56	
	10		6	50/6"		4 MC				10		
110												
	15		18	84		5 SA				12	65	
105								SM	Gray silty fine sand with gravel, interbedded silt lenses (very dense, moist)			
	20		6	50/6"		6 SA				8	47	
100												
	25		2	50/2"		7						
95												
	30		6	50/6"		8 MC				12		
90												
	35		2	50/2"		9						

Note: See Figure A-1 for explanation of symbols.
Coordinates Data Source: Horizontal approximated based on Topographic Survey. Vertical based on Site-specific survey.

Log of Boring GEI-5

GeoEngineers

Project: Cascadia STEM Building (CC4)
Project Location: Cascadia College, Bothell, Washington
Project Number: 10600-003-00

Figure A-3
Sheet 1 of 1

Drilled	Start	End	Total Depth (ft)	Logged By	Checked By	Driller	Drilling Method
	9/5/2018	9/5/2018	36.5	PEB	CWM	Holocene Drilling, Inc.	Hollow-stem Auger

Hammer Data	Autohammer 140 (lbs) / 30 (in) Drop	Drilling Equipment	Diedrich D50
Surface Elevation (ft) / Vertical Datum	92.09 / NGVD29	Top of Casing Elevation (ft)	91.76
Easting (X) / Northing (Y)	1306245 / 280046	Horizontal Datum	WA State Plane North NAD83 (feet)

DOE Well I.D.: BLH 149
A 2 (in) well was installed on 9/5/2018 to a depth of 35 (ft).

Groundwater

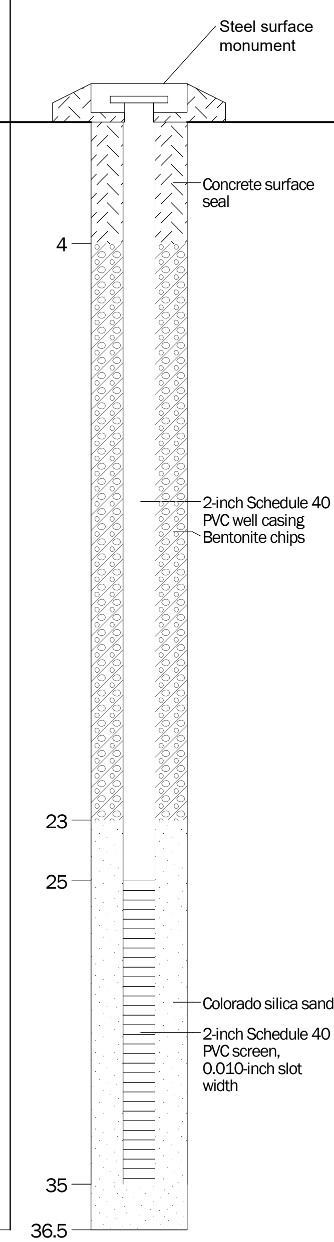
Date Measured	Depth to Water (ft)	Elevation (ft)
10/31/2018	19.55	72.21

Notes:

FIELD DATA

Elevation (feet)	Depth (feet)	Recovered (in)	Blows/foot	Sample Name / Testing	Water Level	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)
	0					TS	3 inches of topsoil		
90		8	50/6"	1 MC		SM	Brown silty fine to medium sand with gravel, roots (very dense, moist) (weathered glacial till)	4	
	5	12	87	2 SA		GP-GM	Gray fine gravel with silt and sand (very dense, moist) (glacial till)	5	9
85		10	69	3 MC		SM	Gray silty fine to coarse sand with gravel (very dense, moist)	5	
	10	9	50/6"	4 SA		SM	Gray silty fine to coarse sand with gravel (very dense, moist)	3	24
80	15	4	50/4"	5 MC				7	
75					▼	SM	Gray silty fine to medium sand with gravel, occasional interbedded silt lenses (very dense, moist to wet)		
	20	10	50/4"	6 SA				10	25
70						SP-SM	Gray fine to medium sand with silt (medium dense, wet) (transitional bed deposits)		
	25	12	14*	7 %F				23	9
65						SP-SM	Gray fine sand with silt (medium dense, wet)		
	30	18	21*	8 %F				23	10
60									
	35	6	25*	9			Becomes moist		
							(*Blow counts not representative due to heave)		

WELL LOG



Note: See Figure A-1 for explanation of symbols.
Coordinates Data Source: Horizontal approximated based on Topographic Survey. Vertical based on Site-specific survey.

Log of Boring with Monitoring Well GEI-6

GeoEngineers

Project: Cascadia STEM Building (CC4)
Project Location: Cascadia College, Bothell, Washington
Project Number: 10600-003-00

Drilled	Start 9/6/2018	End 9/6/2018	Total Depth (ft) 36.5	Logged By PEB Checked By CWM	Driller Holocene Drilling, Inc.	Drilling Method Hollow-stem Auger

Surface Elevation (ft) Vertical Datum	95.41 NGVD29	Hammer Data	Autohammer 140 (lbs) / 30 (in) Drop
Drilling Equipment	Diedrich D50		
Easting (X) Northing (Y)	1306076 280208	System Datum	WA State Plane North NAD83 (feet)
Groundwater not observed at time of exploration			

Notes:

Elevation (feet)	Depth (feet)	FIELD DATA: Interval	Recovered (in)	Blows/foot	Collected Sample	Sample Name / Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
95	0							TS	2 to 3 inches of topsoil			
								SM	Brown silty fine to coarse sand with gravel, occasional roots (very dense, moist) (weathered glacial till)			
			8	50/2"		1 / SA				6	24	
90	5		0	50/1"		2						
								SM	Gray silty fine sand with gravel (very dense, moist) (glacial till)			
			8	50/6"		3 / MC				4		
85	10		12	50/6"		4 / SA			Occasional gravel	10	45	
								SP-SM	Gray fine to medium sand with silt and gravel lenses (very dense, moist to wet) (transitional bed deposits)			
80	15		12	50/6"		5 / %F				16	9	
								CL	Gray lean clay with sand and occasional gravel (very stiff, moist) (glaciolacustrine deposits)			
75	20		18	29		6 / MC				24		
								CL	Gray lean clay with occasional sand lenses (hard, moist)			
70	25		18	70		7 / MC				21		
								CL	Gray lean clay, massive (hard, moist)			
65	30		18	67		8						
60	35		18	41		9 / MC				16		

Note: See Figure A-1 for explanation of symbols.
Coordinates Data Source: Horizontal approximated based on Topographic Survey. Vertical based on Site-specific survey.

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Log of Boring GEI-7

GeoEngineers

Project: Cascadia STEM Building (CC4)
Project Location: Cascadia College, Bothell, Washington
Project Number: 10600-003-00

Drilled	Start 9/6/2018	End 9/6/2018	Total Depth (ft) 36.5	Logged By PEB / Checked By CWM	Driller Holocene Drilling, Inc.	Drilling Method Hollow-stem Auger

Surface Elevation (ft) / Vertical Datum	99.81 / NGVD29	Hammer Data	Autohammer 140 (lbs) / 30 (in) Drop	Drilling Equipment	Diedrich D50
Easting (X) / Northing (Y)	1306037 / 280313	System Datum	WA State Plane North NAD83 (feet)	Groundwater not observed at time of exploration	

Notes:

Elevation (feet)	Depth (feet)	Interval	Recovered (in)	Blows/foot	Collected Sample	Sample Name / Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
	0							TS	3 to 4 inches of topsoil			
								SM	Brown silty fine to medium sand with occasional gravel, roots (very dense, moist) (weathered glacial till)			
			9	50/6"		1						
95	5		18	40		2 / %F		ML	Brown/gray sandy silt, moderate oxidation staining (very stiff to hard, moist) (glaciolacustrine deposits)	12	64	
			14	25		3						
90	10		18	22		4 / AL		CL	Gray lean clay with sand (very stiff, moist)	23		AL (LL = 43; PI = 22)
85	15		18	29		5 / MC			Slight oxidation staining	24		
80	20		18	22		6			Slickensided			
75	25		18	24		7 / MC			Slickensided	28		
70	30		18	32		8			Becomes hard			
65	35		18	30		9 / MC			Becomes very stiff, slickensided	30		

Note: See Figure A-1 for explanation of symbols.
Coordinates Data Source: Horizontal approximated based on Topographic Survey. Vertical based on Site-specific survey.

Log of Boring GEI-8

GeoEngineers

Project: Cascadia STEM Building (CC4)
Project Location: Cascadia College, Bothell, Washington
Project Number: 10600-003-00

Drilled — Start 9/7/2018, End 9/7/2018	Total Depth (ft) 36.5	Logged By PEB; Checked By CWM	Driller Holocene Drilling, Inc.	Drilling Method Hollow-stem Auger
Surface Elevation (ft) 79.23; Vertical Datum NGVD29	Hammer Data: Autohammer 140 (lbs) / 30 (in) Drop		Drilling Equipment: Diedrich D50	
Easting (X) 1306198; Northing (Y) 280352	System Datum: WA State Plane North NAD83 (feet)		Groundwater not observed at time of exploration	

Notes:

FIELD DATA

Elevation (feet)	Depth (feet)	Recovered (in)	Blows/foot	Sample Name / Testing	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
	0				TS	3 inches of topsoil			
					SM	Brown/gray silty fine to medium sand, slight oxidation staining (dense, moist) (weathered glacial till)			
		11	33	1 / MC			16		
75	5	16	30	2					
					SC	Brown/gray clayey fine to medium sand (dense, moist) (glaciolacustrine deposits)			
		18	31	3A / MC / 3B	CL	Gray lean clay with sand, slight oxidation staining (very stiff, moist)	20		
70	10	18	18	4	CL	Gray lean clay with interbedded 8-inch clean sand layer, slickensided (very stiff, moist)			
65					CL	Gray lean clay with occasional interbedded thin sand layers (very stiff, moist)			
	15	18	29	5 / MC			29		
60					CL	Gray lean clay, massive (hard, moist)			
	20	18	35	6 / AL			20		AL (LL = 36; PI = 16)
55	25	18	20	7		Becomes very stiff			
50	30	18	40	8 / MC		Becomes hard	20		
45					CL	Gray sandy lean clay (hard, moist)			
	35	18	47	9					

Note: See Figure A-1 for explanation of symbols.
Coordinates Data Source: Horizontal approximated based on Topographic Survey. Vertical based on Site-specific survey.

Log of Boring GEI-9

GEOENGINEERS

Project: Cascadia STEM Building (CC4)
Project Location: Cascadia College, Bothell, Washington
Project Number: 10600-003-00

Figure A-7
Sheet 1 of 1

Drilled	Start	End	Total Depth (ft)	Logged By	Checked By	Driller	Drilling Method
	9/7/2018	9/7/2018	36.5	PEB	CWM	Holocene Drilling, Inc.	Hollow-stem Auger

Hammer Data	Autohammer 140 (lbs) / 30 (in) Drop	Drilling Equipment	Diedrich D50
Surface Elevation (ft) / Vertical Datum	78.21 / NGVD29	Top of Casing Elevation (ft)	77.42
Easting (X) / Northing (Y)	1306213 / 280264	Horizontal Datum	WA State Plane North NAD83 (feet)

DOE Well I.D.: BLH 151
A 2 (in) well was installed on 9/7/2018 to a depth of 35 (ft).

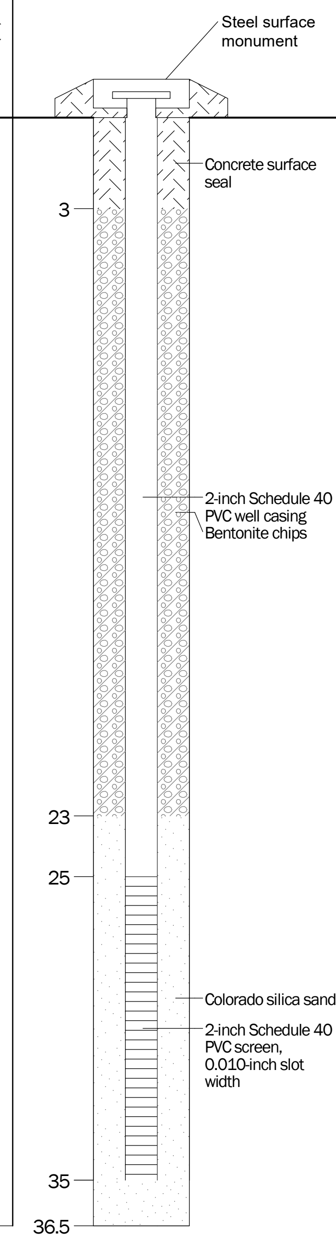
Groundwater Date Measured	Depth to Water (ft)	Elevation (ft)
10/31/2018	12.45	64.97

Notes:

FIELD DATA

Elevation (feet)	Depth (feet)	Recovered (in)	Blows/foot	Sample Name / Testing	Water Level	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)
	0					TS	3 inches of topsoil		
						SM	Gray/brown silty fine to coarse sand with gravel (very dense, moist) (glacial till)		
75		12	79	1 / SA				3	12
	5	8	66/9"	2					
70		3	50/6"	3			Becomes gray		
						CL	Gray sandy lean clay with occasional gravel (hard, moist) (glaciolacustrine deposits)		
	10	16	50	4 / MC				15	
					▼				
65						CL	Gray lean clay with occasional sand (very stiff, moist)		
	15	18	26	5					
60									
	20	18	29	6 / MC			Massive	25	
55									
	25	18	39	7			Becomes hard		
50									
	30	1	50/6"	8 / MC				21	
45						CL	Gray lean clay with occasional interbedded sand lenses (very stiff, moist)		
	35	18	17	9					

WELL LOG



Note: See Figure A-1 for explanation of symbols.
Coordinates Data Source: Horizontal approximated based on Topographic Survey. Vertical based on Site-specific survey.

Log of Boring with Monitoring Well GEI-10

GEOENGINEERS

Project: Cascadia STEM Building (CC4)
Project Location: Cascadia College, Bothell, Washington
Project Number: 10600-003-00

Figure A-8
Sheet 1 of 1

Drilled	Start	End	Total Depth (ft)	Logged By	Checked By	Driller	Drilling Method
	9/6/2018	9/6/2018	36.5	PEB	CWM	Holocene Drilling, Inc.	Hollow-stem Auger

Hammer Data	Autohammer 140 (lbs) / 30 (in) Drop	Drilling Equipment	Diedrich D50
Surface Elevation (ft) / Vertical Datum	88.07 / NGVD29	Top of Casing Elevation (ft)	87.75
Easting (X) / Northing (Y)	1306150 / 280321	Horizontal Datum	WA State Plane North NAD83 (feet)

DOE Well I.D.: BLH 150
A 2 (in) well was installed on 9/6/2018 to a depth of 35 (ft).

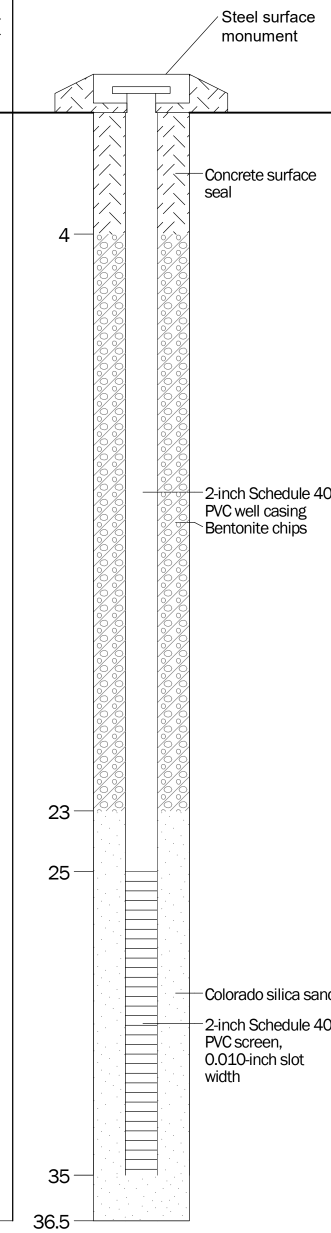
Groundwater Date Measured	Depth to Water (ft)	Elevation (ft)
10/31/2018	4.61	83.14

Notes:

FIELD DATA

Depth (feet)	Recovered (in)	Blows/foot	Sample Name / Testing	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)
0				TS	3 inches of topsoil		
				ML	Brown sandy silt, occasional roots (stiff, moist) (fill)		
~3	13	12	1				
~5	18	30	2	CL	Brown lean clay with sand, occasional roots, slight oxidation staining (very stiff, moist) (glaciolacustrine deposits)		
~8	18	26	3 AL		AL (LL = 45; PI = 23)	26	
~10	18	30	4	CL	Brown/gray silty lean clay with occasional sand (very stiff, moist)		
				CL	Gray lean clay with occasional sand (very stiff, moist)		
~15	18	21	5 MC			33	
				CL	Gray lean clay, massive (very stiff, moist)		
~20	18	20	6				
~25	18	27	7 AL		AL (LL = 42; PI = 20)	31	
				CL	Gray lean clay with occasional interbedded sand lenses, slickensided (hard, moist)		
~30	18	36	8 MC			28	
				CL	Gray lean clay, massive (stiff, moist)		
~35	18	17	9				

WELL LOG



Note: See Figure A-1 for explanation of symbols.
Coordinates Data Source: Horizontal approximated based on Topographic Survey. Vertical based on Site-specific survey.

Log of Boring with Monitoring Well GEI-11

GEOENGINEERS

Project: Cascadia STEM Building (CC4)
Project Location: Cascadia College, Bothell, Washington
Project Number: 10600-003-00

Figure A-9
Sheet 1 of 1

Drilled	Start 9/20/2018	End 9/20/2018	Total Depth (ft) 36.5	Logged By CWM / Checked By CWM	Driller	Advance Drill Technologies, Inc.	Drilling Method: Hollow-stem Auger

Surface Elevation (ft) / Vertical Datum	116.02 / NGVD29	Hammer Data	Autohammer 140 (lbs) / 30 (in) Drop	Drilling Equipment	Diedrich D50 Turbo Track Mounted Drill Rig
Easting (X) / Northing (Y)	1306072 / 280106	System Datum	WA State Plane North NAD83 (feet)	Groundwater not observed at time of exploration	

Notes:

Elevation (feet)	Depth (feet)	Interval	Recovered (in)	Blows/foot	Collected Sample	Sample Name / Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
115	0							TS	2 to 3 inches of topsoil			
								SM	Brown-gray silty fine to medium sand with occasional gravel, roots (dense, moist) (weathered glacial till)			
			18	39		1						
110	5		18	41		2		ML	Brown-gray sandy silt (hard, moist) (glacial till)			
			15	56		3 SA			Occasional gravel	13	64	
105	10		18	70		4						
								SM	Gray silty fine to medium sand with gravel (very dense, moist)			
100	15		11	50/5"		5 ML				8		
95	20		4	50/4"		6						Periodic rough drilling from 21 to 31 feet
90	25		3	50/3"		7						
85	30		2	50/2"		8 %F			Occasional gravel	5	13	
								SP-SM	Gray fine to medium sand with silt; interbedded silt lenses (very dense, moist to wet) (transitional bed deposits)			
80	35		15	70		9						Bottom 6 inches of sample was wet

Note: See Figure A-1 for explanation of symbols.
Coordinates Data Source: Horizontal approximated based on Topographic Survey. Vertical based on Site-specific survey.

Log of Boring GEI-12

GEOENGINEERS

Project: Cascadia STEM Building (CC4)
Project Location: Cascadia College, Bothell, Washington
Project Number: 10600-003-00

Figure A-10
Sheet 1 of 1

Drilled	Start 9/20/2018	End 9/20/2018	Total Depth (ft) 36.5	Logged By CWM / Checked By CWM	Driller: Advance Drill Technologies, Inc.	Drilling Method: Hollow-stem Auger

Surface Elevation (ft) 87.39 Vertical Datum NGVD29	Hammer Data: Autohammer 140 (lbs) / 30 (in) Drop	Drilling Equipment: Diedrich D50 Turbo Track Mounted Drill Rig	
Easting (X) 1306176 Northing (Y) 280166	System Datum: WA State Plane North NAD83 (feet)	Groundwater not observed at time of exploration	

Notes:

Elevation (feet)	Depth (feet)	Interval	Recovered (in)	Blows/foot	Collected Sample	Sample Name / Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
	0							TS	5 inches topsoil			
85								SM	Gray silty fine to medium sand with gravel (very dense, moist) (glacial till)			
			8	70		1						Blow counts overstated due to rock
												Rough drilling at 4 feet
	5		12	90/9"		2 SA		SM	Brown-gray silty fine to medium sand with gravel (very dense, moist)	4	21	
80								SM	Gray silty fine to medium sand with occasional gravel, 5-inch interbedded silt lens (very dense, moist)			
			13	52		3						
	10		15	47		4 %F		SM	Brown silty fine to medium sand with occasional gravel (dense, moist)	5	14	
75								SM	Gray silty fine to coarse sand with gravel (very dense, moist)			
	15		11	50/5"		5						
70												Rough drilling at 16 feet
	20		8	50/2"		6						
65								CL	Gray sandy lean clay with gravel (hard, moist) (glaciolacustrine deposits)			
	25		16	87/10"		7						
60								CL	Gray lean clay (hard, moist)			
	30		18	52		8 AL				17		AL (LL = 45%; PI = 23%)
55												
	35		18	43		9						

Note: See Figure A-1 for explanation of symbols.
Coordinates Data Source: Horizontal approximated based on Topographic Survey. Vertical based on Site-specific survey.

Log of Boring GEI-13

GeoEngineers

Project: Cascadia STEM Building (CC4)
Project Location: Cascadia College, Bothell, Washington
Project Number: 10600-003-00

Drilled	Start: 9/20/2018	End: 9/20/2018	Total Depth (ft): 36.5	Logged By: CWM / Checked By: CWM	Driller: Advance Drill Technologies, Inc. / Drilling Method: Hollow-stem Auger
Hammer Data	Autohammer 140 (lbs) / 30 (in) Drop	Drilling Equipment	Diedrich D50 Turbo Track Mounted Drill Rig		
Surface Elevation (ft) / Vertical Datum	84.09 / NGVD29	Top of Casing Elevation (ft)	83.84		
Easting (X) / Northing (Y)	1306234 / 280145	Horizontal Datum	WA State Plane North NAD83 (feet)		

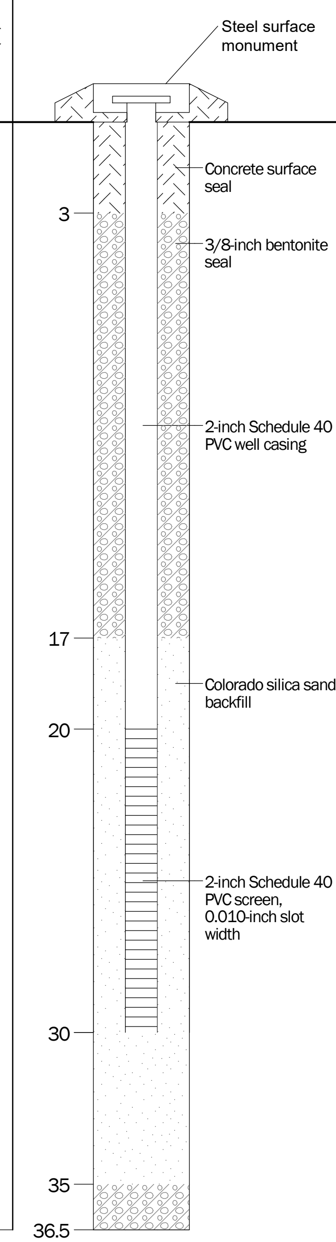
DOE Well I.D.: BKP255
A 2 (in) well was installed on 9/20/2018 to a depth of 35 (ft).

Groundwater Date Measured	Depth to Water (ft)	Elevation (ft)
10/31/2018	17.64	66.20

Notes:

Elevation (feet)	Depth (feet)	Recovered (in)	Blows/foot	Sample Name / Testing	Water Level	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)
	0					TS	4 inches topsoil		
						SM	Brown silty fine to medium sand with gravel, roots (medium dense, moist) (fill)		
		18	23	1A %F 1B				19	28
80						SM	Brown-gray silty fine to medium sand with occasional gravel (medium dense, mosit) (glacial till)		
	5	2	50/6"	2		SM	Brown-gray silty fine to medium sand with gravel (very dense, moist)		
						SM	Gray silty fine to coarse sand with gravel (very dense, moist)		
		10	73	3 %F				6	19
75	10	3	50/3"	4					
70						SP-SM	Gray fine to medium sand with silty and gravel (dense, moist to wet) (transitional bed deposits)		
	15	12	49	5 %F				11	10
					▼				
65						SP-SM	Gray fine to medium sand with silt (very dense, wet)		
	20	18	51	6 SA				20	6
60	25	6	50/6"	7A 7B					
						SM	Gray silty fine to coarse sand with occasional gravel (very dense, moist)		
55	30	2	50/2"	8					
50						CL	Gray lean clay, slicken sided (hard, moist) (glaciolacustrine deposits)		
	35	12	38	9					

WELL LOG



Note: See Figure A-1 for explanation of symbols.
Coordinates Data Source: Horizontal approximated based on Topographic Survey. Vertical based on Site-specific survey.

Log of Boring with Monitoring Well GEI-14

GEOENGINEERS

Project: Cascadia STEM Building (CC4)
Project Location: Cascadia College, Bothell, Washington
Project Number: 10600-003-00

APPENDIX B
Laboratory Testing

APPENDIX B
LABORATORY TESTING

Soil samples obtained from the explorations were transported to our laboratory and examined to confirm or modify field classifications, as well as to evaluate engineering properties of the soil. Representative samples were selected for laboratory testing consisting of moisture content determinations, percent fines content, sieve analysis, Atterberg limits, and California Bearing Ratio (CBR). The tests were performed in general accordance with test methods of the American Society for Testing and Materials (ASTM) or other applicable procedures.

The results of the laboratory tests are presented in Figures B-1 through B-6. The results of the moisture content determinations are presented on the exploration logs at the respective sample depths in Appendix A.

Soil Classifications

Soil samples obtained from the explorations were visually classified in the field and/or in our laboratory using a system based on the Unified Soil Classification System (USCS) and ASTM classification methods. ASTM test method D 2488 was used to visually classify the soil samples, while ASTM D 2487 was used to classify the soils based on laboratory tests results. These classification procedures are incorporated in the exploration logs shown in Figures A-2 through A-15 in Appendix A.

Moisture Content Determinations

Moisture contents tests were completed in general accordance with ASTM D 2216 for representative samples obtained from the explorations. The test results are presented on the exploration logs in Appendix A at the respective sample depth.

Percent Passing U.S. No. 200 Sieve (%F)

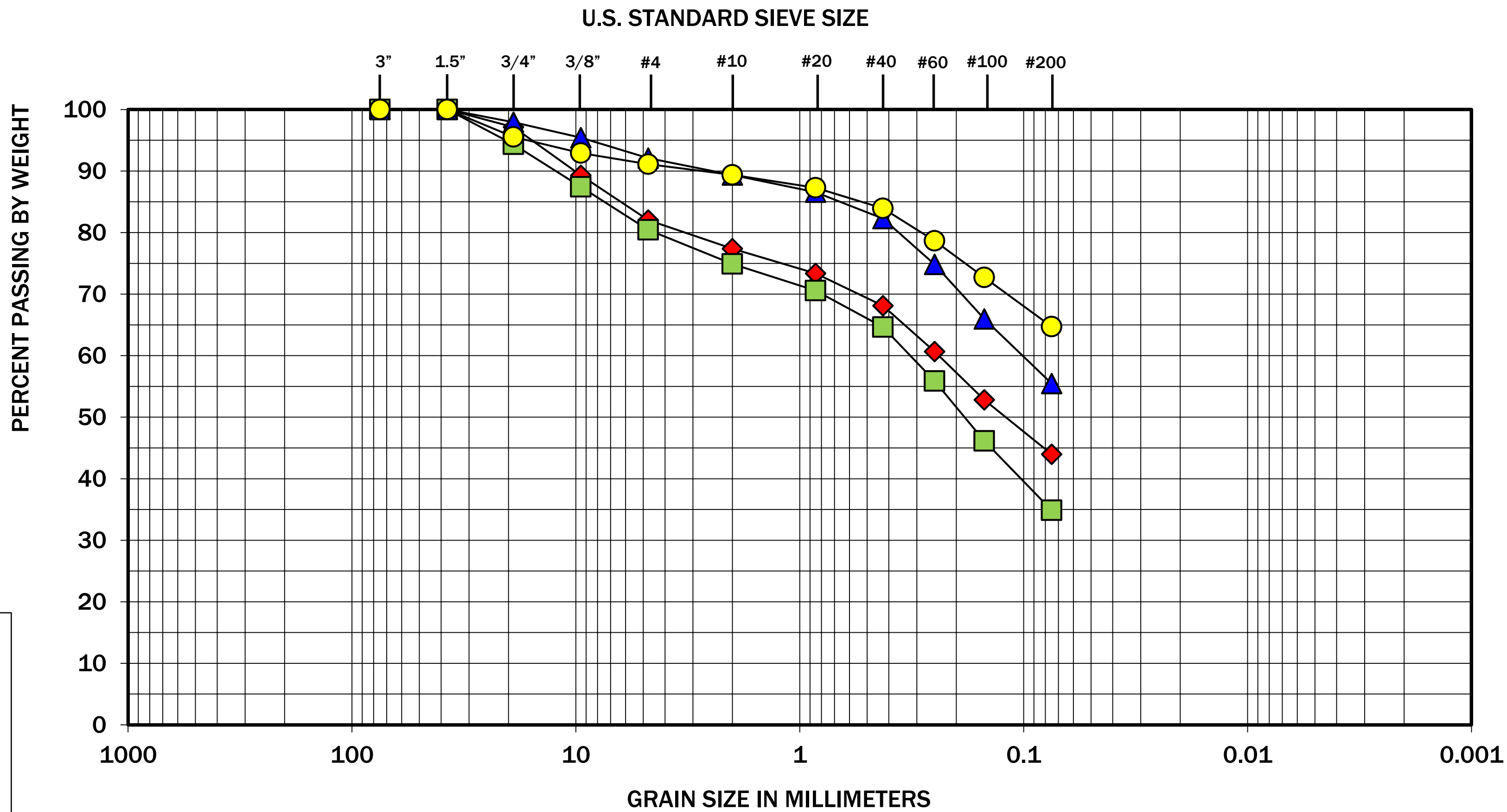
Selected samples were “washed” through the U.S. No. 200 mesh sieve to estimate the relative percentages of coarse- and fine-grained particles in the soil. The percent passing value represents the percentage by weight of the sample finer than the U.S. No. 200 sieve. These tests were conducted to verify field descriptions and to estimate the fines content for analysis purposes. The tests were conducted in accordance with ASTM D 1140, and the results are shown on the exploration logs in Appendix A at the respective sample depths.

Sieve Analysis

Sieve analyses were performed on selected samples in general accordance with ASTM D 422. The wet sieve analysis method was used to estimate the percentage of soil greater than the U.S. No. 200 mesh sieve. The results of the sieve analyses were plotted, classified in general accordance with the USCS, and presented on Figures B-1 through B-4.

Atterberg Limits

Atterberg limits testing was performed on selected fine-grained soil samples. The tests were used to classify the soil and to estimate index properties of the soil. The liquid limit and the plastic limit were performed in general accordance with ASTM D 4318. The results of the Atterberg limits are summarized in Figures B-5 and B-6. The plasticity chart relates the plasticity index (liquid limit minus the plastic limit) to the liquid limit.



COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

Symbol	Boring Number	Depth (feet)	Moisture (%)	Soil Description
◆	GEI-4	5	8	Silty fine sand with gravel (SM)
■	GEI-4	10	7	Silty fine to medium sand with gravel (SM)
▲	GEI-5	5	14	Sandy silt with occasional gravel (ML)
●	GEI-5	15	12	Sandy silt with occasional gravel (ML)

The grain size analysis results were obtained in general accordance with ASTM D 6913.

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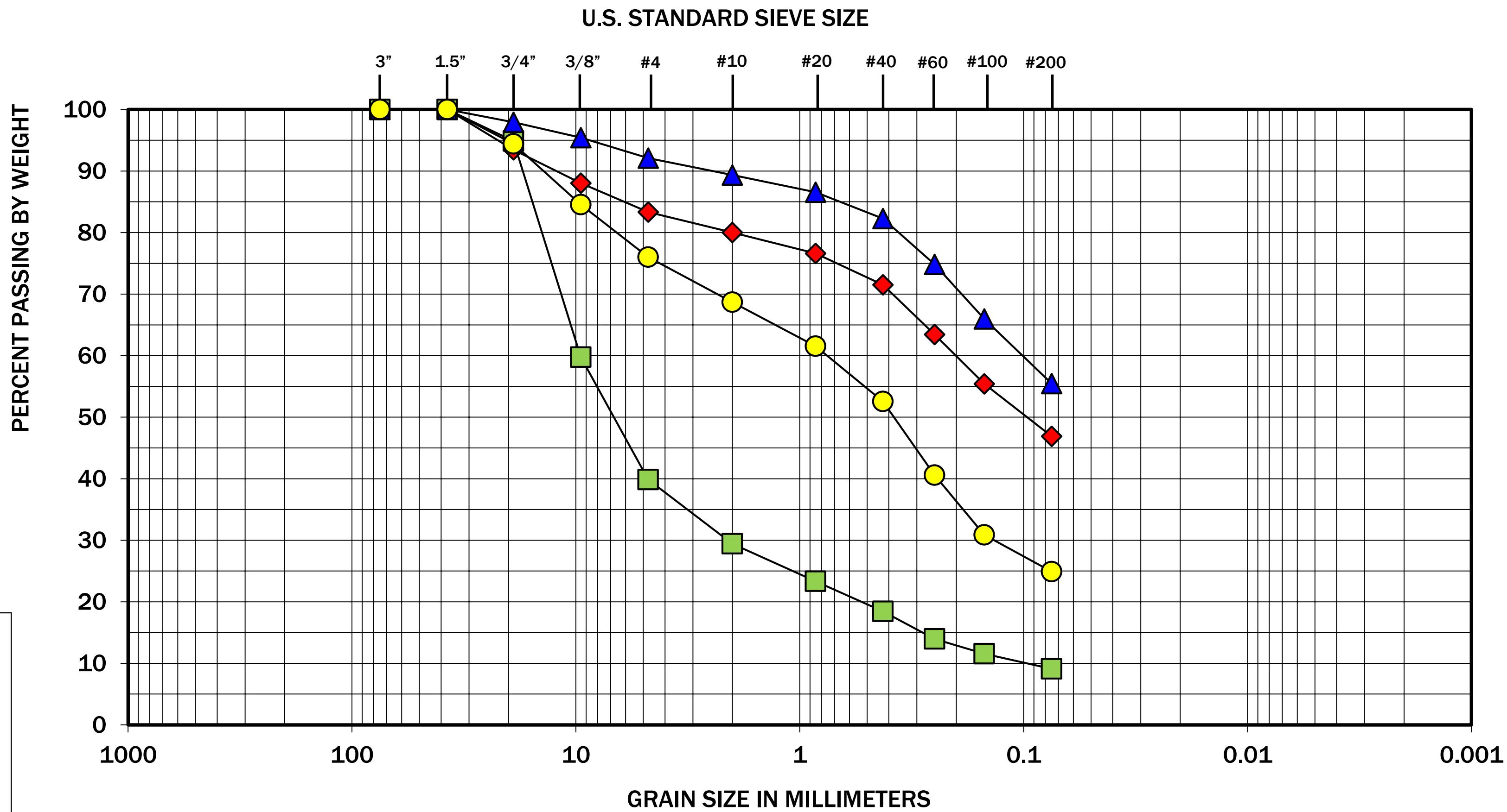
Sieve Analysis Results

Cascadia STEM Building (CC4)
Cascadia College Bothell, Washington

Figure B-1



COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

Symbol	Boring Number	Depth (feet)	Moisture (%)	Soil Description
◆	GEI-5	20	8	Silty fine sand with gravel (SM)
■	GEI-6	5	5	Fine gravel with silt and sand (GP-GM)
▲	GEI-6	10	3	Silty fine to coarse sand with gravel (SM)
●	GEI-6	20	10	Silty fine to medium sand with gravel (SM)

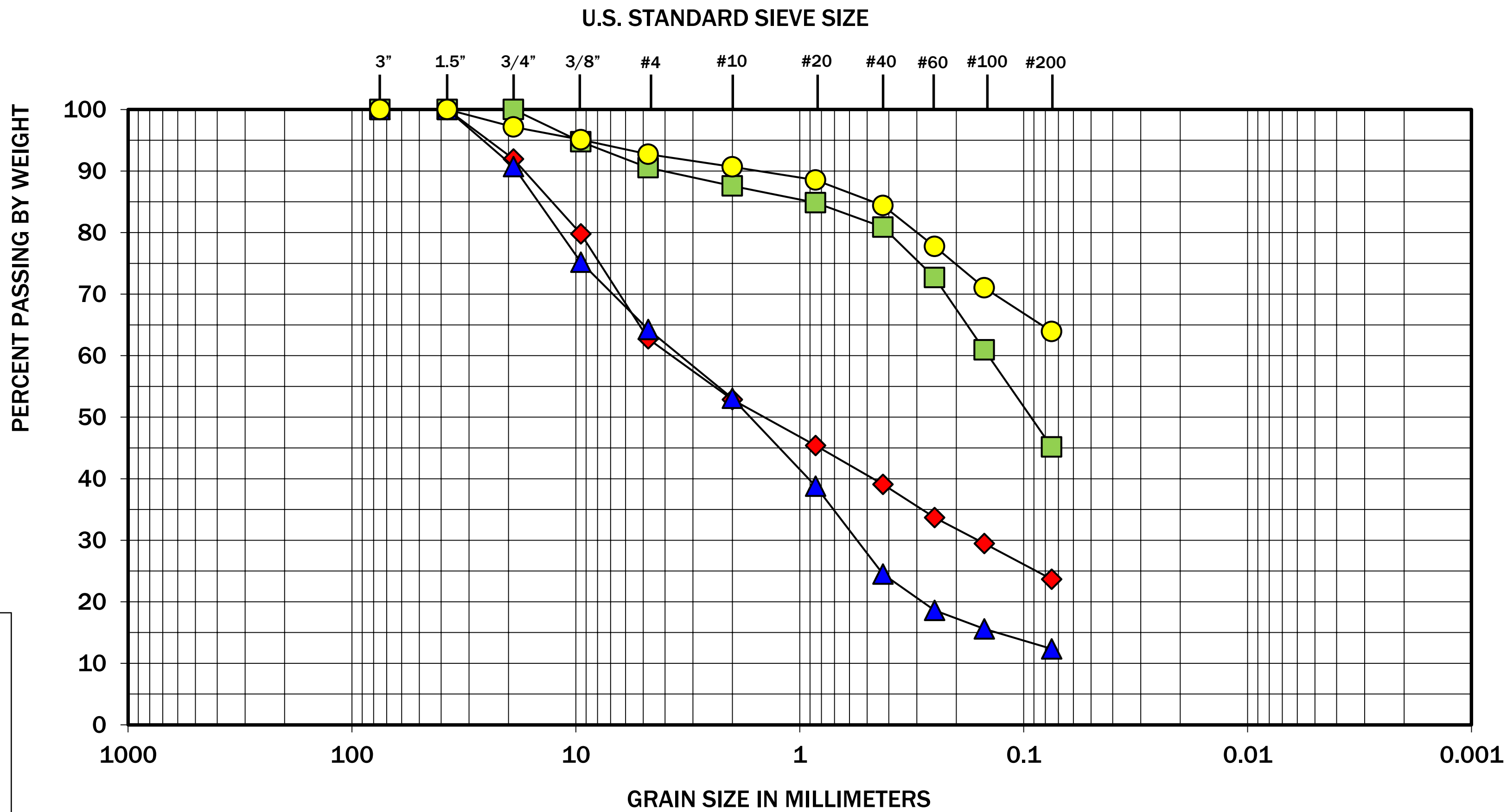
Note: This report may not be reproduced, except in full, without written approval of GeoEngineers, Inc. Test results are applicable only to the specific sample on which they were performed, and should not be interpreted as representative of any other samples obtained at other times, depths or locations, or generated by separate operations or processes.

The grain size analysis results were obtained in general accordance with ASTM D 6913.

Sieve Analysis Results

Cascadia STEM Building (CC4)
Cascadia College Bothell, Washington

Figure B-2



COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

Symbol	Boring Number	Depth (feet)	Moisture (%)	Soil Description
◆	GEI-7	2.5	6	Silty fine to coarse sand with gravel (SM)
■	GEI-7	10	10	Silty fine sand with occasional gravel (SM)
▲	GEI-10	2.5	3	Silty fine to coarse sand with gravel (SM)
●	GEI-12	7.5	13	Sandy silt (ML)

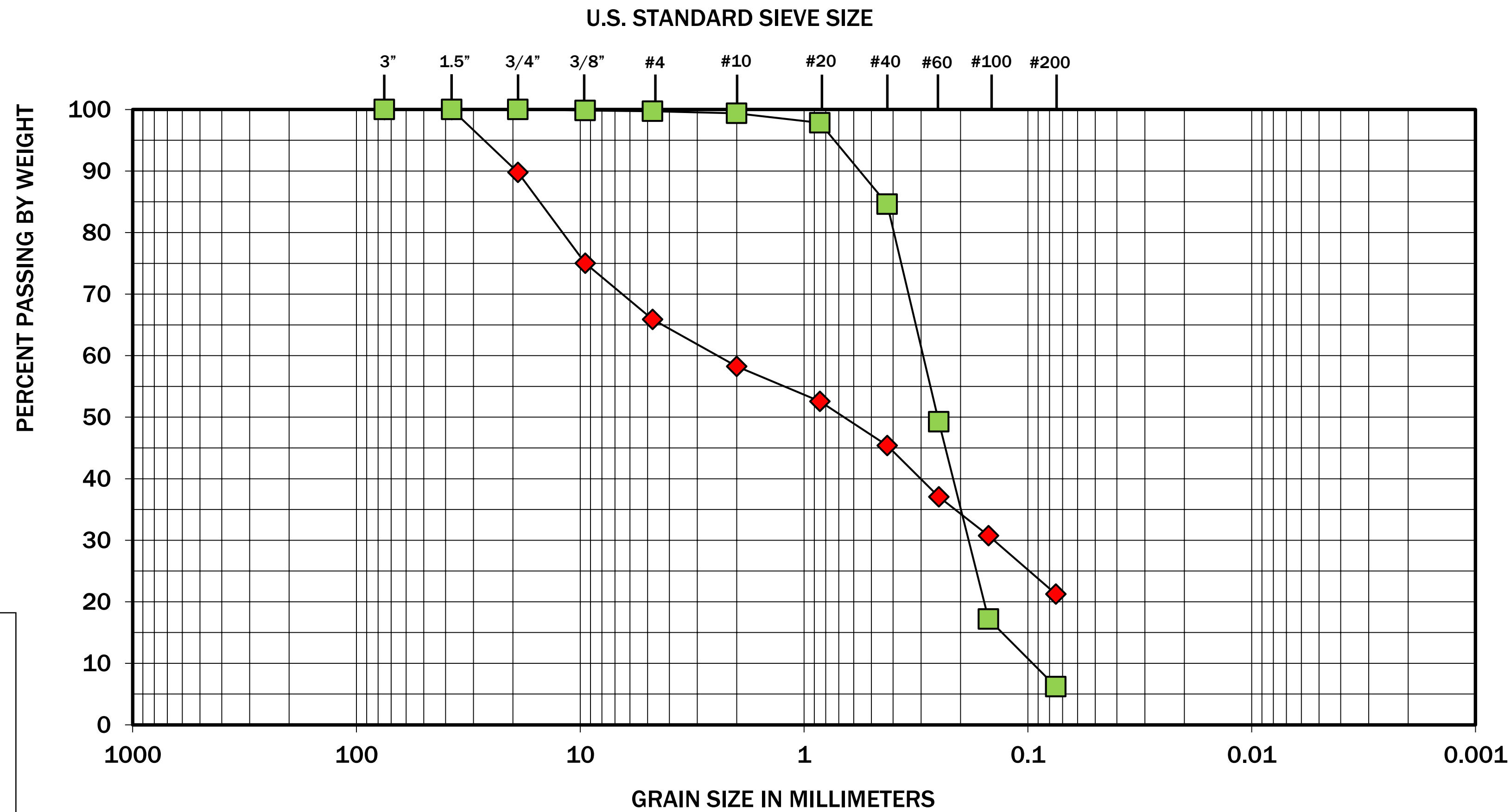
The grain size analysis results were obtained in general accordance with ASTM D 6913.

Sieve Analysis Results

Cascadia STEM Building (CC4)
Cascadia College Bothell, Washington

GeoEngineers

Figure B-3



COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

Symbol	Boring Number	Depth (feet)	Moisture (%)	Soil Description
◆ (red diamond)	GEI-13	5	4	Silty fine to medium sand with gravel (SM)
■ (green square)	GEI-14	20	20	Fine to medium sand with silt (SP-SM)

The grain size analysis results were obtained in general accordance with ASTM D 6913.

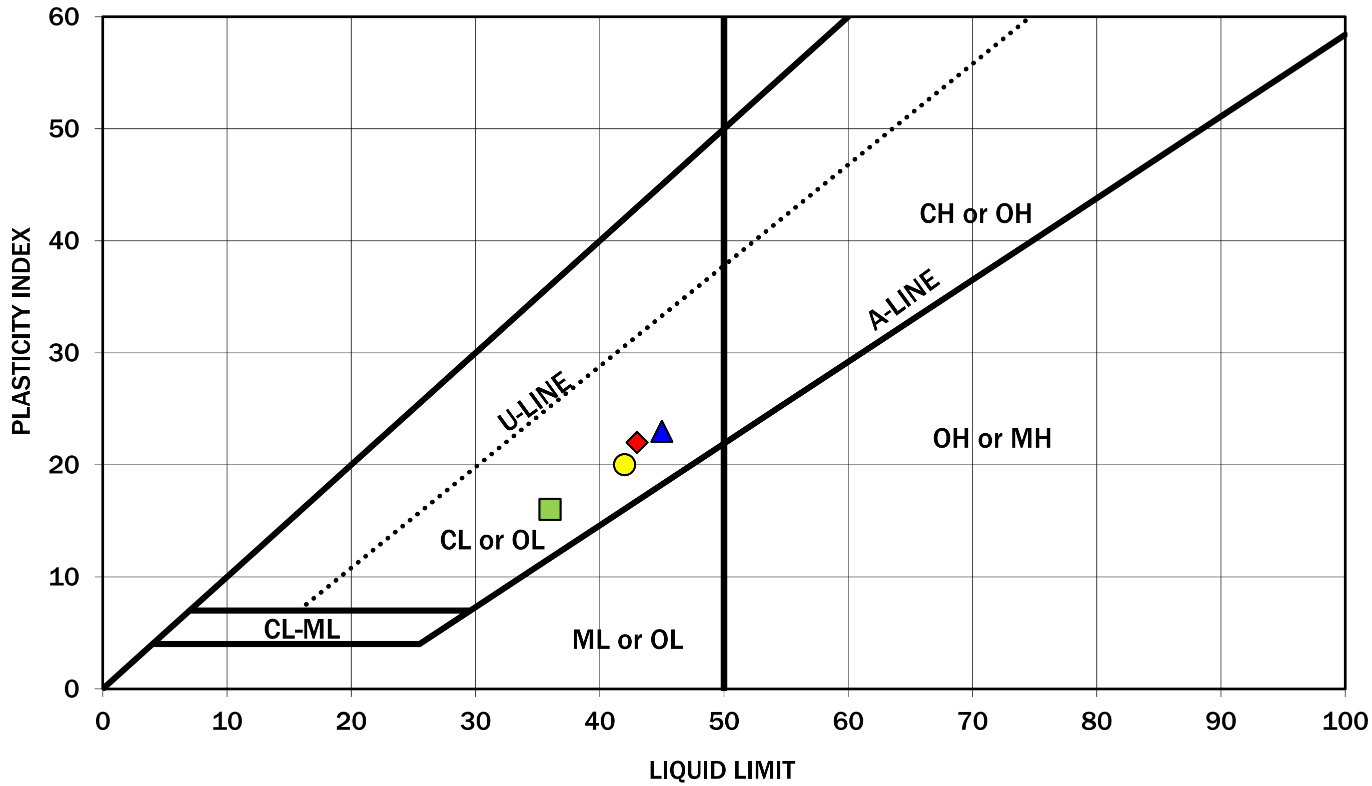
GeoEngineers

Cascadia STEM Building (CC4)
Cascadia College Bothell, Washington

Sieve Analysis Results

Figure B-4

PLASTICITY CHART



Symbol	Boring Number	Depth (feet)	Moisture Content (%)	Liquid Limit (%)	Plasticity Index (%)	Soil Description
◆ (red diamond)	GEI-8	10	23	43	22	Lean clay (CL)
■ (green square)	GEI-9	20	20	36	16	Lean clay (CL)
▲ (blue triangle)	GEI-11	7.5	26	45	23	Lean clay (CL)
● (yellow circle)	GEI-11	25	31	42	20	Lean clay (CL)

The liquid limit and plasticity index were obtained in general accordance with ASTM D 4318.

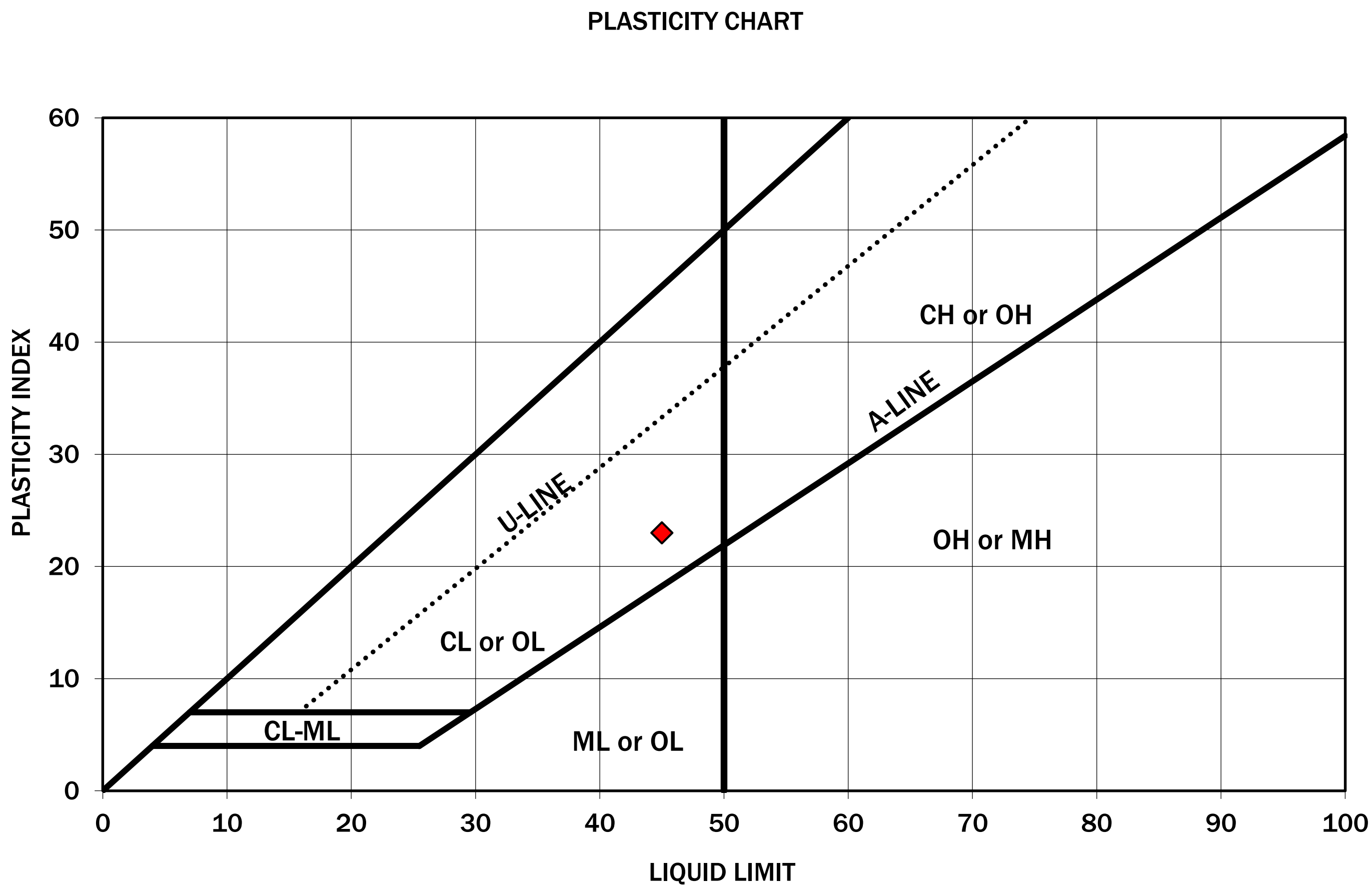
Atterberg Limits Test Results

Cascadia STEM Building (CC4)
Cascadia College Bothell, Washington

GEOENGINEERS

Figure B-5

10600-003-00 Date Exported: 09/19/18



Symbol	Boring Number	Depth (feet)	Moisture Content (%)	Liquid Limit (%)	Plasticity Index (%)	Soil Description
◆	GEI-13	30	17	45	23	Lean clay (CL)

The liquid limit and plasticity index were obtained in general accordance with ASTM D 4318.

Atterberg Limits Test Results

Cascadia STEM Building (CC4)
Cascadia College Bothell, Washington

GeoEngineers

Figure B-6

APPENDIX C
Exploration Logs from Previous Studies

APPENDIX C
EXPLORATION LOGS FROM PREVIOUS STUDIES

Included in this section are relevant logs from the following reports completed for previous campus development:

- "Geotechnical Engineering Services, Phase 4 STEM Building, University of Washington, Bothell, Washington," dated May 24, 2016.
- "Geotechnical Engineering Services, UW Bothell Phase 3 Science & Academic Building, Bothell, Washington," dated May 2, 2011.
- "Geotechnical Engineering Services, The Center for Global Learning and the Arts, Cascadia Community College, Bothell, Washington," dated September 21, 2006.
- "Report, Geotechnical Engineering Services, UWB/CCC Co-Located Campus, Phase 2a Design Development, Bothell, Washington," dated June 25, 1999.
- "Report, Geotechnical Engineering Services, UWB/CCC Co-Located Campus Phase 1 Design Development, Uplands Development and Off-site Improvements, Bothell, Washington," dated May 5, 1998.

Drilled	Start 3/3/2016	End 3/3/2016	Total Depth (ft)	31.5	Logged By EFT Checked By	Driller	Geologic Drill, Inc.	Drilling Method	Hollow-Stem Auger

Surface Elevation (ft) Vertical Datum	119.7 NAVD88	Hammer Data	Autohammer 140 (lbs) / 30 (in) Drop	Drilling Equipment	D-50 Track-Mounted
Easting (X) Northing (Y)		System Datum		Groundwater	Date Measured / Depth to Water (ft) / Elevation (ft)
Notes:					None observed

Elevation (feet)	Depth (feet)	Interval	Recovered (in)	Blows/foot	Collected Sample	Sample Name / Testing	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
	0								TS	Topsoil			
									SM	Brown silty fine to medium sand with gravel (dense to very dense, moist) (weathered till)			
			6	50+		1 MC					9		Cobbles; hard drilling
115	5		6	51		2 SA					8	20	Hard drilling
			14	60		3 MC				Grades to fine sand with occasional gravel	14		Hard drilling
110	10		18	50+		4 MC					15		Cobbles; hard drilling
									SM	Gray silty fine sand with gravel (very dense, moist) (glacial till)			
105	15		15	91		5 MC					10		Hard drilling
100	20		10	85		6							Hard drilling
95	25		9	100+		7 MC					7		Hard drilling
90	30		6	100+		8							Hard drilling

Note: See Figure A-1 for explanation of symbols.

Log of Boring GEI-1

GEOENGINEERS

Project: UW Bothell Phase 4 STEM Building
Project Location: Bothell, Washington
Project Number: 0183-120-00

Drilled	Start 3/3/2016	End 3/3/2016	Total Depth (ft)	31.5	Logged By: EFT Checked By	Driller: Geologic Drill, Inc.	Drilling Method: Hollow-Stem Auger

Hammer Data	Autohammer 140 (lbs) / 30 (in) Drop	Drilling Equipment	D-50 Track-Mounted
Surface Elevation (ft) Vertical Datum	105.9 NAVD88	Top of Casing Elevation (ft)	
Easting (X) Northing (Y)		Horizontal Datum	

DOE Well I.D.: BIK-337
A 2 (in) well was installed on 3/3/2016 to a depth of 30 (ft).

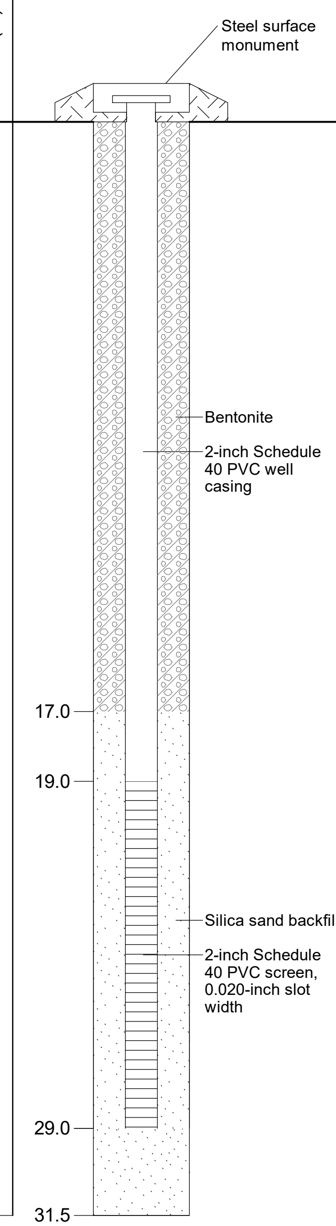
Groundwater Date Measured	Depth to Water (ft)	Elevation (ft)
Well dry on 3/30/16		

Notes:

FIELD DATA / MATERIAL DESCRIPTION

Elevation (feet)	Depth (feet)	Recovered (in)	Blows/foot	Sample Name / Testing	Water Level	Group Classification	Material Description	Moisture Content (%)	Fines Content (%)
105	0					TS	Topsoil		
						SM	Brown silty fine to medium sand with gravel, organic matter (medium dense to dense, moist) (weathered till)		
		10	32	1 SA			Hard drilling	8	28
100	5	9	18	2 MC				15	
		8	25	3					
95	10	18	35	4 SA			Perched groundwater observed at 10 feet	12	26
							Cobbles encountered at 11 feet below ground surface		
						SM	Brownish gray silty fine to medium sand with gravel (very dense, moist) (glacial till)		
		6	86	5					
90	15	18	85	6 MC				12	
85	20	18	100+	7			Boulder encountered at 20 feet		
						SM	Gray silty fine sand (very dense, wet)		
80	25	14	69	8 SA			Perched groundwater observed at 25 feet	17	46
75	30	14	89	9			Increasing gravel content		

WELL LOG



Note: See Figure A-1 for explanation of symbols.

Log of Boring GEI-2

GEOENGINEERS

Project: UW Bothell Phase 4 STEM Building
Project Location: Bothell, Washington
Project Number: 0183-120-00

Figure A-3
Sheet 1 of 1

Drilled	Start 3/3/2016	End 3/3/2016	Total Depth (ft) 26.5	Logged By EFT / Checked By	Driller Geologic Drill, Inc.	Drilling Method Hollow-Stem Auger

Surface Elevation (ft) 94.8 / Vertical Datum NAVD88	Hammer Data: Autohammer 140 (lbs) / 30 (in) Drop	Drilling Equipment: D-50 Track-Mounted	
Easting (X) / Northing (Y)	System / Datum	Groundwater — Date Measured / Depth to Water (ft) / Elevation (ft)	None observed
Notes:			

Elevation (feet)	Depth (feet)	Interval Recovered (in)	Blows/foot	Collected Sample	Sample Name Testing	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
	0							TS	Brown silty fine to medium sand, roots (loose, moist) (topsoil)			
								SM	Brown silty fine to medium sand with occasional gravel, organic matter (loose, moist) (fill)			
		8	6		1 MC					16		
90	5	12	20		2 SA					16	32	
		9	32		3 MC			SM	Brown silty fine to medium sand (dense to very dense, moist) (weathered till)	9		
85	10	14	40		4 MC					12		
								SM	Gray silty fine to medium sand with gravel (very dense, moist) (glacial till)			
80	15	8	50+		5 MC				Becomes grayish brown	7		Cobbles; hard drilling
75	20	9	50+		6							Cobbles; hard drilling
70	25	6			7 MC					5		Hard drilling

Note: See Figure A-1 for explanation of symbols.

Log of Boring GEI-3

GEOENGINEERS

Project: UW Bothell Phase 4 STEM Building
Project Location: Bothell, Washington
Project Number: 0183-120-00

Drilled	Start 8/19/2010	End 8/19/2010	Total Depth (ft) 50.3	Logged By BHC / Checked By LCF	Driller Geologic Drill	Drilling Method Hollow-stem Auger

Hammer Data	Rope and Cathead 140 (lbs) / 30 (in) Drop	Drilling Equipment	Deeprock XL
Surface Elevation (ft) / Vertical Datum	112.4 / NGVD29	Top of Casing Elevation (ft)	112
Latitude / Longitude		Horizontal Datum	N/A

A 2 (in) well was installed on 8/19/2010 to a depth of 50.3 ft.

Groundwater

Date Measured	Depth to Water (ft)	Elevation (ft)
9/23/2010	34.2	78.2

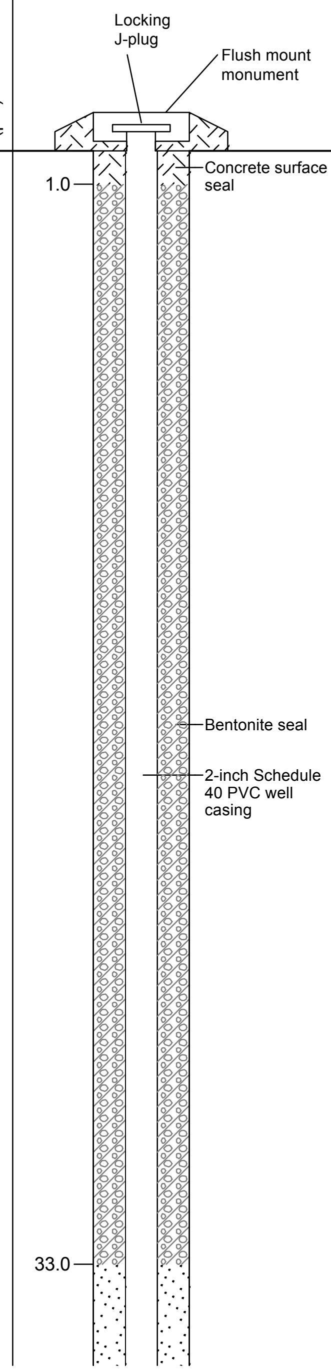
Notes: Auger Data: 4½ inches I.D.; Sampling Method: SPT

FIELD DATA

Depth (feet)	Recovered (in)	Blows/foot	Sample Name	Group Classification	Material Description	Moisture Content, %
0				TS	6 inches topsoil	
				ML	Brown sandy silt with gravel (very stiff, moist) (weathered till)	
	16	27	1			24
				CL-ML	Gray sandy silty clay with occasional gravel, iron-oxide staining (hard, moist)	
5	16	39	2 AL			15
				CL-ML	Gray sandy silty clay with occasional gravel, iron-oxide staining (hard, moist) (glacial till)	
	6	50/5"	3 AL			12
				ML	Gray sandy silt with gravel (hard, moist) %F=51	
10	8	50/4"	4			10
				SM	Gray silty fine sand with occasional gravel (very dense, moist) %F=49	
15	5	50/5"	5			7
20	6	50/6"	6			8
25	4	50/4"	7			7
				ML	Gray sandy silt with occasional gravel, horizontal bedding (hard, moist) (transitional bed deposits) -driller indicated change in drilling action at 26 feet -driller noted increase in gravel at 29 feet	
30	3	50/3"	8			6
35	6	50/6"	9		%F=57	12

Elevation (feet): 110, 105, 100, 95, 90, 85, 80

WELL LOG



Note: See Figure A-1 for explanation of symbols.

Log of Boring B-1

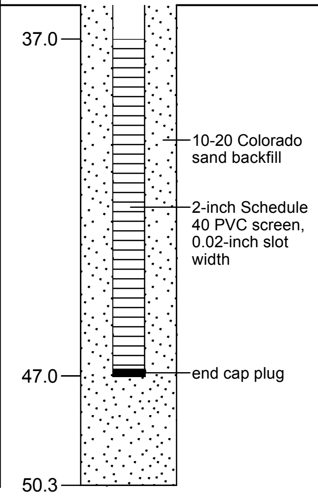
GeoEngineers

Project: Phase 3 Science & Academic Building
Project Location: Bothell, Washington
Project Number: 0183-062-01

Figure A-2
Sheet 1 of 2

Elevation (feet)	Depth (feet)	Interval	Recovered (in)	Blows/foot	Collected Sample	Sample Name	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content, %	Dry Density, (pcf)
75												
									ML/SM	Gray interbedded fine sandy silt and silty fine sand (hard/very dense, moist to wet)		
	40		5	50/6"		10 SA				%F=56	18	
										-driller added water due to heaving		
70												
	45		4	50/4"		11 SA				%F=58	15	
65									SM/SP-SM	Gray interbedded silty fine sand and fine to coarse sand with silt (very dense, wet)		
	50		4	50/4"		12						

WELL LOG



Note: See Figure A-1 for explanation of symbols.

Drilled	Start 8/19/2010	End 8/19/2010	Total Depth (ft)	35.5	Logged By BHC	Checked By LCF	Driller	Geologic Drill	Drilling Method	Hollow-stem Auger

Surface Elevation (ft)	103.5	Hammer Data	Rope and Cathead 140 (lbs) / 30 (in) Drop	Drilling Equipment	Deeprock XL
Vertical Datum	NGVD29				
Latitude / Longitude		System / Datum	N/A		

Notes: Auger Data: 4½ inches I.D.; Sampling Method: SPT

Groundwater Date Measured	Depth to Water (ft)	Elevation (ft)
8/19/2010	32.5	71

Depth (feet)	Recovered (in)	Blows/foot	Sample Name / Testing	Group Classification	Material Description	Sheen	Headspace Vapor (ppm)	Remarks
0				TS	6 inches topsoil			
				SM	Gray silty fine to medium sand with occasional gravel (dense, moist) (weathered till)			
	16	31	1			NS	7	Hydrocarbon odor MC=12%
5	16	38	2 CA			SS	52	Hydrocarbon odor
				SM	Gray silty fine to medium sand with occasional gravel (very dense, moist) (glacial till)			
	16	80	3 SA			NS	7	Hydrocarbon odor MC=9%; %F=47
10	8	50/3"	4 CA			SS	40	Hydrocarbon odor
				SM	Gray silty fine to medium sand with gravel (very dense, moist)			
15	5	50/5"	5 CA			NS	6	MC=7%
20	8	50/3"	6 CA			NS	6	MC=11%
				SM	Gray silty fine to medium sand with occasional gravel and lenses of silt (very dense, moist) (transitional bed deposits)			Driller indicated sandier drilling
								Driller indicated gravel
25	4	50/4"	7			NS	6	MC=13%
				SM	Gray silty fine to medium sand with occasional gravel (very dense, moist to wet)			
30	5	50/5"	8			NS	6	MC=8%
				SM	Gray silty fine to medium sand with gravel (very dense, wet)			
35	6	50/6"	9 CA			SS	4	Driller indicated smoother drilling

Elevation (feet): 100, 95, 90, 85, 80, 75, 70

Note: See Figure A-1 for explanation of symbols.

Log of Boring B-2

GeoEngineers

Project: Phase 3 Science & Academic Building
Project Location: Bothell, Washington
Project Number: 0183-062-01

Figure A-3
Sheet 1 of 1

Drilled	Start 8/20/2010	End 8/19/2010	Total Depth (ft)	35.5	Logged By BHC Checked By LCF	Driller	Geologic Drill	Drilling Method	Hollow-stem Auger

Surface Elevation (ft) Vertical Datum	92 NGVD29	Hammer Data	Rope and Cathead 140 (lbs) / 30 (in) Drop	Drilling Equipment	Deeprock XL
Latitude Longitude		System Datum	N/A		

Notes: Auger Data: 4½ inches I.D.; Sampling Method: SPT

Groundwater Date Measured	Depth to Water (ft)	Elevation (ft)
8/20/2010	32.7	59.3

Elevation (feet)	Depth (feet)	Interval Recovered (in)	Blows/foot	Collected Sample	Sample Name Testing	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content, %	Dry Density, (pcf)	REMARKS
	0							TS	12 inches topsoil			
90								SM	Brown silty fine to medium sand with gravel, iron-oxide staining (dense to very dense, moist) (weathered till)			
		18	71		1 SA					8		%F=27
	5	18	35		2					9		
85								SM	Brownish gray silty fine to medium sand with gravel (very dense, moist) (glacial till)			
		3	50/2"		3							
	10	4	50/4"		4					7		%F=31
80								SM/ML	Gray silty fine to medium sand with occasional gravel and gray silt with sand (very dense/hard, moist) (transitional deposits)			
	15	12	75/9"		5					14		
75								SM	Gray silty fine to medium sand with gravel (very dense, moist)			
	20	2	50/2"		6					10		
70												
	25	6	50/6"		7				Becomes moist to wet	6		
65												
	30	8	50/2"		8					8		
60						∇						
	35	2	50/6"		9				Becomes wet			

Note: See Figure A-1 for explanation of symbols.

Log of Boring B-3

GeoEngineers

Project: Phase 3 Science & Academic Building

Project Location: Bothell, Washington

Project Number: 0183-062-01

Drilled	Start 8/19/2010	End 8/19/2010	Total Depth (ft)	30.3	Logged By BHC / Checked By LCF	Driller	Geologic Drill	Drilling Method	Hollow-stem Auger

Surface Elevation (ft) / Vertical Datum	85 / NGVD29	Hammer Data	Rope and Cathead 140 (lbs) / 30 (in) Drop	Drilling Equipment	Deeprock XL
Latitude / Longitude		System Datum	N/A	Groundwater	

Groundwater:

Date Measured	Depth to Water (ft)	Elevation (ft)
8/19/2010	11	74

Notes: Auger Data: 4½ inches I.D.; Sampling Method: SPT

Elevation (feet)	Depth (feet)	Recovered (in)	Blows/foot	Sample Name / Testing	Water Level	Group Classification	MATERIAL DESCRIPTION	Moisture Content, %	Dry Density, (pcf)	REMARKS
	0					CC	4 inches concrete			
						CR	8 inches crushed rock base course			
		18	43	1		SM	Brown silty fine to medium sand with gravel, iron-oxide staining (dense, moist) (weathered till)	7		
80	5	18	54	2		SM	Gray silty fine to medium sand with gravel, iron-oxide staining (very dense, moist) (glacial till)	10		
		8	79/10"	3 / SA				6		%F=25
75	10	3	50/3"	4	▽		Becomes moist to wet	4		
70	15	3	50/3"	5			Becomes moist	6		
65	20	6	50/6"	6				6		
60	25	3	50/3"	7				5		
55	30	3	50/3"	8						

Note: See Figure A-1 for explanation of symbols.

Log of Boring B-4

GeoEngineers

Project: Phase 3 Science & Academic Building
Project Location: Bothell, Washington
Project Number: 0183-062-01

Figure A-5
Sheet 1 of 1

Drilled	Start	End	Total Depth (ft)	Logged By	Checked By	Driller	Drilling Method
	9/28/2010	9/28/2010	45.5	BHC	LCF	Geologic Drill	Hollow-stem Auger

Hammer Data	Rope and Cathead 140 (lbs) / 30 (in) Drop	Drilling Equipment	Deeprock XL Trailer Rig
Surface Elevation (ft) / Vertical Datum	98.2 / NGVD29	Top of Casing Elevation (ft)	97.8
Latitude / Longitude		Horizontal Datum	N/A

A 2 (in) well was installed on 9/28/2010 to a depth of 45 ft.

Groundwater

Date Measured	Depth to Water (ft)	Elevation (ft)
10/1/2010	22.2	76

Notes: Auger Data: 4¼ inches I.D.; 8½ inches O.D.; Sampling Method: SPT; Groundwater observed at 31 feet bgs (Elev. 67.2 ft) during drilling. Groundwater measured in drill casing at 40.6 ft bgs. (El 57.6 ft) at completion of drilling.

FIELD DATA

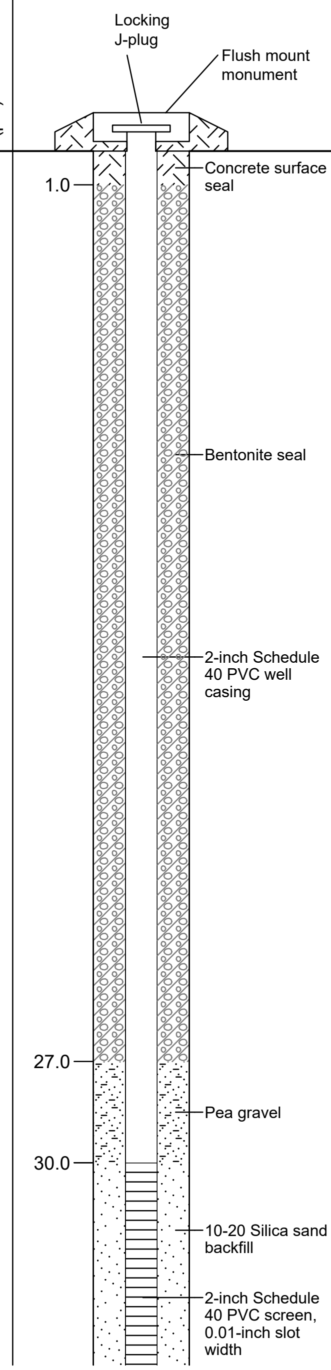
Depth (feet)	Recovered (in)	Blows/foot	Sample Name / Testing	Moisture Content, %
~3	9	22	1 / MC	20
5	16	74	2 / %F	9
~7.5	18	83	3	
10	11	50/5"	4 / MC	6
15	12	50/6"	5 / MC	8
20	11	50/5"	6 / MC	16
25	4	50/4"	7	
30		50/5.5"	8	
35		50/5"	9 / SA	15

MATERIAL DESCRIPTION

Depth (feet)	Group Classification	Material Description
0	GM	Brownish gray silty gravel with sand (gravel path)
~1	ML	Orangish brown sandy silt with occasional gravel (very stiff, moist) (weathered till)
5	SM	Brownish gray silty fine to medium sand with gravel (very dense, moist) (glacial till) %F=44 -Rough drilling
~14		Becomes gray
15		Drill cuttings moist to wet between 15 to 20 feet
16	ML	Gray sandy silt with fine sand partings and occasional gravel (hard, moist) (transitional bed deposits)
24	SM	Gray silty fine to medium sand with gravel, till-like fabric (very dense, moist to wet)
33	ML/SM	Brownish gray interbedded silt and silty fine to medium sand with occasional gravel and fine sand lenses (very dense, wet) %F=52

Elevation (feet): 95, 90, 85, 80, 75, 70, 65

WELL LOG



Note: See Figure A-1 for explanation of symbols.

Log of Boring B-5a

GeoEngineers

Project: Phase 3 Science & Academic Building
Project Location: Bothell, Washington
Project Number: 0183-062-01

Figure A-6
Sheet 1 of 2

Elevation (feet)	Depth (feet)	Interval	Recovered (in)	Blows/foot	Collected Sample	Sample Name / Testing	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content, %	Dry Density, (pcf)	WELL LOG
60									SM	Gray silty fine to medium sand with gravel, till-like fabric (very dense, wet)			
	40		5	100/5"		10 / SA				%F=28	8		
55													
	45		5	50/5"		11							45.0 end cap plug

Note: See Figure A-1 for explanation of symbols.

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Log of Boring B-5a (continued)

GeoEngineers

Project: Phase 3 Science & Academic Building
Project Location: Bothell, Washington
Project Number: 0183-062-01

Figure A-6
Sheet 2 of 2

Date Excavated: 8/20/2010
Equipment: Case 580 SL Backhoe

Logged By: BHC
Total Depth (ft) 3.5

Elevation (feet)	Depth (feet)	SAMPLE: Testing Sample	SAMPLE: Sample Name / Testing	Graphic Log	Group Classification	Encountered Water	MATERIAL DESCRIPTION	Moisture Content, %	REMARKS
					TS		Dark brown sandy silt with gravel and organic matter, roots (loose, moist) (topsoil)		P=4 inches
		X	1					21	
					GM		Brown silty fine to coarse gravel with sand (medium dense, moist) (weathered till)		
	1	X	2 / SA					16	%F=35
					ML		Gray sandy silt with occasional gravel (hard, moist) (glacial till)		
	2								P=2 inches
		X	3				Iron-oxide staining	24	
	3								P<1-inch
									P<1-inch

No groundwater seepage observed
No caving observed

Notes: See Figure A-1 for explanation of symbols.
The depths on the test pit logs are based on an average of measurements across the test pit and should be considered accurate to 0.5 foot.

Log of Test Pit TP-2

GEOENGINEERS

Project: Phase 3 Science & Academic Building
Project Location: Bothell, Washington
Project Number: 0183-062-01

Date Excavated: 8/20/2010

Equipment: Case 580 SL Backhoe

Logged By: BHC

Total Depth (ft) 3.5

Elevation (feet)	Depth (feet)	SAMPLE: Testing Sample	SAMPLE: Sample Name / Testing	Graphic Log	Group Classification	Encountered Water	MATERIAL DESCRIPTION	Moisture Content, %	REMARKS
	0				TS		Dark brown silty fine to medium sand with gravel and organic matter (loose, moist) (topsoil/forest duff)		P=20 inches
	1	X	1a		SM		Brown silty fine to medium sand with gravel (loose, moist) (weathered till)	14	P=10 to 18 inches
	2	X	1b				Becomes medium dense	13	P=6 inches
	2.5				SM		Brownish gray silty fine to medium sand with gravel (very dense, moist) (glacial till)		
	3	X	2					11	P<1-inch %F=41

No groundwater seepage observed

No caving observed

Notes: See Figure A-1 for explanation of symbols.

The depths on the test pit logs are based on an average of measurements across the test pit and should be considered accurate to 0.5 foot.

Log of Test Pit TP-3

GEOENGINEERS

Project: Phase 3 Science & Academic Building

Project Location: Bothell, Washington

Project Number: 0183-062-01

Date Excavated: 8/20/2010 | Logged By: BHC
Equipment: Case 580 SL Backhoe | Total Depth (ft) 6

Elevation (feet)	Depth (feet)	Testing Sample	Sample Name / Testing	Graphic Log	Group Classification	Encountered Water	MATERIAL DESCRIPTION	Moisture Content, %	REMARKS
	0				SOD/TS		4 inches sod/topsoil		P=2 inches
					SM		Dark brown silty fine to medium sand with gravel and organic matter (medium dense, moist) (fill)		
	1								P=2 inches
		X	1					17	
	2								P=2 inches
					SM		Brown silty fine to medium sand with gravel (medium dense, moist) (weathered till)		
	3								P=8 to 10 inches
		X	2					13	%F=14
	4								P=8 to 10 inches
					GM		Gray silty fine to coarse gravel with sand (very dense, moist) (glacial till)		Digging becomes difficult
	5								
		X	3 SA					5	%F=17
	6								

No groundwater seepage observed
No caving observed

Notes: See Figure A-1 for explanation of symbols.
The depths on the test pit logs are based on an average of measurements across the test pit and should be considered accurate to 0.5 foot.

Log of Test Pit TP-6

GEOENGINEERS

Project: Phase 3 Science & Academic Building
Project Location: Bothell, Washington
Project Number: 0183-062-01

Figure A-12
Sheet 1 of 1

Date Excavated: 8/20/2010

Equipment: Case 580 SL Backhoe

Logged By: BHC

Total Depth (ft) 5

Elevation (feet)	Depth (feet)	SAMPLE: Testing Sample	SAMPLE: Sample Name / Testing	Graphic Log	Group Classification	Encountered Water	MATERIAL DESCRIPTION	Moisture Content, %	REMARKS
	0				SM		Gray silty fine to medium sand with gravel and organic matter (medium dense, moist) (weathered till)		P=2 to 4 inches
	0.5				SM		Grayish brown silty fine to medium sand with gravel (medium dense, moist)		
	1								P=2 to 4 inches
	2				SM		Light brown silty fine to medium sand with gravel (medium dense, moist)		P=4 to 6 inches
	2.5	X	1					12	
	3						Becomes dense		P=1 to 4 inches
	4				SM		Grayish brown silty fine to medium sand (very dense, moist) (glacial till)		Digging becomes difficult
	4.5	X	2					7	%F=36
	5						No groundwater seepage observed No caving observed		

Notes: See Figure A-1 for explanation of symbols.
The depths on the test pit logs are based on an average of measurements across the test pit and should be considered accurate to 0.5 foot.

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Log of Test Pit TP-7

GeoEngineers

Project: Phase 3 Science & Academic Building

Project Location: Bothell, Washington

Project Number: 0183-062-01

Figure A-13

Date Excavated: 8/20/2010

Equipment: Case 580 SL Backhoe

Logged By: BHC

Total Depth (ft) 1.5

Elevation (feet)	Depth (feet)	SAMPLE: Testing Sample	SAMPLE: Sample Name / Testing	Graphic Log	Group Classification	Encountered Water	MATERIAL DESCRIPTION	Moisture Content, %	REMARKS
					SOD		2 inches sod		P=2 inches
					SM		Dark brown silty fine to medium sand with gravel (medium dense, moist) (topsoil)		
		X	1						
					SM		Gray silty fine to medium sand with gravel and occasional cobbles (very dense, moist) (glacial till)	8	
	1	X	2 / SA					6	P<1-inch %F=17

No groundwater seepage observed
No caving observed

Notes: See Figure A-1 for explanation of symbols.
The depths on the test pit logs are based on an average of measurements across the test pit and should be considered accurate to 0.5 foot.

Log of Test Pit TP-8

GEOENGINEERS

Project: Phase 3 Science & Academic Building
Project Location: Bothell, Washington
Project Number: 0183-062-01

Date(s) Drilled	06/05/06	Logged By	ZAN	Checked By	RCM
Drilling Contractor	Holocene	Drilling Method	Hollow-stem Auger	Sampling Methods	SPT/D&M
Auger Data	4.5 ID	Hammer Data	140 lb hammer/30 in drop automatic	Drilling Equipment	CME-850 Track Rig
Total Depth (ft)	31.5	Surface Elevation (ft)	± 87.5	Groundwater Level (ft. bgs)	Not Encountered
Vertical Datum		Datum/ System		Easting(x): Northing(y):	

Elevation feet	Depth feet	SAMPLES: Interval	SAMPLES: Recovered (in)	SAMPLES: Blows/foot	SAMPLES: Sub-Sample / Sample Number	Water Level	Graphic Log	Group Symbol	MATERIAL DESCRIPTION	Moisture Content %	Dry Unit Weight, lbs/ft³	OTHER TESTS AND NOTES
	0							TS	Dark brown sandy silt, root zone (loose, moist) (topsoil)	28		
			18	25	1			ML	Light brown silt with fine sand and occasional gravel (very stiff, moist)			
	5		18	33	2			SM	Light brown fine sand with silt (dense, moist)	15		
								CH	Light brown fat clay (very stiff, moist)			
			18	25	3					22		LL=57, PI=32
	10		18	63	4			ML	Light brown to gray silt, slickensided (very stiff, moist)	20	107	pp >4.5 TSF
	15		18	28	5				Gray silt with trace fine sand, slickensided	20		
	20								Gray silt, slickensided			pp >4.5 TSF
	25		18	31	7					27		
	30		18	28	8					24		
	35											

Note: See Figure A-1 for explanation of symbols.

LOG OF BORING B-1

GEOENGINEERS

Project: The Center for Global Learning & The Arts
Project Location: Cascade Community College
Project Number: 10600-002-00

Figure A-2
Sheet 1 of 1

Date(s) Drilled	06/05/06	Logged By	ZAN	Checked By	RCM
Drilling Contractor	Holocene	Drilling Method	Hollow-stem Auger	Sampling Methods	SPT/D&M
Auger Data	4.5 ID	Hammer Data	140 lb hammer/30 in drop automatic	Drilling Equipment	CME-850 Track Rig
Total Depth (ft)	21.5	Surface Elevation (ft)	±86.5	Groundwater Level (ft. bgs)	10.9
Vertical Datum		Datum/ System		Easting(x): Northing(y):	

Elevation feet	Depth feet	SAMPLES: Interval	Recovered (in)	Blows/foot	Sub-Sample Sample Number	Water Level	Graphic Log	Group Symbol	MATERIAL DESCRIPTION	Moisture Content %	Dry Unit Weight, lbs/ft^3	OTHER TESTS AND NOTES
	0							TS	Dark brown sandy silt with occasional gravel, root zone (loose, moist) (topsoil)			
			18	25	1			ML	Light brown silt with occasional fine sand, gray mottling (very stiff, moist)	24		
	5		18	39	2			SM	Light brown, silty fine sand (dense, moist)	18		
			18	30	3			ML	Light brown silt, varved (very stiff, moist)	23		
								ML	Gray silt, slickensided (very stiff to hard, moist)			
	10		18	56	4	∇						pp >4.5 TSF
	15		18	39	5					19		
	20		18	29	6					27		

Piezometer installed in B-2 to a depth of 20 feet

25

30

35

Note: See Figure A-1 for explanation of symbols.

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LOG OF BORING B-2

GEOENGINEERS

Project: The Center for Global Learning & The Arts

Project Location: Cascade Community College

Project Number: 10600-002-00

Figure A-3

Sheet 1 of 1

Date(s) Drilled	06/05/06	Logged By	ZAN	Checked By	RCM
Drilling Contractor	Holocene	Drilling Method	Hollow-stem Auger	Sampling Methods	SPT/D&M
Auger Data	4.5 ID	Hammer Data	140 lb hammer/30 in drop automatic	Drilling Equipment	CME-850 Track Rig
Total Depth (ft)	21.5	Surface Elevation (ft)	±81.5	Groundwater Level (ft. bgs)	7.5
Vertical Datum		Datum/ System		Easting(x): Northing(y):	

Elevation feet	Depth feet	SAMPLES: Interval	SAMPLES: Recovered (in)	SAMPLES: Blows/foot	SAMPLES: Sub-Sample Sample Number	Water Level	Graphic Log	Group Symbol	MATERIAL DESCRIPTION	Moisture Content %	Dry Unit Weight, lbs/ft³	OTHER TESTS AND NOTES
	0							TS	Dark brown silty sand, with gravel and wood fragments, root zone (loose, moist) (topsoil)			
			8	18	1			SP-SM	Light brown fine coarse sand with silt and occasional fine gravel (loose to medium dense, moist to wet)	20		
	5		6	5	2							
			18	51	3	▽				12		
								SM	Light brown silty fine to coarse sand with occasional fine gravel (very dense, wet/moist)			
	10		18	74	4			ML	Gray silt with fine sand (hard, moist)			pp >4.5 TSF
	15		18	38	5					21		
	20		18	20	6				Silt with gravel and fine sand, varved, slickensided			
	25											
	30											
	35											

Note: See Figure A-1 for explanation of symbols.

LOG OF BORING B-3

GEOENGINEERS

Project: The Center for Global Learning & The Arts
Project Location: Cascade Community College
Project Number: 10600-002-00

Figure A-4
Sheet 1 of 1

Date(s) Drilled	06/05/06	Logged By	ZAN	Checked By	RCM
Drilling Contractor	Holocene	Drilling Method	Hollow-stem Auger	Sampling Methods	SPT/D&M
Auger Data	4.5 ID	Hammer Data	140 lb hammer/30 in drop automatic	Drilling Equipment	CME-850 Track Rig
Total Depth (ft)	26.5	Surface Elevation (ft)	±82.5	Groundwater Level (ft. bgs)	Not Encountered
Vertical Datum		Datum/ System		Easting(x): Northing(y):	

Depth feet	Interval	Recovered (in)	Blows/foot	Sample Number	Group Symbol	MATERIAL DESCRIPTION	Moisture Content %	Dry Unit Weight, lbs/ft^3	OTHER TESTS AND NOTES
0					TS	Dark brown sandy silt with roots (loose, moist) (topsoil)			
					ML	Light brown fine sandy silt with gravel (stiff, moist)			
		8	9	1			18		
					ML	Brown and gray silt (very stiff, moist)			
5		18	19	2			24		
		18	31	3					%F=100
						Occasional slickensides			
10		18	36	4		Becomes sandy silt	25	85	pp >4.5 TSF
					ML	Gray silt, slickensided, slight plasticity (very stiff, moist)			
15		18	27	5			23		
20		18	45	6					pp >4.5 TSF
25		18	30	7			20		

Note: See Figure A-1 for explanation of symbols.

V6_GTBORING P:\10\10600002\00\FINALS\1060000200.GPJ GEIV6_1.GDT 9/21/06

LOG OF BORING B-4

GEOENGINEERS

Project: The Center for Global Learning & The Arts
Project Location: Cascade Community College
Project Number: 10600-002-00

Figure A-5
Sheet 1 of 1

Date(s) Drilled	06/05/06	Logged By	ZAN	Checked By	RCM
Drilling Contractor	Holocene	Drilling Method	Hollow-stem Auger	Sampling Methods	SPT/D&M
Auger Data	4.5 ID	Hammer Data	140 lb hammer/30 in drop automatic	Drilling Equipment	CME-850 Track Rig
Total Depth (ft)	21.5	Surface Elevation (ft)	±69.5	Groundwater Level (ft. bgs)	Not Encountered
Vertical Datum		Datum/ System		Easting(x): Northing(y):	

Elevation feet	Depth feet	SAMPLES: Interval	SAMPLES: Recovered (in)	SAMPLES: Blows/foot	SAMPLES: Sub-Sample Sample Number	Water Level	Graphic Log	Group Symbol	MATERIAL DESCRIPTION	Moisture Content %	Dry Unit Weight, lbs/ft^3	OTHER TESTS AND NOTES
	0							TS	Dark brown silty sand, root zone (loose, moist)			
			0	61	1 2			SM	Orange-brown silty sand, slight plasticity (dense, moist)	1		
								ML	Light brown, silt, with occasional fine gravel (very stiff, moist)			
	5		18	25	3					18		
			18	32	4					29		
									White and gray mottling			
								CL	Gray lean clay (very stiff, moist)			
	10		18	63	5					24	102	pp >4.5 TSF LL=43, PI=21
	15		18	19	6				Mottling	21		
								ML	Gray silt with occasional fine sand (very stiff, moist)			
	20		18	25	7					23		
	25											
	30											
	35											

Note: See Figure A-1 for explanation of symbols.

V6_GTBORING P:\10\10600002\00\FINALS\1060000200.GPJ GEIV6_1.GDT 9/21/06

LOG OF BORING B-5

GEOENGINEERS

Project: The Center for Global Learning & The Arts

Project Location: Cascade Community College

Project Number: 10600-002-00

Figure A-6

Sheet 1 of 1

Date(s) Drilled	06/05/06	Logged By	ZAN	Checked By	RCM
Drilling Contractor	Holocene	Drilling Method	Hollow-stem Auger	Sampling Methods	SPT/D&M
Auger Data	4.5 ID	Hammer Data	140 lb hammer/30 in drop automatic	Drilling Equipment	CME-850 Track Rig
Total Depth (ft)	21.5	Surface Elevation (ft)	±80.5	Groundwater Level (ft. bgs)	3
Vertical Datum		Datum/ System		Easting(x): Northing(y):	

Elevation feet	Depth feet	SAMPLES: Recovered (in)	SAMPLES: Blows/foot	SAMPLES: Sample Number	Water Level	Group Symbol	MATERIAL DESCRIPTION	Moisture Content %	Dry Unit Weight, lbs/ft³	OTHER TESTS AND NOTES
	0					TS	Dark brown silty sand with gravel (loose to medium dense, wet) (topsoil)			
		18	11	1	▽	ML	Light brown silt with occasional gravel, gray mottling, iron staining (very stiff, moist)	27		
								19		
	5	18	19	2						
		18	20	3			Occasional slickensides	27		
	10	18	37	4		ML/SM	Light brown fine sandy silt to silty fine sand (very stiff, moist)	26	99	pp >4.5 TSF
						ML	Brown silt, slight plasticity (very stiff, moist)			
	15	18	17	5			Slickensides	34		
	20	18	28	6			Varved, massive (no slickensides)	23		
	25									
	30									
	35									

Note: See Figure A-1 for explanation of symbols.

V6_GTBORING P:\10\10600002\00\FINALS\1060000200.GPJ GEIV6_1.GDT 9/21/06

LOG OF BORING B-6

GEOENGINEERS

Project: The Center for Global Learning & The Arts
Project Location: Cascade Community College
Project Number: 10600-002-00

Figure A-7
Sheet 1 of 1

Date(s) Drilled	06/05/06	Logged By	ZAN	Checked By	RCM
Drilling Contractor	Holocene	Drilling Method	Hollow-stem Auger	Sampling Methods	SPT/D&M
Auger Data	4.5 ID	Hammer Data	140 lb hammer/30 in drop automatic	Drilling Equipment	CME-850 Track Rig
Total Depth (ft)	11.5	Surface Elevation (ft)	±82.5	Groundwater Level (ft. bgs)	7.3
Vertical Datum		Datum/ System		Easting(x): Northing(y):	

Depth feet	Samples: Recovered (in)	Blows/foot	Sample Number	Water Level	Group Symbol	MATERIAL DESCRIPTION	Moisture Content %	Dry Unit Weight, lbs/ft³	OTHER TESTS AND NOTES
0					TS	Dark brown silty sand to sandy silt, root zone (loose, moist) (topsoil)			
	8	25	1		SM	Brown silty sand with gravel (medium dense, moist) (weathered till)	8		
5	12	50/6"	2		SM	Gray silty fine to medium sand with gravel (very dense, moist) (till)	6		
	18	36	3	▽	ML	Light brown silt with occasional fine sand, slight plasticity, slickensides (hard, moist) Becomes gray	23		Perched water also observed at 7 feet during drilling
10	18	35	4			Plastic, slickensides	29	96	pp >4.5 TSF

Piezometer installed in B-7 to a depth of 10 feet

Note: See Figure A-1 for explanation of symbols.

V6_GTBORING P:\10\1060000200\FINALS\1060000200.GPJ GEIV6_1.GDT 9/21/06

LOG OF BORING B-7

GeoEngineers

Project: The Center for Global Learning & The Arts
Project Location: Cascade Community College
Project Number: 10600-002-00

Figure A-8
Sheet 1 of 1

Date(s) Drilled	06/05/06	Logged By	ZAN	Checked By	RCM
Drilling Contractor	Holocene	Drilling Method	Hollow-stem Auger	Sampling Methods	SPT/D&M
Auger Data	4.5 ID	Hammer Data	140 lb hammer/30 in drop automatic	Drilling Equipment	CME-850 Track Rig
Total Depth (ft)	11.5	Surface Elevation (ft)	±86.5	Groundwater Level (ft. bgs)	2.5
Vertical Datum		Datum/ System		Easting(x): Northing(y):	

Elevation feet	Depth feet	SAMPLES: Interval	SAMPLES: Recovered (in)	SAMPLES: Blows/foot	SAMPLES: Sub-Sample Sample Number	Water Level	Graphic Log	Group Symbol	MATERIAL DESCRIPTION	Moisture Content %	Dry Unit Weight, lbs/ft³	OTHER TESTS AND NOTES
	0							TS	Dark brown fine sandy silt with gravel, organics, root zone (loose, moist) (topsoil)			
			18	35	1	▽ (2.5)		SM	Light brown silty fine sand with gravel, iron staining (dense, moist/wet)			
	5		18	35	2			ML	Brown fine sandy silt (very stiff to hard, moist)			
			18	21	3			ML	Gray silt with occasional slickensides, slight plasticity (very stiff, moist)			
	10		18	39	4							
	15											
	20											
	25											
	30											
	35											

Note: See Figure A-1 for explanation of symbols.

LOG OF BORING B-8

GeoEngineers

Project: The Center for Global Learning & The Arts
Project Location: Cascade Community College
Project Number: 10600-002-00

Figure A-9

TEST DATA

BORING B-30

DESCRIPTION

Surface Elevation (ft.): 88

Depth (ft)	Lab Tests	Moisture Content (%)	Dry Density (pcf)	Blow Count	Group Symbol	Description
0					SM	Brownish gray silty fine to medium sand with coarse sand and fine to coarse gravel (dense to very dense, moist) (weathered till)
~3	MD	6	126	46		
~6					SM	Gray silty fine to medium sand with coarse sand and fine to coarse gravel and small cobbles (very dense, moist) (till)
~8	MD	7	120	50/5.5"		
~13.5				50/3"		
~18	MD	6	140	50/4"		
~23				50/5"		
~26					SP-SM	Gray silty fine to medium sand with interbeds of fine to medium sand and occasional fine to coarse gravel (very dense, wet)
27						Ground water at 27.0 feet
~28	MD	6	143	50/5"		

Boring completed at 28.5 feet on 11/24/98
Ground water encountered at 27.0 feet during drilling

Boring completed using truck-mounted drill rig equipped with a 300 pound wireline safety hammer

DEPTH IN FEET: 0, 5, 10, 15, 20, 25, 30, 35, 40

DEPTH IN METERS: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12

Note: See Figure A-2 for explanation of symbols

0113-021-00a AGC:ja 6/28/99

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LOG OF BORING

FIGURE A-11

TEST DATA

BORING B-7

DESCRIPTION

Surface Elevation (ft.): 75.0

Depth in Feet	Lab Tests	Moisture Content (%)	Dry Density (pcf)	Blow Count	Samples	Group Symbol	Description
0						OL	Dark brown organic silt with fine to medium sand and occasional gravel (very soft, moist to wet) (topsoil)
						SM	Brown silty fine to medium sand with fine to coarse gravel (loose, wet)
	MD	29	100	3	■		
5	MD	8	134	63/11"	■	GM	Gray and orange silty fine to coarse gravel with fine to medium sand (very dense, moist) (till)
10	SM	7		50/4.5"	■		
						ML	Gray silt with occasional gravel and interbeds of silty fine to medium sand (hard, moist)
15	MD	19	110	67	■		
							Gravelly drilling at 18.0 to 20.0 feet
20				72/9"	■		
25	MD, TX	13	118	65	■		
30	MD, CS	18	115	57	■		
						ML	Gray silt (very stiff, moist)
35	MD	23	108	24	■		
40				26	■		

Note: See Figure A-2 for explanation of symbols

0113-020-06-1130 :BEB:DJM:CMS 5/1/98

GeoEngineers

LOG OF BORING

FIGURE A-9

TEST DATA

BORING B-7
(Continued)

Lab Tests	Moisture Content (%)	Dry Density (pcf)	Blow Count	Samples	Group Symbol	DESCRIPTION
						Boring completed at 41.5 feet on 12/04/97 Piezometer installed to 20.0 feet Ground water encountered at 5.0 feet during drilling Ground water measured at 1.7 feet in piezometer on 12/31/97

DEPTH IN FEET

40 45 50 55 60 65 70 75 80

Note: See Figure A-2 for explanation of symbols

0113-020-06-1130 :BEB:DJM:CMS 5/1/98

GeoEngineers

LOG OF BORING

FIGURE A-9

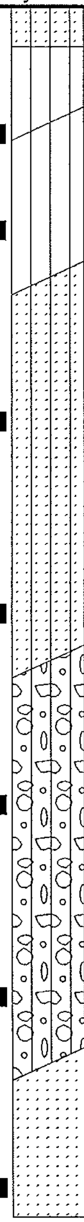
TEST DATA

BORING B-8

DESCRIPTION

Surface Elevation (ft.): 67.0

Depth (ft)	Lab Tests	Moisture Content (%)	Dry Density (pcf)	Blow Count	Samples
~3	MD	17	120	35	■
~6	MD	10	129	36	■
~11	MD	8	122	82/10"	■
~16	MD	7	117	50/4.5"	■
~21	MD	6	126	50/5"	■
~26	MD	7	141	69	■
~31	MD	10	133	77/9"	■



Group Symbol	Description
SM	Brown silty fine to medium sand with occasional gravel (loose, wet) (topsoil)
ML	Orange and gray silt with occasional fine to medium sand (medium stiff, moist)
ML	Brown silt with fine to medium sand and occasional fine to coarse gravel (hard, moist) (weathered till)
SM	Gray silty fine to medium sand with fine to coarse gravel (very dense, moist) (till)
GM	Gray silty fine to coarse gravel with fine to coarse sand (very dense, moist to wet) (till)
SP	Gray fine to medium sand with fine to coarse gravel (very dense, wet) (advance outwash)

Boring completed at 31.5 feet on 12/03/97
Piezometer installed to 30.0 feet
Ground water encountered at 24.0 feet during drilling
Ground water measured at 2.4 feet in piezometer on 12/31/97

DEPTH IN FEET (scale 0–40)

Note: See Figure A-2 for explanation of symbols

0113-020-06-1130 :BEB:DJM:CMS 3/6/98

GeoEngineers

LOG OF BORING

FIGURE A-10

TEST DATA

BORING B-10

DESCRIPTION

Surface Elevation (ft.): 71.0

Lab Tests	Moisture Content (%)	Dry Density (pcf)	Blow Count	Samples	Group Symbol	Description
					OL	2 inches brown organic silt (soft, moist) (topsoil)
					SM	Brown silty fine to medium sand with fine to coarse gravel (medium dense, moist)
					SM	Brown and gray silty fine to medium sand with fine to coarse gravel (medium dense, moist) (weathered till)
MD	10	130	21	■		
					GM	Brown silty fine to coarse gravel with fine to medium sand (very dense, moist) (weathered till)
MD	8	129	51	■		
					SM	Gray silty fine to medium sand with fine to coarse gravel (very dense, moist to wet) (till)
			82/9.5"	■		
MD	9	121	50/5"	■		
MD	6	137	87/10"	■		
					SP-SM	Gray fine to medium sand with silt and fine to coarse gravel (very dense, wet) (till)
MD, DS	8	134	50/6"	■		
					SM	Gray silty fine to medium sand with fine gravel (very dense, moist) (till)
			50/6"	■		
						Gravelly drilling 26.5 to 29.0 feet
MD	8	117	50/5"	■		

DEPTH IN FEET (0–40)

Boring completed at 31.5 feet on 12/03/97
Piezometer installed at 30.0 feet
Ground water encountered at 9.5 feet during drilling
Ground water measured at 3.6 feet in piezometer on 12/31/97

Note: See Figure A-2 for explanation of symbols

0113-020-06-1130 :BEB:DJM:CMS 3/6/98

GeoEngineers

LOG OF BORING

FIGURE A-12

TEST PIT TP-46

TEST DATA

DESCRIPTION

Surface Elevation (ft.): 124.0

Lab Tests	Moisture Content (%)	Dry Density (pcf)	Blow Count	Samples	Group Symbol	Description
					OL	Dark brown organic silt with sand and roots (very soft, moist to wet)
					SM	Orange to brown silty fine to medium sand with occasional fine to coarse gravel (loose to medium dense, moist)
					SM	Brown silty fine sand with occasional fine to coarse gravel (medium dense, moist)
SM	17					
					SM	Gray and orange mottled silty fine to medium sand with gravel (medium dense, moist) (weathered till)
					SM	Gray silty fine to medium sand with fine to coarse gravel (very dense, moist) (till)

DEPTH IN FEET: 0 – 16

Test pit completed at 10.0 feet on 12/10/97
No ground water seepage observed
No caving observed

Note: See Figure A-2 for explanation of symbols

0113-020-06 :DJM:GMD:cms 3/6/98

GeoEngineers

LOG OF TEST PIT

FIGURE A-53

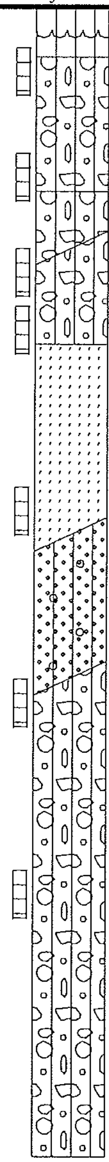
TEST DATA

TEST PIT TP-47

DESCRIPTION

Surface Elevation (ft.): 88.0

Lab Tests	Moisture Content (%)	Dry Density (pcf)	Blow Count	Samples	Group Symbol



DEPTH IN FEET: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16

Group Symbol	Description
OL	Dark brown organic silt with occasional sand, gravel and fine roots (very soft, wet) (topsoil)
GM	Dark brown silty fine gravel with fine to medium sand (loose to medium dense, wet)
GM	Gray silty fine to coarse gravel with sand (loose to medium dense, wet)
GW-GM	Light gray fine to coarse gravel with silt and fine to coarse sand (loose, wet) (recessional outwash)
SP	Light brownish gray fine to medium sand with a trace of silt (loose to medium dense, wet) (recessional outwash)
SW-SM	Gray fine to coarse sand with silt and fine to coarse gravel (dense, wet) (outwash or till)
GM	Gray silty fine to coarse gravel with fine to coarse sand (dense to very dense, moist) (till)

Test pit completed at 12.0 feet on 12/10/97
Slow to moderate ground water seepage observed at 5.6 feet
Minor caving observed between 5.3 and 5.6 feet

Note: See Figure A-2 for explanation of symbols

0113-020-06 :DJM:GMD:cms 3/6/98

GeoEngineers

LOG OF TEST PIT

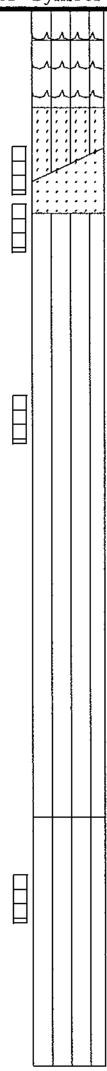
FIGURE A-54

TEST PIT TP-48

TEST DATA

DESCRIPTION

Surface Elevation (ft.): 79.0



Depth (ft)	Lab Tests	Moisture Content (%)	Dry Density (pcf)	Blow Count	Samples	Group Symbol	Description
0						OL	Dark brown organic silt with sand, occasional gravel and roots (very soft, wet) (topsoil)
						OL	Brown organic silt with sand, gravel and occasional roots (soft, moist)
1						SM	Gray and orange mottled silty fine to medium sand with fine to coarse gravel (loose to medium dense, moist to wet) (weathered till)
						SP	Brownish gray fine to coarse sand with a trace of silt (medium dense, wet) (weathered till)
2						ML	Brown and gray silt with occasional fine sand and gray fine to medium sand lenses (hard, moist)
4	SM	17					
8						ML	Gray silt (hard, moist)

Test pit completed at 11.0 feet on 12/10/97
Slow ground water seepage observed at 2.1 and 4.5 feet
No caving observed

DEPTH IN FEET: 0–16; DEPTH IN METERS: 0–4

Note: See Figure A-2 for explanation of symbols

0113-020-06 :DJM:GMD:cms 5/1/98

GeoEngineers

LOG OF TEST PIT

FIGURE A-55

TEST DATA

TEST PIT TP-49

DESCRIPTION

Surface Elevation (ft.): 79.0

Depth (ft)	Lab Tests	Moisture Content (%)	Dry Density (pcf)	Blow Count	Samples	Group Symbol	Description
0						OL	Dark brown sandy organic silt with occasional fine to coarse gravel and roots (soft, wet) (topsoil)
1.4						SP-SM	Brown to gray and orange mottled fine to medium sand with gravel, silt and occasional roots (loose to medium dense, moist to wet) (weathered till)
2.8						SP-SM	Light brown fine to medium sand with fine to coarse gravel and silt (medium dense to dense, moist) (weathered till)
3.7						SM	Gray silty fine to coarse sand with fine gravel (very dense, moist) (till)

Samples taken at approximately 2–2.5 ft, 3.5–4 ft and 11–11.5 ft.

Depth (ft)	Lab Tests	Moisture Content (%)
11	SM,GS	8

Test pit completed at 11.5 feet on 12/10/97
Slow ground water seepage observed at 1.3 feet
Rapid ground water piping observed at 2.9 feet, heavy sheen and strong hydrocarbon odor.
No caving observed

DEPTH IN FEET

Note: See Figure A-2 for explanation of symbols

0113-020-06 :DJM:GMD:cms 3/6/98

GeoEngineers

LOG OF TEST PIT

FIGURE A-56

TEST DATA

TEST PIT TP-62

Lab Tests	Moisture Content (%)	Dry Density (pcf)	Blow Count	Samples	Group Symbol	Depth (ft)	DESCRIPTION Surface Elevation (ft.): 69.0
					ML	0	Grayish brown silt with fine to coarse sand and fine to coarse gravel (very stiff, moist) (fill)
					ML	1.5	Gray silt with fine to coarse sand, fine to coarse gravel and cobbles (hard, moist) (till)
						5.0	Test pit completed at 5.0 feet on 11/4/98 No ground water seepage observed

DEPTH IN FEET: 0–16

DEPTH IN METERS: 0–4

Note: See Figure A-2 for explanation of symbols

GeoEngineers

LOG OF TEST PIT

FIGURE A-47

Boring No. B-6

Logged by: KPR

Date: 1/3/97

Approximate Elev. 105 Feet

Graph/ USCS	Soil Description	Relative Density	Depth (ft.)	Sample	(N) Blows/ foot	Water Content (%)	Notes
OL	Dark brown organic sandy silt (wood cuttings).						
OL / SM	Dark brown organic silty SAND, saturated.	Medium Dense	▼	I	12	38.4	Difficult drilling at 4 feet.
SM	Gray-brown, mottled silty fine to medium SAND with some gravel, saturated to 6 feet becoming moist. (Glacial Till)	Dense	5 ▼	I	39	16.1	
	As above, but no mottles. saturated. (Glacial Till)	Very Dense		I	64/11.5	13.8	
			10	I	86/11.5	11.0	
	As above, but moist to wet. (Glacial Till)	Very Dense					
	As above, but faintly mottled. (Glacial Till)	Very Dense		I	88/11	13.0	
SM	Gray-brown faintly mottled silty fine to medium SAND with some gravel, saturated. (Glacial Till)	Very Dense	15 ▼	I	50/5	10.8	
			20				Bag sample. (Cuttings)
	Gray-brown, mottled silty fine to medium SAND with some gravel, moist to wet. (Glacial Till)	Very Dense		I	50/3	7.3	
			25 ▼				
GP	Brown-gray sandy GRAVEL with silt, medium to coarse sand, small gravel, saturated.	Very Dense		I	50/4	8.9	
			30				Drills cobbly at 31 feet.
SM	Gray-brown silty fine to medium SAND with few gravel inclusions, saturated. (Glacial Till)	Very Dense		I	50/5.5	10.6	
			35				Drills cobbly at 35 feet.
SP	Gray gravelly medium to coarse SAND with silt, saturated.	Very Dense		I	50/6	11.6	

Test boring terminated at 38 feet.
Groundwater seepage encountered at 2.5, 7.5, 16, and 25 feet.
Hole plugged with 1 bag of bentonite chips mixed with cuttings.

DRAFT

TERRA ASSOCIATES
Geotechnical Consultants

BORING LOG
UNIVERSITY OF WASHINGTON
BOTHELL/CASCADIA COMMUNITY COLLEGE
BOTHELL, WASHINGTON

Proj. No. T-3432 | Date 1/97 | Figure A-10

APPENDIX D
Ground Anchor Load Tests

APPENDIX D
GROUND ANCHOR LOAD TESTS

Ground Anchor Load Testing

The locations of the load tests shall be approved by the Engineer and shall be representative of the field conditions. Load tests shall not be performed until the nail/tieback grout and shotcrete wall facing, where present, have attained at least 50 percent of the specified 28-day compressive strengths.

Where temporary casing of the unbonded length of test nails/tiebacks is provided, the casing shall be installed to prevent interaction between the bonded length of the nail/tieback and the casing/testing apparatus.

The testing equipment shall include two dial gauges accurate to 0.001 inch, a dial gauge support, a calibrated jack and pressure gauge, a pump and the load test reaction frame. The dial gauge should be aligned within 5 degrees of the longitudinal nail/tieback axis and shall be supported independently from the load frame/jack and the shoring wall. The hydraulic jack, pressure gauge and pump shall be used to apply and measure the test loads.

The jack and pressure gauge shall be calibrated by an independent testing laboratory as a unit. The pressure gauge shall be graduated in 100 pounds per square inch (psi) increments or less and shall have a range not exceeding twice the anticipated maximum pressure during testing unless approved by the Engineer. The ram travel of the jack shall be sufficient to enable the test to be performed without repositioning the jack.

The jack shall be supported independently and centered over the nail/tieback so that the nail/tieback does not carry the weight of the jack. The jack, bearing plates and stressing anchorage shall be aligned with the nail/tieback. The initial position of the jack shall be such that repositioning of the jack is not necessary during the load test.

The reaction frame should be designed/sized such that excessive deflection of the test apparatus does not occur and that the testing apparatus does not need to be repositioned during the load test. If the reaction frame bears directly on the shoring wall facing, the reaction frame should be designed so as not to damage the facing.

Verification Tests

Prior to production soil nail/tieback installation, at least two soil nails/tiebacks for each soil type shall be tested to validate the design pullout value. All test nails/tiebacks shall be installed by the same methods, personnel, material and equipment as the production anchors. Changes in methods, personnel, material or equipment may require additional verification testing as determined by the Engineer. At least two successful verification tests shall be performed for each installation method and each soil type. The nails/tiebacks used for the verification tests may be used as production nails/tiebacks if approved by the Engineer.

For soil nails, the unbonded length of the test nails shall be at least 3 feet unless approved otherwise by the Engineer. The bond length of the test nails shall not be less than 10 feet and shall not be longer than the bond length that would prevent testing to 200 percent of the design load while not exceeding the allowable bar load. The allowable bar load during testing shall not exceed 80 percent of the steel ultimate strength for Grade 150 bars or 90 percent of the steel ultimate strength for Grade 60 and 75 bars. The allowable tieback load should not exceed 80 percent of the steel ultimate strength.

For soil nails, the design test load shall be determined by multiplying the bond length of the nail times the design load pullout resistance (load transfer). Tieback design test loads should be the design load specified on the shoring drawings. Verification test nails/tiebacks shall be incrementally loaded and unloaded in accordance with the following schedule:

Load	Hold Time (Minutes)
Alignment Load	1
0.25 Design Load (DL)	1
0.5DL	1
0.75DL	1
1.0DL	1
1.25DL	1
1.5DL	60
1.75DL	1
2.0DL	10

The alignment load shall be the minimum load required to align the testing apparatus and should not exceed 5 percent of the design load. The dial gauge should be zeroed after the alignment load is applied. Nail/tieback deflections during the 1.5DL test load shall be recorded at 1, 2, 3, 5, 6, 10, 20, 30, 50 and 60 minutes.

Proof Tests

Proof tests shall be completed on approximately 5 percent of the production nails at locations selected by the owner's representative. Additional testing may be required where nail installation methods are substandard. Proof tests shall be completed on each production tieback.

For soil nails, the unbonded length of the test nails shall be at least 3 feet unless approved otherwise by the Engineer. The bond length of the test nails shall not be less than 10 feet and shall not be longer than the bond length that would prevent testing to 200 percent of the design load while not exceeding the allowable bar load. The allowable bar load during testing shall not exceed 80 percent of the steel ultimate strength for Grade 150 bars or 90 percent of the steel ultimate strength for Grade 60 and 75 bars. The allowable tieback load should not exceed 80 percent of the steel ultimate strength.

For soil nails, the design test load shall be determined by multiplying the bond length of the nail times the design load pullout resistance (load transfer). Tieback design test loads should be the design load specified on the shoring drawings. Proof test nails/tiebacks shall be incrementally loaded and unloaded in accordance with the following schedule:

Load	Hold Time (Minutes)
Alignment Load	1
0.25 Design Load (DL)	1
0.5DL	1
0.75DL	1
1.0DL	1
1.25DL (soil nails)	1
1.33DL (tiebacks)	10
1.5DL (soil nails)	10

The alignment load shall be the minimum load required to align the testing apparatus and should not exceed 5 percent of the design load. The dial gauge should be zeroed after the alignment load is applied. Nail/tieback deflections during the 1.33DL and 1.5DL test loads shall be recorded at 1, 2, 3, 5, 6 and 10 minutes.

Depending upon the nail/tieback deflection performance, the load hold period at 1.33DL (tiebacks) or 1.5DL (soil nails) may be increased to 60 minutes. Nail/tieback movement shall be recorded at 1, 2, 3, 5, 6 and 10 minutes. If the nail/tieback deflection between 1 minute and 10 minutes is greater than 0.04 inches, the 1.33DL/1.5DL load shall be continued to be held for a total of 60 minutes and deflections recorded at 20, 30, 50 and 60 minutes.

Test Nail/Tieback Acceptance

A test nail/tieback shall be considered acceptable when:

1. For verification tests, a nail/tieback is considered acceptable if the creep rate is less than 0.08 inches per log cycle of time between 6 and 60 minutes and the creep rate is linear or decreasing throughout the creep test load hold period.
2. For proof tests, a nail/tieback is considered acceptable if the creep rate is less than 0.04 inches per log cycle of time between 1 and 10 minutes or the creep rate is less than 0.08 inches per log cycle of time between 6 and 60 minutes, and the creep rate is linear or decreasing throughout the creep test load hold period.
3. The total movement at the maximum test load exceeds 80 percent of the theoretical elastic elongation of the unbonded length.
4. Pullout failure does not occur. Pullout failure is defined as the load at which continued attempts to increase the test load result in continued pullout of the test nail/tieback.

Acceptable proof-test nails/tiebacks may be incorporated as production nails/tiebacks provided that the unbonded test length of the nail/tieback hole has not collapsed and the test nail/tieback length and bar size/number of strands are equal to or greater than the scheduled production nail/tieback at the test location. Test nails/tiebacks meeting these criteria shall be completed by grouting the unbonded length. Maintenance of the temporary unbonded length for subsequent grouting is the contractor's responsibility.

The Engineer shall evaluate the verification test results. Nail/tieback installation techniques that do not satisfy the nail/tieback testing requirements shall be considered inadequate. In this case, the contractor shall propose alternative methods and install replacement verification test nails/tiebacks.

The Engineer may require that the contractor replace or install additional production nails/tiebacks in areas represented by inadequate proof tests.

APPENDIX E
Report Limitations and Guidelines for Use

APPENDIX E
REPORT LIMITATIONS AND GUIDELINES FOR USE[1]

This appendix provides information to help you manage your risks with respect to the use of this report.

Geotechnical Services Are Performed for Specific Purposes, Persons and Projects

This report has been prepared for the exclusive use of the University of Washington and Cascadia College, and other project team members for the Bothell STEM 4 building project. This report is not intended for use by others, and the information contained herein is not applicable to other sites.

GeoEngineers structures our services to meet the specific needs of our clients. For example, a geotechnical or geologic study conducted for a civil engineer or architect may not fulfill the needs of a construction contractor or even another civil engineer or architect that are involved in the same project. Because each geotechnical or geologic study is unique, each geotechnical engineering or geologic report is unique, prepared solely for the specific client and project site. Our report is prepared for the exclusive use of our Client. No other party may rely on the product of our services unless we agree in advance to such reliance in writing. This is to provide our firm with reasonable protection against open-ended liability claims by third parties with whom there would otherwise be no contractual limits to their actions. Within the limitations of scope, schedule and budget, our services have been executed in accordance with our Agreement with the Client and generally accepted geotechnical practices in this area at the time this report was prepared. This report should not be applied for any purpose or project except the one originally contemplated.

A Geotechnical Engineering or Geologic Report Is Based on a Unique Set of Project-specific Factors

This report has been prepared for the Bothell STEM 4 building project in Bothell, Washington. GeoEngineers considered a number of unique, project-specific factors when establishing the scope of services for this project and report. Unless GeoEngineers specifically indicates otherwise, do not rely on this report if it was:

- not prepared for you,
- not prepared for your project,
- not prepared for the specific site explored, or
- completed before important project changes were made.

For example, changes that can affect the applicability of this report include those that affect:

- the function of the proposed structure;
- elevation, configuration, location, orientation or weight of the proposed structure;
- composition of the design team; or

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[1] Developed based on material provided by ASFE, Professional Firms Practicing in the Geosciences; www.asfe.org .

- project ownership.

If important changes are made after the date of this report, GeoEngineers should be given the opportunity to review our interpretations and recommendations and provide written modifications or confirmation, as appropriate.

Subsurface Conditions Can Change

This geotechnical or geologic report is based on conditions that existed at the time the study was performed. The findings and conclusions of this report may be affected by the passage of time, by manmade events such as construction on or adjacent to the site, or by natural events such as floods, earthquakes, slope instability or groundwater fluctuations. Always contact GeoEngineers before applying a report to determine if it remains applicable.

Most Geotechnical and Geologic Findings Are Professional Opinions

Our interpretations of subsurface conditions are based on field observations from widely spaced sampling locations at the site. Site exploration identifies subsurface conditions only at those points where subsurface tests are conducted or samples are taken. GeoEngineers reviewed field and laboratory data and then applied our professional judgment to render an opinion about subsurface conditions throughout the site. Actual subsurface conditions may differ, sometimes significantly, from those indicated in this report. Our report, conclusions and interpretations should not be construed as a warranty of the subsurface conditions.

Geotechnical Engineering Report Recommendations Are Not Final

Do not over-rely on the preliminary construction recommendations included in this report. These recommendations are not final, because they were developed principally from GeoEngineers' professional judgment and opinion. GeoEngineers' recommendations can be finalized only by observing actual subsurface conditions revealed during construction. GeoEngineers cannot assume responsibility or liability for this report's recommendations if we do not perform construction observation.

Sufficient monitoring, testing and consultation by GeoEngineers should be provided during construction to confirm that the conditions encountered are consistent with those indicated by the explorations, to provide recommendations for design changes should the conditions revealed during the work differ from those anticipated, and to evaluate whether or not earthwork activities are completed in accordance with our recommendations. Retaining GeoEngineers for construction observation for this project is the most effective method of managing the risks associated with unanticipated conditions.

A Geotechnical Engineering or Geologic Report Could Be Subject to Misinterpretation

Misinterpretation of this report by other design team members can result in costly problems. You could lower that risk by having GeoEngineers confer with appropriate members of the design team after submitting the report. Also retain GeoEngineers to review pertinent elements of the design team's plans and specifications. Contractors can also misinterpret a geotechnical engineering or geologic report. Reduce that risk by having GeoEngineers participate in pre-bid and preconstruction conferences, and by providing construction observation.

Do Not Redraw the Exploration Logs

Geotechnical engineers and geologists prepare final boring and testing logs based upon their interpretation of field logs and laboratory data. To prevent errors or omissions, the logs included in a geotechnical engineering or geologic report should never be redrawn for inclusion in architectural or other design drawings. Only photographic or electronic reproduction is acceptable, but recognize that separating logs from the report can elevate risk.

Give Contractors a Complete Report and Guidance

Some owners and design professionals believe they can make contractors liable for unanticipated subsurface conditions by limiting what they provide for bid preparation. To help prevent costly problems, give contractors the complete geotechnical engineering or geologic report, but preface it with a clearly written letter of transmittal. In that letter, advise contractors that the report was not prepared for purposes of bid development and that the report's accuracy is limited; encourage them to confer with GeoEngineers and/or to conduct additional study to obtain the specific types of information they need or prefer. A pre-bid conference can also be valuable. Be sure contractors have sufficient time to perform additional study. Only then might an owner be in a position to give contractors the best information available, while requiring them to at least share the financial responsibilities stemming from unanticipated conditions. Further, a contingency for unanticipated conditions should be included in your project budget and schedule.

Contractors Are Responsible for Site Safety on Their Own Construction Projects

Our geotechnical recommendations are not intended to direct the contractor's procedures, methods, schedule or management of the work site. The contractor is solely responsible for job site safety and for managing construction operations to minimize risks to on-site personnel and to adjacent properties.

Read These Provisions Closely

Some clients, design professionals and contractors may not recognize that the geoscience practices (geotechnical engineering or geology) are far less exact than other engineering and natural science disciplines. This lack of understanding can create unrealistic expectations that could lead to disappointments, claims and disputes. GeoEngineers includes these explanatory "limitations" provisions in our reports to help reduce such risks. Please confer with GeoEngineers if you are unclear how these "Report Limitations and Guidelines for Use" apply to your project or site.

Geotechnical, Geologic and Environmental Reports Should Not Be Interchanged

The equipment, techniques and personnel used to perform an environmental study differ significantly from those used to perform a geotechnical or geologic study and vice versa. For that reason, a geotechnical engineering or geologic report does not usually relate any environmental findings, conclusions or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. Similarly, environmental reports are not used to address geotechnical or geologic concerns regarding a specific project.

Biological Pollutants

GeoEngineers' Scope of Work specifically excludes the investigation, detection, prevention or assessment of the presence of Biological Pollutants. Accordingly, this report does not include any interpretations, recommendations, findings, or conclusions regarding the detecting, assessing, preventing or abating of Biological Pollutants and no conclusions or inferences should be drawn regarding Biological Pollutants, as they may relate to this project. The term "Biological Pollutants" includes, but is not limited to, molds, fungi, spores, bacteria, and viruses, and/or any of their byproducts.

If Client desires these specialized services, they should be obtained from a consultant who offers services in this specialized field.

Appendix B

Environmental Soil Characterization

UWB-CC Phase 4 STEM Building Site
(UW Project No. 205294)
Bothell, Washington

for
University of Washington

January 10, 2020

GeoEngineers
Earth Science + Technology

Environmental Soil Characterization

UWB-CC Phase 4 STEM Building Site
(UW Project No. 205294)
Bothell, Washington

for
University of Washington

January 10, 2020

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Environmental Soil Characterization

UWB-CC Phase 4 STEM Building Site (UW Project No. 205294) Bothell, Washington

File No. 0183-120-01

January 10, 2020

Prepared for:

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GeoEngineers

Table of Contents

1.0 INTRODUCTION

This report presents the results of the environmental soil characterization study conducted in November 2019 for the University of Washington's (UW's) proposed Phase 4 STEM Building Site (Site) on the University of Washington Bothell (UWB)/Cascadia College (CC) campus in Bothell, Washington. The Site is located immediately south of the existing CC3 building and east of the Truly House and is shown relative to surrounding physical features on Figure 1, Vicinity Map. The layout of the Site is shown on Figure 2, Site Plan.

We understand the results of this environmental soil characterization will be used by UW to evaluate environmental conditions associated with redevelopment of the Site, including planning for soil disposal during construction. GeoEngineers, Inc.'s (GeoEngineers) environmental services have been completed in accordance with the scope of services outlined in our Agreement for Professional Services executed on November 5, 2019. Several geotechnical studies have been completed by GeoEngineers on–adjacent to the Site from 1997 to 2018, the results of which are provided in separate geotechnical reports.

2.0 PROJECT DESCRIPTION

The UWB Phase 4 STEM Building Site (aka Building 24) is owned by UW and is partially covered with mature conifer trees, thick underbrush and a grass lawn to the east. The site slopes down from west to east.

We understand the proposed Phase 4 STEM building will consist of one large building on the hillslope between Discovery Hall (UWB3) and The Center for Global Learning & The Arts (CC3), and east of the Truly House. The final location of the building has not been determined at this time. The building may consist of four levels with a mechanical penthouse. The lower floor levels will be stepped into the hillslope with the lowest finish floor level at a similar elevation as the Crescent Walkway on the east side of the Site.

3.0 SCOPE OF SERVICES

The purpose of the environmental soil characterization study is to evaluate the potential presence of contamination in shallow soil at the Phase 4 STEM Building Site. Soil chemical data from eight shallow borings at the Site will be used to help UW plan for handling and reuse-disposal of soil excavated during construction of the Phase 4 STEM building. Our scope of services consists of the following:

1. Review readily available geotechnical and environmental reports for the historic Truly Farm and area on–adjacent to the proposed Phase 4 STEM Site.
2. Visit the Site to lay out the borings and complete a utility locate to clear the boring locations for drilling. The one-call service and a private utility locate were completed prior to drilling.
3. Subcontract and observe the drilling of eight soil borings using track mounted, direct-push drilling equipment. The borings were completed to depths of up to 10 feet below the ground surface (bgs).
4. Obtain discrete soil samples from the explorations at approximate 2.5-foot depth intervals. Field screen the soil samples for evidence of petroleum hydrocarbons using visual, water sheen and headspace vapor screening methods. Visually classify the samples in general accordance with ASTM International (ASTM) D 2488 and maintain a detailed log of each exploration.

5. Based on soil conditions and field screening results, submit one or two soil samples from each boring for chemical analysis by the petroleum hydrocarbon identification method NWTPH-HCID and total metals using U.S. Environmental Protection Agency (EPA) 6000/7000 methods. The soil testing program focused on shallow soil that will be excavated during construction.
6. Coordinate and subcontract the disposal of investigation derived waste (IDW) soil at a UW-approved disposal facility.
7. Evaluate the soil results relative to Model Toxics Control Act (MTCA) Method A cleanup levels.

4.0 Environmental Soil Characterization

4.1. Historical Review

A Phase I Environmental Site Assessment (ESA) report was completed for the former Truly Farm property where the UWB/CC campus is located (Nowicki Associates 1993). The Phase I ESA identified historic site use at the Truly Farm property that included several gasoline, diesel and home heating oil underground storage tanks (USTs) and aboveground storage tanks (ASTs) near the Truly Ranch House. These historic USTs–ASTs are–were located in the vicinity of the proposed Phase 4 STEM Building Site. Additionally, petroleum-impacted soil has been encountered and removed from construction excavations for several nearby buildings on the campus, including the Library and Discovery Hall.

4.2. Cleanup Levels

Potential contaminants of concern (COCs) at the Site are gasoline-, diesel- and oil-range petroleum hydrocarbons and metals. MTCA Method A cleanup levels for unrestricted land use were selected for soil data evaluation purposes in this study. MTCA Method B cleanup levels were used for selected metals when a Method A cleanup level was not available. Cleanup levels for the potential COCs are shown in Table 1, Soil Chemical Analytical Results.

4.3. General

Eight (8) borings were completed with direct-push drilling equipment on November 7, 2019 to evaluate environmental soil conditions at the Site. Four of the borings (DP-2, DP-4, DP-7 and DP-8) were drilled to depths of 10 feet bgs; the remaining borings met refusal in dense soil at depths ranging from approximately 2.5 to 7.5 feet bgs. The purpose of the explorations was to evaluate shallow soil for possible contamination. A representative of GeoEngineers observed and documented subsurface conditions in the borings and obtained soil samples for field screening and chemical analysis. The approximate boring locations are shown on Figure 2. Field procedures and boring logs are presented in Appendix A.

4.4. Surface Conditions

The proposed Phase 4 STEM Building Site is located on the hillslope between the CC3 building and Discovery Hall. The ground surface in the project area slopes down from west to east from approximately Elevation 122 feet at top of the slope to about Elevation 76 feet at the base of the slope. Vegetation generally consists of tall grass, shrubs and large conifer and deciduous trees. The east side of the Site is bounded by the Crescent Walkway located west of the campus library. The west side of the Site is bounded by a road that connects with 110th Avenue NE north of the Truly House.

4.5. Subsurface Soil Conditions

Soil conditions encountered at the Site include topsoil, fill, and weathered and unweathered glacial till. A more detailed reporting of Site subsurface conditions is provided in the GeoEngineers report "Geotechnical Engineering Services, 2018-267A: Cascadia STEM Building (CC4) Cascadia College" dated November 19, 2018. Observed subsurface soil conditions are summarized below.

Topsoil. Topsoil generally consisted of dark brown sandy silt with roots and typically ranges from 2 to 5 inches thick.

Fill. A thin layer of fill consisting of brown to gray sand with varying amounts of silt and gravel was observed in several borings to depths of up to 2 feet.

Glacial Till. Weathered till was typically encountered starting at about 1 to 2 feet bgs and extends to approximately 3 to 10 feet bgs. The weathered (less dense) till consists of brown silty sand and sandy silt with varying gravel content. Unweathered glacial till underlies the weathered till and generally consists of dense to very dense gray silty sand or sandy silt with variable gravel content. Unweathered till was encountered at 2.5 to 7.5 feet in four borings and was too dense to advance those borings deeper.

4.6. Soil Field Screening and Chemical Testing Results

Discrete soil samples from the borings were screened in the field for evidence of petroleum contamination using visual, water sheen and headspace vapor screening methods. Field screening methods are described in Appendix A.

Discrete soil samples were obtained at 2.5- to 5-foot depth intervals in the borings for field screening and possible chemical analysis. Field screening evidence of petroleum contamination (odor, moderate to heavy sheens, and/or elevated headspace vapor readings) was not observed in samples from the borings. A slight sheen was observed at approximately 1-foot bgs in borings DP-7 and DP-8.

Field screening results are shown on the boring logs and in Table 1.

4.6.1. Soil Chemical Analytical Results

Twelve (12) soil samples were selected from the eight borings as soil representative of Site conditions. The samples were submitted to Fremont Analytical in Seattle, Washington for chemical analysis of:

- Petroleum hydrocarbon identification method NWTPH-HCID, and
- Total metals using EPA 6000/7000 methods.

The laboratory analytical results for the soil samples are presented in Table 1 and are summarized as follows:

- Petroleum hydrocarbons were not detected in the twelve (12) soil samples submitted for chemical analysis; therefore, follow-up analyses for gasoline-, diesel-, and oil-range petroleum were not warranted.
- MTCA metals (arsenic, cadmium, chromium, lead and mercury) were not detected or were detected at low concentrations in the twelve (12) soil samples that were analyzed for metals. The metals concentrations were less than or similar to typical Puget Sound soil "background" levels established by

Washington Department of Ecology in their 1994 Publication #94-115. Additional metals (barium, selenium and silver) were analyzed in samples from DP-1, DP-2, DP-4 and DP-8 for the purpose of waste disposal profiling; these results were either less than the MTCA Method B cleanup levels or not detected.

A copy of the laboratory report is provided in Appendix B.

5.0 CONCLUSIONS

GeoEngineers completed an environmental soil characterization study at the proposed Phase 4 STEM Building Site on the UW/CC co-located campus in Bothell, Washington. The primary purpose of the soil characterization study was to evaluate environmental soil conditions at the Site. The following conclusions are based on our review of a previous Phase I ESA report, observations of subsurface conditions during drilling, and the results of chemical analyses for soil samples collected at the Site.

- A 1993 Phase I ESA report for the Truly Farm Property identified several fuel USTs and ASTs near the Truly House, located uphill and west-adjacent to the Site.
- Environmental soil conditions were evaluated by obtaining soil samples from eight direct-push borings completed across the Site for field screening and chemical analysis. Selected soil samples from depths of 1 to 5 feet bgs were submitted for chemical testing with a focus on shallow soil that will be excavated during construction. Based on field screening results and chemical analytical data, soil excavated during construction at the Site can be handled-disposed as “clean” (unregulated) material. Key findings are as follows:
    - Petroleum hydrocarbons were not detected in any of the soil samples submitted for chemical analysis.
    - Metals (arsenic, chromium, lead) were detected in soil samples at concentrations similar to Puget Sound “background” soil concentrations and do not represent an environmental concern. Cadmium and mercury were not detected.
- Additional environmental soil sampling is likely not needed. If evidence of “hot spot” soil contamination (staining, odor, etc.) is observed during construction excavation in areas that were not explored during this study, we recommend testing to evaluate the suspect soil for contamination prior to disposal.
- Depending on the season/weather conditions, it may be possible to re-use some of the soil from construction excavations as on-site fill after consulting with the project geotechnical engineer on suitability.

6.0 REFERENCES

Nowicki Associates. 1993. Phase I Environmental Site Assessment (Phase I) of Truly Farm Property. Prepared for: unknown. November 1993.

GeoEngineers, Inc. 2018, Geotechnical Engineering Services, 2018-267A: Cascadia STEM Building (CC4) Cascadia College. Prepared for Cascadia College, Bothell, Washington. November 19, 2018.

7.0 LIMITATIONS

We have prepared this report for the exclusive of the University of Washington and their authorized agents to evaluate environmental conditions at the UWB-CC Phase 4 STEM Building Site in Bothell, Washington. This report is not intended for use by others, and the information contained herein is not applicable to other sites. The environmental soil characterization described in this report was completed in general accordance with the Agreement for Professional Services executed on November 5, 2019. Within the limitations of scope, schedule and budget, our services have been executed in accordance with generally accepted environmental science practices in this area at the time this report was prepared. No warranty or other conditions, express or implied, should be understood.

Please refer to Appendix C titled "Report Limitations and Guidelines for Use" for additional information pertaining to use of this report.

TABLES

Table 1

Soil Chemical Analytical Results

Petroleum Hydrocarbons and Metals

UWB-CC Phase 4 STEM Site

Bothell, Washington

Exploration ID[1]	Sample Identification	Sample Depth (feet bgs)	Sample Date	Field Screening[2]		Petroleum Hydrocarbons[3] (mg/kg)			Total Metals[4] (mg/kg)							
				Sheen	Headspace Vapor (ppm)	Gasoline Range	Diesel Range	Heavy Oil Range	Arsenic	Barium	Cadmium	Chromium	Lead	Mercury	Selenium	Silver
Direct Push Borings																
DP-1	DP-1-2.5	2.5	11/7/2019	NS	< 1	< 20.7	< 51.7	< 103	**2.42**	**65.7**	< 0.167	**33.7**	**1.67**	< 0.261	**0.579**	< 0.0836
DP-2	DP-2-2.5	2.5	11/7/2019	NS	< 1	< 25.8	< 64.6	< 129	**7.60**	**141**	< 0.208	**91.5**	**5.38**	< 0.309	**1.09**	**0.105**
	DP-2-5.0	5.0	11/7/2019	NS	< 1	< 19.9	< 49.8	< 99.6	**7.63**	--	< 0.170	**44.0**	**2.28**	< 0.286	--	--
DP-3	DP-3-2.5	2.5	11/7/2019	NS	< 1	< 19.8	< 49.6	< 99.2	**3.65**	--	< 0.169	**40.4**	**2.35**	< 0.254	--	--
DP-4	DP-4-2.0	2.0	11/7/2019	NS	< 1	< 21.5	< 53.6	< 107	**4.52**	**78.4**	< 0.183	**52.6**	**2.99**	< 0.277	**0.9**	< 0.0917
	DP-4-5.0	5.0	11/7/2019	NS	< 1	< 21.0	< 52.6	< 105	**3.12**	--	< 0.182	**36.8**	**2.45**	< 0.249	--	--
DP-5	DP-5-1.5	1.5	11/7/2019	NS	< 1	< 20.8	< 51.9	< 104	**3.79**	--	< 0.177	**39.0**	**2.67**	< 0.234	--	--
DP-6	DP-6-2.5	2.5	11/7/2019	NS	< 1	< 20.1	< 50.2	< 100	**1.91**	--	< 0.171	**42.3**	**2.00**	< 0.253	--	--
DP-7	DP-7-1.0	1.0	11/7/2019	SS	< 1	< 25.1	< 62.9	< 126	**6.04**	--	< 0.212	**57.9**	**5.69**	< 0.302	--	--
	DP-7-2.5	2.5	11/7/2019	NS	< 1	< 23.8	< 59.5	< 119	**8.85**	--	< 0.211	**89.5**	**7.66**	< 0.326	--	--
DP-8	DP-8-1.0	1.0	11/7/2019	SS	< 1	< 21.1	< 52.8	< 106	**4.56**	**58.1**	< 0.170	**34.2**	**3.50**	< 0.237	**0.583**	< 0.0849
	DP-8-2.0	2.0	11/7/2019	NS	< 1	< 19.8	< 49.6	< 99.2	**4.17**	--	< 0.165	**30.8**	**3.31**	< 0.230	--	--
MTCA Method A Cleanup Level for Unrestricted Land Use						100[5]	2,000	2,000	20	16,000[6]	2	2,000[7]	250	2	400[6]	400[6]
Puget Sound Background Concentration[8]									7	NA	1	48	24	0.07	NA	NA

Notes:

[1] Approximate exploration locations are shown on Figure 2.

[2] Field screening methods are described in Appendix A.

[3] Petroleum hydrocarbon identification screening analyzed by Northwest Method NWTPH-HCID.

[4] Total metals analyzed by U.S. Environmental Protection Agency (EPA) 6020/7471.

[5] Cleanup level when no detectable benzene in soil.

[6] Model Toxics Control Act (MTCA) Method B cleanup level for direct contact derived from Ecology's "CLARC Master Spreadsheet.xlsx" interim update May 2019.

[7] Cleanup level for Chromium III.

[8] Naturally occurring background soil metal concentration in Puget Sound region (Department of Ecology 1994).

< = analyte not detected at a concentration greater than the indicated detection limit

-- = not analyzed

bgs = below ground surface

NA=Not Applicable

mg/kg = milligrams per kilogram

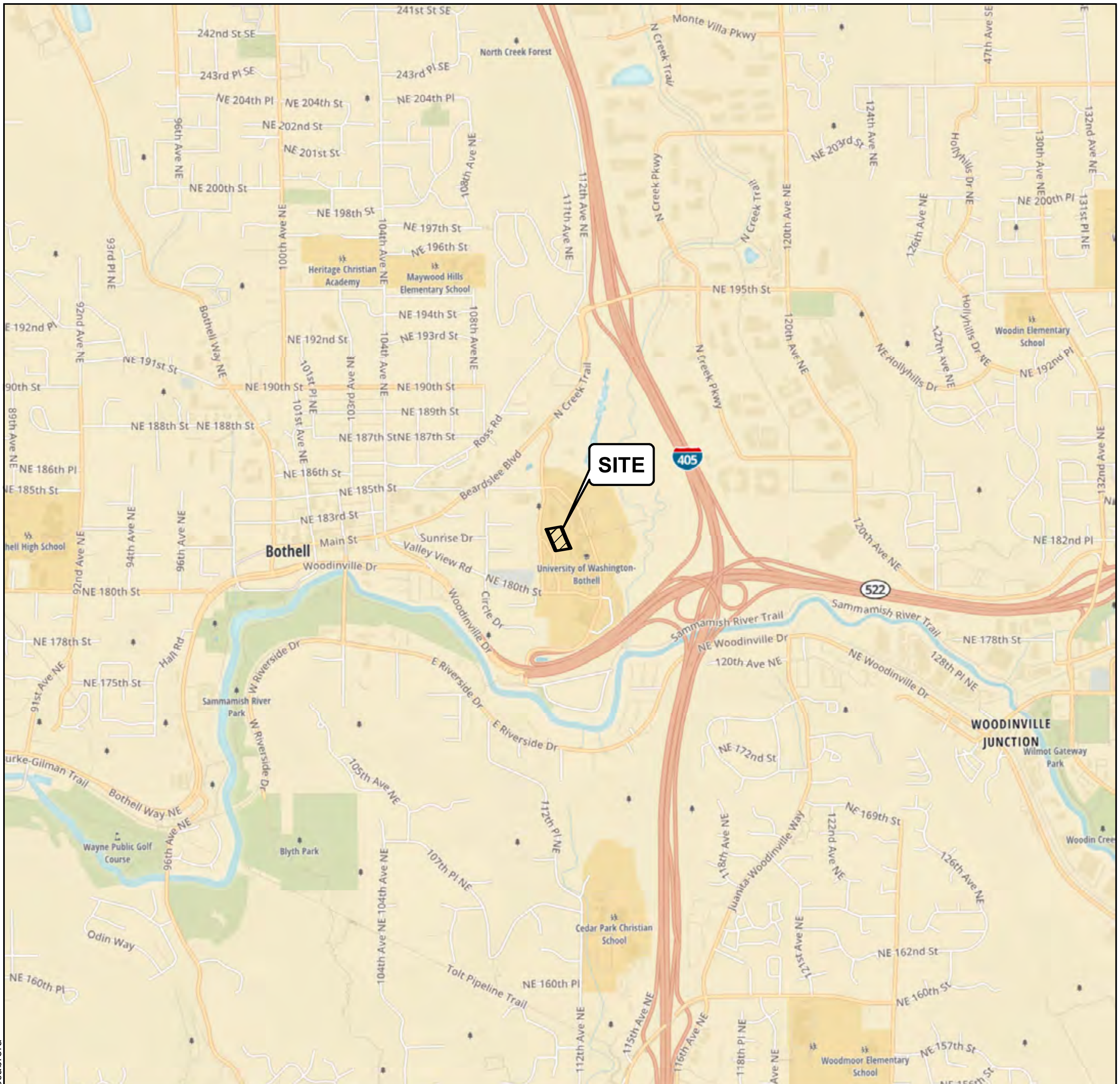
NS = No sheen; SS=Slight sheen

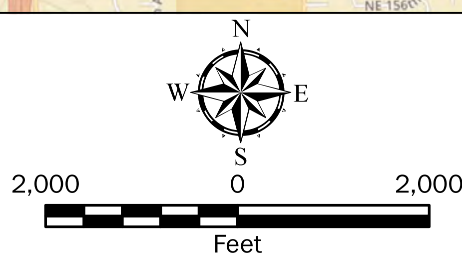
ppm = parts per million

Bolded value indicates analyte was detected at the listed concentration.

Chemical analytical testing by Fremont Analytical in Seattle, Washington. Laboratory analytical reports in Appendix B.

FIGURES





Notes:

1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.

Data Source: Mapbox Open Street Map, 2016

Projection: NAD 1983 UTM Zone 10N

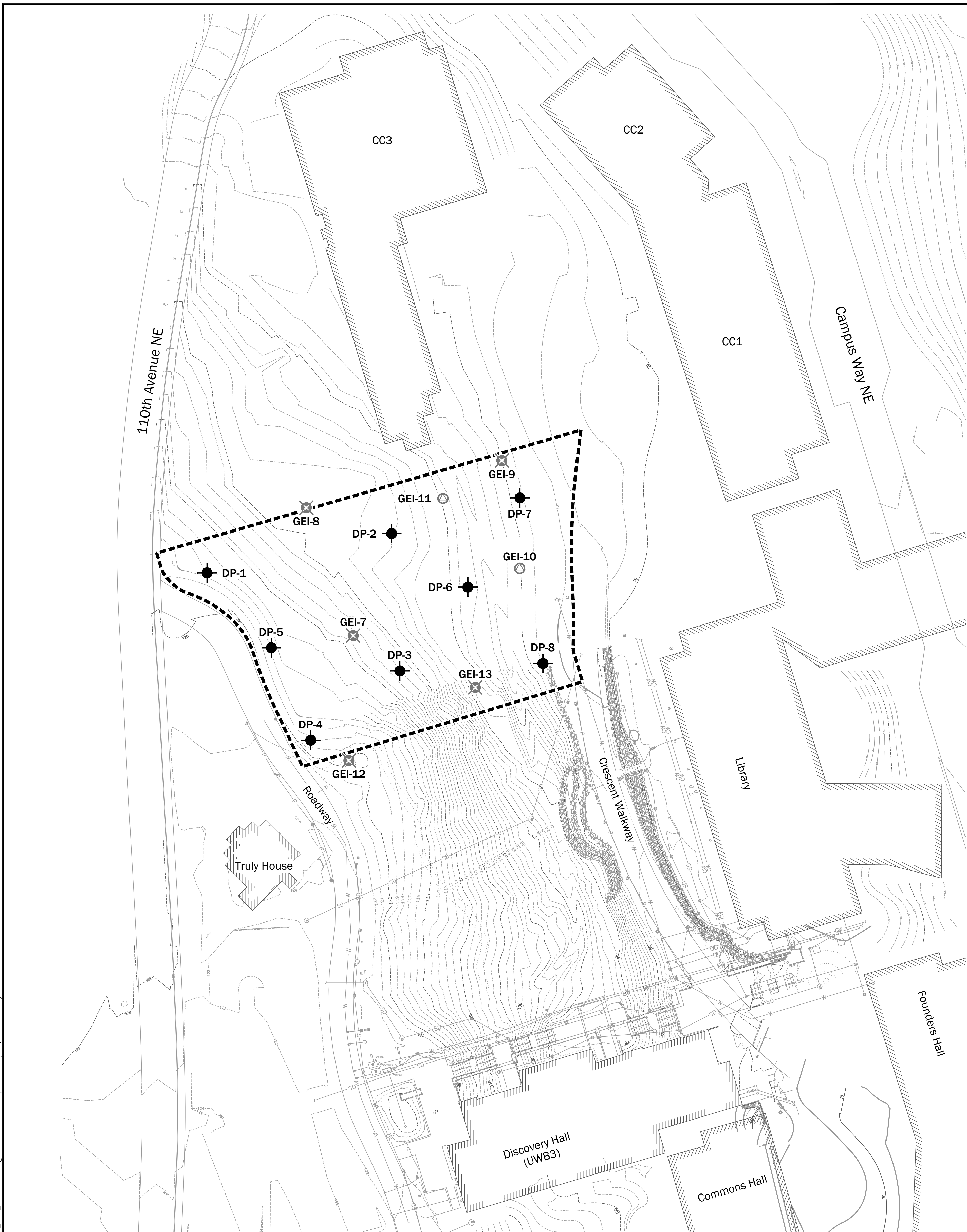
Vicinity Map

UW Bothell - Cascadia College
Phase 4 STEM Building
Bothell, Washington

GeoEngineers

Figure 1

P:\10\1060003\GIS\1060000300_F01_VM.mxd Date Exported: 10/22/18 by ccabrera



Legend

DP-1 — Environmental Soil Boring by GeoEngineers, November 2019

Boundary of 2019 Environmental Soil Characterization Study

GEI-12 — Geotechnical Boring by GeoEngineers, 2018

GEI-4 — Geotechnical Boring with Monitoring Well by GeoEngineers, 2018

Notes:

1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.
3. Only previous drilling investigation locations that are within the 2019 Environmental Study Area are shown. All other previous investigations are covered in separate geotechnical reports.

Data Source: Site survey by Otak, received 08/27/18.

Projection: WA State Plane, North Zone, NAD83, US Foot

Site Plan

UW Bothell - Cascadia College
Phase 4 STEM Building
Bothell, Washington

GeoEngineers

Figure 2

\\geoengineers.com\WAN\Projects\10\10600003\CAD\01\Geotech\0018312001_F02_Site Plan.dwg TAB:F02 Date Exported: 12/03/19 - 9:52 by mwoods

APPENDICES

APPENDIX A
Field Procedures and Boring Logs

APPENDIX A
FIELD PROCEDURES AND BORING LOGS

Soil Sampling

Subsurface conditions at the Site were evaluated by completing eight direct-push explorations using equipment owned and operated by Cascade Drilling of Woodinville, Washington. Direct-push drilling was conducted in general accordance with Washington Administrative Code (WAC) 173-760 by a Washington state-licensed drilling company.

The boring explorations extended to depths ranging from approximately 2.5 to 10 feet below the ground surface (bgs). Soil samples were collected in clean, plastic 1.5-inch diameter disposable liners. Using a stainless-steel knife or new gloves, soil from the sampler was placed in containers provided by the testing laboratory for potential chemical analysis. A portion of the sample was placed in a plastic bag for field screening. The sampling equipment was decontaminated before each sampling attempt with a Liqui-Nox® solution wash and a distilled water rinse.

A representative from our staff selected the exploration locations and observed and classified the soil encountered. Soil in the explorations was visually classified in general accordance with ASTM International (ASTM) D 2488-94. Figure A-1, Key to Exploration Logs provides an explanation key for the logs. The boring logs are presented in Figures A-2 through A-9.

Selected samples from the borings were submitted for chemical analysis based on field screening results and depth relative to the proposed construction excavations. Samples submitted for chemical analysis are designated with "CA" on the logs. The soil samples were placed in a cooler with ice for transport to the laboratory. Standard chain-of-custody procedures were followed in transporting the soil samples to the laboratory.

Drill cuttings generated during drilling activities were temporarily stored on site in a labeled 20-gallon drum. The drum was disposed at Waste Management, a UW-approved disposal facility, in January 2020.

Field Screening of Soil Samples

Soil samples obtained from the borings were screened in the field for evidence of contamination using (1) visual examination; (2) sheen screening; and (3) vapor headspace screening with a photoionization detector (PID). The results of headspace and sheen screening are included on the boring logs and in Table 1.

Visual screening consists of inspecting the soil for stains indicative of petroleum-related contamination. Visual screening is generally more effective when contamination is related to heavy petroleum hydrocarbons, such as motor oil or hydraulic oil, or when hydrocarbon concentrations are high. Sheen screening and headspace vapor screening are more sensitive methods that have been effective in detecting contamination at concentrations less than regulatory cleanup guidelines. Sheen screening involves placing soil in a pan of water and observing the water surface for signs of sheen. Sheen classifications are as follows:

No Sheen (NS)	No visible sheen on water surface.

Slight Sheen (SS)	Light, colorless, dull sheen; spread is irregular, not rapid; sheen dissipates rapidly.
Moderate Sheen (MS)	Light to heavy sheen, may have some color/iridescence; spread is irregular to flowing; few remaining areas of no sheen on water surface.
Heavy Sheen (HS)	Heavy sheen with color/iridescence; spread is rapid; entire water surface may be covered with sheen.

Headspace vapor screening involves placing a soil sample in a plastic sample bag. Air is captured in the bag and the bag is shaken to expose the soil to the air trapped in the bag. The probe of a PID is inserted in the bag and the instrument measures the concentration of combustible vapor in the air removed from the sample headspace. The PID measures concentrations in ppm (parts per million) and is calibrated to isobutylene. The PID is designed to quantify combustible gas and organic vapor concentrations up to 2,500 ppm. The PID has a lower threshold of significance of 1 ppm in this application. Field screening results are site-specific and vary with soil type, soil moisture content, temperature and type of contaminant.

SOIL CLASSIFICATION CHART

MAJOR DIVISIONS			SYMBOLS GRAPH	SYMBOLS LETTER	TYPICAL DESCRIPTIONS
COARSE GRAINED SOILS — MORE THAN 50% RETAINED ON NO. 200 SIEVE	GRAVEL AND GRAVELLY SOILS — MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	CLEAN GRAVELS (LITTLE OR NO FINES)		GW	WELL-GRADED GRAVELS, GRAVEL - SAND MIXTURES
				GP	POORLY-GRADED GRAVELS, GRAVEL - SAND MIXTURES
		GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)		GM	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES
				GC	CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES
	SAND AND SANDY SOILS — MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE	CLEAN SANDS (LITTLE OR NO FINES)		SW	WELL-GRADED SANDS, GRAVELLY SANDS
				SP	POORLY-GRADED SANDS, GRAVELLY SAND
		SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)		SM	SILTY SANDS, SAND - SILT MIXTURES
				SC	CLAYEY SANDS, SAND - CLAY MIXTURES
FINE GRAINED SOILS — MORE THAN 50% PASSING NO. 200 SIEVE	SILTS AND CLAYS	LIQUID LIMIT LESS THAN 50		ML	INORGANIC SILTS, ROCK FLOUR, CLAYEY SILTS WITH SLIGHT PLASTICITY
				CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
				OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS	LIQUID LIMIT GREATER THAN 50		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS SILTY SOILS
				CH	INORGANIC CLAYS OF HIGH PLASTICITY
				OH	ORGANIC CLAYS AND SILTS OF MEDIUM TO HIGH PLASTICITY
HIGHLY ORGANIC SOILS				PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

NOTE: Multiple symbols are used to indicate borderline or dual soil classifications

ADDITIONAL MATERIAL SYMBOLS

SYMBOLS GRAPH	SYMBOLS LETTER	TYPICAL DESCRIPTIONS
	AC	Asphalt Concrete
	CC	Cement Concrete
	CR	Crushed Rock/ Quarry Spalls
	SOD	Sod/Forest Duff
	TS	Topsoil

Groundwater Contact

Measured groundwater level in exploration, well, or piezometer

Measured free product in well or piezometer

Graphic Log Contact

Distinct contact between soil strata

Approximate contact between soil strata

Material Description Contact

Contact between geologic units

Contact between soil of the same geologic unit

Laboratory / Field Tests

%F	Percent fines
%G	Percent gravel
AL	Atterberg limits
CA	Chemical analysis
CP	Laboratory compaction test
CS	Consolidation test
DD	Dry density
DS	Direct shear
HA	Hydrometer analysis
MC	Moisture content
MD	Moisture content and dry density
Mohs	Mohs hardness scale
OC	Organic content
PM	Permeability or hydraulic conductivity
PI	Plasticity index
PL	Point lead test
PP	Pocket penetrometer
SA	Sieve analysis
TX	Triaxial compression
UC	Unconfined compression
VS	Vane shear

Sheen Classification

NS	No Visible Sheen
SS	Slight Sheen
MS	Moderate Sheen
HS	Heavy Sheen

Sampler Symbol Descriptions

- 2.4-inch I.D. split barrel
- Standard Penetration Test (SPT)
- Shelby tube
- Piston
- Direct-Push
- Bulk or grab
- Continuous Coring

Blowcount is recorded for driven samplers as the number of blows required to advance sampler 12 inches (or distance noted). See exploration log for hammer weight and drop.

"P" indicates sampler pushed using the weight of the drill rig.

"WOH" indicates sampler pushed using the weight of the hammer.

NOTE: The reader must refer to the discussion in the report text and the logs of explorations for a proper understanding of subsurface conditions. Descriptions on the logs apply only at the specific exploration locations and at the time the explorations were made; they are not warranted to be representative of subsurface conditions at other locations or times.

Key to Exploration Logs

GEOENGINEERS

Figure A-1

Drilled	Start 11/7/2019	End 11/7/2019	Total Depth (ft)	5	Logged By / Checked By	Driller	Drilling Method	Direct Push

Surface Elevation (ft) / Vertical Datum: Undetermined	Hammer Data	Drilling Equipment	Genuine GeoProbe 7822 DT
Easting (X) / Northing (Y)	System Datum	Groundwater not observed at time of exploration	
Notes:			

Elevation (feet)	Depth (feet)	FIELD DATA: Interval	Recovered (in)	Blows/foot	Collected Sample	Sample Name / Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)	REMARKS
	0		36					TS	Approximately 3 inches grass, organic matter with root mat			Soft to 2½ feet, then drilling was hard
						1		SW-SM	Brown fine to coarse sand with silt, trace roots (moist)	NS	<1	
						2.5 / CA		SM	Gray silty fine to medium sand with coarse sand, occasional fine gravel (dry to moist)	NS	<1	
									No recovery	NS	<1	Driller noted rocks in shoe
	5								Refusal at 5 feet (very dense soil)			

Note: See Figure A-1 for explanation of symbols.
Coordinates Data Source: Horizontal approximated based on . Vertical approximated based on .

Log of Boring DP-1

GeoEngineers

Project: UW Bothell CC STEM Building
Project Location: Bothell, Washington
Project Number: 0183-120-01

Figure A-2
Sheet 1 of 1

Drilled	Start 11/7/2019	End 11/7/2019	Total Depth (ft) 10	Logged By / Checked By	Driller	Drilling Method: Direct Push

Surface Elevation (ft) / Vertical Datum: Undetermined	Hammer Data	Drilling Equipment: Genuine GeoProbe 7822 DT
Easting (X) / Northing (Y)	System Datum	Groundwater not observed at time of exploration

Notes:

Elevation (feet)	Depth (feet)	FIELD DATA: Interval	FIELD DATA: Recovered (in)	FIELD DATA: Blows/foot	FIELD DATA: Collected Sample	FIELD DATA: Sample Name / Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)	REMARKS
	0		60					TS	Dark brown grass, organic matter with wood and roots			
								ML	Brown sandy silt (moist)	NS	<1	
										NS	<1	
						CA						
									Silt content decreasing			
								SP-SM	Brown fine to medium sand with silt (moist)	NS	<1	
	5		60			CA				NS	<1	
									Silt content increases			
								SM	Brown silty fine to medium sand (moist)	NS	<1	
								ML	Dary gray silt (moist)	NS	<1	
	10											

Note: See Figure A-1 for explanation of symbols.
Coordinates Data Source: Horizontal approximated based on . Vertical approximated based on .

Log of Boring DP-2

GeoEngineers

Project: UW Bothell CC STEM Building
Project Location: Bothell, Washington
Project Number: 0183-120-01

Drilled	Start 11/7/2019	End 11/7/2019	Total Depth (ft) 6	Logged By / Checked By	Driller	Drilling Method: Direct Push
Surface Elevation (ft) / Vertical Datum	Undetermined		Hammer Data		Drilling Equipment: Genuine GeoProbe 7822 DT
Easting (X) / Northing (Y)			System Datum		Groundwater not observed at time of exploration

Notes:

Elevation (feet)	Depth (feet)	Interval	Recovered (in)	Blows/foot	Collected Sample	Sample Name / Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)	REMARKS
	0		36					TS	Dark brown silty fine sand with organic matter (roots)	NS	<1	
								SW-SM	Brown fine to coarse sand with silt, occasional organic matter (roots)			
								SP-SM	Brown fine to medium sand with silt and occasional fine gravel (dry to moist)			
						CA			Becomes gray	NS	<1	
									No recovery			
	5		12					SP-SM	Gray fine to coarse sand with silt and fine gravel (moist)	NS	<1	

Refusal at 6 feet (very dense soil)

Note: See Figure A-1 for explanation of symbols.
Coordinates Data Source: Horizontal approximated based on . Vertical approximated based on .

Log of Boring DP-3

GeoEngineers

Project: UW Bothell CC STEM Building
Project Location: Bothell, Washington
Project Number: 0183-120-01

Drilled	Start 11/7/2019	End 11/7/2019	Total Depth (ft) 10	Logged By / Checked By	Driller	Drilling Method: Direct Push

Surface Elevation (ft) / Vertical Datum: Undetermined	Hammer Data	Drilling Equipment: Genuine GeoProbe 7822 DT
Easting (X) / Northing (Y)	System Datum	Groundwater not observed at time of exploration

Notes:

Elevation (feet)	Depth (feet)	Interval	Recovered (in)	Blows/foot	Collected Sample	Sample Name / Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)	REMARKS
	0		24					TS	Approximately 2 inches dark brown roots and grasses			
								SW-SM	Brown fine to coarse sand with silt and organic material (roots), occasional gravel (moist)	NS	<1	
								SM	Gray silty fine to medium sand with occasional fine gravel (moist) Orange oxidation from 1 to 2 feet			
						CA			No recovery	NS	<1	
	5		60			CA		SM	Gray silty fine to medium sand with occasional fine gravel (moist)	NS	<1	
										NS	<1	
										NS	<1	
										NS	<1	
	10											

Note: See Figure A-1 for explanation of symbols.
Coordinates Data Source: Horizontal approximated based on . Vertical approximated based on .

Log of Boring DP-4

GeoEngineers

Project: UW Bothell CC STEM Building
Project Location: Bothell, Washington
Project Number: 0183-120-01

Figure A-5
Sheet 1 of 1

Drilled	Start 11/7/2019	End 11/7/2019	Total Depth (ft) 2.5	Logged By / Checked By	Driller	Drilling Method: Direct Push

Surface Elevation (ft) / Vertical Datum: Undetermined	Hammer Data	Drilling Equipment: Genuine GeoProbe 7822 DT
Easting (X) / Northing (Y)	System Datum	Groundwater not observed at time of exploration

Notes:

Elevation (feet)	Depth (feet)	FIELD DATA: Interval	FIELD DATA: Recovered (in)	FIELD DATA: Blows/foot	FIELD DATA: Collected Sample	FIELD DATA: Sample Name / Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)	REMARKS
	0		18					TS	Approximately 2 inches dark brown organic matter, root mass and grass			
								SW-SM	Brown fine to coarse sand with silt, occasional organic matter (wood, roots) (moist)	NS	<1	
						CA		SP-SM	Gray fine to medium sand with silt and fine gravel (moist)	NS	<1	
									No recovery			

Refusal at 2½ feet (very dense soil)

Note: See Figure A-1 for explanation of symbols.
Coordinates Data Source: Horizontal approximated based on . Vertical approximated based on .

Log of Boring DP-5

GeoEngineers

Project: UW Bothell CC STEM Building
Project Location: Bothell, Washington
Project Number: 0183-120-01

Drilled	Start 11/7/2019	End 11/7/2019	Total Depth (ft)	7.5	Logged By / Checked By		Driller		Drilling Method	Direct Push

Surface Elevation (ft) / Vertical Datum	Undetermined	Hammer Data		Drilling Equipment	Genuine GeoProbe 7822 DT
Easting (X) / Northing (Y)		System Datum		Groundwater not observed at time of exploration	

Notes:

Elevation (feet)	Depth (feet)	FIELD DATA: Interval	Recovered (in)	Blows/foot	Collected Sample	Sample Name / Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)	REMARKS
	0		36					TS	Dark brown organic matter, root wads and silty sand	NS	<1	
								SW-SM	Brown fine to coarse sand with silt and organic matter (small roots) (moist)			
								SP-SM	Brown/gray fine to medium sand with silt and occasional fine gravel (moist)	NS	<1	
										NS	<1	
						CA			No recovery			
	5		30					SP-SM	Brown/gray fine to medium sand with silt and occasional fine gravel (moist)	NS	<1	
									Grades to silty fine to medium sand			
								SM	Dark gray silty fine to medium sand	NS	<1	

Refusal at 7½ feet (very dense soil)

Note: See Figure A-1 for explanation of symbols.
Coordinates Data Source: Horizontal approximated based on . Vertical approximated based on .

Log of Boring DP-6

GeoEngineers

Project: UW Bothell CC STEM Building
Project Location: Bothell, Washington
Project Number: 0183-120-01

Figure A-7
Sheet 1 of 1

Drilled	Start 11/7/2019	End 11/7/2019	Total Depth (ft) 10	Logged By / Checked By	Driller	Drilling Method: Direct Push

Surface Elevation (ft) / Vertical Datum: Undetermined	Hammer Data	Drilling Equipment: Genuine GeoProbe 7822 DT
Easting (X) / Northing (Y)	System Datum	Groundwater not observed at time of exploration

Notes:

Elevation (feet)	Depth (feet)	Interval	Recovered (in)	Blows/foot	Collected Sample	Sample Name / Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)	REMARKS
	0		48					SW-SM	Red/brown fine to coarse sand with silt and roots (moist)			
								ML	Brown sandy silt (moist)	SS	<1	
						CA						
									Fine sand lens at 2 feet			
										NS	<1	
						CA						
								SM	Brown silty fine sand (moist)			
									No recovery	NS	<1	
	5		36					SM	Brown silty fine sand (moist)			
								SP-SM	Brown fine sand with silt (moist)	NS	<1	
								SM	Brown silty fine sand (moist)	NS	<1	
								ML	Gray silt (moist)	NS	<1	
										NS	<1	
									No recovery			
	10											

Note: See Figure A-1 for explanation of symbols.
Coordinates Data Source: Horizontal approximated based on . Vertical approximated based on .

Log of Boring DP-7

GEOENGINEERS

Project: UW Bothell CC STEM Building
Project Location: Bothell, Washington
Project Number: 0183-120-01

Figure A-8
Sheet 1 of 1

Drilled	Start 11/7/2019	End 11/7/2019	Total Depth (ft) 10	Logged By / Checked By	Driller	Drilling Method: Direct Push

Surface Elevation (ft) / Vertical Datum: Undetermined	Hammer Data	Drilling Equipment: Genuine GeoProbe 7822 DT
Easting (X) / Northing (Y)	System Datum	Groundwater not observed at time of exploration

Notes:

Elevation (feet)	Depth (feet)	FIELD DATA: Interval	Recovered (in)	Blows/foot	Collected Sample	Sample Name / Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)	REMARKS
	0		24					TS	Dark brown silty sand, roots and grasses			
								SP-SM	Brown medium to coarse sand with silt and fine gravel (moist) (fill)			
						CA				SS	<1	
						CA			No recovery	NS	<1	
	5		24					SP-SM	Gray medium to coarse sand with silt and fine gravel (moist)	NS	<1	
								ML	Gray silt (hard, moist)			
									No recovery	NS	<1	
	10											

Note: See Figure A-1 for explanation of symbols.
Coordinates Data Source: Horizontal approximated based on . Vertical approximated based on .

Log of Boring DP-8

GeoEngineers

Project: UW Bothell CC STEM Building
Project Location: Bothell, Washington
Project Number: 0183-120-01

APPENDIX B
Chemical Analytical Data

APPENDIX B
CHEMICAL ANALYTICAL DATA

Analytical Methods

Chain-of-custody procedures were followed during the transport of the soil and groundwater samples to the analytical laboratory. The samples were held in cold storage pending extraction and/or analysis. The analytical results, analytical methods reference and laboratory quality control (QC) records are included in this appendix. The analytical results are also summarized in the text and tables of this report.

Analytical Data Review

The laboratory maintains an internal quality assurance program as documented in its laboratory quality assurance manual. The laboratory uses a combination of blanks, surrogate recoveries, duplicates, matrix spike recoveries, matrix spike duplicate recoveries, blank spike recoveries and blank spike duplicate recoveries to evaluate the validity of the analytical results. The laboratory also uses data quality goals for individual chemicals or groups of chemicals based on the long-term performance of the test methods. The data quality goals were included in the laboratory reports. The laboratory compared each group of samples with the existing data quality goals and noted any exceptions in the laboratory report. Data quality exceptions documented by the accredited laboratory were reviewed by GeoEngineers and are addressed in the data quality exception section of this appendix.

Analytical Data Review Summary

No significant data quality exceptions were noted in the laboratory report during our review. Based on our data quality review, it is our opinion that the analytical data are of acceptable quality for their intended use in this report.

3600 Fremont Ave. N.
Seattle, WA 98103
T: (206) 352-3790
F: (206) 352-7178
info@fremontanalytical.com

GeoEngineers
Chris Brown
2101 4th Ave, Suite 950
Seattle, WA 98121

RE: UW Bothell - STEM Building
Work Order Number: 1911101

November 15, 2019

Attention Chris Brown:

Fremont Analytical, Inc. received 24 sample(s) on 11/8/2019 for the analyses presented in the following report.

Hydrocarbon Identification by NWTPH-HCID
Mercury by EPA Method 7471
Sample Moisture (Percent Moisture)
Total Metals by EPA Method 6020B

This report consists of the following:

- Case Narrative
- Analytical Results
- Applicable Quality Control Summary Reports
- Chain of Custody

All analyses were performed consistent with the Quality Assurance program of Fremont Analytical, Inc. Please contact the laboratory if you should have any questions about the results.

Thank you for using Fremont Analytical.

Sincerely,

Brianna Barnes
Project Manager

CC:
Jim Roth

DoD/ELAP Certification #L17-135, ISO/IEC 17025:2005
ORELAP Certification: WA 100009-007 (NELAP Recognized)

Date: *11/15/2019*

CLIENT: GeoEngineers
Project: UW Bothell - STEM Building
Work Order: 1911101

Work Order Sample Summary

Lab Sample ID	Client Sample ID	Date/Time Collected	Date/Time Received
1911101-001	DP-1-1.0	11/07/2019 9:15 AM	11/08/2019 10:30 AM
1911101-002	DP-1-2.5	11/07/2019 9:20 AM	11/08/2019 10:30 AM
1911101-003	DP-2-2.5	11/07/2019 11:35 AM	11/08/2019 10:30 AM
1911101-004	DP-2-5.0	11/07/2019 11:40 AM	11/08/2019 10:30 AM
1911101-005	DP-2-8.0	11/07/2019 11:45 AM	11/08/2019 10:30 AM
1911101-006	DP-2-10.0	11/07/2019 11:50 AM	11/08/2019 10:30 AM
1911101-007	DP-3-2.5	11/07/2019 11:10 AM	11/08/2019 10:30 AM
1911101-008	DP-3-5.0	11/07/2019 11:20 AM	11/08/2019 10:30 AM
1911101-009	DP-4-2.0	11/07/2019 10:10 AM	11/08/2019 10:30 AM
1911101-010	DP-4-5.0	11/07/2019 10:20 AM	11/08/2019 10:30 AM
1911101-011	DP-4-7.5	11/07/2019 10:30 AM	11/08/2019 10:30 AM
1911101-012	DP-4-10.0	11/07/2019 10:40 AM	11/08/2019 10:30 AM
1911101-013	DP-5-1.5	11/07/2019 9:55 AM	11/08/2019 10:30 AM
1911101-014	DP-6-2.5	11/07/2019 12:15 PM	11/08/2019 10:30 AM
1911101-015	DP-6-5.0	11/07/2019 12:20 PM	11/08/2019 10:30 AM
1911101-016	DP-6-7.5	11/07/2019 12:25 PM	11/08/2019 10:30 AM
1911101-017	DP-7-1.0	11/07/2019 12:55 PM	11/08/2019 10:30 AM
1911101-018	DP-7-2.5	11/07/2019 1:00 PM	11/08/2019 10:30 AM
1911101-019	DP-7-6.0	11/07/2019 1:10 PM	11/08/2019 10:30 AM
1911101-020	DP-7-7.5	11/07/2019 1:15 PM	11/08/2019 10:30 AM
1911101-021	DP-8-1.0	11/07/2019 1:30 PM	11/08/2019 10:30 AM
1911101-022	DP-8-2.0	11/07/2019 1:35 PM	11/08/2019 10:30 AM
1911101-023	DP-8-5.0	11/07/2019 1:40 PM	11/08/2019 10:30 AM
1911101-024	DP-8-7.0	11/07/2019 1:45 PM	11/08/2019 10:30 AM

Note: If no "Time Collected" is supplied, a default of 12:00AM is assigned

Fremont Analytical

Case Narrative

WO#: **1911101**

Date: **11/15/2019**

CLIENT: GeoEngineers
Project: UW Bothell - STEM Building

I. SAMPLE RECEIPT:
Samples receipt information is recorded on the attached Sample Receipt Checklist.

II. GENERAL REPORTING COMMENTS:
Results are reported on a wet weight basis unless dry-weight correction is denoted in the units field on the analytical report ("mg/kg-dry" or "ug/kg-dry").

Matrix Spike (MS) and MS Duplicate (MSD) samples are tested from an analytical batch of "like" matrix to check for possible matrix effect. The MS and MSD will provide site specific matrix data only for those samples which are spiked by the laboratory. The sample chosen for spike purposes may or may not have been a sample submitted in this sample delivery group. The validity of the analytical procedures for which data is reported in this analytical report is determined by the Laboratory Control Sample (LCS) and the Method Blank (MB). The LCS and the MB are processed with the samples and the MS/MSD to ensure method criteria are achieved throughout the entire analytical process.

III. ANALYSES AND EXCEPTIONS:
Exceptions associated with this report will be footnoted in the analytical results page(s) or the quality control summary page(s) and/or noted below.

Qualifiers:

* - Flagged value is not within established control limits
B - Analyte detected in the associated Method Blank
D - Dilution was required
E - Value above quantitation range
H - Holding times for preparation or analysis exceeded
I - Analyte with an internal standard that does not meet established acceptance criteria
J - Analyte detected below Reporting Limit
N - Tentatively Identified Compound (TIC)
Q - Analyte with an initial or continuing calibration that does not meet established acceptance criteria (<20%RSD, <20% Drift or minimum RRF)
S - Spike recovery outside accepted recovery limits
ND - Not detected at the Reporting Limit
R - High relative percent difference observed

Acronyms:

%Rec - Percent Recovery
CCB - Continued Calibration Blank
CCV - Continued Calibration Verification
DF - Dilution Factor
HEM - Hexane Extractable Material
ICV - Initial Calibration Verification
LCS/LCSD - Laboratory Control Sample / Laboratory Control Sample Duplicate
MB or MBLANK - Method Blank
MDL - Method Detection Limit
MS/MSD - Matrix Spike / Matrix Spike Duplicate
PDS - Post Digestion Spike
Ref Val - Reference Value
RL - Reporting Limit
RPD - Relative Percent Difference
SD - Serial Dilution
SGT - Silica Gel Treatment
SPK - Spike
Surr - Surrogate

Analytical Report

Work Order: **1911101**
Date Reported: **11/15/2019**

Client: GeoEngineers
Project: UW Bothell - STEM Building
Lab ID: 1911101-002
Client Sample ID: DP-1-2.5

Collection Date: 11/7/2019 9:20:00 AM
Matrix: Soil

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
Hydrocarbon Identification by NWTPH-HCID				Batch ID: 26485		Analyst: DW
Gasoline	ND	20.7		mg/Kg-dry	1	11/13/2019 2:01:23 PM
Mineral Spirits	ND	31.0		mg/Kg-dry	1	11/13/2019 2:01:23 PM
Kerosene	ND	51.7		mg/Kg-dry	1	11/13/2019 2:01:23 PM
Diesel (Fuel Oil)	ND	51.7		mg/Kg-dry	1	11/13/2019 2:01:23 PM
Heavy Oil	ND	103		mg/Kg-dry	1	11/13/2019 2:01:23 PM
Mineral Oil	ND	103		mg/Kg-dry	1	11/13/2019 2:01:23 PM
Surr: 2-Fluorobiphenyl	87.3	50 - 150		%Rec	1	11/13/2019 2:01:23 PM
Surr: o-Terphenyl	92.6	50 - 150		%Rec	1	11/13/2019 2:01:23 PM
Mercury by EPA Method 7471				Batch ID: 26522		Analyst: TN
Mercury	ND	0.261		mg/Kg-dry	1	11/15/2019 3:40:39 PM
Total Metals by EPA Method 6020B				Batch ID: 26475		Analyst: WC
Arsenic	2.42	0.209		mg/Kg-dry	1	11/14/2019 7:23:31 PM
Barium	65.7	0.418		mg/Kg-dry	1	11/14/2019 7:23:31 PM
Cadmium	ND	0.167		mg/Kg-dry	1	11/14/2019 7:23:31 PM
Chromium	33.7	0.0836		mg/Kg-dry	1	11/14/2019 7:23:31 PM
Lead	1.67	0.167		mg/Kg-dry	1	11/14/2019 7:23:31 PM
Selenium	0.579	0.418		mg/Kg-dry	1	11/14/2019 7:23:31 PM
Silver	ND	0.0836		mg/Kg-dry	1	11/14/2019 7:23:31 PM
Sample Moisture (Percent Moisture)				Batch ID: R55276		Analyst: SBM
Percent Moisture	8.04	0.500		wt%	1	11/13/2019 1:18:41 PM

Client: GeoEngineers
Collection Date: 11/7/2019 11:35:00 AM
Project: UW Bothell - STEM Building
Lab ID: 1911101-003
Matrix: Soil
Client Sample ID: DP-2-2.5

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
Hydrocarbon Identification by NWTPH-HCID				Batch ID: 26485		Analyst: DW
Gasoline	ND	25.8		mg/Kg-dry	1	11/13/2019 3:01:09 PM
Mineral Spirits	ND	38.7		mg/Kg-dry	1	11/13/2019 3:01:09 PM
Kerosene	ND	64.6		mg/Kg-dry	1	11/13/2019 3:01:09 PM
Diesel (Fuel Oil)	ND	64.6		mg/Kg-dry	1	11/13/2019 3:01:09 PM
Heavy Oil	ND	129		mg/Kg-dry	1	11/13/2019 3:01:09 PM
Mineral Oil	ND	129		mg/Kg-dry	1	11/13/2019 3:01:09 PM
Surr: 2-Fluorobiphenyl	82.9	50 - 150		%Rec	1	11/13/2019 3:01:09 PM
Surr: o-Terphenyl	95.4	50 - 150		%Rec	1	11/13/2019 3:01:09 PM
Mercury by EPA Method 7471				Batch ID: 26522		Analyst: TN
Mercury	ND	0.309		mg/Kg-dry	1	11/15/2019 3:42:14 PM
Total Metals by EPA Method 6020B				Batch ID: 26475		Analyst: WC
Arsenic	7.60	0.260		mg/Kg-dry	1	11/14/2019 7:29:08 PM
Barium	141	0.520		mg/Kg-dry	1	11/14/2019 7:29:08 PM
Cadmium	ND	0.208		mg/Kg-dry	1	11/14/2019 7:29:08 PM
Chromium	91.5	0.104		mg/Kg-dry	1	11/14/2019 7:29:08 PM
Lead	5.38	0.208		mg/Kg-dry	1	11/14/2019 7:29:08 PM
Selenium	1.09	0.520		mg/Kg-dry	1	11/14/2019 7:29:08 PM
Silver	0.105	0.104		mg/Kg-dry	1	11/14/2019 7:29:08 PM
Sample Moisture (Percent Moisture)				Batch ID: R55276		Analyst: SBM
Percent Moisture	23.7	0.500		wt%	1	11/13/2019 1:18:41 PM

Analytical Report

Work Order: **1911101**
Date Reported: **11/15/2019**

Client: GeoEngineers
Project: UW Bothell - STEM Building
Lab ID: 1911101-004
Client Sample ID: DP-2-5.0

Collection Date: 11/7/2019 11:40:00 AM
Matrix: Soil

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
Hydrocarbon Identification by NWTPH-HCID				Batch ID: 26485		Analyst: DW
Gasoline	ND	19.9		mg/Kg-dry	1	11/13/2019 3:31:37 PM
Mineral Spirits	ND	29.9		mg/Kg-dry	1	11/13/2019 3:31:37 PM
Kerosene	ND	49.8		mg/Kg-dry	1	11/13/2019 3:31:37 PM
Diesel (Fuel Oil)	ND	49.8		mg/Kg-dry	1	11/13/2019 3:31:37 PM
Heavy Oil	ND	99.6		mg/Kg-dry	1	11/13/2019 3:31:37 PM
Mineral Oil	ND	99.6		mg/Kg-dry	1	11/13/2019 3:31:37 PM
Surr: 2-Fluorobiphenyl	86.9	50 - 150		%Rec	1	11/13/2019 3:31:37 PM
Surr: o-Terphenyl	93.7	50 - 150		%Rec	1	11/13/2019 3:31:37 PM
Mercury by EPA Method 7471				Batch ID: 26522		Analyst: TN
Mercury	ND	0.286		mg/Kg-dry	1	11/15/2019 3:43:50 PM
Total Metals by EPA Method 6020B				Batch ID: 26475		Analyst: WC
Arsenic	7.63	0.213		mg/Kg-dry	1	11/14/2019 7:34:45 PM
Cadmium	ND	0.170		mg/Kg-dry	1	11/14/2019 7:34:45 PM
Chromium	44.0	0.0850		mg/Kg-dry	1	11/14/2019 7:34:45 PM
Lead	2.28	0.170		mg/Kg-dry	1	11/14/2019 7:34:45 PM
Sample Moisture (Percent Moisture)				Batch ID: R55276		Analyst: SBM
Percent Moisture	10.9	0.500		wt%	1	11/13/2019 1:18:41 PM

Analytical Report

Work Order: **1911101**
Date Reported: **11/15/2019**

Client: GeoEngineers
Collection Date: 11/7/2019 11:10:00 AM
Project: UW Bothell - STEM Building
Lab ID: 1911101-007
Matrix: Soil
Client Sample ID: **DP-3-2.5**

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
Hydrocarbon Identification by NWTPH-HCID				Batch ID: 26485		Analyst: DW
Gasoline	ND	19.8		mg/Kg-dry	1	11/13/2019 4:01:28 PM
Mineral Spirits	ND	29.8		mg/Kg-dry	1	11/13/2019 4:01:28 PM
Kerosene	ND	49.6		mg/Kg-dry	1	11/13/2019 4:01:28 PM
Diesel (Fuel Oil)	ND	49.6		mg/Kg-dry	1	11/13/2019 4:01:28 PM
Heavy Oil	ND	99.2		mg/Kg-dry	1	11/13/2019 4:01:28 PM
Mineral Oil	ND	99.2		mg/Kg-dry	1	11/13/2019 4:01:28 PM
Surr: 2-Fluorobiphenyl	84.8	50 - 150		%Rec	1	11/13/2019 4:01:28 PM
Surr: o-Terphenyl	90.3	50 - 150		%Rec	1	11/13/2019 4:01:28 PM
Mercury by EPA Method 7471				Batch ID: 26522		Analyst: TN
Mercury	ND	0.254		mg/Kg-dry	1	11/15/2019 3:45:26 PM
Total Metals by EPA Method 6020B				Batch ID: 26475		Analyst: WC
Arsenic	3.65	0.212		mg/Kg-dry	1	11/14/2019 7:40:23 PM
Cadmium	ND	0.169		mg/Kg-dry	1	11/14/2019 7:40:23 PM
Chromium	40.4	0.0846		mg/Kg-dry	1	11/14/2019 7:40:23 PM
Lead	2.35	0.169		mg/Kg-dry	1	11/14/2019 7:40:23 PM
Sample Moisture (Percent Moisture)				Batch ID: R55276		Analyst: SBM
Percent Moisture	5.46	0.500		wt%	1	11/13/2019 1:18:41 PM

Analytical Report

Work Order: **1911101**
Date Reported: **11/15/2019**

Client: GeoEngineers
Project: UW Bothell - STEM Building
Lab ID: 1911101-009
Client Sample ID: **DP-4-2.0**

Collection Date: 11/7/2019 10:10:00 AM
Matrix: Soil

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
Hydrocarbon Identification by NWTPH-HCID				Batch ID: 26485		Analyst: DW
Gasoline	ND	21.5		mg/Kg-dry	1	11/13/2019 4:31:22 PM
Mineral Spirits	ND	32.2		mg/Kg-dry	1	11/13/2019 4:31:22 PM
Kerosene	ND	53.6		mg/Kg-dry	1	11/13/2019 4:31:22 PM
Diesel (Fuel Oil)	ND	53.6		mg/Kg-dry	1	11/13/2019 4:31:22 PM
Heavy Oil	ND	107		mg/Kg-dry	1	11/13/2019 4:31:22 PM
Mineral Oil	ND	107		mg/Kg-dry	1	11/13/2019 4:31:22 PM
Surr: 2-Fluorobiphenyl	84.9	50 - 150		%Rec	1	11/13/2019 4:31:22 PM
Surr: o-Terphenyl	92.2	50 - 150		%Rec	1	11/13/2019 4:31:22 PM
Mercury by EPA Method 7471				Batch ID: 26522		Analyst: TN
Mercury	ND	0.277		mg/Kg-dry	1	11/15/2019 3:50:24 PM
Total Metals by EPA Method 6020B				Batch ID: 26475		Analyst: WC
Arsenic	4.52	0.229		mg/Kg-dry	1	11/14/2019 7:46:01 PM
Barium	78.4	0.458		mg/Kg-dry	1	11/14/2019 7:46:01 PM
Cadmium	ND	0.183		mg/Kg-dry	1	11/14/2019 7:46:01 PM
Chromium	52.6	0.0917		mg/Kg-dry	1	11/14/2019 7:46:01 PM
Lead	2.99	0.183		mg/Kg-dry	1	11/14/2019 7:46:01 PM
Selenium	0.900	0.458		mg/Kg-dry	1	11/14/2019 7:46:01 PM
Silver	ND	0.0917		mg/Kg-dry	1	11/14/2019 7:46:01 PM
Sample Moisture (Percent Moisture)				Batch ID: R55276		Analyst: SBM
Percent Moisture	14.8	0.500		wt%	1	11/13/2019 1:18:41 PM

Analytical Report

Work Order: **1911101**
Date Reported: **11/15/2019**

Client: GeoEngineers
Project: UW Bothell - STEM Building
Lab ID: 1911101-010
Client Sample ID: **DP-4-5.0**
Collection Date: 11/7/2019 10:20:00 AM
Matrix: Soil

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
Hydrocarbon Identification by NWTPH-HCID				Batch ID: 26485		Analyst: DW
Gasoline	ND	21.0		mg/Kg-dry	1	11/13/2019 5:01:37 PM
Mineral Spirits	ND	31.5		mg/Kg-dry	1	11/13/2019 5:01:37 PM
Kerosene	ND	52.6		mg/Kg-dry	1	11/13/2019 5:01:37 PM
Diesel (Fuel Oil)	ND	52.6		mg/Kg-dry	1	11/13/2019 5:01:37 PM
Heavy Oil	ND	105		mg/Kg-dry	1	11/13/2019 5:01:37 PM
Mineral Oil	ND	105		mg/Kg-dry	1	11/13/2019 5:01:37 PM
Surr: 2-Fluorobiphenyl	90.2	50 - 150		%Rec	1	11/13/2019 5:01:37 PM
Surr: o-Terphenyl	97.2	50 - 150		%Rec	1	11/13/2019 5:01:37 PM
Mercury by EPA Method 7471				Batch ID: 26522		Analyst: TN
Mercury	ND	0.249		mg/Kg-dry	1	11/15/2019 3:52:01 PM
Total Metals by EPA Method 6020B				Batch ID: 26475		Analyst: WC
Arsenic	3.12	0.227		mg/Kg-dry	1	11/14/2019 7:50:38 PM
Cadmium	ND	0.182		mg/Kg-dry	1	11/14/2019 7:50:38 PM
Chromium	36.8	0.0910		mg/Kg-dry	1	11/14/2019 7:50:38 PM
Lead	2.45	0.182		mg/Kg-dry	1	11/14/2019 7:50:38 PM
Sample Moisture (Percent Moisture)				Batch ID: R55276		Analyst: SBM
Percent Moisture	13.4	0.500		wt%	1	11/13/2019 1:18:41 PM

Analytical Report

Work Order: **1911101**
Date Reported: **11/15/2019**

Client: GeoEngineers
Collection Date: 11/7/2019 9:55:00 AM
Project: UW Bothell - STEM Building
Lab ID: 1911101-013
Matrix: Soil
Client Sample ID: DP-5-1.5

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
Hydrocarbon Identification by NWTPH-HCID				Batch ID: 26485		Analyst: DW
Gasoline	ND	20.8		mg/Kg-dry	1	11/13/2019 7:02:25 PM
Mineral Spirits	ND	31.1		mg/Kg-dry	1	11/13/2019 7:02:25 PM
Kerosene	ND	51.9		mg/Kg-dry	1	11/13/2019 7:02:25 PM
Diesel (Fuel Oil)	ND	51.9		mg/Kg-dry	1	11/13/2019 7:02:25 PM
Heavy Oil	ND	104		mg/Kg-dry	1	11/13/2019 7:02:25 PM
Mineral Oil	ND	104		mg/Kg-dry	1	11/13/2019 7:02:25 PM
Surr: 2-Fluorobiphenyl	90.3	50 - 150		%Rec	1	11/13/2019 7:02:25 PM
Surr: o-Terphenyl	93.7	50 - 150		%Rec	1	11/13/2019 7:02:25 PM
Mercury by EPA Method 7471				Batch ID: 26522		Analyst: TN
Mercury	ND	0.234		mg/Kg-dry	1	11/15/2019 3:53:38 PM
Total Metals by EPA Method 6020B				Batch ID: 26475		Analyst: WC
Arsenic	3.79	0.221		mg/Kg-dry	1	11/14/2019 7:55:16 PM
Cadmium	ND	0.177		mg/Kg-dry	1	11/14/2019 7:55:16 PM
Chromium	39.0	0.0884		mg/Kg-dry	1	11/14/2019 7:55:16 PM
Lead	2.67	0.177		mg/Kg-dry	1	11/14/2019 7:55:16 PM
Sample Moisture (Percent Moisture)				Batch ID: R55276		Analyst: SBM
Percent Moisture	9.54	0.500		wt%	1	11/13/2019 1:18:41 PM

Analytical Report

Work Order: **1911101**
Date Reported: **11/15/2019**

Client: GeoEngineers
Project: UW Bothell - STEM Building
Lab ID: 1911101-014
Client Sample ID: **DP-6-2.5**

Collection Date: 11/7/2019 12:15:00 PM
Matrix: Soil

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
Hydrocarbon Identification by NWTPH-HCID				Batch ID: 26485		Analyst: DW
Gasoline	ND	20.1		mg/Kg-dry	1	11/13/2019 7:32:39 PM
Mineral Spirits	ND	30.1		mg/Kg-dry	1	11/13/2019 7:32:39 PM
Kerosene	ND	50.2		mg/Kg-dry	1	11/13/2019 7:32:39 PM
Diesel (Fuel Oil)	ND	50.2		mg/Kg-dry	1	11/13/2019 7:32:39 PM
Heavy Oil	ND	100		mg/Kg-dry	1	11/13/2019 7:32:39 PM
Mineral Oil	ND	100		mg/Kg-dry	1	11/13/2019 7:32:39 PM
Surr: 2-Fluorobiphenyl	80.5	50 - 150		%Rec	1	11/13/2019 7:32:39 PM
Surr: o-Terphenyl	86.7	50 - 150		%Rec	1	11/13/2019 7:32:39 PM
Mercury by EPA Method 7471				Batch ID: 26522		Analyst: TN
Mercury	ND	0.253		mg/Kg-dry	1	11/15/2019 3:55:17 PM
Total Metals by EPA Method 6020B				Batch ID: 26475		Analyst: WC
Arsenic	1.91	0.214		mg/Kg-dry	1	11/14/2019 7:59:53 PM
Cadmium	ND	0.171		mg/Kg-dry	1	11/14/2019 7:59:53 PM
Chromium	42.3	0.0855		mg/Kg-dry	1	11/14/2019 7:59:53 PM
Lead	2.00	0.171		mg/Kg-dry	1	11/14/2019 7:59:53 PM
Sample Moisture (Percent Moisture)				Batch ID: R55276		Analyst: SBM
Percent Moisture	8.64	0.500		wt%	1	11/13/2019 1:18:41 PM

Analytical Report

Work Order: **1911101**
Date Reported: **11/15/2019**

Client: GeoEngineers
Project: UW Bothell - STEM Building
Lab ID: 1911101-017
Client Sample ID: **DP-7-1.0**
Collection Date: 11/7/2019 12:55:00 PM
Matrix: Soil

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
Hydrocarbon Identification by NWTPH-HCID				Batch ID: 26485		Analyst: DW
Gasoline	ND	25.1		mg/Kg-dry	1	11/13/2019 8:02:47 PM
Mineral Spirits	ND	37.7		mg/Kg-dry	1	11/13/2019 8:02:47 PM
Kerosene	ND	62.9		mg/Kg-dry	1	11/13/2019 8:02:47 PM
Diesel (Fuel Oil)	ND	62.9		mg/Kg-dry	1	11/13/2019 8:02:47 PM
Heavy Oil	ND	126		mg/Kg-dry	1	11/13/2019 8:02:47 PM
Mineral Oil	ND	126		mg/Kg-dry	1	11/13/2019 8:02:47 PM
Surr: 2-Fluorobiphenyl	74.5	50 - 150		%Rec	1	11/13/2019 8:02:47 PM
Surr: o-Terphenyl	81.3	50 - 150		%Rec	1	11/13/2019 8:02:47 PM
Mercury by EPA Method 7471				Batch ID: 26522		Analyst: TN
Mercury	ND	0.302		mg/Kg-dry	1	11/15/2019 3:56:52 PM
Total Metals by EPA Method 6020B				Batch ID: 26475		Analyst: WC
Arsenic	6.04	0.264		mg/Kg-dry	1	11/14/2019 8:04:31 PM
Cadmium	ND	0.212		mg/Kg-dry	1	11/14/2019 8:04:31 PM
Chromium	57.9	0.106		mg/Kg-dry	1	11/14/2019 8:04:31 PM
Lead	5.69	0.212		mg/Kg-dry	1	11/14/2019 8:04:31 PM
Sample Moisture (Percent Moisture)				Batch ID: R55276		Analyst: SBM
Percent Moisture	26.1	0.500		wt%	1	11/13/2019 1:18:41 PM

Analytical Report

Work Order: **1911101**
Date Reported: **11/15/2019**

Client: GeoEngineers
Collection Date: 11/7/2019 1:00:00 PM
Project: UW Bothell - STEM Building
Lab ID: 1911101-018
Matrix: Soil
Client Sample ID: DP-7-2.5

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
Hydrocarbon Identification by NWTPH-HCID				Batch ID: 26485		Analyst: DW
Gasoline	ND	23.8		mg/Kg-dry	1	11/13/2019 8:32:59 PM
Mineral Spirits	ND	35.7		mg/Kg-dry	1	11/13/2019 8:32:59 PM
Kerosene	ND	59.5		mg/Kg-dry	1	11/13/2019 8:32:59 PM
Diesel (Fuel Oil)	ND	59.5		mg/Kg-dry	1	11/13/2019 8:32:59 PM
Heavy Oil	ND	119		mg/Kg-dry	1	11/13/2019 8:32:59 PM
Mineral Oil	ND	119		mg/Kg-dry	1	11/13/2019 8:32:59 PM
Surr: 2-Fluorobiphenyl	82.2	50 - 150		%Rec	1	11/13/2019 8:32:59 PM
Surr: o-Terphenyl	92.8	50 - 150		%Rec	1	11/13/2019 8:32:59 PM
Mercury by EPA Method 7471				Batch ID: 26522		Analyst: TN
Mercury	ND	0.326		mg/Kg-dry	1	11/15/2019 3:58:28 PM
Total Metals by EPA Method 6020B				Batch ID: 26475		Analyst: WC
Arsenic	8.85	0.264		mg/Kg-dry	1	11/14/2019 8:09:08 PM
Cadmium	ND	0.211		mg/Kg-dry	1	11/14/2019 8:09:08 PM
Chromium	89.5	0.106		mg/Kg-dry	1	11/14/2019 8:09:08 PM
Lead	7.66	0.211		mg/Kg-dry	1	11/14/2019 8:09:08 PM
Sample Moisture (Percent Moisture)				Batch ID: R55276		Analyst: SBM
Percent Moisture	24.8	0.500		wt%	1	11/13/2019 1:18:41 PM

Analytical Report

Work Order: **1911101**
Date Reported: **11/15/2019**

Client: GeoEngineers
Project: UW Bothell - STEM Building
Lab ID: 1911101-021
Client Sample ID: DP-8-1.0
Collection Date: 11/7/2019 1:30:00 PM
Matrix: Soil

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
Hydrocarbon Identification by NWTPH-HCID				Batch ID: 26485		Analyst: DW
Gasoline	ND	21.1		mg/Kg-dry	1	11/13/2019 9:03:03 PM
Mineral Spirits	ND	31.7		mg/Kg-dry	1	11/13/2019 9:03:03 PM
Kerosene	ND	52.8		mg/Kg-dry	1	11/13/2019 9:03:03 PM
Diesel (Fuel Oil)	ND	52.8		mg/Kg-dry	1	11/13/2019 9:03:03 PM
Heavy Oil	ND	106		mg/Kg-dry	1	11/13/2019 9:03:03 PM
Mineral Oil	ND	106		mg/Kg-dry	1	11/13/2019 9:03:03 PM
Surr: 2-Fluorobiphenyl	81.6	50 - 150		%Rec	1	11/13/2019 9:03:03 PM
Surr: o-Terphenyl	86.7	50 - 150		%Rec	1	11/13/2019 9:03:03 PM
Mercury by EPA Method 7471				Batch ID: 26522		Analyst: TN
Mercury	ND	0.237		mg/Kg-dry	1	11/15/2019 4:00:05 PM
Total Metals by EPA Method 6020B				Batch ID: 26475		Analyst: WC
Arsenic	4.56	0.212		mg/Kg-dry	1	11/15/2019 1:14:24 PM
Barium	58.1	0.425		mg/Kg-dry	1	11/14/2019 8:23:02 PM
Cadmium	ND	0.170		mg/Kg-dry	1	11/14/2019 8:23:02 PM
Chromium	34.2	0.0849		mg/Kg-dry	1	11/14/2019 8:23:02 PM
Lead	3.50	0.170		mg/Kg-dry	1	11/14/2019 8:23:02 PM
Selenium	0.583	0.425		mg/Kg-dry	1	11/14/2019 8:23:02 PM
Silver	ND	0.0849		mg/Kg-dry	1	11/14/2019 8:23:02 PM
Sample Moisture (Percent Moisture)				Batch ID: R55276		Analyst: SBM
Percent Moisture	7.30	0.500		wt%	1	11/13/2019 1:18:41 PM

Analytical Report

Work Order: **1911101**
Date Reported: **11/15/2019**

Client: GeoEngineers
Project: UW Bothell - STEM Building
Lab ID: 1911101-022
Client Sample ID: DP-8-2.0
Collection Date: 11/7/2019 1:35:00 PM
Matrix: Soil

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
Hydrocarbon Identification by NWTPH-HCID				Batch ID: 26485		Analyst: DW
Gasoline	ND	19.8		mg/Kg-dry	1	11/13/2019 9:33:16 PM
Mineral Spirits	ND	29.7		mg/Kg-dry	1	11/13/2019 9:33:16 PM
Kerosene	ND	49.6		mg/Kg-dry	1	11/13/2019 9:33:16 PM
Diesel (Fuel Oil)	ND	49.6		mg/Kg-dry	1	11/13/2019 9:33:16 PM
Heavy Oil	ND	99.2		mg/Kg-dry	1	11/13/2019 9:33:16 PM
Mineral Oil	ND	99.2		mg/Kg-dry	1	11/13/2019 9:33:16 PM
Surr: 2-Fluorobiphenyl	77.9	50 - 150		%Rec	1	11/13/2019 9:33:16 PM
Surr: o-Terphenyl	84.6	50 - 150		%Rec	1	11/13/2019 9:33:16 PM
Mercury by EPA Method 7471				Batch ID: 26522		Analyst: TN
Mercury	ND	0.230		mg/Kg-dry	1	11/15/2019 4:01:41 PM
Total Metals by EPA Method 6020B				Batch ID: 26475		Analyst: WC
Arsenic	4.17	0.207		mg/Kg-dry	1	11/15/2019 1:20:01 PM
Cadmium	ND	0.165		mg/Kg-dry	1	11/14/2019 8:27:40 PM
Chromium	30.8	0.0827		mg/Kg-dry	1	11/14/2019 8:27:40 PM
Lead	3.31	0.165		mg/Kg-dry	1	11/14/2019 8:27:40 PM
Sample Moisture (Percent Moisture)				Batch ID: R55276		Analyst: SBM
Percent Moisture	4.78	0.500		wt%	1	11/13/2019 1:18:41 PM

Work Order: 1911101
CLIENT: GeoEngineers
Project: UW Bothell - STEM Building

QC SUMMARY REPORT

Total Metals by EPA Method 6020B

Sample ID **MB-26475** | SampType: **MBLK** | Units: **mg/Kg** | Prep Date: **11/12/2019** | RunNo: **55329**
Client ID: **MBLKS** | Batch ID: **26475** | Analysis Date: **11/14/2019** | SeqNo: **1100073**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Arsenic	ND	0.198									
Barium	ND	0.397									
Cadmium	ND	0.159									
Chromium	ND	0.0794									
Lead	ND	0.159									
Selenium	ND	0.397									
Silver	ND	0.0794									

Sample ID **LCS-26475** | SampType: **LCS** | Units: **mg/Kg** | Prep Date: **11/12/2019** | RunNo: **55329**
Client ID: **LCSS** | Batch ID: **26475** | Analysis Date: **11/14/2019** | SeqNo: **1100074**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Arsenic	40.8	0.195	39.06	0	105	80	120				
Barium	39.6	0.391	39.06	0	101	80	120				
Cadmium	2.04	0.156	1.953	0	104	80	120				
Chromium	40.8	0.0781	39.06	0	104	80	120				
Lead	19.3	0.156	19.53	0	99.0	80	120				
Selenium	3.95	0.391	3.906	0	101	80	120				
Silver	9.95	0.0781	9.766	0	102	80	120				

Sample ID **1911095-001ADUP** | SampType: **DUP** | Units: **mg/Kg-dry** | Prep Date: **11/12/2019** | RunNo: **55329**
Client ID: **BATCH** | Batch ID: **26475** | Analysis Date: **11/14/2019** | SeqNo: **1100076**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Arsenic	6.42	0.236						5.408	17.1	20	
Barium	107	0.473						102.6	4.12	20	
Cadmium	ND	0.189						0		20	
Chromium	33.5	0.0946						37.55	11.4	20	
Lead	7.81	0.189						7.281	6.97	20	
Selenium	0.816	0.473						0.7394	9.87	20	

Date: *11/15/2019*

Work Order: 1911101
CLIENT: GeoEngineers
Project: UW Bothell - STEM Building

QC SUMMARY REPORT

Total Metals by EPA Method 6020B

Sample ID **1911095-001ADUP** SampType: **DUP** Units: **mg/Kg-dry** Prep Date: **11/12/2019** RunNo: **55329**
Client ID: **BATCH** Batch ID: **26475** Analysis Date: **11/14/2019** SeqNo: **1100076**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual

Sample ID **1911095-001AMS** SampType: **MS** Units: **mg/Kg-dry** Prep Date: **11/12/2019** RunNo: **55329**
Client ID: **BATCH** Batch ID: **26475** Analysis Date: **11/14/2019** SeqNo: **1100078**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Arsenic	57.6	0.235	46.91	5.408	111	75	125				
Barium	159	0.469	46.91	102.6	120	75	125				
Cadmium	2.66	0.188	2.346	0.1126	109	75	125				
Chromium	86.7	0.0938	46.91	37.55	105	75	125				
Lead	30.0	0.188	23.46	7.281	96.8	75	125				
Selenium	5.26	0.469	4.691	0.7394	96.3	75	125				
Silver	11.4	0.0938	11.73	0.1359	95.8	75	125				

Sample ID **1911095-001AMSD** SampType: **MSD** Units: **mg/Kg-dry** Prep Date: **11/12/2019** RunNo: **55329**
Client ID: **BATCH** Batch ID: **26475** Analysis Date: **11/14/2019** SeqNo: **1100079**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Arsenic	57.5	0.236	47.29	5.408	110	75	125	57.57	0.179	20	
Barium	163	0.473	47.29	102.6	127	75	125	159.0	2.22	20	S
Cadmium	2.74	0.189	2.364	0.1126	111	75	125	2.662	2.94	20	
Chromium	83.1	0.0946	47.29	37.55	96.3	75	125	86.66	4.22	20	
Lead	30.7	0.189	23.64	7.281	99.1	75	125	30.00	2.34	20	
Selenium	5.49	0.473	4.729	0.7394	101	75	125	5.256	4.41	20	
Silver	11.8	0.0946	11.82	0.1359	98.8	75	125	11.37	3.89	20	

NOTES:
S - Outlying spike recovery(ies) observed. A duplicate analysis was performed and recovered within range.

Fremont Analytical

Date: *11/15/2019*

Work Order: 1911101
CLIENT: GeoEngineers
Project: UW Bothell - STEM Building

QC SUMMARY REPORT

Total Metals by EPA Method 6020B

Sample ID **1911095-001ADUP**	SampType: **DUP**		Units: **mg/Kg-dry**		Prep Date: **11/12/2019**		RunNo: **55329**				
Client ID: **BATCH**	Batch ID: **26475**				Analysis Date: **11/15/2019**		SeqNo: **1100381**				
Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Silver	ND	0.0946						0.09485	27.4	20	

Work Order: 1911101
CLIENT: GeoEngineers
Project: UW Bothell - STEM Building

QC SUMMARY REPORT

Mercury by EPA Method 7471

Sample ID **MB-26522** SampType: **MBLK** Units: **mg/Kg** Prep Date: **11/15/2019** RunNo: **55350**
Client ID: **MBLKS** Batch ID: **26522** Analysis Date: **11/15/2019** SeqNo: **1100669**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Mercury	ND	0.240									

Sample ID **LCS-26522** SampType: **LCS** Units: **mg/Kg** Prep Date: **11/15/2019** RunNo: **55350**
Client ID: **LCSS** Batch ID: **26522** Analysis Date: **11/15/2019** SeqNo: **1100670**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Mercury	0.442	0.223	0.4464	0	99.0	80	120				

Sample ID **1911095-001ADUP** SampType: **DUP** Units: **mg/Kg-dry** Prep Date: **11/15/2019** RunNo: **55350**
Client ID: **BATCH** Batch ID: **26522** Analysis Date: **11/15/2019** SeqNo: **1100672**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Mercury	ND	0.290						0		20	

Sample ID **1911095-001AMS** SampType: **MS** Units: **mg/Kg-dry** Prep Date: **11/15/2019** RunNo: **55350**
Client ID: **BATCH** Batch ID: **26522** Analysis Date: **11/15/2019** SeqNo: **1100674**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Mercury	0.599	0.279	0.5576	0.03475	101	70	130				

Sample ID **1911095-001AMSD** SampType: **MSD** Units: **mg/Kg-dry** Prep Date: **11/15/2019** RunNo: **55350**
Client ID: **BATCH** Batch ID: **26522** Analysis Date: **11/15/2019** SeqNo: **1100676**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Mercury	0.601	0.284	0.5683	0.03475	99.7	70	130	0.5989	0.404	20	

Date: *11/15/2019*

Work Order: 1911101
CLIENT: GeoEngineers
Project: UW Bothell - STEM Building

QC SUMMARY REPORT

Hydrocarbon Identification by NWTPH-HCID

Sample ID **MB-26485** SampType: **MBLK** Units: **mg/Kg** Prep Date: **11/13/2019** RunNo: **55291**
Client ID: **MBLKS** Batch ID: **26485** Analysis Date: **11/13/2019** SeqNo: **1099102**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Gasoline	ND	20.0									
Mineral Spirits	ND	30.0									
Kerosene	ND	50.0									
Diesel (Fuel Oil)	ND	50.0									
Heavy Oil	ND	100									
Mineral Oil	ND	100									
Surr: 2-Fluorobiphenyl	17.1		20.00		85.3	50	150				
Surr: o-Terphenyl	18.5		20.00		92.4	50	150				

Sample ID **LCS-26485** SampType: **LCS** Units: **mg/Kg** Prep Date: **11/13/2019** RunNo: **55291**
Client ID: **LCSS** Batch ID: **26485** Analysis Date: **11/13/2019** SeqNo: **1099103**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Diesel (Fuel Oil)	590	50.0	500.0	0	118	65	135				
Surr: 2-Fluorobiphenyl	19.6		20.00		97.8	50	150				
Surr: o-Terphenyl	18.4		20.00		91.9	50	150				

Sample ID **1911101-002ADUP** SampType: **DUP** Units: **mg/Kg-dry** Prep Date: **11/13/2019** RunNo: **55291**
Client ID: **DP-1-2.5** Batch ID: **26485** Analysis Date: **11/13/2019** SeqNo: **1099105**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Gasoline	ND	20.7						0		30	
Mineral Spirits	ND	31.1						0		30	
Kerosene	ND	51.8						0		30	
Diesel (Fuel Oil)	ND	51.8						0		30	
Heavy Oil	ND	104						0		30	
Mineral Oil	ND	104						0		30	
Surr: 2-Fluorobiphenyl	18.0		20.71		87.1	50	150		0		
Surr: o-Terphenyl	19.2		20.71		92.7	50	150		0		

Date: *11/15/2019*

Work Order: 1911101
CLIENT: GeoEngineers
Project: UW Bothell - STEM Building

QC SUMMARY REPORT

Sample Moisture (Percent Moisture)

Sample ID **1911101-004ADUP** SampType: **DUP** Units: **wt%** Prep Date: **11/13/2019** RunNo: **55276**
Client ID: **DP-2-5.0** Batch ID: **R55276** Analysis Date: **11/13/2019** SeqNo: **1098885**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Percent Moisture	10.9	0.500						10.88	0.113	20	

Sample ID **1911096-002ADUP** SampType: **DUP** Units: **wt%** Prep Date: **11/13/2019** RunNo: **55276**
Client ID: **BATCH** Batch ID: **R55276** Analysis Date: **11/13/2019** SeqNo: **1098900**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Percent Moisture	20.8	0.500						19.62	5.91	20	

Sample Log-In Check List

Client Name:	**GEI**	Work Order Number:	**1911101**
Logged by:	**Clare Griggs**	Date Received:	**11/8/2019 10:30:00 AM**

Chain of Custody

1. Is Chain of Custody complete? — Yes ☑ No ☐ Not Present ☐
2. How was the sample delivered? — Client

Log In

3. Coolers are present? — Yes ☑ No ☐ NA ☐
4. Shipping container/cooler in good condition? — Yes ☑ No ☐
5. Custody Seals present on shipping container/cooler? (Refer to comments for Custody Seals not intact) — Yes ☐ No ☐ Not Required ☑
6. Was an attempt made to cool the samples? — Yes ☑ No ☐ NA ☐
7. Were all items received at a temperature of >0°C to 10.0°C* — Yes ☑ No ☐ NA ☐
8. Sample(s) in proper container(s)? — Yes ☑ No ☐
9. Sufficient sample volume for indicated test(s)? — Yes ☑ No ☐
10. Are samples properly preserved? — Yes ☑ No ☐
11. Was preservative added to bottles? — Yes ☐ No ☑ NA ☐
12. Is there headspace in the VOA vials? — Yes ☐ No ☐ NA ☑
13. Did all samples containers arrive in good condition(unbroken)? — Yes ☑ No ☐
14. Does paperwork match bottle labels? — Yes ☑ No ☐
15. Are matrices correctly identified on Chain of Custody? — Yes ☑ No ☐
16. Is it clear what analyses were requested? — Yes ☑ No ☐
17. Were all holding times able to be met? — Yes ☑ No ☐

Special Handling (if applicable)

18. Was client notified of all discrepancies with this order? — Yes ☐ No ☐ NA ☑

Person Notified: Date:

By Whom: Via: ☐ eMail ☐ Phone ☐ Fax ☐ In Person

Regarding:

Client Instructions:

19. Additional remarks:

Item Information

Item #	Temp ºC
Cooler	4.6
Sample	7.9
Temp Blank	7.2

* Note: DoD/ELAP and TNI require items to be received at 4°C +/- 2°C

Fremont Analytical
3600 Fremont Ave N.
Seattle, WA 98103
Tel: 206-352-3790
Fax: 206-352-7178

Chain of Custody Record & Laboratory Services Agreement

Date: 11/7/19 Page: 1 of: 3

Laboratory Project No (internal): 1911101

Client: GEI

Address:

City, State, Zip: Seattle, WA

Telephone:

Fax:

Project Name: UW Bothell-STEM Building

Project No: 0183-120-01

Collected by: CJG

Location:

Report To (PM): Chris Brown + Jim Roth

PM Email: CBrown@geoengineers.com

Special Remarks: Analyses added 11/8/19 per CJG @ Noon

Sample Disposal: ☐ Return to client ☐ Disposal by lab (after 30 days)

#	Sample Name	Sample Date	Sample Time	Sample Type (Matrix)*	VOCs (EPA 8260 / 624)	GX/BTEX	BTEX	Gasoline Range Organics (GX)	Hydrocarbon Identification (HCID)	Diesel/Heavy Oil Range Organics (DX)	SVOCs (EPA 8270 / 625)	PAHs (EPA 8270 - SIM)	PCBs (EPA 8082 / 608)	Metals** (EPA 6020 / 200.8)	Total (T) / Dissolved (D)	Anions (IC)***	EDB (8011)	HOLD	RCRA 8 Metals	MTCA 5 Metals	Comments
1	DP-1-1.0	11/7/19	0915	S														X			
2	DP-1-2.5	↓	0920	↓					X									↓	X		
3	DP-2-2.5	↓	1135	↓					X									↓	X		
4	DP-2-5.0	↓	1140	↓					X									↓		X	
5	DP-2-8.0	↓	1145	↓														↓			
6	DP-2-10.0	↓	1150	↓														↓			
7	DP-3-2.5	↓	1110	↓					X									↓		X	
8	DP-3-5.0	↓	1120	↓														↓			
9	DP-4-~~10~~2.0	↓	1010	↓					X									↓	X		
10	DP-4-5.0	↓	1020	↓					X									↓		X	

*Matrix: A = Air, AQ = Aqueous, B = Bulk, O = Other, P = Product, S = Soil, SD = Sediment, SL = Solid, W = Water, DW = Drinking Water, GW = Ground Water, SW = Storm Water, WW = Waste Water

**Metals (Circle): MTCA-5 RCRA-8 Priority Pollutants TAL *Individual:* Ag Al As B Ba Be Ca Cd Co Cr Cu Fe Hg K Mg Mn Mo Na Ni Pb Sb Se Sr Sn Ti Tl U V Zn

***Anions (Circle): Nitrate Nitrite Chloride Sulfate Bromide O-Phosphate Fluoride Nitrate+Nitrite

Turn-around Time: ☒ Standard ☐ 3 Day ☐ 2 Day ☐ Next Day Same Day ____ (specify)

I represent that I am authorized to enter into this Agreement with Fremont Analytical on behalf of the Client named above and that I have verified Client's agreement to each of the terms on the front and backside of this Agreement.

Relinquished	Date/Time	Received	Date/Time
x [signature]	1030/11/8/19	x [signature]	11/8/19 1030
x		x	

Fremont Analytical

3600 Fremont Ave N.
Seattle, WA 98103
Tel: 206-352-3790
Fax: 206-352-7178

Chain of Custody Record & Laboratory Services Agreement

Client: GEI
Address:
City, State, Zip: Seattle, WA
Telephone:
Fax:

Date: 11/7/19 Page: 2 of: 3
Project Name: UW Bothell - STEM Building
Project No: 0183-120-01
Collected by: CJG
Location:
Report To (PM):
PM Email:

Laboratory Project No (internal):
Special Remarks:
Sample Disposal: ☐ Return to client ☐ Disposal by lab (after 30 days)

#	Sample Name	Sample Date	Sample Time	Sample Type (Matrix)*	VOCs (EPA 8260 / 624)	GX/BTEX	BTEX	Gasoline Range Organics (GX)	Hydrocarbon Identification (HCID)	Diesel/Heavy Oil Range Organics (DX)	SVOCs (EPA 8270 / 625)	PAHs (EPA 8270 - SIM)	PCBs (EPA 8082 / 608)	Metals** (EPA 6020 / 200.8)	Total (T) / Dissolved (D)	Anions (IC)***	EDB (8011)	HOLD		MTCA5 Metals		Comments
1	DP-4-7.5	11/7/19	1030	S														X				
2	DP-4-10.0	↓	1040	↓														↓				
3	DP-5-1.5		0955						X											X		
4	DP-6-2.5		1215						X											X		
5	DP-6-5.0		1220																			
6	DP-6-7.5		1225																			
7	DP-7-1.0		1255						X											X		
8	DP-7-2.5		1300						X											X		
9	DP-7-6.0		1310																			
10	DP-7-7.5	↓	1315	↓														↓				

*Matrix: A = Air, AQ = Aqueous, B = Bulk, O = Other, P = Product, S = Soil, SD = Sediment, SL = Solid, W = Water, DW = Drinking Water, GW = Ground Water, SW = Storm Water, WW = Waste Water

**Metals (Circle): MTCA-5 RCRA-8 Priority Pollutants TAL *Individual:* Ag Al As B Ba Be Ca Cd Co Cr Cu Fe Hg K Mg Mn Mo Na Ni Pb Sb Se Sr Sn Ti Tl U V Zn

***Anions (Circle): Nitrate Nitrite Chloride Sulfate Bromide O-Phosphate Fluoride Nitrate+Nitrite

Turn-around Time:
☒ Standard
☐ 3 Day
☐ 2 Day
☐ Next Day
Same Day ____ (specify)

I represent that I am authorized to enter into this Agreement with Fremont Analytical on behalf of the Client named above and that I have verified Client's agreement to each of the terms on the front and backside of this Agreement.

Relinquished	Date/Time	Received	Date/Time
x [signature]	11/8/19/1030	x [signature]	11/8/19 1050
x		x	

Fremont Analytical

3600 Fremont Ave N.
Seattle, WA 98103
Tel: 206-352-3790
Fax: 206-352-7178

Chain of Custody Record & Laboratory Services Agreement

Client: GEI

Address:

City, State, Zip: Seattle, WA

Telephone:

Fax:

Date: 11/7/19 Page: 3 of: 3

Project Name: UW Bothell - STEM Building

Project No: 0183-120-01

Collected by:

Location:

Report To (PM):

PM Email:

Laboratory Project No (internal):

Special Remarks:

Sample Disposal: ☐ Return to client ☐ Disposal by lab (after 30 days)

	Sample Name	Sample Date	Sample Time	Sample Type (Matrix)*	VOCs (EPA 8260 / 624)	GX/BTEX	BTEX	Gasoline Range Organics (GX)	Hydrocarbon Identification (HCID)	Diesel/Heavy Oil Range Organics (DX)	SVOCs (EPA 8270 / 625)	PAHs (EPA 8270 - SIM)	PCBs (EPA 8082 / 608)	Metals** (EPA 6020 / 200.8)	Total (T) / Dissolved (D)	Anions (IC)***	EDB (8011)	Hold	MTCA 5 Metals	RCRA 8 Metals	Comments
1	DP-8-1.0	11/7/19	1330	S				X									X		X		
2	DP-8-2.0	↓	1335	↓				X									↓	X			
3	DP-8-5.0	↓	1340	↓													↓				
4	DP-8-7.0	↓	1345	↓													↓				
5																					
6																					
7																					
8																					
9																					
10																					

*Matrix: A = Air, AQ = Aqueous, B = Bulk, O = Other, P = Product, S = Soil, SD = Sediment, SL = Solid, W = Water, DW = Drinking Water, GW = Ground Water, SW = Storm Water, WW = Waste Water

**Metals (Circle): MTCA-5 RCRA-8 Priority Pollutants TAL *Individual:* Ag Al As B Ba Be Ca Cd Co Cr Cu Fe Hg K Mg Mn Mo Na Ni Pb Sb Se Sr Sn Ti Tl U V Zn

***Anions (Circle): Nitrate Nitrite Chloride Sulfate Bromide O-Phosphate Fluoride Nitrate+Nitrite

I represent that I am authorized to enter into this Agreement with Fremont Analytical on behalf of the Client named above and that I have verified Client's agreement to each of the terms on the front and backside of this Agreement.

Relinquished	Date/Time	Received	Date/Time
x [signature]	11/8/19 / 1030	x [signature]	11/8/19 1030
x		x	

Turn-around Time:
☒ Standard
☐ 3 Day
☐ 2 Day
☐ Next Day
Same Day ______ *(specify)*

APPENDIX C
Report Limitations and Guidelines for Use

APPENDIX C
REPORT LIMITATIONS AND GUIDELINES FOR USE[1]

This appendix provides information to help you manage your risks with respect to the use of this report.

Read These Provisions Closely

Some clients, design professionals and contractors may not recognize that the geosciences practices (geotechnical engineering, geology and environmental science) are far less exact than other engineering and natural science disciplines. This lack of understanding can create unrealistic expectations that could lead to disappointments, claims and disputes. GeoEngineers includes these explanatory "limitations" provisions in our reports to help reduce such risks. Please confer with GeoEngineers if you are unclear how these "Report Limitations and Guidelines for Use" apply to your project or site.

Environmental Services Are Performed for Specific Purposes, Persons and Projects

This report has been prepared for the exclusive use of the University of Washington and their authorized agents. This report is not intended for use by others, and the information contained herein is not applicable to other sites.

GeoEngineers structures our services to meet the specific needs of our clients. For example, an environmental site assessment or remedial action study conducted for a property owner may not fulfill the needs of a prospective purchaser of the same property. Because each environmental study is unique, each environmental report is unique, prepared solely for the specific client and project site. No one except the University of Washington should rely on this report without first conferring with GeoEngineers. This report should not be applied for any purpose or project except the one originally contemplated.

This Environmental Report Is Based on a Unique Set of Project-Specific Factors

This report applies to the proposed UWB-CC Phase 4 STEM Building Site on the UW Bothell campus in Bothell, Washington. GeoEngineers considered a number of unique, project-specific factors when establishing the scope of services for this project and report. Unless GeoEngineers specifically indicates otherwise, do not rely on this report if it was:

- not prepared for you,
- not prepared for your project,
- not prepared for the specific site explored, or
- completed before important project changes were made.

If important changes are made after the date of this report, GeoEngineers should be given the opportunity to review our interpretations and recommendations and provide written modifications or confirmation, as appropriate.

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[1] Developed based on material provided by GBA, The GeoProfessional Business Association.

Reliance Conditions for Third Parties

No third party may rely on the product of our services unless GeoEngineers agrees in advance, and in writing to such reliance. This is to provide our firm with reasonable protection against open-ended liability claims by third parties with whom there would otherwise be no contractual limits to their actions.

Environmental Regulations Are Always Evolving

Some substances may be present in the site vicinity in quantities or under conditions that may have led, or may lead, to contamination of the subject site, but are not included in current local, state or federal regulatory definitions of hazardous substances or do not otherwise present current potential liability. GeoEngineers cannot be responsible if the standards for appropriate inquiry, or regulatory definitions of hazardous substance, change or if more stringent environmental standards are developed in the future.

Subsurface Conditions Can Change

This report is based on conditions that existed at the time our site studies were performed. The findings and conclusions of this report may be affected by the passage of time, by manmade events such as construction on or adjacent to the site, by new releases of hazardous substances, or by natural events such as floods, earthquakes and slope instability or groundwater fluctuations. Always contact GeoEngineers before applying this report to determine if it is still applicable.

Biological Pollutants

GeoEngineers' Scope of Work specifically excludes the investigation, detection, prevention or assessment of the presence of Biological Pollutants. Accordingly, this report does not include any interpretations, recommendations, findings, or conclusions regarding the detecting, assessing, preventing or abating of Biological Pollutants and no conclusions or inferences should be drawn regarding Biological Pollutants, as they may relate to this project. The term "Biological Pollutants" includes, but is not limited to, molds, fungi, spores, bacteria, and viruses, and/or any of their byproducts.

If Client desires these specialized services, they should be obtained from a consultant who offers services in this specialized field.

Do Not Redraw the Exploration Logs

Environmental scientists prepare final boring and testing logs based upon their interpretation of field logs and laboratory data. To prevent errors or omissions, the logs included in an environmental report should never be redrawn for inclusion in other design drawings. Only photographic or electronic reproduction is acceptable, but recognize that separating logs from the report can elevate risk.

Geotechnical, Geologic and Environmental Reports Should Not Be Interchanged

The equipment, techniques and personnel used to perform an environmental study differ significantly from those used to perform a geotechnical or geologic study and vice versa. For that reason, a geotechnical engineering or geologic report does not usually relate any environmental findings, conclusions or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. Similarly, environmental reports are not used to address geotechnical or geologic concerns regarding a specific project.

Soil and Groundwater End Use

The cleanup levels referenced in this report are site- and situation-specific. The cleanup levels may not be applicable for other sites or for other on-Site uses of the affected media (soil and/or groundwater). Note that hazardous substances may be present in some of the Site soil, surface water and/or groundwater at detectable concentrations that are less than the referenced cleanup levels. GeoEngineers should be contacted prior to the export of soil or water from the subject Site or reuse of the affected media on Site to evaluate the potential for associated environmental liabilities. We cannot be responsible for potential environmental liability arising out of the transfer of soil and/or water from the subject Site to another location or its reuse on Site in instances that we were not aware of or could not control.

Most Environmental Findings Are Professional Opinions

Our interpretations of subsurface conditions are based on field observations and chemical analytical data from widely spaced sampling locations at the Site. Site exploration identifies subsurface conditions only at those points where subsurface tests are conducted or samples are taken. GeoEngineers reviewed field and laboratory data and then applied our professional judgment to render an opinion about subsurface conditions throughout the Site. Actual subsurface conditions may differ—sometimes significantly—from those indicated in this report. Our report, conclusions and interpretations should not be construed as a warranty of the subsurface conditions.

GeoEngineers

Appendix C

Transportation Impact Analysis

UW BOTHELL/CASCADIA COLLEGE STEM4 BUILDING

Prepared for:

University of Washington

September 2020

Prepared by:

transpogroup

WHAT TRANSPORTATION CAN BE.

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Introduction

This Transportation Impact Analysis (TIA) summarizes the potential transportation-related impacts associated with the development of a new academic building on the UW Bothell/Cascadia College Campus (the Campus). The Campus is located just west of I-405 and north of SR-522. The following sections summarize the existing conditions, future without-project conditions, and project impacts.

Project Description

The proposed project includes the construction of the Phase 4 Science Technology Engineering Mathematics (STEM) building on the west side of the UW Bothell/Cascadia College Campus. The building is anticipated to accommodate a capacity of 650 full-time equivalent (FTE) students. The proposed project is located just east of 110th Avenue NE and south of NE 183rd Court is anticipated to be constructed and fully occupied by 2023. The site vicinity is shown in Figure 1. A preliminary site plan is shown in Figure 2.

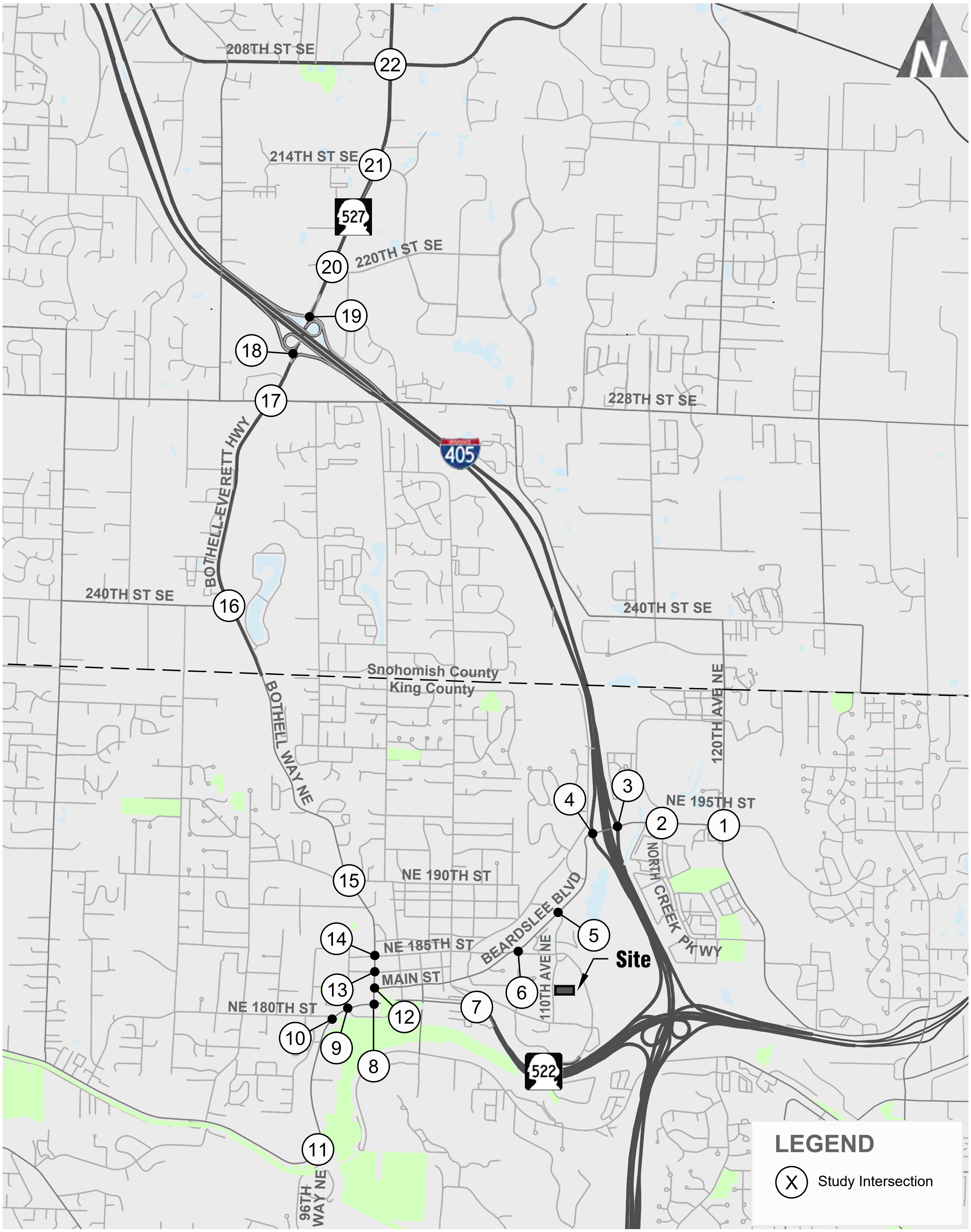
Analysis Approach and Study Area

The scope of this analysis meets the concurrency requirements outlined within the City of Bothell Municipal Code (BMC 17.03) and within the Transportation Element of the "*Imagine Bothell*…Comprehensive Plan." To comply with City of Bothell concurrency requirements, an analysis is required for all concurrency corridors impacted by 10 or more weekday PM peak hour trips. Based upon the estimated net new trip generation and distribution patterns, the following concurrency corridors were evaluated:

- Beardslee Boulevard/NE 195th Street
- SR-522 (Bothell Way NE)
- SR-527 (Bothell-Everett Highway)

The study intersections along this corridor are shown in Figure 1.

Based on the City's requirements, the intersections along the concurrency corridors were evaluated under existing, without-project, and with-project weekday PM peak hour conditions. Site-generated impacts were determined by comparing without- and with-project traffic conditions. A horizon planning year of 2023 was used for this analysis.



Site Vicinity and Study Intersections

UW Bothell/Cascadia College STEM4 Building

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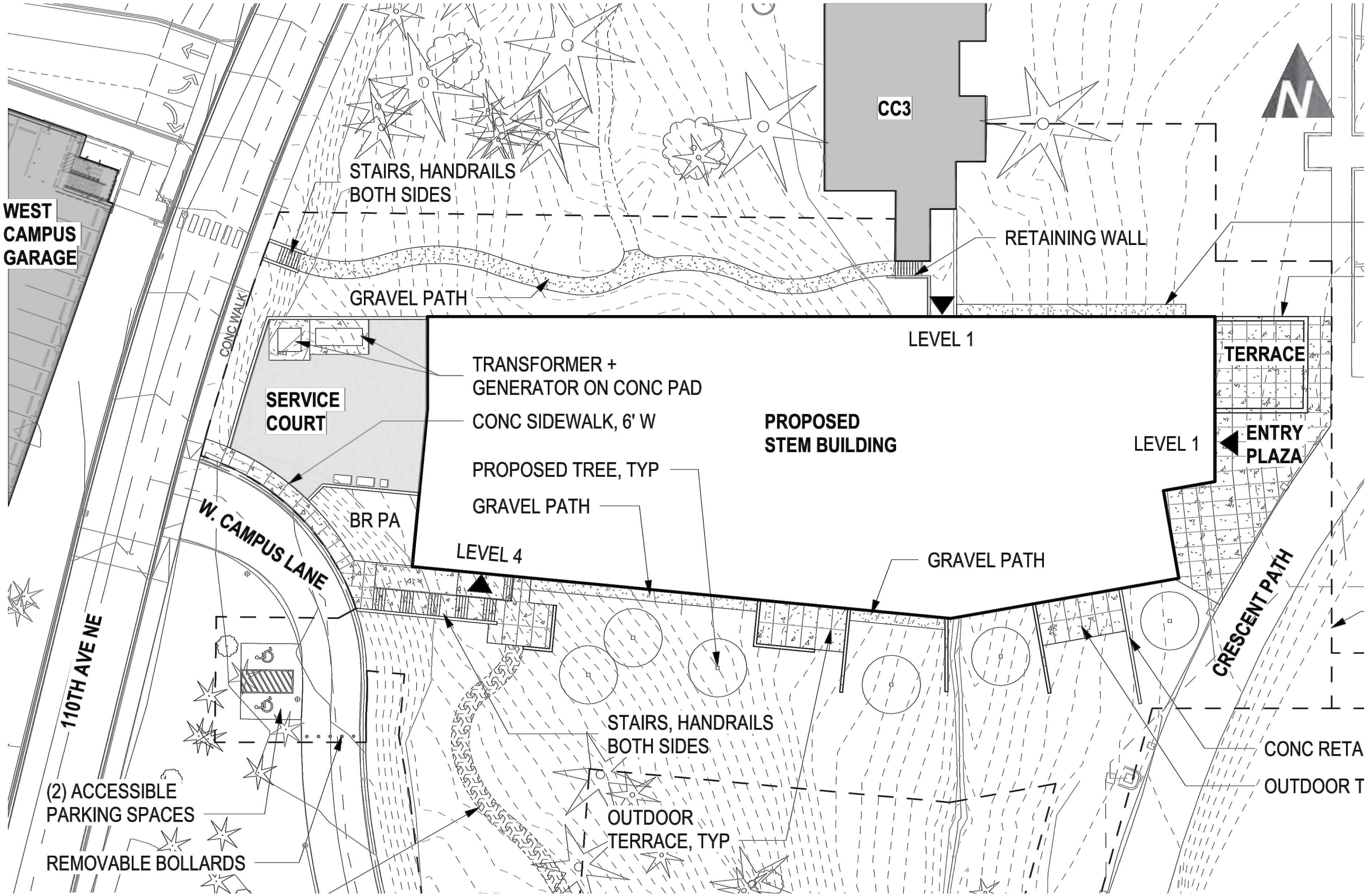
FIGURE 1



Preliminary Site Plan

FIGURE 2

UW Bothell/Cascadia College STEM4 Building

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Existing & Future Without-Project Conditions

This section summarizes existing and future (2023) without-project conditions within the study area defined for this analysis. An evaluation of the existing and future without-project conditions provides a baseline against which project impacts are measured.

Roadway Network

The primary roadways within the study area and their characteristics near study intersections are described in Table 1.

Table 1. Roadway Network Existing Conditions Summary

Roadway	Classification	Speed Limit	# Lanes	Bicycle Facilities	Pedestrian Facilities
Bothell Way NE (SR-522)	Principal Arterial	35 mph	4	None	Intermittent sidewalks
Main Street	Minor Arterial	25 mph	2	None	Sidewalks
98th Avenue NE	Collector	25 mph	3	None	Sidewalks
Kaysner Avenue NE	Local Access Street	25 mph	2	None	Sidewalks on south side
96th Avenue NE	Local Access Street	25 mph	2	None	Sidewalks
NE 185th Street	Collector	25 mph	2	None	Sidewalks
North Creek Parkway	Collector	25 mph	5	Bike Lanes	Sidewalks
120th Avenue NE	Minor Arterial	35 mph	4-5	Partial bike lanes	Sidewalks
Beardslee Boulevard	Minor Arterial	30 mph	2-4	Bike lanes	Sidewalks
NE 183rd Street	Local Access Street	25 mph	2	None	Intermittent sidewalks
240th Street SE	Collector	30 mph	2	None	Sidewalks on south side
228th Street SE	Minor Arterial	30 mph	4-5	Bike lanes	Sidewalks
220th Street SE	Collector	25 mph	4	None	Sidewalks
NE 180th Street	Collector	25 mph	2	Bike lanes	Sidewalks
NE 190th/191st Street	Collector	25 mph	2-3	None	Sidewalks
NE 195th Street	Minor Arterial	30 mph	5	Bike lanes	Sidewalks
214th Street SE	Local Access Street	25 mph	2	North Creek Trail	North Creek Trail
Maltby Road (SR-524)	Principal Arterial	35 mph	3-5	None	Intermittent sidewalks
Bothell-Everett Highway (SR-527)	Principal Arterial	30-40 mph	3-7	Bike Lanes	Intermittent sidewalks
110th Avenue NE	Local Access Street	20 mph	2	None	Sidewalks on east side

1. Roadway functional classifications are based on the *City of Bothell's Imagine Bothell…Comprehensive Plan 2015 Periodic Plan and Code Update.*

As shown in Table 1, pedestrian facilities are provided on one or both sides of all study area roadways.

Planned Improvements

The City of Bothell's 2021-2026 Six Year TIP was reviewed for future transportation improvements that may impact the study area's street network. The following projects were identified:

- **TIP #3 SR-522, Stage 3:** A continuation of the SR-522 improvements, this project will widen general purpose lanes, add BAT lanes in each direction, improve sidewalks, add a center median, connect signals, and improve illumination, landscaping and water infrastructure between 96th Avenue NE and 83rd Place NE. The project is anticipated to be completed by 2021.

- **TIP #5 Adaptive Signal Control System, Phase 2:** This project includes installing adaptive signal control systems in 13 intersections along Bothell Way (NE 191st St to SR 522) and SR 522 (96th Ave NE to Campus Way S) to accommodate for changing traffic patterns and ease traffic congestion. This project is anticipated to be completed in 2022.
- **TIP #6 Beardslee Boulevard Widening (Campus to I-405):** This project includes an additional eastbound lane on Beardslee Boulevard from 110th Avenue NE to I-405, as well as corresponding bike lane, signal modifications, illumination, and roadway improvements. This project is anticipated to be completed between 2024-2026.
- **TIP #8 NE 185th Street Transit Oriented Street:** This project includes streetscaping improvements on NE 185th Street between Beardslee Boulevard and Bothell Way and 98th Avenue NE between SR-522 and Bothell Way NE in preparation for use as a transit-oriented-street (TOS). It will also include intersection improvements at the 98th Avenue NE/NE 193rd Street intersection, as well as improvements at the NE 185th Street intersections with 101st Avenue NE, 104th Avenue NE, and Beardslee Boulevard. A transit station will be located at the NE 185th Street and 101st Avenue NE intersection. This project is anticipated to be completed between 2024-2026.
- **TIP #9 SR 522, Stage 2b Improvements:** Similar to TIP project #3 above, this project with provide improvements to access, transit, sidewalks, curb, gutter, landscaping, between illumination 98th Avenue NE and 96th Avenue NE. The project is expected to be completed between 2024-2026.
- **TIP #10 Bothell Way Widening (Reder Way to 240th Street SE):** This project will widen Bothell Way NE from 2 to 4-5 lanes between Reder Way and 240th Street SE. Intersection improvements, protected bike lanes, landscaping strips, lighting, sidewalks and environment improvements will be made. The project is anticipated to be completed sometime between 2024-2026.
- **TIP #22 Bothell Downtown Center Access Improvements to SR 522 BRT and Transit Corridor:** This project includes replacing existing damaged sidewalks in the north-south direction on 102nd Avenue NE between NE 185th Street and the 102nd Avenue NE Bridge in order to connect transit users with the downtown businesses and to provide safe and accessible routes that meet ADA requirements to and from multimodal corridors. This project is anticipated to be completed after the 2023 horizon year and is not included in the analysis.

Overall, only TIP project #5 was included in the traffic operations analysis. Due to the future adaptive signal control system along Bothell Way and SR 522, signal timing splits were optimized at the following intersections under future (2023) without- and with-project conditions:

7. Kaysner Way/Bothell Way NE
8. Bothell Way NE/SR-522
9. 98th Avenue NE/Bothell Way NE
10. NE 180th Street/Bothell Way NE
11. 96th Avenue NE/Bothell Way NE
12. Bothell Way NE/Main Street
13. Bothell Way NE/NE 183rd Street
14. Bothell Way NE/NE 185th Street
15. Bothell Way NE/NE 190th Street

Traffic Volumes

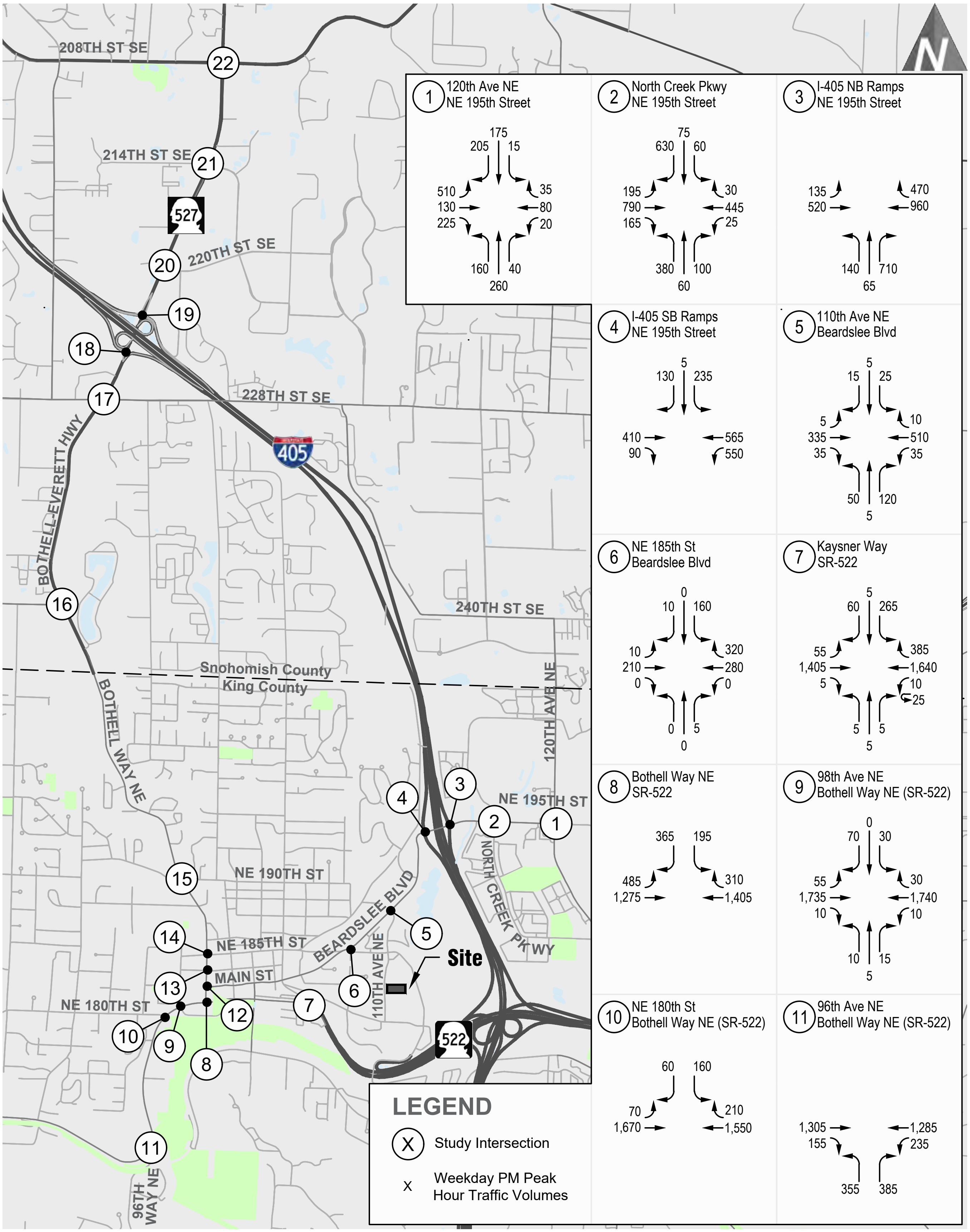
Due to COVID-19 and the impact to current traffic volumes and travel patterns, traffic counts collected during the weekday PM peak hour in May 2018 and September 2019 were utilized at the 22 study intersections. Traffic counts from 2018 and 2019 were grown to existing 2020 conditions using a growth rate of 2 percent. Detailed intersection traffic counts are provided in Appendix A. Existing traffic volumes are shown in Figure 3 and Figure 4.

To forecast future (2023) background traffic volumes at the study intersections, existing traffic counts were increased to account for annual background growth, and traffic volumes from City-identified development projects in the pipeline were added. The existing traffic counts were increased by an annual growth rate of 2 percent, except for the intersections along SR-522 between Kaysner Way and 96th Avenue NE, and Bothell Way NE between NE 190th Street and SR-522, which were increased by an annual growth rate of 4 percent. The 4 percent annual growth rate is consistent with future growth projected in the Downtown Bothell area. The 2 percent annual growth rate is supported by the City of Bothell Comprehensive Plan that predicts an average annual growth of approximately 1 to 2 percent in PM peak hour traffic volumes on Beardslee Boulevard between 112th Avenue NE and 110th Avenue NE.

Traffic from City-identified development projects in the pipeline were also added to the forecasts. While some of the projects listed are completed as of today, the developments were partially occupied at the time of the May 2018 and September 2019 counts. Full occupancy volumes from these pipeline projects were included in the analysis, resulting in a conservative forecast of future traffic. A list of pipeline projects included in the analysis is summarized below:

1. **The Junction** – Mixed-use building in the Downtown Bothell neighborhood at the northwest corner of the Bothell Way NE/NE 185th Street intersection. The development includes approximately 130 apartment units in addition to medical office, restaurant, walk-in bank, and retail space.
2. **Dawson Townhomes, Lots O and N** – Residential development in the Downtown Bothell neighborhood along 96th Avenue NE between NE 182nd Street and NE 185th Street including approximately 103 townhomes.
3. **98th Apartments** – Residential development in the Downtown Bothell neighborhood including approximately 80 apartment units.
4. **Parcel P** – Mixed-use development in the Downtown Bothell neighborhood at the northeast corner of the 96th Avenue NE/NE 185th Street intersection, including approximately 120 apartment units and 12,600 square feet of office space.
5. **Urbane Village I** – Residential development on 240th Street SE west of 7th Avenue SE including approximately 98 townhomes.
6. **Cedar Park South** – Residential development north of 228th Street SE on 9th Avenue SE including approximately 35 single-family homes.
7. **Cedar Park North** – Residential development north of 228th Street SE on 9th Avenue SE including approximately 15 single-family homes.
8. **Gateway/Beardslee South** – Residential development at the northeast corner of the 110th Avenue NE/Beardslee Boulevard intersection including approximately 60 townhomes.
9. **Preston North** – Residential development including 94 townhomes located on the north side of the Seattle Times building at the southeast corner of the 120th Avenue NE/NE 195th Street intersection.
10. **Preston South –** Residential development including 59 townhomes located on the south side of the Seattle Times building at the northeast corner of the 120th Avenue NE/North Creek Parkway intersection.
11. **Seattle Times Redevelopment** – Residential development located along 120th Avenue NE between NE 195th Street and North Creek Parkway including approximately 802 apartments, 110 townhomes, and 6,000 square feet of retail.
12. Office development located at the 98th Avenue NE/NE 183rd Street intersection which generates approximately 30 trips, per coordination with City staff.
13. Residential townhomes at the 91st Avenue NE/NE Bothell Way intersection generating approximately 30 trips, per coordination with City staff.
14. Residential development of approximately 100 single-family homes located west 126th Avenue NE along 244th Street SE, per coordination with City staff.

The 2023 without-project traffic volumes are shown on Figure 5 and Figure 6.



Existing (2020) Weekday PM Peak Hour Traffic Volumes

UW Bothell/Cascadia College STEM4 Building

FIGURE 3

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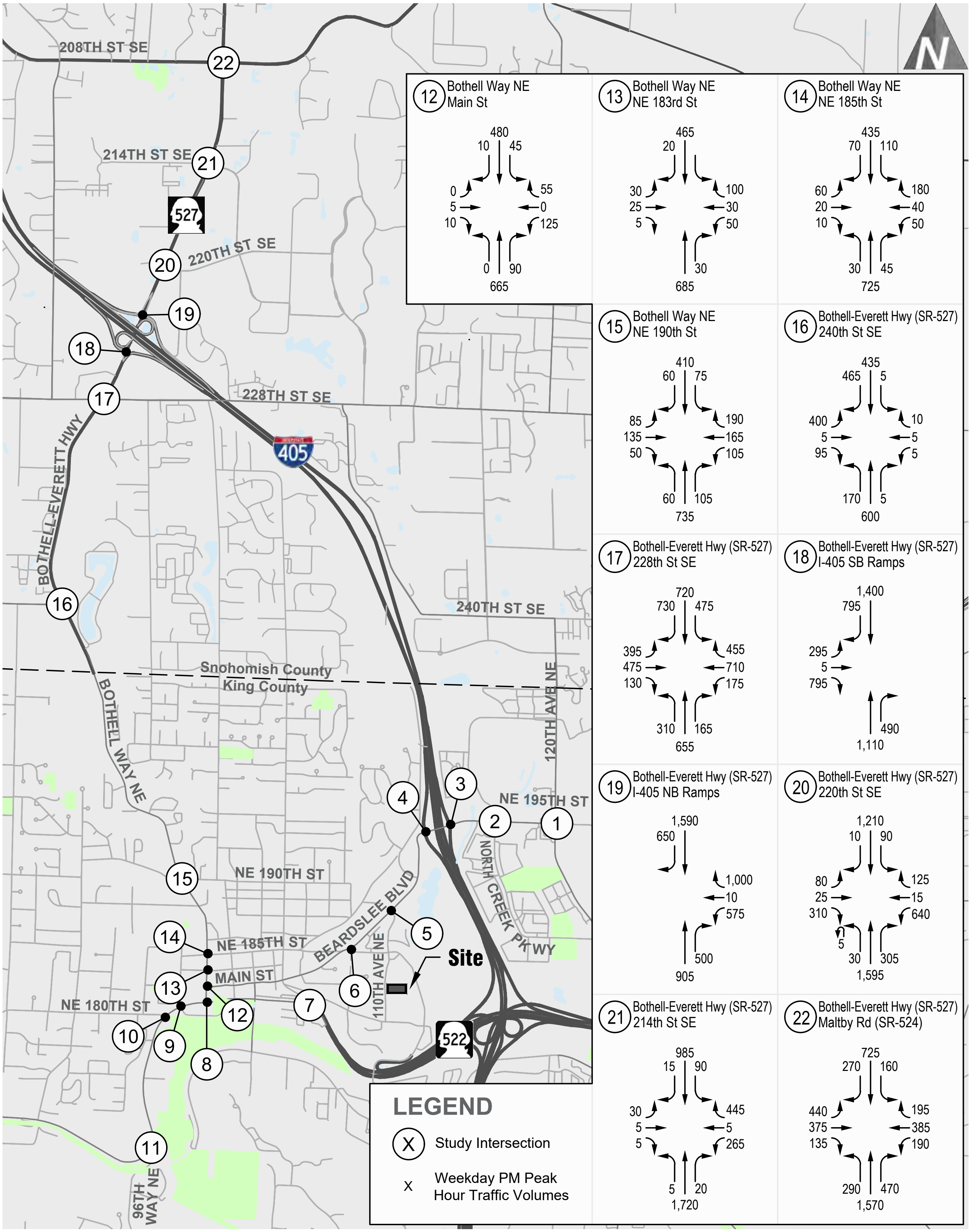

Existing (2020) Weekday PM Peak Hour Traffic Volumes

FIGURE **4**

UW Bothell/Cascadia College STEM4 Building

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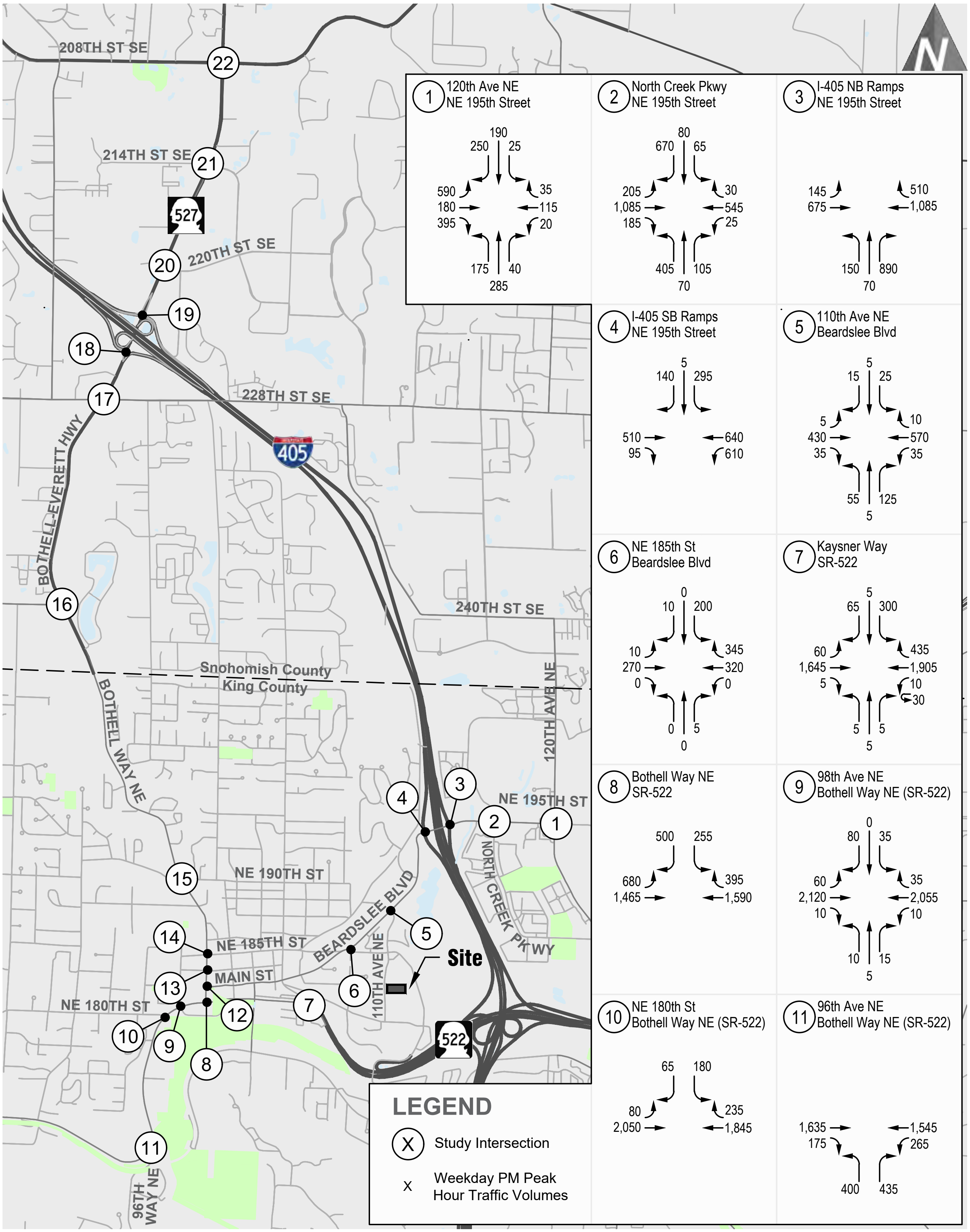

Future (2023) Without-Project Weekday PM Peak Hour Traffic Volumes

FIGURE **5**

UW Bothell/Cascadia College STEM4 Building

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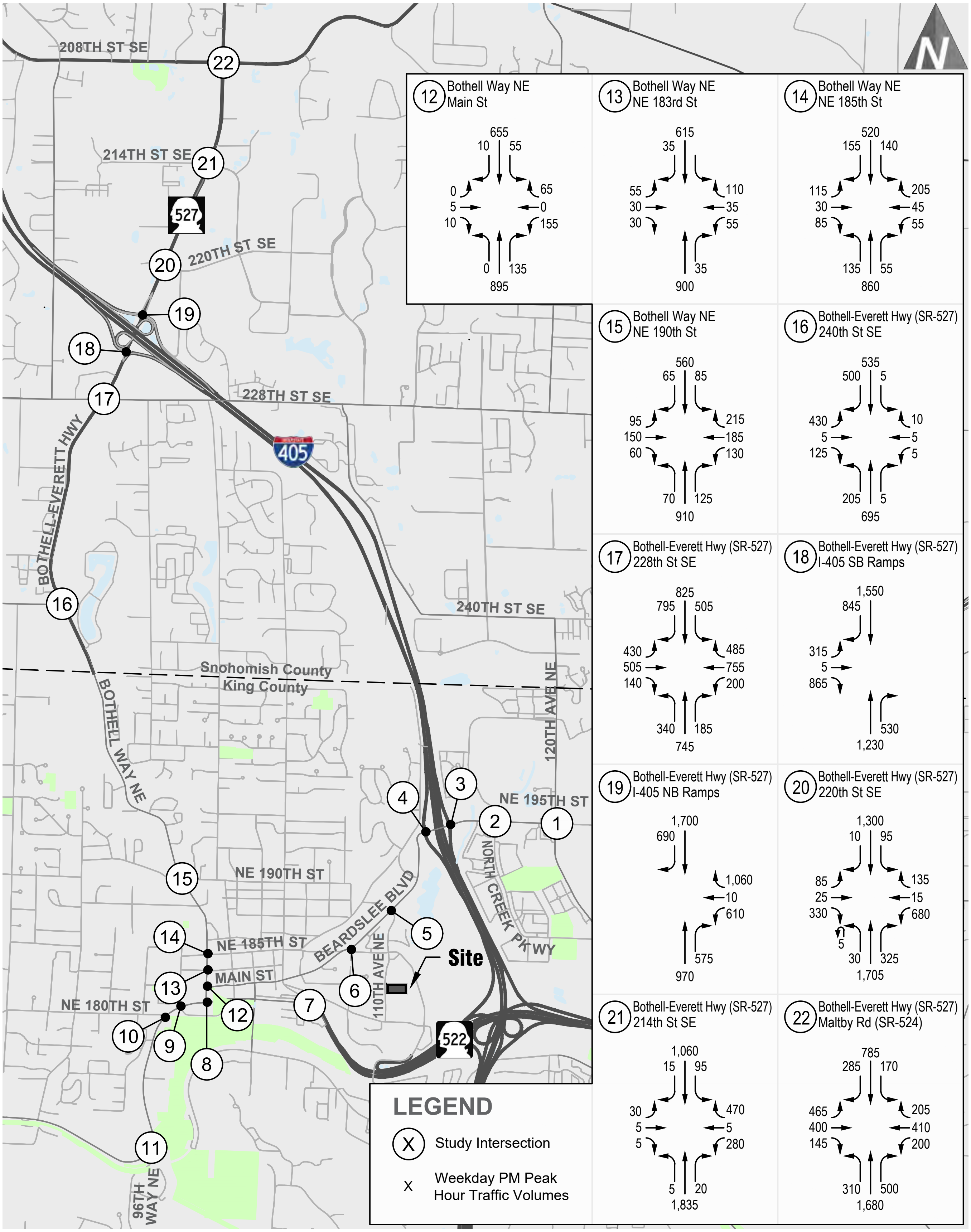


Future (2023) Without-Project Weekday PM Peak Hour Traffic Volumes

UW Bothell/Cascadia College STEM4 Building

transpogroup

FIGURE 6

Traffic Operations

A level of service (LOS) analysis was conducted for the study area intersections for the weekday PM peak hour. All study intersections were analyzed using Synchro 10. This software program provides an analysis based on methodologies presented in the *Highway Capacity Manual* (HCM) (Transportation Research Board, 6th Edition).

LOS values range from LOS A, which indicates good operating conditions with little or no delay, to LOS F, which indicates extreme congestion and long vehicle delays. LOS is measured in terms of total average intersection delay for signalized and all-way stop-controlled intersections. LOS is measured in terms of the average delay for the worst minor street movement for two-way stop-controlled intersections. A more detailed explanation of LOS criteria is provided in Appendix B.

LOS concurrency results are based upon a corridor level of service and are determined as a weighted average of intersection delays along the length of each impacted concurrency corridor. This method is described in the Transportation Element of the City of Bothell's Comprehensive Plan (TR-12) and is consistent with City of Bothell concurrency standards (BMC 17.03.007).

Existing signal timing settings were provided by the City of Bothell, WSDOT, and Snohomish County. Signal timing were kept consistent with existing conditions for the future (2023) without-project analysis, other than the signals included in the adaptive signal timing improvement where future splits were optimized. Detailed LOS worksheets for the study intersections are included in Appendix C. LOS results are summarized in Table 2.

Table 2. Existing and Future (2023) Without-Project PM Peak Hour LOS Summary

Corridor Intersection	Traffic Control	Existing				2023 Without-Project			
		TEV[1]	LOS[2]	Delay[3]	WM[4]	TEV	LOS	Delay	WM
Beardslee Boulevard/NE 195th Street									
1. 120th Avenue NE/NE 195th Street	Signal	1,855	C	27	-	2,300	C	29	-
2. North Creek Parkway/NE 195th Street	Signal	2,955	D	37	-	3,470	D	40	-
3. I-405 NB Ramps/NE 195th Street	Signal	3,000	C	30	-	3,525	E	55	-
4. I-405 SB Ramps/NE 195th Street	Signal	1,985	B	18	-	2,295	C	21	-
5. 110th Avenue NE/Beardslee Boulevard[5]	Signal	1,150	C	29	-	1,315	C	29	-
6. Beardslee Boulevard/NE 185th Street[6]	TWSC	995	A	7	SB	1,160	A	10	SB
Weighted Average Delay Along Corridor			***C***	***27.2***			***D***	***35.3***	
SR-522 (Bothell Way NE)									
7. Kaysner Way/SR-522	Signal	3,870	C	24	-	4,475	C	29	-
8. Bothell Way NE/SR-522[5]	Signal	4,035	D	38	-	4,885	E	77	-
9. 98th Avenue NE/Bothell Way NE	Signal	3,710	B	14	-	4,435	B	11	-
10. NE 180th Street/Bothell Way NE[5]	Signal	3,720	B	20	-	4,455	C	26	-
11. 96th Avenue NE/Bothell Way NE	Signal	3,720	C	26	-	4,455	C	34	-
Weighted Average Delay Along Corridor			***C***	***24.6***			***D***	***36.2***	
SR-527 (Bothell-Everett Highway)									
12. Bothell Way NE/Main Street	Signal	1,485	B	12	-	1,985	C	31	-
13. Bothell Way NE/NE 183rd Street	Signal	1,440	A	8	-	1,900	B	12	-
14. Bothell Way NE/NE 185th Street	Signal	1,775	B	15	-	2,400	C	22	-
15. Bothell Way NE/NE 190th Street	Signal	2,175	C	25	-	2,650	D	47	-
16. Bothell-Everett Highway/240th Street SE[5]	Signal	2,200	C	30	-	2,525	D	43	-
17. Bothell-Everett Highway/228th Street SE	Signal	5,395	E	68	-	5,910	E	73	-
18. Bothell-Everett Highway/I-405 SB Ramps[5]	Signal	4,890	A	8	-	5,340	B	13	-
19. Bothell-Everett Highway/I-405 NB Ramps	Signal	5,230	B	13	-	5,615	D	40	-
20. Bothell-Everett Highway/220th Street SE[7]	Signal	4,440	E	72	-	4,740	D	53	-
21. Bothell-Everett Highway/214th Street SE[5]	Signal	3,590	C	33	-	3,825	E	56	-
22. Bothell-Everett Highway/Maltby Road[5]	Signal	5,205	F	83	-	5,555	F	99	-
Weighted Average Delay Along Corridor			***D***	***40.0***			***D***	***49.7***	

Note: TWSC = Two-Way Stop-Controlled, AWSC = All-Way Stop-Controlled
1. TEV = Total entering vehicles for given condition
2. LOS = Level of service, based on Highway Capacity Manual 6t Edition methodology
3. Delay = Average delay in seconds per vehicle
4. WM = Worst movement reported for two-way stop-controlled intersections
5. Analyzed in HCM 2000 due to non-standard signal phasing structure
6. Intersection delay calculated by computing average delay for all movements
7. Includes adaptive signal control system, resulting optimized intersection splits

As shown in Table 2, all the corridors operate at LOS C during existing conditions with the exception of the SR-527 (Bothell-Everett Highway) corridor, which operates at LOS D. With the growth in background traffic by 2023, all three study corridors are anticipated to operate at LOS D with an increase in weighted average delay of approximately 12 seconds or less. The City of Bothell Comprehensive Plan identifies the LOS standard as LOS E or better for concurrency corridors. Therefore, all corridors would operate within the City of Bothell concurrency requirements under existing and future without-project conditions.

Traffic Safety

Collision records were reviewed within the study area to document any potential traffic safety issues. The most recent summary of collision data from WSDOT is for the three-year period between January 1, 2017 and December 31, 2019.

A summary of the total and average annual number of reported collisions as well as the collisions rate at each off-site study intersection is provided in Table 3. The collision rate is representative of the number of collisions per one million entering vehicles (MEV) at each intersection. Intersections with a rate greater than 1.0 collision per MEV are typically noted for further investigation to determine whether an adverse condition exists.

Table 3. Collision Data Summary (2017-2019)

Intersection	Collisions per Year			Annual Average	Collisions Per MEV[1]
	2017	2018	2019		
1. 120th Avenue NE/NE 195th Street	4	1	2	2.3	0.35
2. North Creek Parkway/NE 195th Street	2	2	2	2.0	0.19
3. I-405 NB Ramp/NE 195th Street	6	8	15	9.7	0.90
4. I-405 SB Ramp/NE 195th Street	3	2	5	3.3	0.47
5. 110th Avenue NE/Beardslee Boulevard	4	2	0	2.0	0.49
6. Beardslee Boulevard/NE 185th Street	2	0	1	1.0	0.28
7. Kaysner Way/Bothell Way NE	9	9	1	6.3	0.46
8. Bothell Way NE/SR-522	2	3	3	2.7	0.18
9. 98th Avenue NE/Bothell Way NE	5	4	3	4.0	0.30
10. NE 180th Street/Bothell Way NE	1	2	5	2.7	0.20
11. 96th Avenue NE/Bothell Way NE	8	9	3	6.7	0.50
12. Bothell Way NE/Main Street	2	0	2	1.3	0.26
13. Bothell Way NE/NE 183rd Street	3	3	0	2.0	0.40
14. Bothell Way NE/NE 185th Street	2	3	1	2.0	0.32
15. Bothell Way NE/NE 190th Street	4	2	1	2.3	0.31
16. Bothell-Everett Highway/240th Street SE	4	3	2	3.0	0.39
17. Bothell-Everett Highway/228th Street SE	16	8	10	11.3	0.60
18. Bothell-Everett Highway/I-405 SB Ramps	27	21	16	21.3	1.24
19. Bothell-Everett Highway/I-405 NB Ramps	12	6	7	8.3	0.45
20. Bothell-Everett Highway/220th Street SE	17	23	18	19.3	1.24
21. Bothell-Everett Highway/214th Street SE	5	11	8	8.0	0.64
22. Bothell-Everett Highway/Maltby Road	14	19	15	16.0	0.88

1. MEV = Million Entering Vehicles calculated with the assumption that PM peak hour ~ 10% of daily traffic

As shown in Table 3, all study intersections have a collisions per MEV rate of one collision or less with the exceptions of the Bothell-Everett Highway/I-405 SB Ramps and Bothell-Everett Highway/220th Street SE intersections, both of which have a collision per MEV rate of 1.24. At both intersections the majority of collisions were classified as rear-end and angle collisions. No fatalities occurred and no collisions involved pedestrians or bicyclists at this intersection.

At all study intersections, approximately 75 percent of collisions resulted in property damage only. The majority of collisions were classified as rear end, angle, and sideswipe. It was also noted there were four collisions involving pedestrians or bicyclists, with one each at the 98th Avenue NE/Bothell Way NE, NE 108th Street/Bothell Way NE, Bothell Way NE/Main Street, and Bothell-Everett Highway/Maltby Road intersections. No fatalities occurred as the result of any study area collisions. Based on the data summarized in Table 3, no safety issues are identified at the study intersections.

Transit Service

Community Transit, Sound Transit and King County Metro Transit provides service within the vicinity of the project site. The nearest transit stops are located approximately 500 feet north of the site, just south of the NE 185th Street/110th Avenue intersection. Table 4 provides information about the three routes served.

Table 4. Existing Transit Routes

Routes	Area Served	Approximate Weekday Operating Hours	Approximate Weekend Operating Hours	Weekday PM Peak Headways (min)
105	Bothell to Mariner P&R	4:50 a.m. – 10:10 p.m.	6:30 a.m. – 9:30 p.m.	30
106	Bothell to Mariner P&R	5:40 a.m. – 7:30 p.m.	-	45
230/231	Kirkland TC to Woodinville P&R	6:50 a.m. – 10:45 p.m.	7:05 a.m. – 9:05 p.m.	30
239	UW Bothell/Cascadia College to Totem Lake TC to Kirkland TC	5:20 a.m. – 1:00 a.m.	6:05 a.m. – 12:55 a.m.	30
312/522	UW Bothell/Cascadia College to Downtown Seattle	4:35 a.m. – 8:50 a.m. and 2:40 p.m. – 7:35 p.m.	-	10
372	University District to Lake City to Bothell	5:10 a.m. - 1:35 a.m.	-	8-15
535	Lynwood to Bothell	5:05 a.m. to 10:45 p.m.	8:00 a.m. – 9:00 p.m.[1]	30
931	Bothell to Downtown Seattle via Redmond	6:15 a.m. – 7:55 p.m.	-	30

Source: Community Transit, Sound Transit, and King County Metro (August 2020).

In addition, the Bothell Park & Ride located southwest of the project site on SR-522 is approximately 0.8 miles from the site, or about a 15-20-minute walking distance. The park and ride are served by King County Metro route 342, in addition to a number of routes in the table above. Daily service via these routes extends from Bothell to Seattle, Shoreline, Redmond, and Renton.

Future Sound Transit and WSDOT transit improvements are planned within the study area to be constructed outside of the anticipated 2023 buildout. The following improvements are identified:

- **Sound Transit SR 522/NE 145th Street Bus Rapid Transit (BRT):** This project will install BRT service between the Shoreline South/NE 145th Street Link Light Rail station and the SR 522/I-405 interchange. BRT service provides fast, frequent, and reliable transit service with off-board fare payment and multiple-door entry and exit. This project includes improvements to Beardslee Boulevard and NE 185th Street within the study area to add bus lanes and transit priority improvements. The Sound Transit BRT improvements are anticipated to be constructed in 2024, outside of the future buildout year for the project; therefore, no changes to the future analysis were assumed for this improvement.
- **WSDOT I-405, SR 522 Vicinity to SR 527 Express Toll Lanes (ETL) Improvement Project:** This project adds one new express toll lane in each direction of I-405 between SR 522 and SR 527. In addition, the project includes transit and roadway improvements along SR 527 in the vicinity of the study area, including channelization improvements to the 220th Street SE intersection at SR 527.

The Sound Transit SR 522/NE 145th Street BRT and WSDOT ETL improvements will increase transit service to the vicinity of the UW Bothell/Cascadia College Campus. Increased service in the vicinity of the campus is anticipated to encourage students, faculty, and staff to utilize alternative modes when traveling to/from UW Bothell/Cascadia College. These improvements are anticipated to affect the population utilizing the proposed STEM building.

Project Impacts

This section of the analysis documents potential project-generated impacts on the surrounding street network and study intersections, including project trip generation, trip distribution and assignment, estimated future traffic volumes, and future operations at study intersections. Potential impacts to traffic safety, transit service, and non-motorized facilities are also identified. Finally, City of Bothell concurrency requirements, potential mitigation measures, and impact fees are discussed.

Trip Generation

Weekday daily and PM peak hour trip rates were estimated using observations conducted on the UW Bothell/Cascadia College campus as part of the Fall 2019 Parking Utilization Study.

Weekday peak hour trip generation for the proposed project is based on campus trip rates derived from midweek data collected at the entrances/exits to the school as part of the Fall 2019 Parking Utilization Study. Traffic volumes were collected in October 2019. Rates were developed for the AM (7:00 to 9:00 a.m.) and PM (4:00 to 6:00 p.m.) peak periods consistent with City of Bothell standards and represent the peak of the adjacent street system.

Weekday trip generation estimates are summarized in Table 5 and include inbound and outbound peak hour estimates. Detailed trip generation calculations are included in Appendix D.

Table 5. Weekday Vehicle Trip Generation

		Daily		PM Peak Hour Trips			
Land Use	**Size**	**Rate**	**Total**	**Rate**	**In**	**Out**	**Total**
Proposed Use							
STEM Building	650 FTE	1.70	1,107	0.20	52	78	130
Net New Vehicle Trips			***1,107***		***52***	***78***	***130***

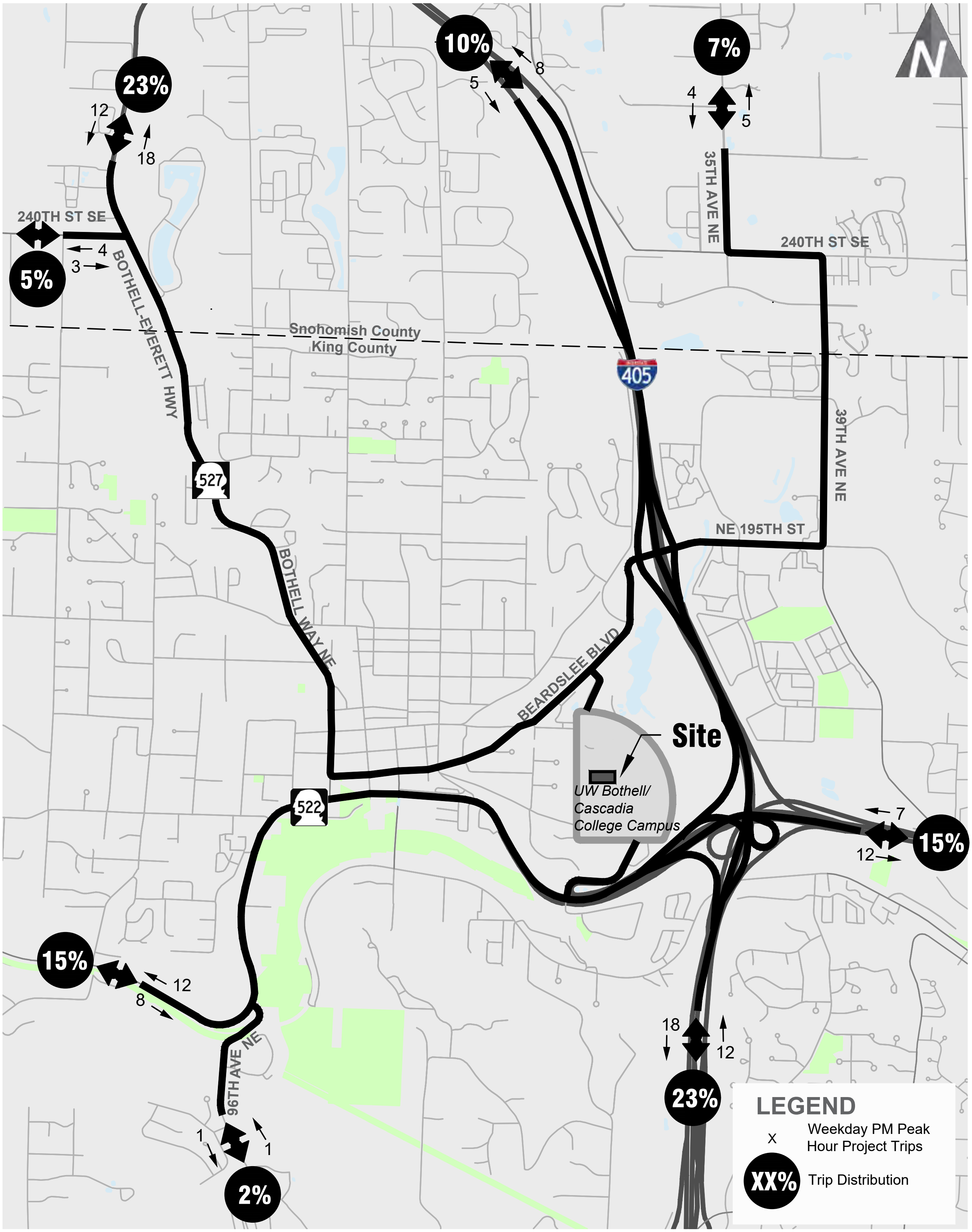
Notes: FTE = Full Time Equivalent Students

As shown in Table 5, the development is estimated to generate approximately 1,170 net new weekday daily trips with 130 occurring during the weekday PM peak hour.

Trip Distribution & Assignment

Trip distribution patterns were forecast based on anticipated travel patterns, existing travel patterns, and similar projects in the area. Based on overall travel patterns identified in the University of Washington Bothell/Cascadia College Master Plan, approximately 45 percent of campus traffic is distributed to/from the north and would utilize the north campus access from Beardslee Boulevard. Approximately 55 percent of campus traffic is distributed to/from the south and would access the campus via Campus Way NE. Trip distribution patterns used in the analysis assume 23 percent of project traffic would travel to/from the south on I-405 and 10 percent of project traffic would travel to/from the north on I-405, with most of these trips accessing I-405 at the NE 195th Street interchange based on the sites proximity to the interchange and likely commuting travel patterns. Approximately 45 percent of project traffic would travel to/from the west, with 17 percent accessing SR 522 and 28 percent directed toward SR-527. The remaining traffic would travel to/from the east on SR 522 and to/from the north on 120th Avenue NE. These trip patterns are also generally supported by future trip patterns predicted in the City of Bothell Comprehensive Plan.

Figure 7 illustrates the estimated trip distribution and assignment of the project trips.



Project Trip Distribution and Assignment

FIGURE

7

UW Bothell/Cascadia College STEM4 Building

transpogroup

Sep 29, 2020 - 9:01am Francescal M:\19\1.19199.00 - UWB_CC STEM Bldg\Graphics\DWG\Graphics_19199.dwg Layout: Trip Dist

Traffic Volumes

Future with-project volumes were estimated by adding site-generated weekday PM peak hour traffic volumes to future (2023) without-project traffic volumes. The resulting 2023 with-project traffic volumes are illustrated in Figure 8 and Figure 9.

Traffic Operations

A level of service analysis was conducted for 2023 with-project conditions and is compared to 2023 without-project conditions to identify project impacts. The future with-project analysis documents the project impacts of adding new trips to the intersections without modifying lane channelization from future without-project conditions. Signal timings were kept consistent with existing conditions for future (2023) with- and without-project analyses, except at the signals affected by the planned adaptive signal timing improvement. Splits at those signals were optimized based on traffic volumes. The results of the LOS analysis are summarized in Table 6 and results of the 2023 without-project analysis have also been included for comparison purposes. Detailed LOS worksheets are included in Appendix C.

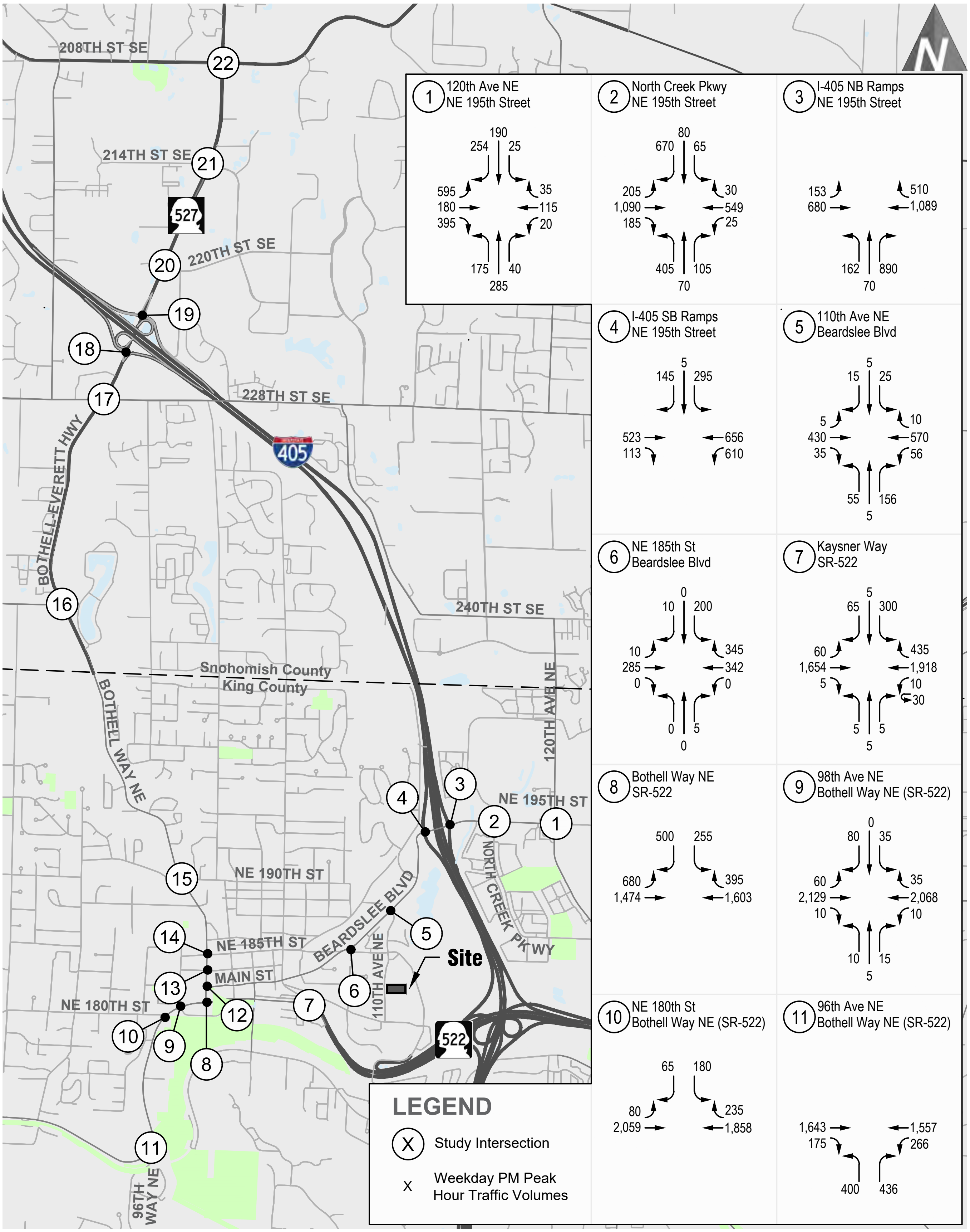
Table 6. Future (2023) PM Peak Hour LOS Summary

Corridor Intersection	Traffic Control	2023 Without-Project				2023 With-Project			
		TEV[1]	LOS[2]	Delay[3]	WM[4]	TEV	LOS	Delay	WM
Beardslee Boulevard/NE 195th Street									
1. 120th Avenue NE/NE 195th Street	Signal	2,300	C	29	-	2,309	C	30	-
2. North Creek Parkway/NE 195th Street	Signal	3,470	D	40	-	3,479	D	40	-
3. I-405 NB Ramps/NE 195th Street	Signal	3,525	E	55	-	3,554	E	57	-
4. I-405 SB Ramps/NE 195th Street	Signal	2,295	C	21	-	2,347	C	21	-
5. 110th Avenue NE/Beardslee Boulevard[5]	Signal	1,315	C	29	-	1,367	C	30	-
6. Beardslee Boulevard/NE 185th Street[6]	TWSC	1,160	A	10	SB	1,197	B	13	SB
Weighted Average Delay Along Corridor			**D**	**35.3**			**D**	**36.2**	
SR 522 (Bothell Way NE)									
7. Kaysner Way/SR-522	Signal	4,475	C	29	-	4,497	C	30	-
8. Bothell Way NE/SR-522[5]	Signal	4,885	E	77	-	4,907	E	77	-
9. 98th Avenue NE/Bothell Way NE	Signal	4,435	B	11	-	4,457	B	11	-
10. NE 180th Street/Bothell Way NE[5]	Signal	4,455	C	26	-	4,477	C	26	-
11. 96th Avenue NE/Bothell Way NE	Signal	4,455	C	34	-	4,477	C	35	-
Weighted Average Delay Along Corridor			**D**	**36.2**			**D**	**36.4**	
SR 527 (Bothell-Everett Highway)									
12. Bothell Way NE/Main Street	Signal	1,985	C	31	-	2,022	C	29	-
13. Bothell Way NE/NE 183rd Street	Signal	1,900	B	12	-	1,937	B	12	-
14. Bothell Way NE/NE 185th Street	Signal	2,400	C	22	-	2,437	C	23	-
15. Bothell Way NE/NE 190th Street	Signal	2,650	D	47	-	2,687	D	51	-
16. Bothell-Everett Highway/240th Street SE[5]	Signal	2,525	D	43	-	2,562	D	44	-
17. Bothell-Everett Highway/228th Street SE	Signal	5,910	E	73	-	5,940	E	75	-
18. Bothell-Everett Highway/I-405 SB Ramps[5]	Signal	5,340	B	13	-	5,370	B	13	-
19. Bothell-Everett Highway/I-405 NB Ramps	Signal	5,615	D	40	-	5,645	D	40	-
20. Bothell-Everett Highway/220th Street SE[5]	Signal	4,740	D	53	-	4,470	D	53	-
21. Bothell-Everett Highway/214th Street SE[5]	Signal	3,825	E	56	-	3,855	E	58	-
22. Bothell-Everett Highway/Maltby Road[5]	Signal	5,555	F	99	-	5,585	F	101	-
Weighted Average Delay Along Corridor			**D**	**49.7**			**D**	**50.6**	

Note: TWSC = Two-Way Stop-Controlled, AWSC = All-Way Stop-Controlled
1. TEV = Total entering vehicles for given condition
2. LOS = Level of service, based on Highway Capacity Manual 6th Edition methodology
3. Delay = Average delay in seconds per vehicle
4. WM = Worst movement reported for two-way stop-controlled intersections

5. Analyzed in HCM 2000 due to non-standard signal phasing structure
6. Intersection delay calculated by computing average delay for all movements

As shown in Table 6 with the addition of project traffic the concurrency corridors are forecast to operate at the same LOS as under future without-project conditions, with a change in delay of approximately one second or less. All corridors operate at LOS D or better, which meet the City's LOS E or better corridor standard. Thus, City of Bothell concurrency requirements are anticipated to continue to be met with the addition of the project.

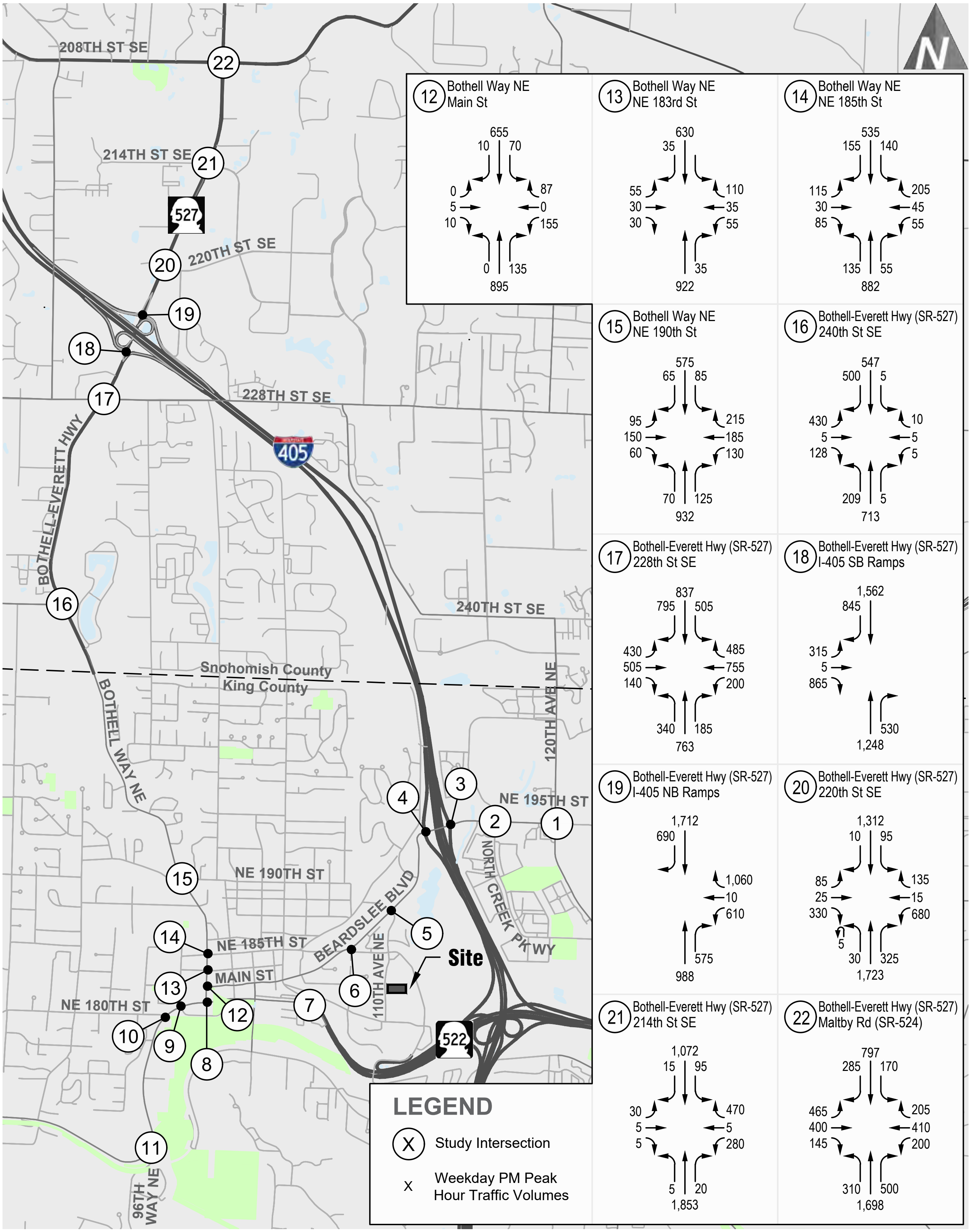


Future (2023) With-Project Weekday PM Peak Hour Traffic Volumes

FIGURE 8

UW Bothell/Cascadia College STEM4 Building

transpogroup



Future (2023) With-Project Weekday PM Peak Hour Traffic Volumes

FIGURE **9**

UW Bothell/Cascadia College STEM4 Building

transpogroup

Traffic Safety

Traffic generated by the proposed development would likely result in a proportionate increase in the probability of traffic accidents. It is unlikely, however, that this traffic would create a safety hazard or significantly increase the number of reported accidents at most locations within the project vicinity, based on the minimal increase in overall traffic volumes and the anticipated impacts to intersection operations.

Transit Service

It is assumed that most of the future students at the proposed development would likely continue to travel to drive as their main mode of transportation, but a percentage may use public transportation, with transit stops within walking distance of the site. Increases in transit ridership attributable to the proposed project would have a positive impact by reducing the estimated automobile traffic volumes and subsequently decrease impacts to traffic operations and safety. It is expected that the existing transit service would be able to accommodate the potential increase in demand attributable to the proposed project.

Non-motorized Facilities

The existing UW Bothell/Cascadia College campus includes a detailed network of non-motorized facilities, with on-campus pedestrian paths, marked crosswalks, and bicycle facilities. The development will provide sidewalks that connect to the existing pedestrian network on the UW Bothell/Cascadia College campus. This includes connections to 110th Avenue NE, W Campus Lane, Crescent Path, and the Campus Promenade. The proposed non-motorized connections are shown on the site plan included on Figure 2.

Parking

Consistent with the trip generation, peak parking demand was developed based on data collected in the Fall 2019 Parking Utilization Study. Based on parking data collected in Fall 2019, the peak parking demand rate for the campus is 0.24 vehicles per student FTE. This rate is based on the on-campus student FTE totals of 7,745 students, which does not include 315 online FTE associated with Cascadia College. In addition, the rate was developed based on an observed Fall 2019 peak parking demand of 1,870 vehicles within the areas shown in Figure 10. The on-campus parking supply of 2,101 spaces was observed during Fall 2019; however, this supply is anticipated to increase to 2,706 spaces with the addition of the planned West Garage.

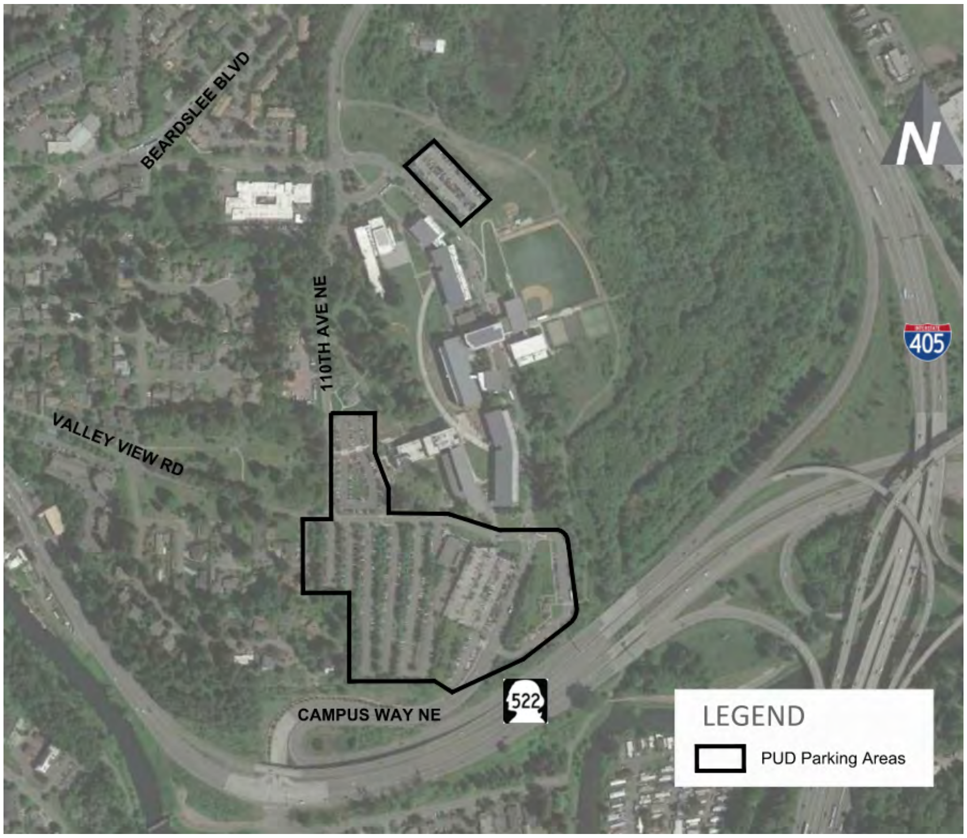


Figure 10. On Campus Parking Areas

Based on the anticipated proposed STEM building capacity of 650 FTEs, a peak parking demand of 156 vehicles is anticipated for the development and is summarized in Table 7.

Table 7. Peak Parking Demand and Utilization Summary

Scenario	Campus Parking Supply	Incremental Project Demand	Campus Peak Parking Demand	Parking Utilization
Existing Conditions (Fall 2019)	2,101	-	1,870	89%
With West Garage	2,706	-	1,870	69%
With STEM Building	2,706	156	2,026	75%

As shown in Table 7, with the addition of 156 vehicles associated with the STEM building project, future on-campus parking utilization is anticipated to be approximately 75 percent.

Concurrency

The study area was determined based upon the anticipated peak hour distribution of site-generated traffic volumes as described in the introduction to this report. As specified in the City's guidelines, the study area includes any concurrency corridor impacted by 10 or more weekday PM peak hour trips.

Based upon the City's criteria, the project trip generation and distribution, and the LOS results, the concurrency corridors studied are anticipated to operate at LOS D or better under existing and future conditions and thus meet the City's concurrency standard of LOS E or better during the weekday PM peak hour. Thus, this project meets City of Bothell concurrency requirements.

Mitigation

As noted in the traffic study, no improvements at off-site intersections are necessary to mitigate the impacts of the project. The proposed project will be required to pay Transportation Impact Fees to the City of Bothell and Snohomish County. The following section highlights the impact fees to be paid to each jurisdiction. These estimates should be considered preliminary until confirmed.

City of Bothell Transportation Impact Fees

The City of Bothell 2019 traffic impact fees for a university/college are $1,112 per student. Based on an anticipated student FTE of 650 associated with the STEM building, the transportation impact fee is estimated to be $722,800. Including the required 3 percent administration fee, the total transportation impact fee is estimated to be $744,484. This fee is a preliminary calculation and the final impact fee would be calculated by the City of Bothell. Fees are based on current rates at the time of building permit issuance.

Snohomish County Impact Fees

The City of Bothell has entered into an interlocal agreement with Snohomish County where projects within the City of Bothell are required to provide a mitigation offer to Snohomish County. The County has developed a payment system based on the project's city area, current Snohomish County impact fees, and estimated impact to County roads. Based on Figure 7, we have not identified any locations where trips above the County's 3-trip threshold would impact unincorporated County roadway improvements; therefore, no County impact fee contributions would be required. Snohomish County impact fees will be determined through coordination with County staff.

Summary of Findings

- The proposed project includes the construction a new STEM building on the University of Washington Bothell/Cascadia College Campus just east of 110th Avenue NE and south of NE 183rd Court. The development is anticipated to be constructed and fully occupied by 2023.
- The development is estimated to generate approximately 1,107 net new weekday daily trips with 130 occurring during the weekday PM peak hour.
- Based on City of Bothell criteria, the concurrency corridors of Beardslee Boulevard/NE 195th Street, SR-522 (Bothell Way NE), and SR-527 (Bothell-Everett Highway) are impacted by 10 or more average weekday PM peak hour trips and meet the City's criteria for analysis.
- The concurrency corridors listed above are expected to operate at LOS D under future with-project conditions and meet City of Bothell concurrency requirements.
- It is unlikely that increased traffic generated by the proposed development would create a safety hazard or significantly increase the number of reported accidents at most locations within the project vicinity, based on the minimal increase in overall traffic volumes and the anticipated impacts to intersection operations.
- It is expected that the existing transit service would be able to accommodate the potential increase in demand attributable to the proposed project.
- Transportation impacts fees to the City of Bothell is estimated to be $744,484, including an administrative fee of 3 percent. The impact fees to Snohomish County will be determined through coordination with County staff. These fees are considered preliminary estimates and would be finalized with the City and County upon review.

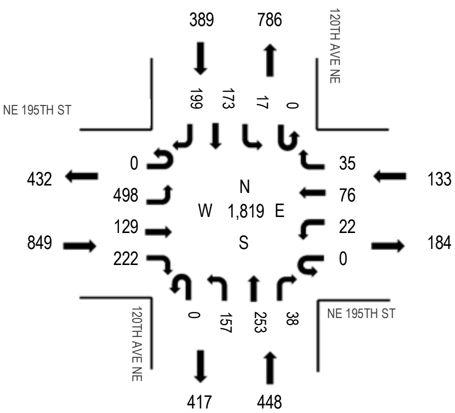
Appendix A: Traffic Counts

(303) 216-2439
www.alltrafficdata.net

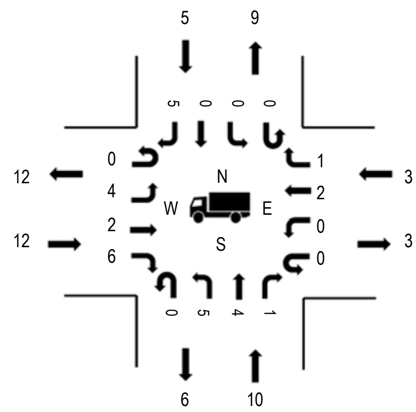
Location: 1 120TH AVE NE & NE 195TH ST PM
Date: Tuesday, September 10, 2019
Peak Hour: 05:00 PM - 06:00 PM

Peak Hour

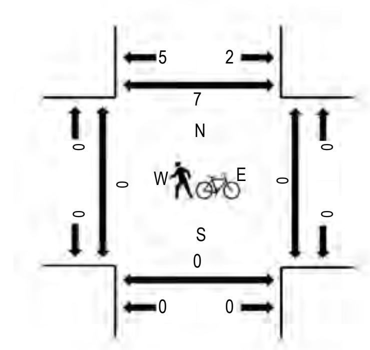
All Vehicles



Heavy Vehicles



Pedestrians/Bicycles in Crosswalk



	HV%	PHF
EB	1.4%	0.90
WB	2.3%	0.71
NB	2.2%	0.79
SB	1.3%	0.79
All	1.6%	0.95

Traffic Counts - All Vehicles

Interval Start Time	NE 195TH ST Eastbound U-Turn	Left	Thru	Right	NE 195TH ST Westbound U-Turn	Left	Thru	Right	120TH AVE NE Northbound U-Turn	Left	Thru	Right	120TH AVE NE Southbound U-Turn	Left	Thru	Right	Total	Rolling Hour
4:00 PM	0	101	25	43	0	5	24	12	0	44	32	9	0	2	47	83	427	1,683
4:15 PM	0	115	28	31	0	6	12	5	0	40	46	11	0	5	36	58	393	1,717
4:30 PM	0	130	31	55	0	3	22	12	0	39	50	6	0	2	22	49	421	1,746
4:45 PM	0	131	36	52	0	5	14	4	0	48	65	2	0	2	40	43	442	1,805
5:00 PM	0	141	32	61	0	7	27	13	0	33	52	10	0	4	29	52	461	1,819
5:15 PM	0	137	29	69	0	6	19	4	0	33	57	4	0	4	24	36	422	
5:30 PM	0	114	33	48	0	3	16	8	0	51	81	9	0	4	64	49	480	
5:45 PM	0	106	35	44	0	6	14	10	0	40	63	15	0	5	56	62	456	
Count Total	0	975	249	403	0	41	148	68	0	328	446	66	0	28	318	432	3,502	
Peak Hour	0	498	129	222	0	22	76	35	0	157	253	38	0	17	173	199	1,819	

Traffic Counts - Heavy Vehicles and Pedestrians/Bicycles in Crosswalk

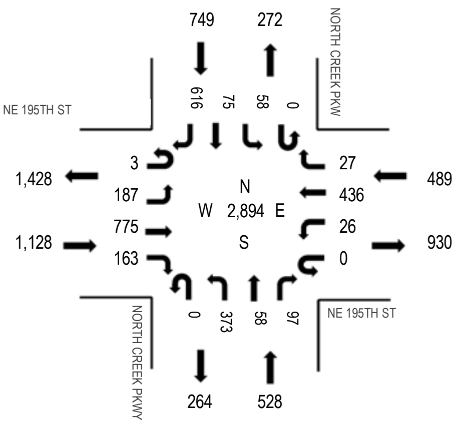
Interval Start Time	Heavy Vehicles EB	NB	WB	SB	Total	Interval Start Time	Pedestrians/Bicycles on Crosswalk EB	NB	WB	SB	Total
4:00 PM	2	3	0	4	9	4:00 PM	0	1	0	1	2
4:15 PM	7	0	2	2	11	4:15 PM	0	0	0	1	1
4:30 PM	1	5	0	0	6	4:30 PM	0	2	0	1	3
4:45 PM	5	1	1	1	8	4:45 PM	0	0	0	0	0
5:00 PM	4	4	2	3	13	5:00 PM	0	0	0	2	2
5:15 PM	4	2	0	0	6	5:15 PM	0	0	0	1	1
5:30 PM	1	3	1	1	6	5:30 PM	0	0	0	2	2
5:45 PM	3	1	0	1	5	5:45 PM	0	0	0	2	2
Count Total	27	19	6	12	64	Count Total	0	3	0	10	13
Peak Hour	12	10	3	5	30	Peak Hour	0	0	0	7	7

(303) 216-2439
www.alltrafficdata.net

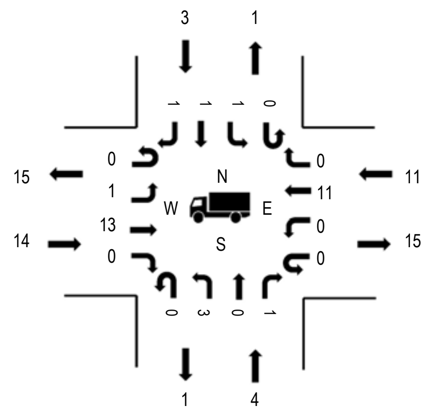
Location: 2 NORTH CREEK PKWY & NE 195TH ST PM
Date: Tuesday, September 10, 2019
Peak Hour: 04:30 PM - 05:30 PM

Peak Hour

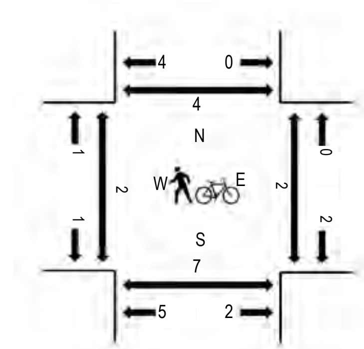
All Vehicles



Heavy Vehicles



Pedestrians/Bicycles in Crosswalk



	HV%	PHF
EB	1.2%	0.98
WB	2.2%	0.84
NB	0.8%	0.95
SB	0.4%	0.89
All	1.1%	0.97

Traffic Counts - All Vehicles

Interval Start Time	NE 195TH ST Eastbound				NE 195TH ST Westbound				NORTH CREEK PKWY Northbound				NORTH CREEK PKWY Southbound				Total	Rolling Hour
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right		
4:00 PM	0	36	154	29	0	7	139	3	0	100	9	19	0	7	19	174	696	2,797
4:15 PM	0	58	175	20	0	9	125	8	0	77	4	9	0	3	14	145	647	2,848
4:30 PM	1	44	202	32	0	5	115	7	0	96	11	32	0	10	14	166	735	2,894
4:45 PM	1	56	180	36	0	6	96	6	0	88	16	23	0	21	24	166	719	2,840
5:00 PM	1	45	195	48	0	10	130	5	0	103	19	16	0	17	15	143	747	2,767
5:15 PM	0	42	198	47	0	5	95	9	0	86	12	26	0	10	22	141	693	
5:30 PM	0	38	159	38	0	9	96	7	0	83	12	27	0	21	31	160	681	
5:45 PM	1	70	209	28	0	7	115	5	0	65	8	16	0	7	10	105	646	
Count Total	4	389	1,472	278	0	58	911	50	0	698	91	168	0	96	149	1,200	5,564	
Peak Hour	3	187	775	163	0	26	436	27	0	373	58	97	0	58	75	616	2,894	

Traffic Counts - Heavy Vehicles and Pedestrians/Bicycles in Crosswalk

Interval Start Time	Heavy Vehicles EB	NB	WB	SB	Total	Interval Start Time	Pedestrians/Bicycles on Crosswalk EB	NB	WB	SB	Total
4:00 PM	3	2	6	3	14	4:00 PM	0	0	2	3	5
4:15 PM	6	5	2	2	15	4:15 PM	1	0	0	1	2
4:30 PM	2	1	2	0	5	4:30 PM	0	0	0	0	0
4:45 PM	4	0	2	3	9	4:45 PM	0	2	1	1	4
5:00 PM	4	2	6	0	12	5:00 PM	0	2	1	1	4
5:15 PM	4	1	1	0	6	5:15 PM	2	3	0	2	7
5:30 PM	5	0	4	3	12	5:30 PM	2	0	0	1	3
5:45 PM	4	0	2	1	7	5:45 PM	2	0	0	1	3
Count Total	32	11	25	12	80	Count Total	7	7	4	10	28
Peak Hour	14	4	11	3	32	Peak Hour	2	7	2	4	15

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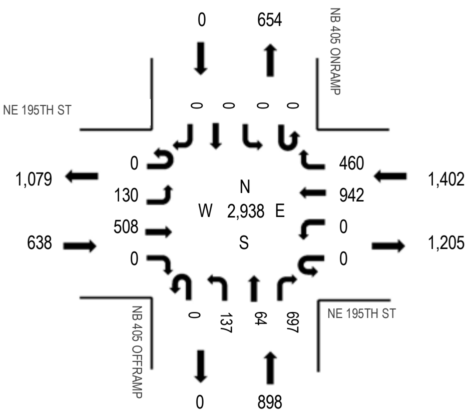
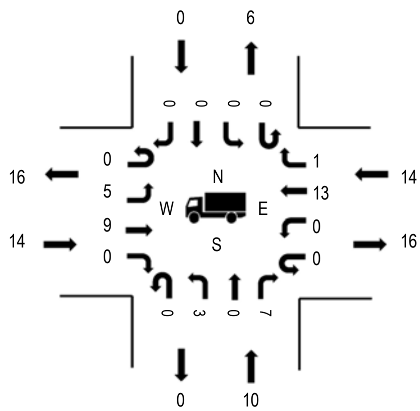
Location: 3 NB 405 OFFRAMP & NE 195TH ST PM
Date: Tuesday, September 10, 2019
Peak Hour: 04:30 PM - 05:30 PM

Peak Hour

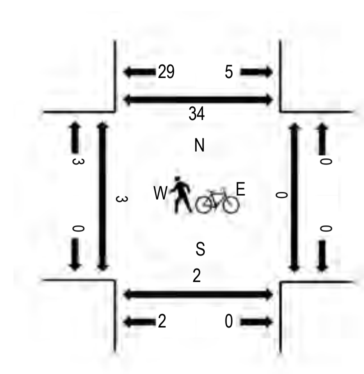
All Vehicles



Heavy Vehicles



Pedestrians/Bicycles in Crosswalk



	HV%	PHF
EB	2.2%	0.86
WB	1.0%	0.97
NB	1.1%	0.94
SB	0.0%	0.00
All	1.3%	0.99

Traffic Counts - All Vehicles

Interval Start Time	NE 195TH ST Eastbound				NE 195TH ST Westbound				NB 405 OFFRAMP Northbound				NB 405 ONRAMP Southbound				Total	Rolling Hour
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right		
4:00 PM	0	40	111	0	0	0	250	153	0	45	5	145	0	0	0	0	749	2,867
4:15 PM	0	38	106	0	0	0	232	116	0	30	1	138	0	0	0	0	661	2,858
4:30 PM	0	34	130	0	0	0	238	123	0	27	18	164	0	0	0	0	734	2,938
4:45 PM	0	26	104	0	0	0	255	99	0	37	16	186	0	0	0	0	723	2,898
5:00 PM	0	30	129	0	0	0	233	118	0	31	19	180	0	0	0	0	740	2,818
5:15 PM	0	40	145	0	0	0	216	120	0	42	11	167	0	0	0	0	741	
5:30 PM	0	25	104	0	0	0	229	115	0	28	10	183	0	0	0	0	694	
5:45 PM	0	27	127	0	0	0	188	95	0	24	5	177	0	0	0	0	643	
Count Total	0	260	956	0	0	0	1,841	939	0	264	85	1,340	0	0	0	0	5,685	
Peak Hour	0	130	508	0	0	0	942	460	0	137	64	697	0	0	0	0	2,938	

Traffic Counts - Heavy Vehicles and Pedestrians/Bicycles in Crosswalk

Interval Start Time	Heavy Vehicles EB	NB	WB	SB	Total	Interval Start Time	Pedestrians/Bicycles on Crosswalk EB	NB	WB	SB	Total
4:00 PM	3	3	8	0	14	4:00 PM	1	1	0	7	9
4:15 PM	6	3	12	0	21	4:15 PM	2	1	0	9	12
4:30 PM	1	1	4	0	6	4:30 PM	1	0	0	6	7
4:45 PM	4	5	2	0	11	4:45 PM	0	1	0	6	7
5:00 PM	4	1	8	0	13	5:00 PM	2	0	0	5	7
5:15 PM	5	3	0	0	8	5:15 PM	0	1	0	17	18
5:30 PM	2	5	3	0	10	5:30 PM	0	0	0	10	10
5:45 PM	6	2	3	0	11	5:45 PM	0	0	0	8	8
Count Total	31	23	40	0	94	Count Total	6	4	0	68	78
Peak Hour	14	10	14	0	38	Peak Hour	3	2	0	34	39

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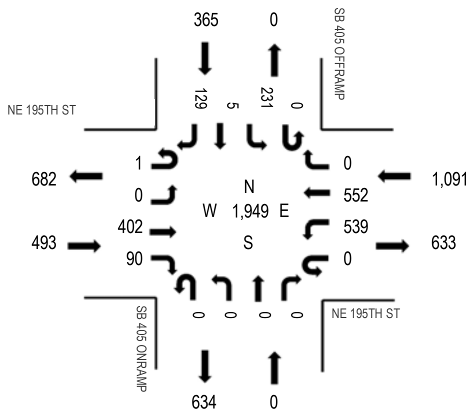
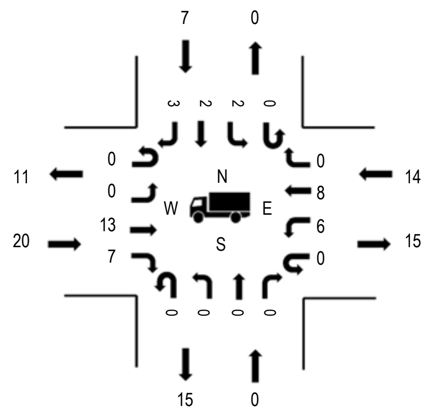
Location: 4 SB 405 ONRAMP & NE 195TH ST PM
Date: Tuesday, September 10, 2019
Peak Hour: 04:30 PM - 05:30 PM

Peak Hour

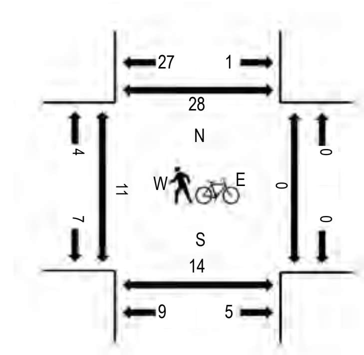
All Vehicles



Heavy Vehicles



Pedestrians/Bicycles in Crosswalk



	HV%	PHF
EB	4.1%	0.89
WB	1.3%	0.91
NB	0.0%	0.00
SB	1.9%	0.79
All	2.1%	0.97

Traffic Counts - All Vehicles

Interval Start Time	NE 195TH ST Eastbound				NE 195TH ST Westbound				SB 405 ONRAMP Northbound				SB 405 OFFRAMP Southbound				Total	Rolling Hour
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right		
4:00 PM	0	0	120	34	0	132	158	0	0	0	0	0	1	38	0	38	521	1,943
4:15 PM	1	0	97	20	0	149	126	0	0	0	0	0	0	36	0	28	457	1,905
4:30 PM	1	0	104	22	0	129	136	0	0	0	0	0	0	59	1	23	475	1,949
4:45 PM	0	0	85	18	0	160	139	0	0	0	0	0	0	42	3	43	490	1,919
5:00 PM	0	0	116	23	0	136	129	0	0	0	0	0	0	59	1	19	483	1,850
5:15 PM	0	0	97	27	0	114	148	0	0	0	0	0	0	71	0	44	501	
5:30 PM	0	0	89	18	0	136	125	0	0	0	0	0	0	45	0	32	445	
5:45 PM	0	0	91	28	0	113	113	0	0	0	0	0	0	57	0	19	421	
Count Total	2	0	799	190	0	1,069	1,074	0	0	0	0	0	1	407	5	246	3,793	
Peak Hour	1	0	402	90	0	539	552	0	0	0	0	0	0	231	5	129	1,949	

Traffic Counts - Heavy Vehicles and Pedestrians/Bicycles in Crosswalk

Interval Start Time	Heavy Vehicles EB	NB	WB	SB	Total	Interval Start Time	Pedestrians/Bicycles on Crosswalk EB	NB	WB	SB	Total
4:00 PM	7	0	6	2	15	4:00 PM	0	6	0	4	10
4:15 PM	6	0	5	1	12	4:15 PM	2	1	0	10	13
4:30 PM	3	0	1	1	5	4:30 PM	2	2	0	3	7
4:45 PM	5	0	4	3	12	4:45 PM	1	2	0	5	8
5:00 PM	4	0	9	2	15	5:00 PM	3	4	0	3	10
5:15 PM	8	0	0	1	9	5:15 PM	5	6	0	17	28
5:30 PM	2	0	6	1	9	5:30 PM	3	3	0	10	16
5:45 PM	10	0	3	0	13	5:45 PM	4	2	0	6	12
Count Total	45	0	34	11	90	Count Total	20	26	0	58	104
Peak Hour	20	0	14	7	41	Peak Hour	11	14	0	28	53

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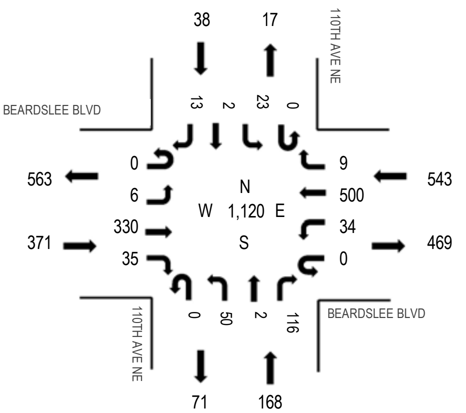
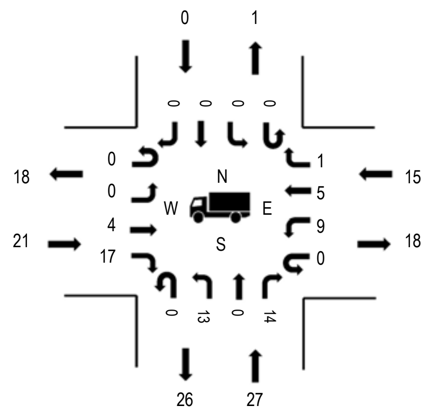
Location: 5 110TH AVE NE & BEARDSLEE BLVD PM
Date: Tuesday, September 10, 2019
Peak Hour: 04:00 PM - 05:00 PM

Peak Hour

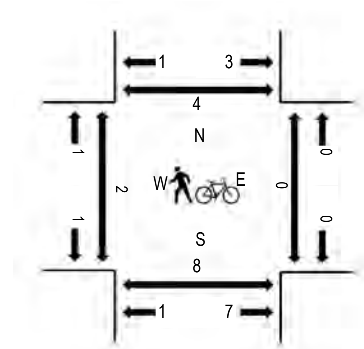
All Vehicles



Heavy Vehicles



Pedestrians/Bicycles in Crosswalk



	HV%	PHF
EB	5.7%	0.94
WB	2.8%	0.88
NB	16.1%	0.75
SB	0.0%	0.73
All	5.6%	0.96

Traffic Counts - All Vehicles

Interval Start Time	BEARDSLEE BLVD Eastbound				BEARDSLEE BLVD Westbound				110TH AVE NE Northbound				110TH AVE NE Southbound				Total	Rolling Hour
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right		
4:00 PM	0	2	85	12	0	8	115	1	0	15	1	40	0	5	2	6	292	1,120
4:15 PM	0	3	87	9	0	10	115	3	0	16	0	26	0	4	0	1	274	1,105
4:30 PM	0	0	78	7	0	9	125	3	0	11	1	27	0	8	0	4	273	1,116
4:45 PM	0	1	80	7	0	7	145	2	0	8	0	23	0	6	0	2	281	1,085
5:00 PM	0	0	102	5	0	11	119	0	0	7	0	24	0	3	0	6	277	1,057
5:15 PM	0	0	87	6	0	8	148	0	0	8	0	21	0	4	0	3	285	
5:30 PM	0	2	67	7	0	7	122	2	0	14	0	16	0	5	0	0	242	
5:45 PM	0	0	88	6	0	7	117	1	0	7	0	23	0	3	0	1	253	
Count Total	0	8	674	59	0	67	1,006	12	0	86	2	200	0	38	2	23	2,177	
Peak Hour	0	6	330	35	0	34	500	9	0	50	2	116	0	23	2	13	1,120	

Traffic Counts - Heavy Vehicles and Pedestrians/Bicycles in Crosswalk

Interval Start Time	Heavy Vehicles EB	NB	WB	SB	Total	Interval Start Time	Pedestrians/Bicycles on Crosswalk EB	NB	WB	SB	Total
4:00 PM	7	8	4	0	19	4:00 PM	1	4	0	2	7
4:15 PM	6	7	6	0	19	4:15 PM	0	0	0	1	1
4:30 PM	4	5	1	0	10	4:30 PM	1	2	0	1	4
4:45 PM	4	7	4	0	15	4:45 PM	0	2	0	0	2
5:00 PM	8	3	5	0	16	5:00 PM	1	0	3	3	7
5:15 PM	6	11	1	0	18	5:15 PM	0	4	1	2	7
5:30 PM	5	4	3	0	12	5:30 PM	0	1	2	2	5
5:45 PM	7	11	3	0	21	5:45 PM	0	0	1	0	1
Count Total	47	56	27	0	130	Count Total	3	13	7	11	34
Peak Hour	21	27	15	0	63	Peak Hour	2	8	0	4	14

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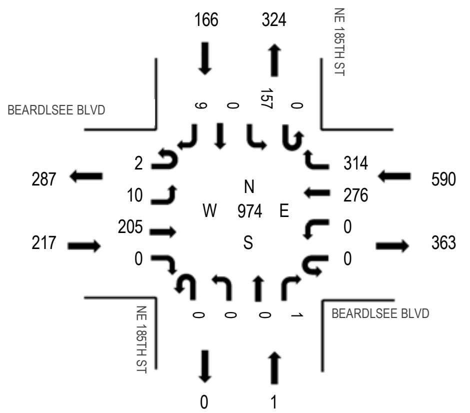
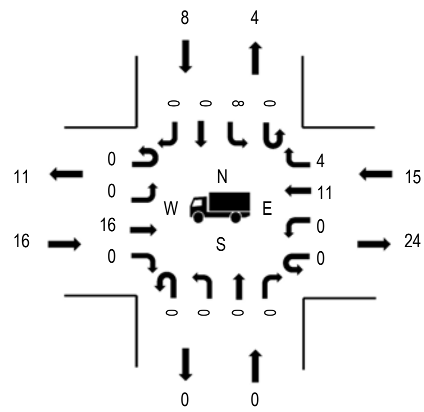
Location: 6 NE 185TH ST & BEARDLSEE BLVD PM
Date: Tuesday, September 10, 2019
Peak Hour: 04:45 PM - 05:45 PM

Peak Hour

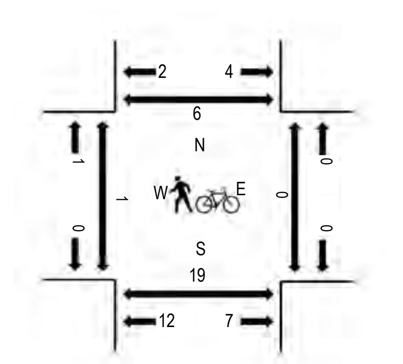
All Vehicles



Heavy Vehicles



Pedestrians/Bicycles in Crosswalk



	HV%	PHF
EB	7.4%	0.94
WB	2.5%	0.90
NB	0.0%	0.25
SB	4.8%	0.97
All	4.0%	0.95

Traffic Counts - All Vehicles

Interval Start Time	BEARDLSEE BLVD Eastbound U-Turn	Left	Thru	Right	BEARDLSEE BLVD Westbound U-Turn	Left	Thru	Right	NE 185TH ST Northbound U-Turn	Left	Thru	Right	NE 185TH ST Southbound U-Turn	Left	Thru	Right	Total	Rolling Hour
4:00 PM	0	2	71	0	0	0	65	71	0	0	0	0	0	32	0	0	241	962
4:15 PM	0	4	59	0	0	0	63	74	0	0	0	0	0	34	0	1	235	950
4:30 PM	0	5	61	0	0	0	64	71	0	0	0	0	0	27	0	2	230	969
4:45 PM	2	1	51	0	0	0	84	80	0	0	0	0	0	36	0	2	256	974
5:00 PM	0	0	58	0	0	0	54	75	0	0	0	0	0	41	0	1	229	931
5:15 PM	0	5	52	0	0	0	69	85	0	0	0	0	0	42	0	1	254	
5:30 PM	0	4	44	0	0	0	69	74	0	0	0	1	0	38	0	5	235	
5:45 PM	0	0	49	0	0	0	59	66	0	0	0	0	0	38	0	1	213	
Count Total	2	21	445	0	0	0	527	596	0	0	0	1	0	288	0	13	1,893	
Peak Hour	2	10	205	0	0	0	276	314	0	0	0	1	0	157	0	9	974	

Traffic Counts - Heavy Vehicles and Pedestrians/Bicycles in Crosswalk

Interval Start Time	Heavy Vehicles EB	NB	WB	SB	Total	Interval Start Time	Pedestrians/Bicycles on Crosswalk EB	NB	WB	SB	Total
4:00 PM	5	0	4	2	11	4:00 PM	3	5	0	4	12
4:15 PM	6	0	6	1	13	4:15 PM	1	6	0	0	7
4:30 PM	5	0	2	0	7	4:30 PM	0	6	0	1	7
4:45 PM	1	0	6	4	11	4:45 PM	0	7	0	1	8
5:00 PM	6	0	4	2	12	5:00 PM	0	5	0	3	8
5:15 PM	4	0	3	1	8	5:15 PM	1	5	0	1	7
5:30 PM	5	0	2	1	8	5:30 PM	0	2	0	1	3
5:45 PM	6	0	3	0	9	5:45 PM	1	2	0	0	3
Count Total	38	0	30	11	79	Count Total	6	38	0	11	55
Peak Hour	16	0	15	8	39	Peak Hour	1	19	0	6	26

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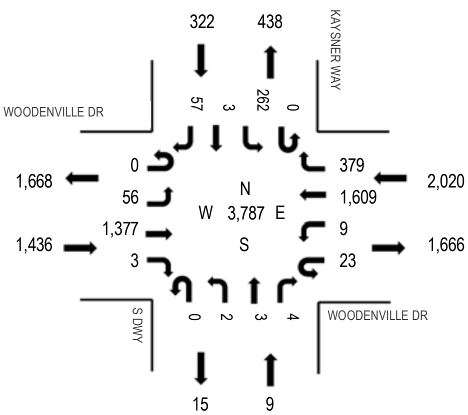
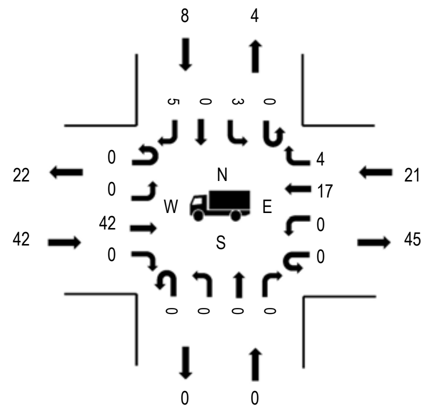
Location: 7 S DWY & WOODENVILLE DR PM
Date: Tuesday, September 10, 2019
Peak Hour: 04:30 PM - 05:30 PM

Peak Hour

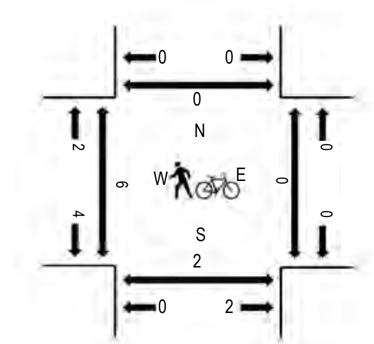
All Vehicles



Heavy Vehicles



Pedestrians/Bicycles in Crosswalk



	HV%	PHF
EB	2.9%	0.83
WB	1.0%	0.98
NB	0.0%	0.45
SB	2.5%	0.89
All	1.9%	0.94

Traffic Counts - All Vehicles

Interval Start Time	WOODENVILLE DR Eastbound				WOODENVILLE DR Westbound				S DWY Northbound				KAYSNER WAY Southbound				Total	Rolling Hour
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right		
4:00 PM	0	16	343	0	4	3	377	86	0	2	1	1	0	75	0	15	923	3,721
4:15 PM	0	9	336	0	2	2	351	90	0	1	0	1	0	70	0	13	875	3,729
4:30 PM	0	13	421	0	6	3	400	94	0	0	0	2	0	56	0	12	1,007	3,787
4:45 PM	0	12	310	1	4	3	402	93	0	2	2	1	0	65	1	20	916	3,751
5:00 PM	0	12	328	2	8	3	395	92	0	0	0	1	0	77	1	12	931	3,710
5:15 PM	0	19	318	0	5	0	412	100	0	0	1	0	0	64	1	13	933	
5:30 PM	1	15	386	0	7	1	394	90	0	3	1	1	0	50	1	21	971	
5:45 PM	0	11	290	0	8	3	385	105	0	1	0	0	0	61	0	11	875	
Count Total	1	107	2,732	3	44	18	3,116	750	0	9	5	7	0	518	4	117	7,431	
Peak Hour	0	56	1,377	3	23	9	1,609	379	0	2	3	4	0	262	3	57	3,787	

Traffic Counts - Heavy Vehicles and Pedestrians/Bicycles in Crosswalk

Interval Start Time	Heavy Vehicles EB	NB	WB	SB	Total	Interval Start Time	Pedestrians/Bicycles on Crosswalk EB	NB	WB	SB	Total
4:00 PM	20	0	6	5	31	4:00 PM	4	1	0	0	5
4:15 PM	12	0	11	6	29	4:15 PM	1	0	0	0	1
4:30 PM	23	0	13	1	37	4:30 PM	2	1	0	0	3
4:45 PM	7	0	2	4	13	4:45 PM	3	1	0	0	4
5:00 PM	7	0	4	2	13	5:00 PM	1	0	0	0	1
5:15 PM	5	0	2	1	8	5:15 PM	0	0	0	0	0
5:30 PM	8	0	5	2	15	5:30 PM	0	0	0	0	0
5:45 PM	2	0	4	2	8	5:45 PM	0	0	0	0	0
Count Total	84	0	47	23	154	Count Total	11	3	0	0	14
Peak Hour	42	0	21	8	71	Peak Hour	6	2	0	0	8

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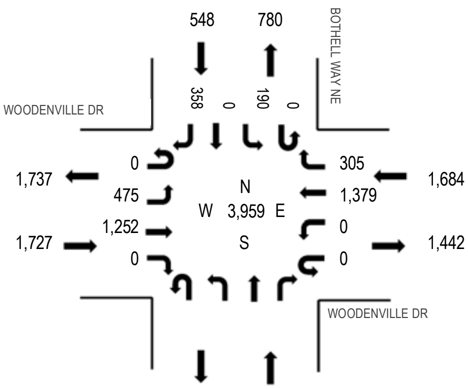
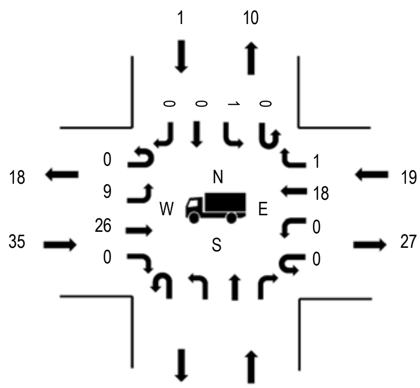
Location: 8 BOTHELL WAY NE & WOODENVILLE DR PM
Date: Tuesday, September 10, 2019
Peak Hour: 04:45 PM - 05:45 PM

Peak Hour

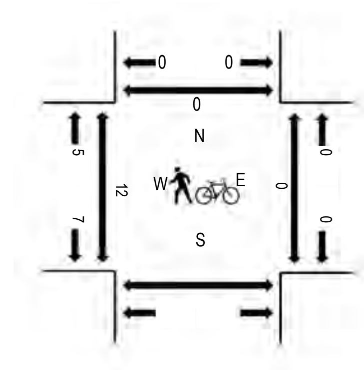
All Vehicles



Heavy Vehicles



Pedestrians/Bicycles in Crosswalk



	HV%	PHF
EB	2.0%	0.96
WB	1.1%	0.93
NB		
SB	0.2%	0.91
All	1.4%	0.98

Traffic Counts - All Vehicles

Interval Start Time	WOODENVILLE DR Eastbound U-Turn	Left	Thru	Right	WOODENVILLE DR Westbound U-Turn	Left	Thru	Right	Northbound U-Turn	Left	Thru	Right	BOTHELL WAY NE Southbound U-Turn	Left	Thru	Right	Total	Rolling Hour
4:00 PM	0	122	314	0	0	0	306	74					0	56	0	87	959	3,897
4:15 PM	0	80	330	0	0	0	355	52					0	47	0	89	953	3,894
4:30 PM	0	116	360	0	0	0	309	56					0	54	0	94	989	3,956
4:45 PM	0	120	314	0	0	0	363	88					0	38	0	73	996	3,959
5:00 PM	0	123	290	0	0	0	325	76					0	51	0	91	956	3,935
5:15 PM	0	111	341	0	0	0	351	68					0	48	0	96	1,015	
5:30 PM	0	121	307	0	0	0	340	73					0	53	0	98	992	
5:45 PM	0	94	287	0	0	0	365	92					0	39	0	95	972	
Count Total	0	887	2,543	0	0	0	2,714	579					0	386	0	723	7,832	
Peak Hour	0	475	1,252	0	0	0	1,379	305					0	190	0	358	3,959	

Traffic Counts - Heavy Vehicles and Pedestrians/Bicycles in Crosswalk

Interval Start Time	Heavy Vehicles EB	NB	WB	SB	Total	Interval Start Time	Pedestrians/Bicycles on Crosswalk EB	NB	WB	SB	Total
4:00 PM	23		6	6	35	4:00 PM	5		0	0	5
4:15 PM	12		12	3	27	4:15 PM	1		0	0	1
4:30 PM	21		6	5	32	4:30 PM	4		0	0	4
4:45 PM	9		2	0	11	4:45 PM	5		0	0	5
5:00 PM	11		7	0	18	5:00 PM	4		0	0	4
5:15 PM	9		3	0	12	5:15 PM	1		0	0	1
5:30 PM	6		7	1	14	5:30 PM	2		0	0	2
5:45 PM	3		4	0	7	5:45 PM	4		0	0	4
Count Total	94		47	15	156	Count Total	26		0	0	26
Peak Hour	35		19	1	55	Peak Hour	12		0	0	12

(303) 216-2439
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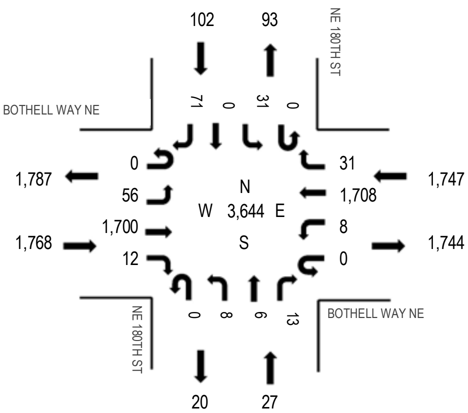
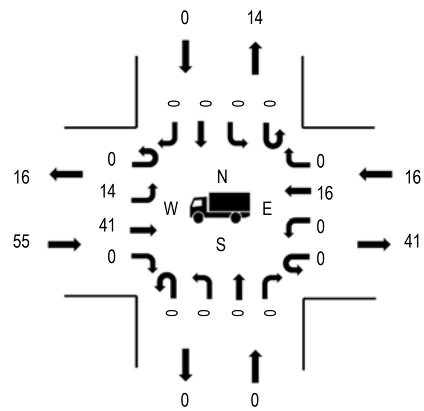
Location: 9 NE 180TH ST & BOTHELL WAY NE PM
Date: Tuesday, September 10, 2019
Peak Hour: 04:45 PM - 05:45 PM

Peak Hour

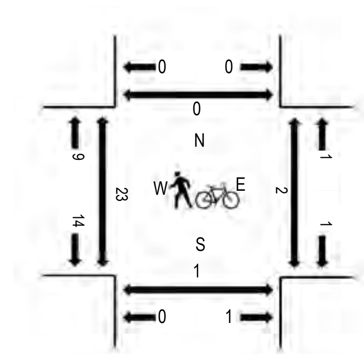
All Vehicles



Heavy Vehicles



Pedestrians/Bicycles in Crosswalk



	HV%	PHF
EB	3.1%	0.89
WB	0.9%	0.97
NB	0.0%	0.75
SB	0.0%	0.91
All	1.9%	0.95

Traffic Counts - All Vehicles

Interval	BOTHELL WAY NE				BOTHELL WAY NE				NE 180TH ST				NE 180TH ST					
	Eastbound				Westbound				Northbound				Southbound					Rolling
Start Time	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	Total	Hour
4:00 PM	0	15	406	2	1	3	399	13	0	1	3	5	0	9	0	12	869	3,573
4:15 PM	0	10	392	3	1	3	427	8	0	4	3	2	0	3	0	19	875	3,548
4:30 PM	0	15	431	6	0	0	403	9	0	4	1	3	0	14	2	16	904	3,637
4:45 PM	0	11	431	2	0	2	441	7	0	2	1	6	0	6	0	16	925	3,644
5:00 PM	0	12	382	3	0	1	407	8	0	1	2	2	0	9	0	17	844	3,605
5:15 PM	0	21	469	4	0	2	431	3	0	3	1	4	0	5	0	21	964	
5:30 PM	0	12	418	3	0	3	429	13	0	2	2	1	0	11	0	17	911	
5:45 PM	0	14	397	0	0	9	437	5	0	4	2	3	0	7	0	8	886	
Count Total	0	110	3,326	23	2	23	3,374	66	0	21	15	26	0	64	2	126	7,178	
Peak Hour	0	56	1,700	12	0	8	1,708	31	0	8	6	13	0	31	0	71	3,644	

Traffic Counts - Heavy Vehicles and Pedestrians/Bicycles in Crosswalk

Interval	Heavy Vehicles					Interval	Pedestrians/Bicycles on Crosswalk				
Start Time	EB	NB	WB	SB	Total	Start Time	EB	NB	WB	SB	Total
4:00 PM	24	0	10	0	34	4:00 PM	1	0	0	0	1
4:15 PM	15	0	11	0	26	4:15 PM	7	0	1	0	8
4:30 PM	23	0	8	0	31	4:30 PM	4	1	1	0	6
4:45 PM	10	0	3	0	13	4:45 PM	2	1	0	0	3
5:00 PM	18	0	5	0	23	5:00 PM	11	0	1	0	12
5:15 PM	15	0	3	0	18	5:15 PM	7	0	1	0	8
5:30 PM	12	0	5	0	17	5:30 PM	3	0	0	0	3
5:45 PM	8	0	3	0	11	5:45 PM	2	0	1	0	3
Count Total	125	0	48	0	173	Count Total	37	2	5	0	44
Peak Hour	55	0	16	0	71	Peak Hour	23	1	2	0	26

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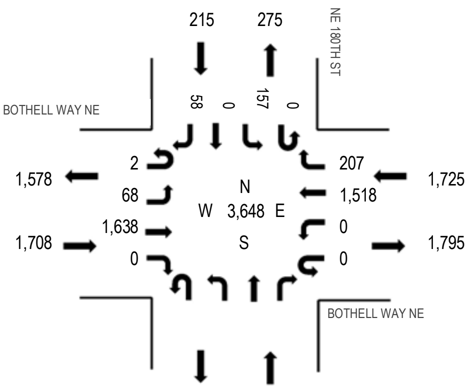
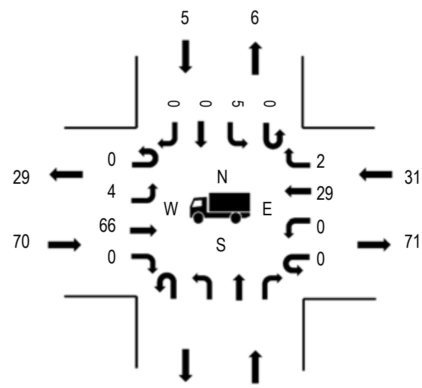
Location: 10 NE 180TH ST & BOTHELL WAY NE PM
Date: Tuesday, September 10, 2019
Peak Hour: 04:00 PM - 05:00 PM

Peak Hour

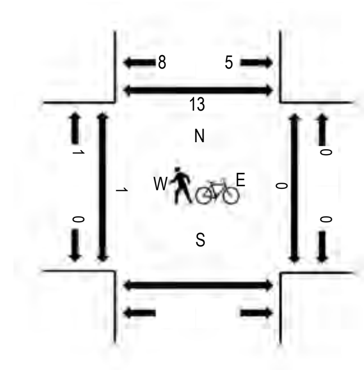
All Vehicles



Heavy Vehicles



Pedestrians/Bicycles in Crosswalk



	HV%	PHF
EB	4.1%	0.98
WB	1.8%	0.97
NB		
SB	2.3%	0.84
All	2.9%	0.99

Traffic Counts - All Vehicles

Interval Start Time	BOTHELL WAY NE Eastbound U-Turn	Left	Thru	Right	BOTHELL WAY NE Westbound U-Turn	Left	Thru	Right	Northbound U-Turn	Left	Thru	Right	NE 180TH ST Southbound U-Turn	Left	Thru	Right	Total	Rolling Hour
4:00 PM	1	20	407	0	0	0	376	40					0	38	0	20	902	3,648
4:15 PM	1	21	388	0	0	0	388	57					0	46	0	18	919	3,595
4:30 PM	0	14	420	0	0	0	364	57					0	43	0	12	910	3,628
4:45 PM	0	13	423	0	0	0	390	53					0	30	0	8	917	3,617
5:00 PM	1	12	367	0	0	0	366	56					0	37	0	10	849	3,577
5:15 PM	1	11	453	0	0	0	384	64					0	25	0	14	952	
5:30 PM	0	21	386	0	0	0	362	77					0	38	0	15	899	
5:45 PM	1	28	368	0	0	0	377	68					0	25	0	10	877	
Count Total	5	140	3,212	0	0	0	3,007	472					0	282	0	107	7,225	
Peak Hour	2	68	1,638	0	0	0	1,518	207					0	157	0	58	3,648	

Traffic Counts - Heavy Vehicles and Pedestrians/Bicycles in Crosswalk

Interval Start Time	Heavy Vehicles EB	NB	WB	SB	Total	Interval Start Time	Pedestrians/Bicycles on Crosswalk EB	NB	WB	SB	Total
4:00 PM	19		8	3	30	4:00 PM	0		0	6	6
4:15 PM	21		11	1	33	4:15 PM	0		0	6	6
4:30 PM	16		8	1	25	4:30 PM	1		0	0	1
4:45 PM	14		4	0	18	4:45 PM	0		0	1	1
5:00 PM	15		5	0	20	5:00 PM	1		0	3	4
5:15 PM	13		4	0	17	5:15 PM	0		0	6	6
5:30 PM	10		7	0	17	5:30 PM	1		0	7	8
5:45 PM	9		4	0	13	5:45 PM	0		0	1	1
Count Total	117		51	5	173	Count Total	3		0	30	33
Peak Hour	70		31	5	106	Peak Hour	1		0	13	14

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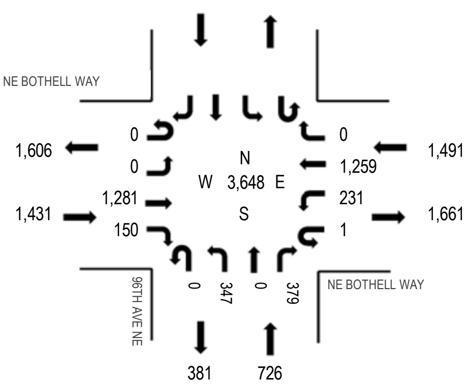
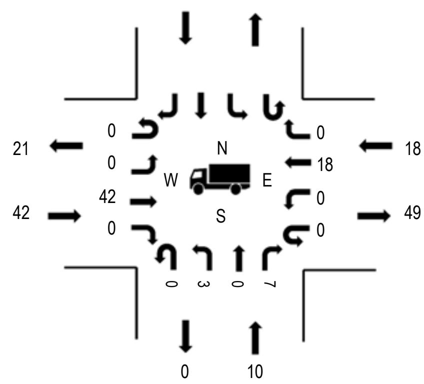
Location: 11 96TH AVE NE & NE BOTHELL WAY PM
Date: Tuesday, September 10, 2019
Peak Hour: 05:00 PM - 06:00 PM

Peak Hour

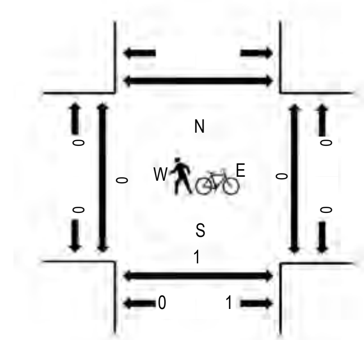
All Vehicles



Heavy Vehicles



Pedestrians/Bicycles in Crosswalk



	HV%	PHF
EB	2.9%	0.95
WB	1.2%	1.00
NB	1.4%	0.81
SB		
All	1.9%	0.94

Traffic Counts - All Vehicles

Interval Start Time	NE BOTHELL WAY Eastbound U-Turn	Left	Thru	Right	NE BOTHELL WAY Westbound U-Turn	Left	Thru	Right	96TH AVE NE Northbound U-Turn	Left	Thru	Right	Southbound U-Turn	Left	Thru	Right	Total	Rolling Hour
4:00 PM	0	0	315	30	0	50	334	0	0	79	0	100					908	3,566
4:15 PM	0	0	348	35	0	46	318	0	0	86	0	95					928	3,557
4:30 PM	0	0	314	34	0	50	323	0	0	79	0	67					867	3,601
4:45 PM	0	0	296	38	0	50	291	0	0	97	0	91					863	3,638
5:00 PM	0	0	333	40	0	37	336	0	0	66	0	87					899	3,648
5:15 PM	0	0	343	32	0	66	308	0	0	112	0	111					972	
5:30 PM	0	0	309	45	1	64	309	0	0	82	0	94					904	
5:45 PM	0	0	296	33	0	64	306	0	0	87	0	87					873	
Count Total	0	0	2,554	287	1	427	2,525	0	0	688	0	732					7,214	
Peak Hour	0	0	1,281	150	1	231	1,259	0	0	347	0	379					3,648	

Traffic Counts - Heavy Vehicles and Pedestrians/Bicycles in Crosswalk

Interval Start Time	Heavy Vehicles EB	NB	WB	SB	Total	Interval Start Time	Pedestrians/Bicycles on Crosswalk EB	NB	WB	SB	Total
4:00 PM	23	4	7		34	4:00 PM	0	0	0		0
4:15 PM	17	6	9		32	4:15 PM	0	0	0		0
4:30 PM	18	0	9		27	4:30 PM	0	0	0		0
4:45 PM	8	4	5		17	4:45 PM	0	0	0		0
5:00 PM	14	2	5		21	5:00 PM	0	0	0		0
5:15 PM	10	7	3		20	5:15 PM	0	0	0		0
5:30 PM	9	0	5		14	5:30 PM	0	1	0		1
5:45 PM	9	1	5		15	5:45 PM	0	0	0		0
Count Total	108	24	48		180	Count Total	0	1	0		1
Peak Hour	42	10	18		70	Peak Hour	0	1	0		1

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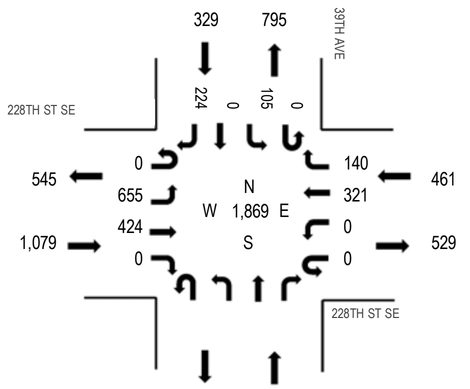
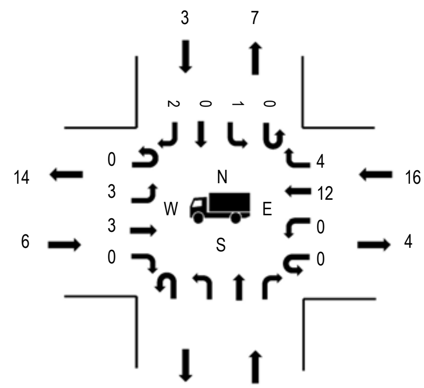
Location: 12 39TH AVE & 228TH ST SE PM
Date: Tuesday, September 10, 2019
Peak Hour: 04:45 PM - 05:45 PM

Peak Hour

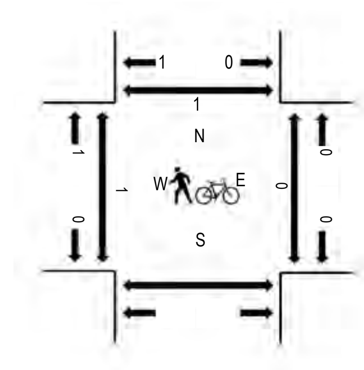
All Vehicles



Heavy Vehicles



Pedestrians/Bicycles in Crosswalk



	HV%	PHF
EB	0.6%	0.95
WB	3.5%	0.83
NB		
SB	0.9%	0.89
All	1.3%	0.97

Traffic Counts - All Vehicles

Interval Start Time	228TH ST SE Eastbound U-Turn	Left	Thru	Right	228TH ST SE Westbound U-Turn	Left	Thru	Right	Northbound U-Turn	Left	Thru	Right	39TH AVE Southbound U-Turn	Left	Thru	Right	Total	Rolling Hour
4:00 PM	0	128	131	0	0	0	82	28					0	25	0	44	438	1,808
4:15 PM	0	147	124	0	0	0	85	42					0	21	0	48	467	1,830
4:30 PM	0	146	102	0	0	0	70	32					0	17	0	56	423	1,846
4:45 PM	0	145	113	0	0	0	100	39					0	27	0	56	480	1,869
5:00 PM	0	172	102	0	0	0	83	35					0	21	0	47	460	1,851
5:15 PM	0	179	105	0	0	0	71	36					0	29	0	63	483	
5:30 PM	0	159	104	0	0	0	67	30					0	28	0	58	446	
5:45 PM	0	172	98	0	0	0	58	33					0	32	0	69	462	
Count Total	0	1,248	879	0	0	0	616	275					0	200	0	441	3,659	
Peak Hour	0	655	424	0	0	0	321	140					0	105	0	224	1,869	

Traffic Counts - Heavy Vehicles and Pedestrians/Bicycles in Crosswalk

Interval Start Time	Heavy Vehicles EB	NB	WB	SB	Total	Interval Start Time	Pedestrians/Bicycles on Crosswalk EB	NB	WB	SB	Total
4:00 PM	8		0	1	9	4:00 PM	0		0	3	3
4:15 PM	7		7	3	17	4:15 PM	0		0	0	0
4:30 PM	8		6	6	20	4:30 PM	0		0	0	0
4:45 PM	0		10	2	12	4:45 PM	0		0	1	1
5:00 PM	2		3	0	5	5:00 PM	1		0	0	1
5:15 PM	1		2	0	3	5:15 PM	0		0	0	0
5:30 PM	3		1	1	5	5:30 PM	0		0	0	0
5:45 PM	1		1	0	2	5:45 PM	2		0	1	3
Count Total	30		30	13	73	Count Total	3		0	5	8
Peak Hour	6		16	3	25	Peak Hour	1		0	1	2

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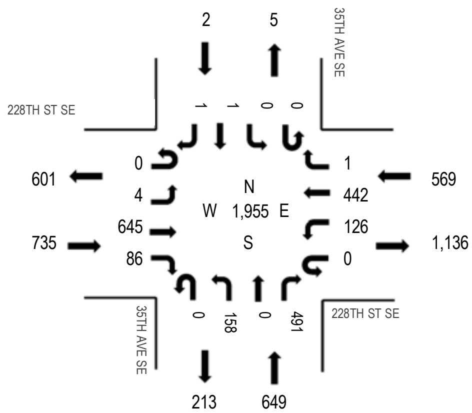
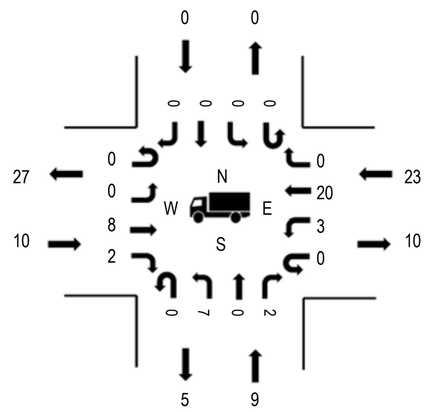
Location: 13 35TH AVE SE & 228TH ST SE PM
Date: Tuesday, September 10, 2019
Peak Hour: 04:30 PM - 05:30 PM

Peak Hour

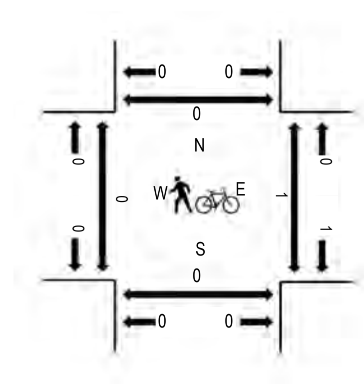
All Vehicles



Heavy Vehicles



Pedestrians/Bicycles in Crosswalk



	HV%	PHF
EB	1.4%	0.94
WB	4.0%	0.94
NB	1.4%	0.93
SB	0.0%	0.25
All	2.1%	0.95

Traffic Counts - All Vehicles

Interval Start Time	228TH ST SE Eastbound				228TH ST SE Westbound				35TH AVE SE Northbound				35TH AVE SE Southbound				Total	Rolling Hour
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right		
4:00 PM	0	1	194	26	0	19	106	0	0	24	0	82	0	0	0	1	453	1,890
4:15 PM	0	0	173	25	0	22	114	0	0	32	0	111	0	0	0	1	478	1,920
4:30 PM	0	0	155	25	0	40	91	1	0	41	0	111	0	0	0	0	464	1,955
4:45 PM	0	2	170	16	0	25	126	0	0	35	0	121	0	0	0	0	495	1,953
5:00 PM	0	0	148	24	0	29	106	0	0	43	0	131	0	0	1	1	483	1,945
5:15 PM	0	2	172	21	0	32	119	0	0	39	0	128	0	0	0	0	513	
5:30 PM	0	0	154	32	0	31	98	0	0	22	0	120	0	0	0	5	462	
5:45 PM	0	1	164	16	0	34	99	0	0	33	0	139	0	0	0	1	487	
Count Total	0	6	1,330	185	0	232	859	1	0	269	0	943	0	0	1	9	3,835	
Peak Hour	0	4	645	86	0	126	442	1	0	158	0	491	0	0	1	1	1,955	

Traffic Counts - Heavy Vehicles and Pedestrians/Bicycles in Crosswalk

Interval Start Time	Heavy Vehicles					Interval Start Time	Pedestrians/Bicycles on Crosswalk				
	EB	NB	WB	SB	Total		EB	NB	WB	SB	Total
4:00 PM	7	2	1	0	10	4:00 PM	0	1	0	0	1
4:15 PM	8	3	4	0	15	4:15 PM	0	0	1	0	1
4:30 PM	7	4	11	0	22	4:30 PM	0	0	0	0	0
4:45 PM	1	1	8	0	10	4:45 PM	0	0	1	0	1
5:00 PM	1	2	2	0	5	5:00 PM	0	0	0	0	0
5:15 PM	1	2	2	0	5	5:15 PM	0	0	0	0	0
5:30 PM	2	2	1	0	5	5:30 PM	0	0	0	1	1
5:45 PM	2	1	0	0	3	5:45 PM	0	0	0	0	0
Count Total	29	17	29	0	75	Count Total	0	1	2	1	4
Peak Hour	10	9	23	0	42	Peak Hour	0	0	1	0	1

Location: 14 35TH AVE SE & 240TH ST SE PM
Date: Tuesday, September 10, 2019
Peak Hour: 04:45 PM - 05:45 PM

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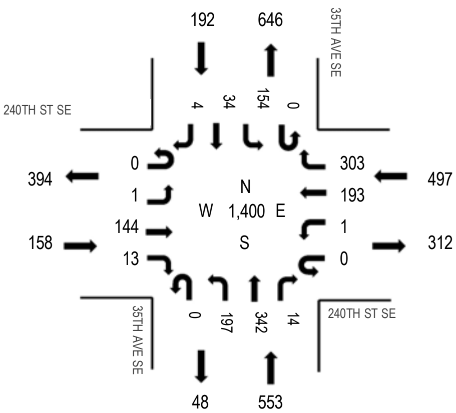
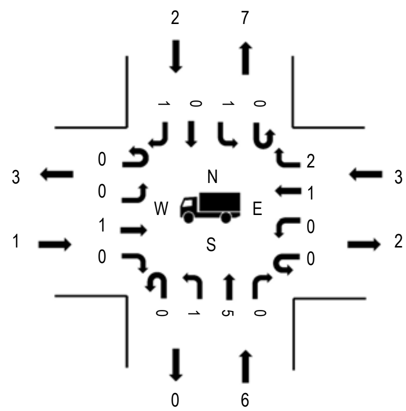
Peak Hour

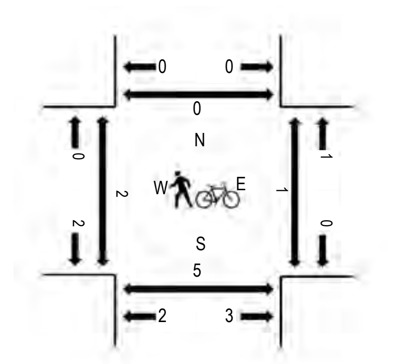
All Vehicles



Heavy Vehicles



Pedestrians/Bicycles in Crosswalk



	HV%	PHF
EB	0.6%	0.90
WB	0.6%	0.96
NB	1.1%	0.92
SB	1.0%	0.87
All	0.9%	0.99

Traffic Counts - All Vehicles

Interval Start Time	240TH ST SE Eastbound U-Turn	Left	Thru	Right	240TH ST SE Westbound U-Turn	Left	Thru	Right	35TH AVE SE Northbound U-Turn	Left	Thru	Right	35TH AVE SE Southbound U-Turn	Left	Thru	Right	Total	Rolling Hour
4:00 PM	0	1	26	10	0	0	44	52	0	42	48	6	0	31	5	1	266	1,259
4:15 PM	0	0	33	7	0	0	42	75	0	37	62	1	0	30	11	0	298	1,348
4:30 PM	0	0	29	6	0	0	38	78	0	60	74	6	0	38	15	2	346	1,399
4:45 PM	0	0	39	5	0	0	46	78	0	47	84	2	0	37	10	1	349	1,400
5:00 PM	0	0	29	3	0	0	58	68	0	57	89	4	0	34	12	1	355	1,353
5:15 PM	0	1	41	2	0	0	46	83	0	49	80	5	0	41	1	0	349	
5:30 PM	0	0	35	3	0	1	43	74	0	44	89	3	0	42	11	2	347	
5:45 PM	0	0	32	0	0	0	44	79	0	23	78	2	0	31	12	1	302	
Count Total	0	2	264	36	0	1	361	587	0	359	604	29	0	284	77	8	2,612	
Peak Hour	0	1	144	13	0	1	193	303	0	197	342	14	0	154	34	4	1,400	

Traffic Counts - Heavy Vehicles and Pedestrians/Bicycles in Crosswalk

Interval Start Time	Heavy Vehicles EB	NB	WB	SB	Total	Interval Start Time	Pedestrians/Bicycles on Crosswalk EB	NB	WB	SB	Total
4:00 PM	0	0	3	1	4	4:00 PM	0	3	0	0	3
4:15 PM	1	1	3	0	5	4:15 PM	0	0	0	0	0
4:30 PM	0	2	1	3	6	4:30 PM	0	3	0	0	3
4:45 PM	1	0	1	1	3	4:45 PM	1	1	1	0	3
5:00 PM	0	3	1	1	5	5:00 PM	1	1	0	0	2
5:15 PM	0	1	1	0	2	5:15 PM	0	0	0	0	0
5:30 PM	0	2	0	0	2	5:30 PM	0	3	0	0	3
5:45 PM	1	0	0	1	2	5:45 PM	0	3	0	0	3
Count Total	3	9	10	7	29	Count Total	2	14	1	0	17
Peak Hour	1	6	3	2	12	Peak Hour	2	5	1	0	8

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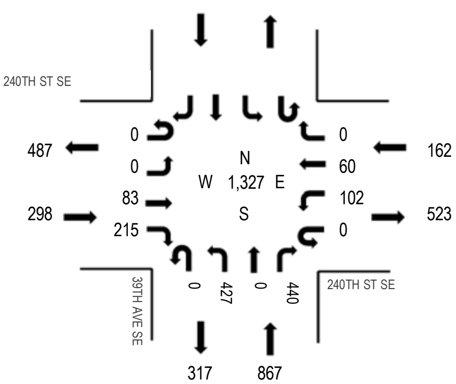
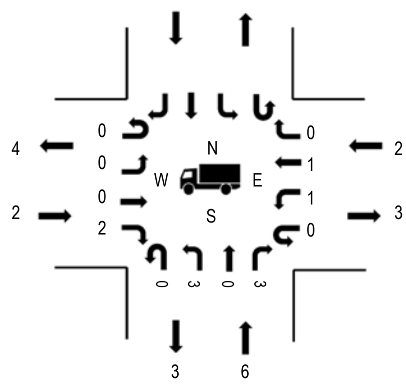
Location: 15 39TH AVE SE & 240TH ST SE PM
Date: Tuesday, September 10, 2019
Peak Hour: 04:30 PM - 05:30 PM

Peak Hour

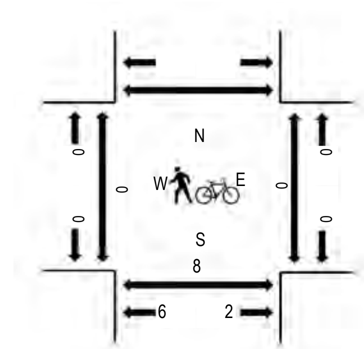
All Vehicles



Heavy Vehicles



Pedestrians/Bicycles in Crosswalk



	HV%	PHF
EB	0.7%	0.89
WB	1.2%	0.76
NB	0.7%	0.93
SB		
All	0.8%	0.91

Traffic Counts - All Vehicles

Interval Start Time	240TH ST SE Eastbound U-Turn	Left	Thru	Right	240TH ST SE Westbound U-Turn	Left	Thru	Right	39TH AVE SE Northbound U-Turn	Left	Thru	Right	Southbound U-Turn	Left	Thru	Right	Total	Rolling Hour
4:00 PM	0	0	19	47	0	23	16	0	0	83	0	87					275	1,263
4:15 PM	0	0	21	43	0	30	22	0	0	86	0	110					312	1,292
4:30 PM	0	0	15	55	0	24	15	0	0	104	0	97					310	1,327
4:45 PM	0	0	23	57	0	34	19	0	0	114	0	119					366	1,319
5:00 PM	0	0	18	46	0	24	15	0	0	95	0	106					304	1,261
5:15 PM	0	0	27	57	0	20	11	0	0	114	0	118					347	
5:30 PM	0	0	18	55	0	23	10	0	0	87	0	109					302	
5:45 PM	0	0	16	43	0	36	20	0	0	91	0	102					308	
Count Total	0	0	157	403	0	214	128	0	0	774	0	848					2,524	
Peak Hour	0	0	83	215	0	102	60	0	0	427	0	440					1,327	

Traffic Counts - Heavy Vehicles and Pedestrians/Bicycles in Crosswalk

Interval Start Time	Heavy Vehicles EB	NB	WB	SB	Total	Interval Start Time	Pedestrians/Bicycles on Crosswalk EB	NB	WB	SB	Total
4:00 PM	0	3	3		6	4:00 PM	0	1	0		1
4:15 PM	1	3	3		7	4:15 PM	1	1	0		2
4:30 PM	0	2	2		4	4:30 PM	0	3	0		3
4:45 PM	2	2	0		4	4:45 PM	0	3	0		3
5:00 PM	0	1	0		1	5:00 PM	0	2	0		2
5:15 PM	0	1	0		1	5:15 PM	0	0	0		0
5:30 PM	0	2	1		3	5:30 PM	0	2	5		7
5:45 PM	0	1	0		1	5:45 PM	0	4	0		4
Count Total	3	15	9		27	Count Total	1	16	5		22
Peak Hour	2	6	2		10	Peak Hour	0	8	0		8

(303) 216-2439
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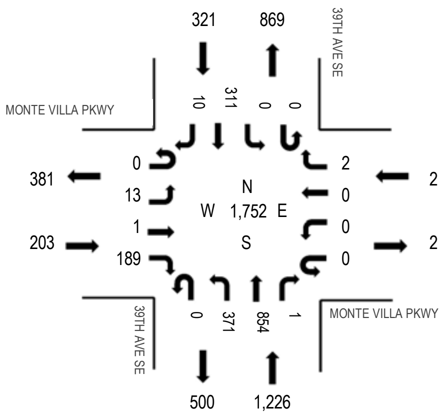
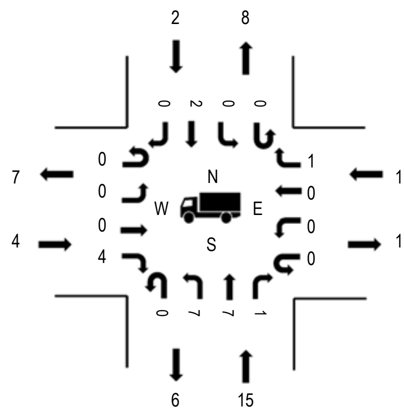
Location: 16 39TH AVE SE & MONTE VILLA PKWY PM
Date: Tuesday, September 10, 2019
Peak Hour: 04:30 PM - 05:30 PM

Peak Hour

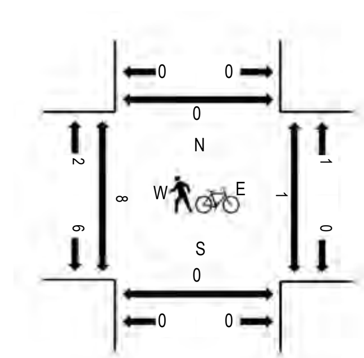
All Vehicles



Heavy Vehicles



Pedestrians/Bicycles in Crosswalk



	HV%	PHF
EB	2.0%	0.76
WB	50.0%	0.50
NB	1.2%	0.96
SB	0.6%	0.88
All	1.3%	0.96

Traffic Counts - All Vehicles

Interval Start Time	MONTE VILLA PKWY Eastbound				MONTE VILLA PKWY Westbound				39TH AVE SE Northbound				39TH AVE SE Southbound				Total	Rolling Hour
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right		
4:00 PM	0	1	0	67	0	0	0	0	0	51	158	0	0	0	68	6	351	1,622
4:15 PM	0	4	0	49	0	1	0	0	0	67	197	0	0	0	74	0	392	1,711
4:30 PM	0	4	1	62	0	0	0	1	0	71	201	0	0	0	80	3	423	1,752
4:45 PM	0	3	0	41	0	0	0	1	0	97	222	1	0	0	87	4	456	1,730
5:00 PM	0	3	0	52	0	0	0	0	0	106	210	0	0	0	66	3	440	1,676
5:15 PM	0	3	0	34	0	0	0	0	0	97	221	0	0	0	78	0	433	
5:30 PM	0	2	0	26	0	0	0	1	0	99	193	0	0	1	78	1	401	
5:45 PM	0	2	0	33	0	0	0	0	0	89	197	1	0	0	76	4	402	
Count Total	0	22	1	364	0	1	0	3	0	677	1,599	2	0	1	607	21	3,298	
Peak Hour	0	13	1	189	0	0	0	2	0	371	854	1	0	0	311	10	1,752	

Traffic Counts - Heavy Vehicles and Pedestrians/Bicycles in Crosswalk

Interval Start Time	Heavy Vehicles EB	NB	WB	SB	Total	Interval Start Time	Pedestrians/Bicycles on Crosswalk EB	NB	WB	SB	Total
4:00 PM	0	3	0	1	4	4:00 PM	0	1	1	1	3
4:15 PM	0	6	0	2	8	4:15 PM	1	0	2	1	4
4:30 PM	2	4	0	1	7	4:30 PM	0	0	0	0	0
4:45 PM	1	4	1	1	7	4:45 PM	3	0	1	0	4
5:00 PM	0	4	0	0	4	5:00 PM	2	0	0	0	2
5:15 PM	1	3	0	0	4	5:15 PM	3	0	0	0	3
5:30 PM	0	4	0	1	5	5:30 PM	0	0	2	0	2
5:45 PM	3	2	0	0	5	5:45 PM	0	0	3	0	3
Count Total	7	30	1	6	44	Count Total	9	1	9	2	21
Peak Hour	4	15	1	2	22	Peak Hour	8	0	1	0	9

(303) 216-2439
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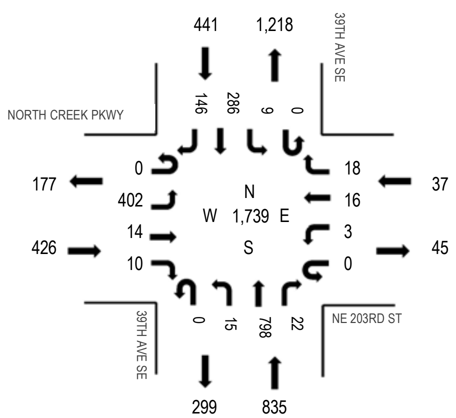
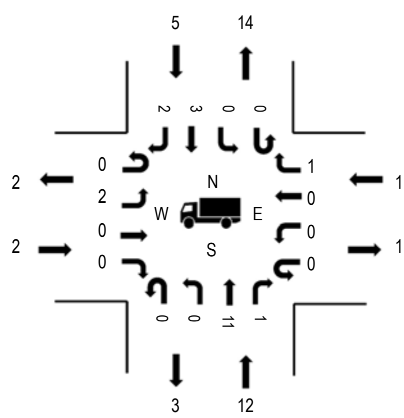
Location: 17 39TH AVE SE & NE 203RD ST PM
Date: Tuesday, September 10, 2019
Peak Hour: 04:45 PM - 05:45 PM

Peak Hour

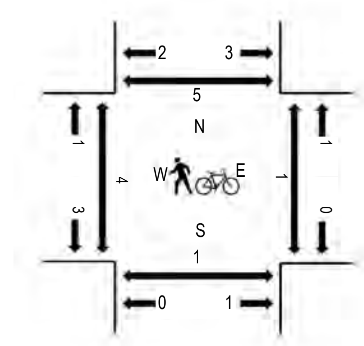
All Vehicles



Heavy Vehicles



Pedestrians/Bicycles in Crosswalk



	HV%	PHF
EB	0.5%	0.95
WB	2.7%	0.62
NB	1.4%	0.98
SB	1.1%	0.83
All	1.2%	0.93

Traffic Counts - All Vehicles

Interval Start Time	NORTH CREEK PKWY Eastbound				NE 203RD ST Westbound				39TH AVE SE Northbound				39TH AVE SE Southbound				Total	Rolling Hour
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right		
4:00 PM	0	63	6	10	0	1	4	2	0	0	130	3	0	3	103	25	350	1,645
4:15 PM	0	104	5	4	0	2	1	3	0	3	161	8	0	4	91	32	418	1,723
4:30 PM	0	100	2	6	0	2	1	1	0	11	163	8	0	5	78	35	412	1,717
4:45 PM	0	107	3	2	0	0	4	2	0	6	203	5	0	4	81	48	465	1,739
5:00 PM	0	98	3	0	0	1	3	2	0	0	211	3	0	3	74	30	428	1,667
5:15 PM	0	104	1	4	0	0	2	8	0	4	189	7	0	1	54	38	412	
5:30 PM	0	93	7	4	0	2	7	6	0	5	195	7	0	1	77	30	434	
5:45 PM	0	101	2	1	0	2	0	3	0	2	174	6	0	1	79	22	393	
Count Total	0	770	29	31	0	10	22	27	0	31	1,426	47	0	22	637	260	3,312	
Peak Hour	0	402	14	10	0	3	16	18	0	15	798	22	0	9	286	146	1,739	

Traffic Counts - Heavy Vehicles and Pedestrians/Bicycles in Crosswalk

Interval Start Time	Heavy Vehicles EB	NB	WB	SB	Total
4:00 PM	1	3	0	1	5
4:15 PM	1	4	0	2	7
4:30 PM	1	4	0	3	8
4:45 PM	0	4	0	3	7
5:00 PM	0	3	1	0	4
5:15 PM	1	3	0	1	5
5:30 PM	1	2	0	1	4
5:45 PM	1	0	0	3	4
Count Total	6	23	1	14	44
Peak Hour	2	12	1	5	20

Interval Start Time	Pedestrians/Bicycles on Crosswalk EB	NB	WB	SB	Total
4:00 PM	1	1	1	0	3
4:15 PM	1	3	3	0	7
4:30 PM	0	0	0	0	0
4:45 PM	0	0	0	0	0
5:00 PM	3	0	0	3	6
5:15 PM	1	0	0	0	1
5:30 PM	0	1	1	2	4
5:45 PM	0	0	0	1	1
Count Total	6	5	5	6	22
Peak Hour	4	1	1	5	11

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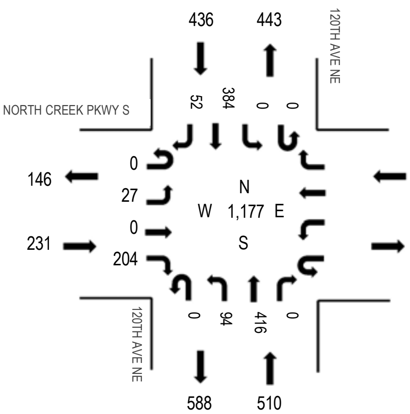
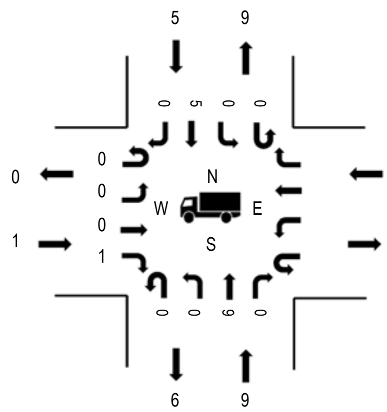
Location: 18 120TH AVE NE & NORTH CREEK PKWY S PM
Date: Tuesday, September 10, 2019
Peak Hour: 05:00 PM - 06:00 PM

Peak Hour

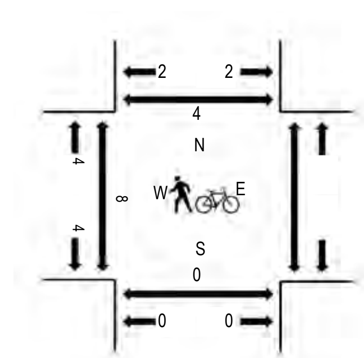
All Vehicles



Heavy Vehicles



Pedestrians/Bicycles in Crosswalk



	HV%	PHF
EB	0.4%	0.85
WB		
NB	1.8%	0.86
SB	1.1%	0.83
All	1.3%	0.92

Traffic Counts - All Vehicles

Interval Start Time	NORTH CREEK PKWY S Eastbound U-Turn	Left	Thru	Right	Westbound U-Turn	Left	Thru	Right	120TH AVE NE Northbound U-Turn	Left	Thru	Right	120TH AVE NE Southbound U-Turn	Left	Thru	Right	Total	Rolling Hour
4:00 PM	0	6	0	60					0	13	78	0	0	0	108	3	268	953
4:15 PM	0	8	0	44					0	16	71	0	0	0	71	4	214	988
4:30 PM	0	7	0	47					0	19	100	0	0	0	79	3	255	1,086
4:45 PM	0	6	0	46					0	12	61	0	0	0	87	4	216	1,152
5:00 PM	0	9	0	58					0	25	107	0	0	0	92	12	303	1,177
5:15 PM	0	6	0	53					0	29	120	0	0	0	85	19	312	
5:30 PM	0	6	0	62					0	26	96	0	0	0	113	18	321	
5:45 PM	0	6	0	31					0	14	93	0	0	0	94	3	241	
Count Total	0	54	0	401					0	154	726	0	0	0	729	66	2,130	
Peak Hour	0	27	0	204					0	94	416	0	0	0	384	52	1,177	

Traffic Counts - Heavy Vehicles and Pedestrians/Bicycles in Crosswalk

Interval Start Time	Heavy Vehicles EB	NB	WB	SB	Total
4:00 PM	2	3		1	6
4:15 PM	0	2		2	4
4:30 PM	1	6		0	7
4:45 PM	1	0		2	3
5:00 PM	0	4		2	6
5:15 PM	0	3		0	3
5:30 PM	1	1		2	4
5:45 PM	0	1		1	2
Count Total	5	20		10	35
Peak Hour	1	9		5	15

Interval Start Time	Pedestrians/Bicycles on Crosswalk EB	NB	WB	SB	Total
4:00 PM	0	0		0	0
4:15 PM	3	0		0	3
4:30 PM	1	0		0	1
4:45 PM	1	0		0	1
5:00 PM	2	0		0	2
5:15 PM	1	0		0	1
5:30 PM	2	0		2	4
5:45 PM	3	0		2	5
Count Total	13	0		4	17
Peak Hour	8	0		4	12

All Traffic Data Services Inc.

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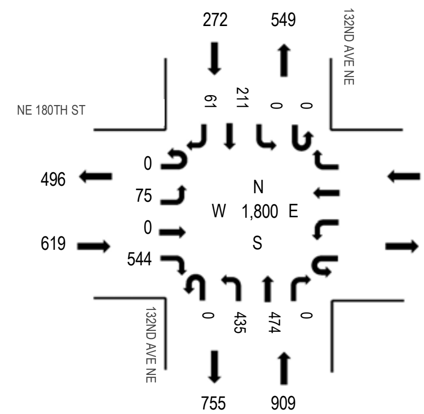
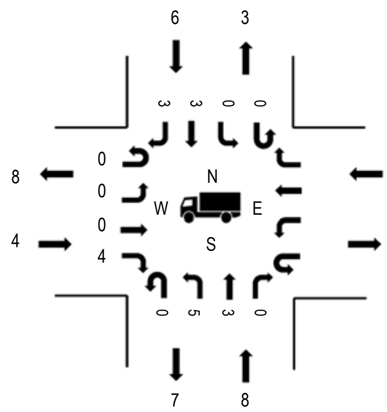
Location: 19 132ND AVE NE & NE 180TH ST PM
Date: Tuesday, September 10, 2019
Peak Hour: 05:00 PM - 06:00 PM

Peak Hour

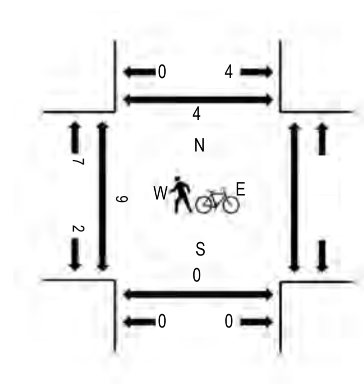
All Vehicles



Heavy Vehicles



Pedestrians/Bicycles in Crosswalk



	HV%	PHF
EB	0.6%	0.97
WB		
NB	0.9%	0.91
SB	2.2%	0.85
All	1.0%	0.94

Traffic Counts - All Vehicles

Interval Start Time	NE 180TH ST Eastbound				Westbound				132ND AVE NE Northbound				132ND AVE NE Southbound				Total	Rolling Hour
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right		
4:00 PM	0	21	0	141					0	82	78	0	0	0	48	11	381	1,578
4:15 PM	0	10	0	131					0	96	100	0	0	0	36	18	391	1,645
4:30 PM	0	15	0	112					0	100	107	0	0	0	48	16	398	1,734
4:45 PM	0	15	0	118					0	96	120	0	0	0	47	12	408	1,795
5:00 PM	0	22	0	130					0	93	123	0	0	0	60	20	448	1,800
5:15 PM	0	18	0	134					0	137	114	0	0	0	59	18	480	
5:30 PM	0	15	0	140					0	109	129	0	0	0	53	13	459	
5:45 PM	0	20	0	140					0	96	108	0	0	0	39	10	413	
Count Total	0	136	0	1,046					0	809	879	0	0	0	390	118	3,378	
Peak Hour	0	75	0	544					0	435	474	0	0	0	211	61	1,800	

Traffic Counts - Heavy Vehicles and Pedestrians/Bicycles in Crosswalk

Interval Start Time	Heavy Vehicles EB	NB	WB	SB	Total	Interval Start Time	Pedestrians/Bicycles on Crosswalk EB	NB	WB	SB	Total
4:00 PM	2	3		2	7	4:00 PM	0	0		0	0
4:15 PM	2	3		4	9	4:15 PM	0	0		0	0
4:30 PM	2	6		2	10	4:30 PM	1	0		0	1
4:45 PM	1	0		0	1	4:45 PM	0	0		0	0
5:00 PM	2	3		4	9	5:00 PM	2	0		1	3
5:15 PM	0	1		2	3	5:15 PM	4	0		3	7
5:30 PM	2	2		0	4	5:30 PM	3	0		0	3
5:45 PM	0	2		0	2	5:45 PM	0	0		0	0
Count Total	11	20		14	45	Count Total	10	0		4	14
Peak Hour	4	8		6	18	Peak Hour	9	0		4	13

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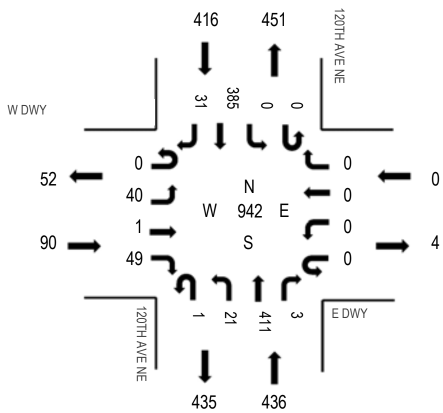
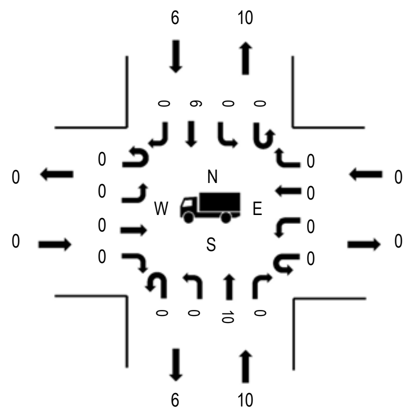
Location: 20 120TH AVE NE & E DWY PM
Date: Tuesday, September 10, 2019
Peak Hour: 05:00 PM - 06:00 PM

Peak Hour

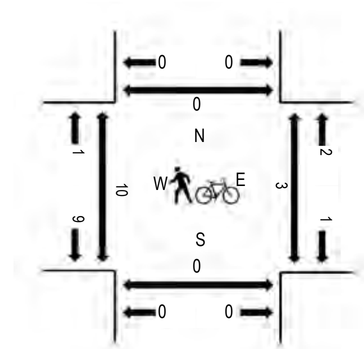
All Vehicles



Heavy Vehicles



Pedestrians/Bicycles in Crosswalk



	HV%	PHF
EB	0.0%	0.78
WB	0.0%	0.00
NB	2.3%	0.84
SB	1.4%	0.94
All	1.7%	0.90

Traffic Counts - All Vehicles

Interval Start Time	W DWY Eastbound U-Turn	Left	Thru	Right	E DWY Westbound U-Turn	Left	Thru	Right	120TH AVE NE Northbound U-Turn	Left	Thru	Right	120TH AVE NE Southbound U-Turn	Left	Thru	Right	Total	Rolling Hour
4:00 PM	0	3	1	7	0	0	0	1	0	4	92	2	0	0	89	6	205	787
4:15 PM	0	14	0	3	0	0	0	1	0	8	82	0	0	2	67	5	182	805
4:30 PM	0	9	0	4	0	0	0	0	0	4	88	1	0	0	77	1	184	833
4:45 PM	0	13	0	9	0	0	0	1	0	8	87	0	0	2	87	9	216	910
5:00 PM	0	4	1	14	0	0	0	0	0	6	97	2	0	0	93	6	223	942
5:15 PM	0	11	0	11	0	0	0	0	0	5	85	0	0	0	94	4	210	
5:30 PM	0	10	0	10	0	0	0	0	0	3	127	0	0	0	107	4	261	
5:45 PM	0	15	0	14	0	0	0	0	1	7	102	1	0	0	91	17	248	
Count Total	0	79	2	72	0	0	0	3	1	45	760	6	0	4	705	52	1,729	
Peak Hour	0	40	1	49	0	0	0	0	1	21	411	3	0	0	385	31	942	

Traffic Counts - Heavy Vehicles and Pedestrians/Bicycles in Crosswalk

Interval Start Time	Heavy Vehicles EB	NB	WB	SB	Total
4:00 PM	0	3	0	1	4
4:15 PM	0	1	0	1	2
4:30 PM	0	5	0	1	6
4:45 PM	1	0	0	1	2
5:00 PM	0	5	0	3	8
5:15 PM	0	2	0	1	3
5:30 PM	0	2	0	1	3
5:45 PM	0	1	0	1	2
Count Total	1	19	0	10	30
Peak Hour	0	10	0	6	16

Interval Start Time	Pedestrians/Bicycles on Crosswalk EB	NB	WB	SB	Total
4:00 PM	0	0	2	0	2
4:15 PM	2	0	0	0	2
4:30 PM	3	0	1	0	4
4:45 PM	2	0	3	0	5
5:00 PM	3	0	1	0	4
5:15 PM	4	0	0	0	4
5:30 PM	1	0	2	0	3
5:45 PM	2	0	0	0	2
Count Total	17	0	9	0	26
Peak Hour	10	0	3	0	13

(303) 216-2439
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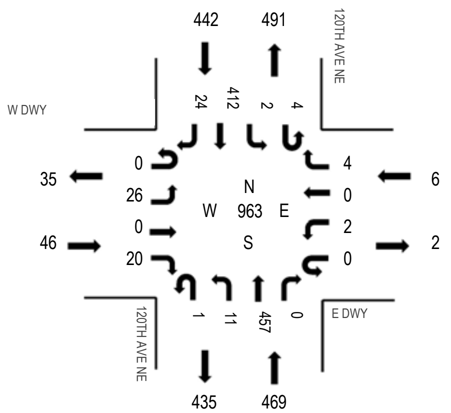
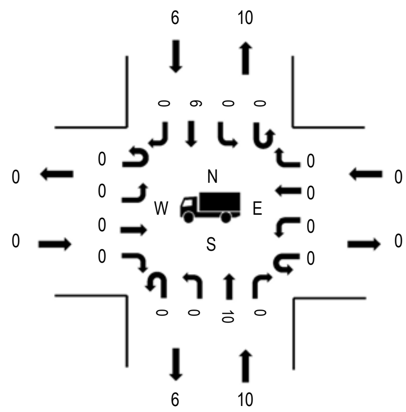
Location: 21 120TH AVE NE & E DWY PM
Date: Tuesday, September 10, 2019
Peak Hour: 05:00 PM - 06:00 PM

Peak Hour

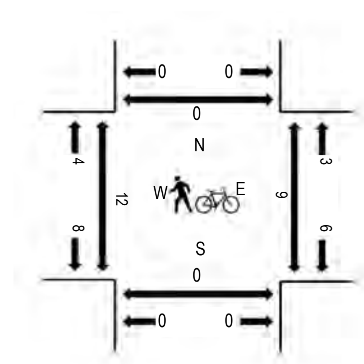
All Vehicles



Heavy Vehicles



Pedestrians/Bicycles in Crosswalk



	HV%	PHF
EB	0.0%	0.58
WB	0.0%	0.50
NB	2.1%	0.90
SB	1.4%	0.84
All	1.7%	0.93

Traffic Counts - All Vehicles

Interval Start Time	W DWY Eastbound U-Turn	Left	Thru	Right	E DWY Westbound U-Turn	Left	Thru	Right	120TH AVE NE Northbound U-Turn	Left	Thru	Right	120TH AVE NE Southbound U-Turn	Left	Thru	Right	Total	Rolling Hour
4:00 PM	0	5	0	1	0	1	0	2	0	0	88	1	0	0	97	2	197	711
4:15 PM	0	4	0	1	0	1	0	0	0	1	78	0	0	0	68	2	155	772
4:30 PM	0	1	0	2	0	0	0	2	0	0	111	0	1	0	80	1	198	857
4:45 PM	0	2	0	0	0	2	0	0	0	0	64	0	0	1	90	2	161	908
5:00 PM	0	13	0	7	0	2	0	1	0	2	129	0	2	1	92	9	258	963
5:15 PM	0	7	0	10	0	0	0	0	0	6	113	0	0	1	96	7	240	
5:30 PM	0	1	0	3	0	0	0	3	1	2	108	0	2	0	125	4	249	
5:45 PM	0	5	0	0	0	0	0	0	0	1	107	0	0	0	99	4	216	
Count Total	0	38	0	24	0	6	0	8	1	12	798	1	5	3	747	31	1,674	
Peak Hour	0	26	0	20	0	2	0	4	1	11	457	0	4	2	412	24	963	

Traffic Counts - Heavy Vehicles and Pedestrians/Bicycles in Crosswalk

Interval Start Time	Heavy Vehicles EB	NB	WB	SB	Total	Interval Start Time	Pedestrians/Bicycles on Crosswalk EB	NB	WB	SB	Total
4:00 PM	0	3	0	1	4	4:00 PM	0	1	0	0	1
4:15 PM	0	1	0	2	3	4:15 PM	3	0	1	1	5
4:30 PM	0	5	0	0	5	4:30 PM	3	0	1	0	4
4:45 PM	0	1	0	2	3	4:45 PM	4	0	1	0	5
5:00 PM	0	5	0	3	8	5:00 PM	2	0	5	0	7
5:15 PM	0	3	0	0	3	5:15 PM	4	0	2	0	6
5:30 PM	0	1	0	2	3	5:30 PM	1	0	1	0	2
5:45 PM	0	1	0	1	2	5:45 PM	5	0	1	0	6
Count Total	0	20	0	11	31	Count Total	22	1	12	1	36
Peak Hour	0	10	0	6	16	Peak Hour	12	0	9	0	21

(303) 216-2439
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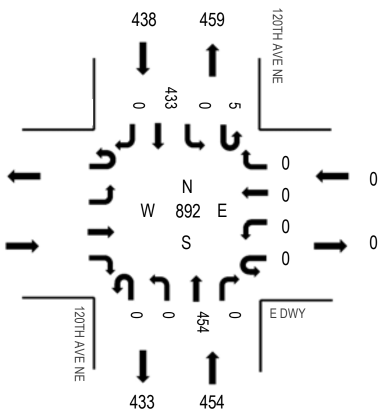
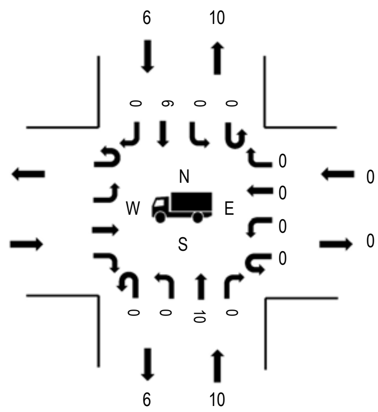
Location: 22 120TH AVE NE & E DWY PM
Date: Tuesday, September 10, 2019
Peak Hour: 05:00 PM - 06:00 PM

Peak Hour

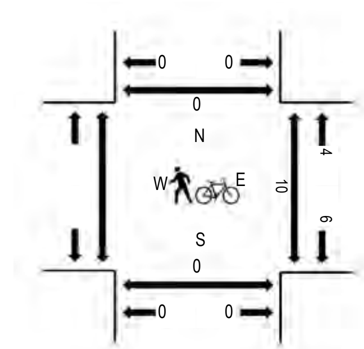
All Vehicles



Heavy Vehicles



Pedestrians/Bicycles in Crosswalk



	HV%	PHF
EB		
WB	0.0%	0.00
NB	2.2%	0.89
SB	1.4%	0.85
All	1.8%	0.95

Traffic Counts - All Vehicles

Interval Start Time	Eastbound				E DWY Westbound				120TH AVE NE Northbound				120TH AVE NE Southbound				Total	Rolling Hour
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right		
4:00 PM					0	1	0	0	0	0	87	0	0	0	102	0	190	686
4:15 PM					0	0	0	0	0	0	82	0	0	0	66	0	148	722
4:30 PM					0	0	0	0	0	0	109	0	0	0	81	0	190	808
4:45 PM					0	0	0	0	0	0	65	0	0	0	93	0	158	848
5:00 PM					0	0	0	0	0	0	127	0	0	0	99	0	226	892
5:15 PM					0	0	0	0	0	0	126	0	1	0	107	0	234	
5:30 PM					0	0	0	0	0	0	101	0	2	0	127	0	230	
5:45 PM					0	0	0	0	0	0	100	0	2	0	100	0	202	
Count Total					0	1	0	0	0	0	797	0	5	0	775	0	1,578	
Peak Hour					0	0	0	0	0	0	454	0	5	0	433	0	892	

Traffic Counts - Heavy Vehicles and Pedestrians/Bicycles in Crosswalk

Interval Start Time	Heavy Vehicles EB	NB	WB	SB	Total
4:00 PM		2	0	1	3
4:15 PM		1	0	2	3
4:30 PM		5	0	0	5
4:45 PM		0	0	2	2
5:00 PM		5	0	3	8
5:15 PM		3	0	0	3
5:30 PM		1	0	2	3
5:45 PM		1	0	1	2
Count Total		18	0	11	29
Peak Hour		10	0	6	16

Interval Start Time	Pedestrians/Bicycles on Crosswalk EB	NB	WB	SB	Total
4:00 PM		0	2	0	2
4:15 PM		0	2	0	2
4:30 PM		0	1	0	1
4:45 PM		0	2	0	2
5:00 PM		0	5	0	5
5:15 PM		0	2	0	2
5:30 PM		0	1	0	1
5:45 PM		0	2	0	2
Count Total		0	17	0	17
Peak Hour		0	10	0	10

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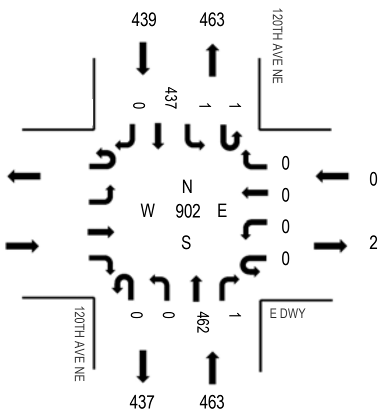
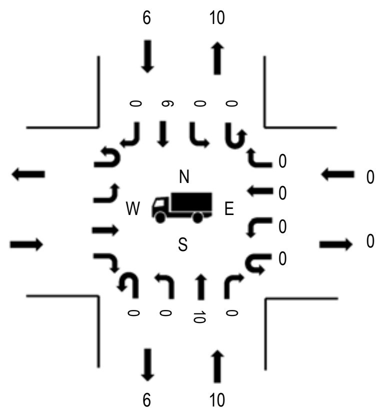
Location: 23 120TH AVE NE & E DWY PM
Date: Tuesday, September 10, 2019
Peak Hour: 05:00 PM - 06:00 PM

Peak Hour

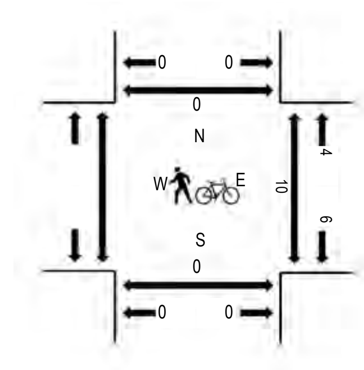
All Vehicles



Heavy Vehicles



Pedestrians/Bicycles in Crosswalk



	HV%	PHF
EB		
WB	0.0%	0.00
NB	2.2%	0.87
SB	1.4%	0.84
All	1.8%	0.96

Traffic Counts - All Vehicles

Interval Start Time	Eastbound U-Turn	Eastbound Left	Eastbound Thru	Eastbound Right	E DWY Westbound U-Turn	E DWY Westbound Left	E DWY Westbound Thru	E DWY Westbound Right	120TH AVE NE Northbound U-Turn	120TH AVE NE Northbound Left	120TH AVE NE Northbound Thru	120TH AVE NE Northbound Right	120TH AVE NE Southbound U-Turn	120TH AVE NE Southbound Left	120TH AVE NE Southbound Thru	120TH AVE NE Southbound Right	Total	Rolling Hour
4:00 PM					0	0	0	0	0	0	86	1	0	0	109	0	196	703
4:15 PM					0	0	0	0	0	0	79	0	0	0	72	0	151	740
4:30 PM					0	0	0	0	0	0	110	0	0	0	84	0	194	824
4:45 PM					0	0	0	0	0	0	69	0	0	0	93	0	162	865
5:00 PM					0	0	0	0	0	0	133	0	0	0	100	0	233	902
5:15 PM					0	0	0	0	0	0	125	0	1	0	109	0	235	
5:30 PM					0	0	0	0	0	0	105	0	0	1	129	0	235	
5:45 PM					0	0	0	0	0	0	99	1	0	0	99	0	199	
Count Total					0	0	0	0	0	0	806	2	1	1	795	0	1,605	
Peak Hour					0	0	0	0	0	0	462	1	1	1	437	0	902	

Traffic Counts - Heavy Vehicles and Pedestrians/Bicycles in Crosswalk

Interval Start Time	Heavy Vehicles EB	NB	WB	SB	Total
4:00 PM		2	0	1	3
4:15 PM		1	0	2	3
4:30 PM		5	0	0	5
4:45 PM		0	0	2	2
5:00 PM		5	0	3	8
5:15 PM		3	0	0	3
5:30 PM		1	0	2	3
5:45 PM		1	0	1	2
Count Total		18	0	11	29
Peak Hour		10	0	6	16

Interval Start Time	Pedestrians/Bicycles on Crosswalk EB	NB	WB	SB	Total
4:00 PM		0	2	0	2
4:15 PM		0	2	0	2
4:30 PM		0	2	0	2
4:45 PM		0	2	0	2
5:00 PM		0	5	0	5
5:15 PM		0	2	0	2
5:30 PM		0	1	0	1
5:45 PM		0	2	0	2
Count Total		0	18	0	18
Peak Hour		0	10	0	10

(303) 216-2439
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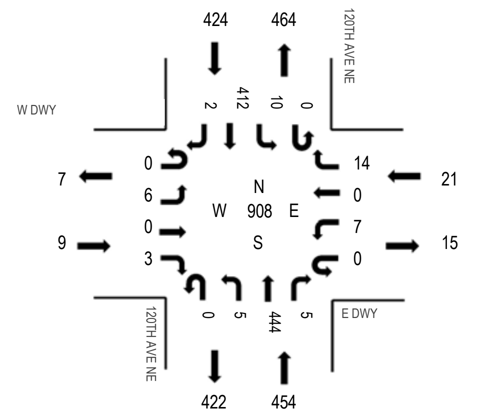
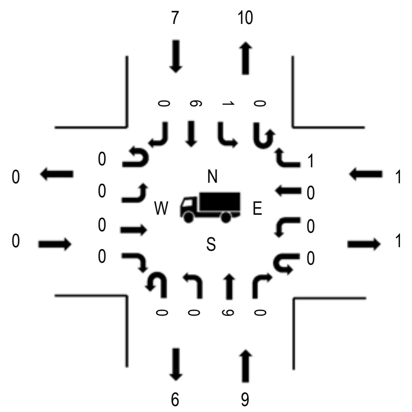
Location: 24 120TH AVE NE & E DWY PM
Date: Tuesday, September 10, 2019
Peak Hour: 05:00 PM - 06:00 PM

Peak Hour

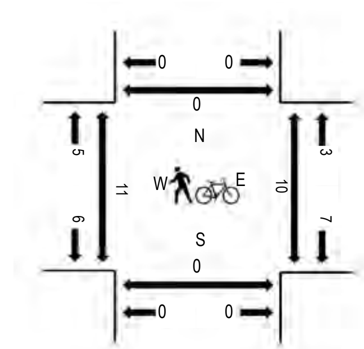
All Vehicles



Heavy Vehicles



Pedestrians/Bicycles in Crosswalk



	HV%	PHF
EB	0.0%	0.32
WB	4.8%	0.29
NB	2.0%	0.90
SB	1.7%	0.88
All	1.9%	0.92

Traffic Counts - All Vehicles

Interval Start Time	W DWY Eastbound U-Turn	Left	Thru	Right	E DWY Westbound U-Turn	Left	Thru	Right	120TH AVE NE Northbound U-Turn	Left	Thru	Right	120TH AVE NE Southbound U-Turn	Left	Thru	Right	Total	Rolling Hour
4:00 PM	0	0	0	2	0	0	0	1	0	0	83	1	0	4	105	0	196	711
4:15 PM	0	0	0	0	0	3	0	1	0	2	78	0	0	0	72	0	156	762
4:30 PM	0	0	0	1	0	2	0	1	0	1	108	0	0	4	79	0	196	840
4:45 PM	0	1	1	0	0	0	0	2	0	0	66	2	0	2	89	0	163	873
5:00 PM	0	4	0	3	0	6	0	12	0	2	119	1	0	3	96	1	247	908
5:15 PM	0	1	0	0	0	1	0	0	0	0	124	2	0	4	102	0	234	
5:30 PM	0	1	0	0	0	0	0	0	0	2	105	1	0	2	118	0	229	
5:45 PM	0	0	0	0	0	0	0	2	0	1	96	1	0	1	96	1	198	
Count Total	0	7	1	6	0	12	0	19	0	8	779	8	0	20	757	2	1,619	
Peak Hour	0	6	0	3	0	7	0	14	0	5	444	5	0	10	412	2	908	

Traffic Counts - Heavy Vehicles and Pedestrians/Bicycles in Crosswalk

Interval Start Time	Heavy Vehicles EB	NB	WB	SB	Total	Interval Start Time	Pedestrians/Bicycles on Crosswalk EB	NB	WB	SB	Total
4:00 PM	0	2	0	1	3	4:00 PM	0	0	2	0	2
4:15 PM	0	1	0	2	3	4:15 PM	3	0	2	0	5
4:30 PM	0	5	0	0	5	4:30 PM	3	0	0	0	3
4:45 PM	0	0	0	2	2	4:45 PM	2	0	3	0	5
5:00 PM	0	4	1	3	8	5:00 PM	3	0	6	0	9
5:15 PM	0	3	0	1	4	5:15 PM	3	0	2	0	5
5:30 PM	0	1	0	1	2	5:30 PM	2	0	1	0	3
5:45 PM	0	1	0	2	3	5:45 PM	3	0	1	0	4
Count Total	0	17	1	12	30	Count Total	19	0	17	0	36
Peak Hour	0	9	1	7	17	Peak Hour	11	0	10	0	21

Appendix B: LOS Definitions

Highway Capacity Manual 2010/6th Edition

Signalized intersection level of service (LOS) is defined in terms of a weighted average control delay for the entire intersection. Control delay quantifies the increase in travel time that a vehicle experiences due to the traffic signal control as well as provides a surrogate measure for driver discomfort and fuel consumption. Signalized intersection LOS is stated in terms of average control delay per vehicle (in seconds) during a specified time period (e.g., weekday PM peak hour). Control delay is a complex measure based on many variables, including signal phasing and coordination (i.e., progression of movements through the intersection and along the corridor), signal cycle length, and traffic volumes with respect to intersection capacity and resulting queues. Table 1 summarizes the LOS criteria for signalized intersections, as described in the *Highway Capacity Manual 2010* and 6th Edition (Transportation Research Board, 2010 and 2016, respectively).

Table 1. Level of Service Criteria for Signalized Intersections

Level of Service	Average Control Delay (seconds/vehicle)	General Description
A	≤10	Free Flow
B	>10 – 20	Stable Flow (slight delays)
C	>20 – 35	Stable flow (acceptable delays)
D	>35 – 55	Approaching unstable flow (tolerable delay, occasionally wait through more than one signal cycle before proceeding)
E	>55 – 80	Unstable flow (intolerable delay)
F[1]	>80	Forced flow (congested and queues fail to clear)

Source: *Highway Capacity Manual 2010 and 6th Edition*, Transportation Research Board, 2010 and 2016, respectively.
1. If the volume-to-capacity (v/c) ratio for a lane group exceeds 1.0 LOS F is assigned to the individual lane group. LOS for overall approach or intersection is determined solely by the control delay.

Unsignalized intersection LOS criteria can be further reduced into two intersection types: all-way stop and two-way stop control. All-way stop control intersection LOS is expressed in terms of the weighted average control delay of the overall intersection or by approach. Two-way stop-controlled intersection LOS is defined in terms of the average control delay for each minor-street movement (or shared movement) as well as major-street left-turns. This approach is because major-street through vehicles are assumed to experience zero delay, a weighted average of all movements results in very low overall average delay, and this calculated low delay could mask deficiencies of minor movements. Table 2 shows LOS criteria for unsignalized intersections.

Table 2. Level of Service Criteria for Unsignalized Intersections

Level of Service	Average Control Delay (seconds/vehicle)
A	0 – 10
B	>10 – 15
C	>15 – 25
D	>25 – 35
E	>35 – 50
F[1]	>50

Source: *Highway Capacity Manual 2010 and 6th Edition*, Transportation Research Board, 2010 and 2016, respectively.
1. If the volume-to-capacity (v/c) ratio exceeds 1.0, LOS F is assigned an individual lane group for all unsignalized intersections, or minor street approach at two-way stop-controlled intersections. Overall intersection LOS is determined solely by control delay.

Appendix C: LOS Worksheets

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	510	130	225	20	80	35	160	260	40	15	175	205
Future Volume (veh/h)	510	130	225	20	80	35	160	260	40	15	175	205
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		0.98	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1885	1885	1885	1870	1870	1870	1870	1870	1870	1885	1885	1885
Adj Flow Rate, veh/h	537	137	237	21	84	37	161	283	42	16	184	216
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %	1	1	1	2	2	2	2	2	2	1	1	1
Cap, veh/h	816	1014	856	39	117	51	213	381	56	24	277	256
Arrive On Green	0.76	0.90	0.90	0.02	0.10	0.10	0.12	0.12	0.12	0.16	0.16	0.16
Sat Flow, veh/h	1795	1885	1591	1781	1221	538	1781	3189	468	150	1727	1598
Grp Volume(v), veh/h	537	137	237	21	0	121	161	165	160	200	0	216
Grp Sat Flow(s),veh/h/ln	1795	1885	1591	1781	0	1759	1781	1870	1786	1878	0	1598
Q Serve(g_s), s	14.4	0.8	2.0	1.2	0.0	6.7	8.7	8.5	8.7	10.0	0.0	13.1
Cycle Q Clear(g_c), s	14.4	0.8	2.0	1.2	0.0	6.7	8.7	8.5	8.7	10.0	0.0	13.1
Prop In Lane	1.00		1.00	1.00		0.31	1.00		0.26	0.08		1.00
Lane Grp Cap(c), veh/h	816	1014	856	39	0	168	213	223	213	301	0	256
V/C Ratio(X)	0.66	0.14	0.28	0.53	0.00	0.72	0.76	0.74	0.75	0.66	0.00	0.84
Avail Cap(c_a), veh/h	816	1014	856	194	0	389	410	430	411	507	0	431
HCM Platoon Ratio	1.67	1.67	1.67	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.88	0.88	0.88	1.00	0.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	8.3	2.4	2.4	48.4	0.0	43.9	42.6	42.5	42.6	39.5	0.0	40.8
Incr Delay (d2), s/veh	1.7	0.2	0.7	4.1	0.0	2.2	2.1	1.8	2.0	0.9	0.0	3.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	3.7	0.4	0.7	0.6	0.0	3.0	3.9	4.0	3.9	4.7	0.0	5.3
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	10.0	2.6	3.2	52.5	0.0	46.1	44.7	44.3	44.6	40.4	0.0	43.7
LnGrp LOS	B	A	A	D	A	D	D	D	D	D	A	D
Approach Vol, veh/h		911			142			486			416	
Approach Delay, s/veh		7.1			47.0			44.5			42.1	
Approach LOS		A			D			D			D	
Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	5.7	58.3		15.9	50.0	14.1		20.0				
Change Period (Y+Rc), s	3.5	4.5		4.0	4.5	4.5		4.0				
Max Green Setting (Gmax), s	10.9	23.1		23.0	10.9	22.1		27.0				
Max Q Clear Time (g_c+I1), s	3.2	4.0		10.7	16.4	8.7		15.1				
Green Ext Time (p_c), s	0.0	0.9		1.2	0.0	0.3		0.9				
Intersection Summary												
HCM 6th Ctrl Delay			26.8									
HCM 6th LOS			C									

Notes

User approved volume balancing among the lanes for turning movement.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	195	790	165	25	445	30	380	60	100	60	75	630
Future Volume (veh/h)	195	790	165	25	445	30	380	60	100	60	75	630
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.99	1.00		0.99	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1885	1885	1885	1870	1870	1870	1885	1885	1885	1900	1900	1900
Adj Flow Rate, veh/h	201	814	170	26	459	31	392	62	103	62	0	700
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Percent Heavy Veh, %	1	1	1	2	2	2	1	1	1	0	0	0
Cap, veh/h	233	1559	690	46	1151	77	481	209	348	81	0	757
Arrive On Green	0.13	0.44	0.44	0.03	0.34	0.34	0.14	0.33	0.33	0.05	0.00	0.24
Sat Flow, veh/h	1795	3582	1585	1781	3376	227	3483	636	1057	1810	0	3207
Grp Volume(v), veh/h	201	814	170	26	241	249	392	0	165	62	0	700
Grp Sat Flow(s),veh/h/ln	1795	1791	1585	1781	1777	1827	1742	0	1693	1810	0	1603
Q Serve(g_s), s	11.0	16.6	6.8	1.4	10.3	10.4	10.9	0.0	7.2	3.4	0.0	21.3
Cycle Q Clear(g_c), s	11.0	16.6	6.8	1.4	10.3	10.4	10.9	0.0	7.2	3.4	0.0	21.3
Prop In Lane	1.00		1.00	1.00		0.12	1.00		0.62	1.00		1.00
Lane Grp Cap(c), veh/h	233	1559	690	46	606	623	481	0	557	81	0	757
V/C Ratio(X)	0.86	0.52	0.25	0.57	0.40	0.40	0.81	0.00	0.30	0.76	0.00	0.93
Avail Cap(c_a), veh/h	260	1559	690	240	606	623	714	0	557	371	0	770
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.80	0.80	0.80	0.81	0.81	0.81	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	42.6	20.6	17.9	48.2	25.1	25.2	41.9	0.0	24.9	47.2	0.0	37.3
Incr Delay (d2), s/veh	18.9	1.0	0.7	8.6	1.6	1.6	4.6	0.0	0.3	13.5	0.0	16.8
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	6.0	7.0	2.6	0.7	4.6	4.7	5.0	0.0	2.9	1.8	0.0	10.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	61.5	21.6	18.5	56.8	26.7	26.7	46.4	0.0	25.2	60.7	0.0	54.2
LnGrp LOS	E	C	B	E	C	C	D	A	C	E	A	D
Approach Vol, veh/h		1185			516			557			762	
Approach Delay, s/veh		28.0			28.2			40.1			54.7	
Approach LOS		C			C			D			D	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	7.1	48.0	17.3	27.6	16.5	38.6	8.0	36.9
Change Period (Y+Rc), s	4.5	4.5	3.5	4.0	3.5	4.5	3.5	4.0
Max Green Setting (Gmax), s	13.5	25.5	20.5	24.0	14.5	25.5	20.5	24.0
Max Q Clear Time (g_c+I1), s	3.4	18.6	12.9	23.3	13.0	12.4	5.4	9.2
Green Ext Time (p_c), s	0.0	4.1	0.9	0.3	0.1	3.3	0.1	0.7

Intersection Summary	
HCM 6th Ctrl Delay	37.0
HCM 6th LOS	D

Notes

User approved pedestrian interval to be less than phase max green.

User approved volume balancing among the lanes for turning movement.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	135	520	0	0	960	470	140	65	710	0	0	0
Future Volume (veh/h)	135	520	0	0	960	470	140	65	710	0	0	0
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0			
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		0.96	1.00		1.00			
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00			
Work Zone On Approach		No			No			No				
Adj Sat Flow, veh/h/ln	1870	1870	0	0	1885	1885	1885	1885	1885			
Adj Flow Rate, veh/h	136	525	0	0	970	475	141	448	462			
Peak Hour Factor	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99			
Percent Heavy Veh, %	2	2	0	0	1	1	1	1	1			
Cap, veh/h	260	1924	0	0	1515	648	151	479	539			
Arrive On Green	0.06	0.54	0.00	0.00	0.42	0.42	0.34	0.34	0.34			
Sat Flow, veh/h	1781	3647	0	0	3676	1533	446	1417	1593			
Grp Volume(v), veh/h	136	525	0	0	970	475	589	0	462			
Grp Sat Flow(s),veh/h/ln	1781	1777	0	0	1791	1533	1863	0	1593			
Q Serve(g_s), s	4.0	7.9	0.0	0.0	21.2	25.6	30.3	0.0	26.7			
Cycle Q Clear(g_c), s	4.0	7.9	0.0	0.0	21.2	25.6	30.3	0.0	26.7			
Prop In Lane	1.00		0.00	0.00		1.00	0.24		1.00			
Lane Grp Cap(c), veh/h	260	1924	0	0	1515	648	630	0	539			
V/C Ratio(X)	0.52	0.27	0.00	0.00	0.64	0.73	0.93	0.00	0.86			
Avail Cap(c_a), veh/h	589	1928	0	0	1944	832	648	0	554			
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00			
Upstream Filter(I)	1.00	1.00	0.00	0.00	1.00	1.00	1.00	0.00	1.00			
Uniform Delay (d), s/veh	17.4	12.2	0.0	0.0	22.6	23.9	31.7	0.0	30.5			
Incr Delay (d2), s/veh	1.2	0.1	0.0	0.0	0.6	3.0	20.6	0.0	12.4			
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			
%ile BackOfQ(50%),veh/ln	1.7	3.0	0.0	0.0	8.8	9.5	16.8	0.0	11.8			
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	18.6	12.3	0.0	0.0	23.3	26.9	52.2	0.0	42.9			
LnGrp LOS	B	B	A	A	C	C	D	A	D			
Approach Vol, veh/h		661			1445			1051				
Approach Delay, s/veh		13.6			24.4			48.1				
Approach LOS		B			C			D				
Timer - Assigned Phs		2			5	6		8				
Phs Duration (G+Y+Rc), s		59.9			11.7	48.1		39.1				
Change Period (Y+Rc), s		6.3			5.6	6.3		5.6				
Max Green Setting (Gmax), s		53.7			24.4	53.7		34.4				
Max Q Clear Time (g_c+I1), s		9.9			6.0	27.6		32.3				
Green Ext Time (p_c), s		5.8			0.2	14.2		1.2				
Intersection Summary												
HCM 6th Ctrl Delay			30.1									
HCM 6th LOS			C									

Notes

User approved volume balancing among the lanes for turning movement.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	410	90	550	565	0	0	0	0	235	5	130
Future Volume (veh/h)	0	410	90	550	565	0	0	0	0	235	5	130
Initial Q (Qb), veh	0	0	0	0	0	0				0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.98	1.00		1.00				1.00		0.97
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00				1.00	1.00	1.00
Work Zone On Approach		No			No						No	
Adj Sat Flow, veh/h/ln	0	1841	1841	1885	1885	0				1870	1870	1870
Adj Flow Rate, veh/h	0	423	93	567	582	0				190	77	134
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97				0.97	0.97	0.97
Percent Heavy Veh, %	0	4	4	1	1	0				2	2	2
Cap, veh/h	0	771	168	738	1092	0				374	126	220
Arrive On Green	0.00	0.27	0.27	0.21	0.58	0.00				0.21	0.21	0.21
Sat Flow, veh/h	0	2938	620	3483	1885	0				1781	602	1047
Grp Volume(v), veh/h	0	258	258	567	582	0				190	0	211
Grp Sat Flow(s),veh/h/ln	0	1749	1718	1742	1885	0				1781	0	1649
Q Serve(g_s), s	0.0	7.3	7.5	8.9	10.9	0.0				5.5	0.0	6.7
Cycle Q Clear(g_c), s	0.0	7.3	7.5	8.9	10.9	0.0				5.5	0.0	6.7
Prop In Lane	0.00		0.36	1.00		0.00				1.00		0.64
Lane Grp Cap(c), veh/h	0	474	465	738	1092	0				374	0	347
V/C Ratio(X)	0.00	0.55	0.55	0.77	0.53	0.00				0.51	0.00	0.61
Avail Cap(c_a), veh/h	0	1619	1591	1466	1746	0				1048	0	970
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00				1.00	1.00	1.00
Upstream Filter(I)	0.00	1.00	1.00	1.00	1.00	0.00				1.00	0.00	1.00
Uniform Delay (d), s/veh	0.0	18.1	18.1	21.5	7.4	0.0				20.2	0.0	20.7
Incr Delay (d2), s/veh	0.0	1.4	1.5	1.3	0.6	0.0				1.1	0.0	1.7
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0				0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.0	2.9	2.9	3.5	3.4	0.0				2.2	0.0	2.5
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	0.0	19.5	19.6	22.8	8.0	0.0				21.3	0.0	22.5
LnGrp LOS	A	B	B	C	A	A				C	A	C
Approach Vol, veh/h		516			1149						401	
Approach Delay, s/veh		19.5			15.3						21.9	
Approach LOS		B			B						C	
Timer - Assigned Phs	1	2		4		6						
Phs Duration (G+Y+Rc), s	17.9	22.0		18.1		39.9						
Change Period (Y+Rc), s	5.6	6.3		5.9		6.3						
Max Green Setting (Gmax), s	24.4	53.7		34.1		53.7						
Max Q Clear Time (g_c+I1), s	10.9	9.5		8.7		12.9						
Green Ext Time (p_c), s	1.4	5.2		1.9		6.6						
Intersection Summary												
HCM 6th Ctrl Delay			17.6									
HCM 6th LOS			B									

Notes

User approved volume balancing among the lanes for turning movement.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	5	335	35	35	510	10	50	5	120	25	5	15
Future Volume (vph)	5	335	35	35	510	10	50	5	120	25	5	15
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	3.0	3.0	4.0	3.0	3.0		4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	
Frpb, ped/bikes	1.00	1.00	0.96	1.00	1.00	0.97		1.00	1.00	1.00	0.98	
Flpb, ped/bikes	1.00	1.00	1.00	0.99	1.00	1.00		1.00	1.00	1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85		1.00	0.85	1.00	0.89	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00		0.96	1.00	0.95	1.00	
Satd. Flow (prot)	1699	1792	1463	1741	1845	1519		1559	1392	1805	1651	
Flt Permitted	0.47	1.00	1.00	0.55	1.00	1.00		0.78	1.00	0.95	1.00	
Satd. Flow (perm)	834	1792	1463	1011	1845	1519		1264	1392	1805	1651	
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	5	349	36	36	531	10	52	5	125	26	5	16
RTOR Reduction (vph)	0	0	21	0	0	5	0	0	117	0	14	0
Lane Group Flow (vph)	5	349	15	36	531	5	0	57	8	26	7	0
Confl. Peds. (#/hr)	4		8	8		4	2					2
Heavy Vehicles (%)	6%	6%	6%	3%	3%	3%	16%	16%	16%	0%	0%	0%
Turn Type	custom	NA	Perm	custom	NA	Perm	Perm	NA	custom	custom	NA	
Protected Phases	5	2 9		1	6 10			3 8	3	7	7	
Permitted Phases	9		2 9	10		6 10	3 8			7		
Actuated Green, G (s)	15.0	47.8	47.8	23.4	52.3	52.3		29.1	7.0	16.3	16.3	
Effective Green, g (s)	15.0	47.8	47.8	23.4	52.3	52.3		29.1	7.0	16.3	16.3	
Actuated g/C Ratio	0.13	0.42	0.42	0.20	0.46	0.46		0.25	0.06	0.14	0.14	
Clearance Time (s)	4.0			4.0					4.0	4.0	4.0	
Vehicle Extension (s)	3.0			3.0					2.5	2.0	2.0	
Lane Grp Cap (vph)	116	746	609	241	841	692		320	84	256	234	
v/s Ratio Prot	0.00	0.19		c0.01	c0.29				0.01	c0.01	0.00	
v/s Ratio Perm	0.01		0.01	0.02		0.00		c0.05				
v/c Ratio	0.04	0.47	0.02	0.15	0.63	0.01		0.18	0.09	0.10	0.03	
Uniform Delay, d1	43.5	24.2	19.7	37.1	23.8	17.0		33.5	50.8	42.8	42.4	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.2	0.2	0.0	0.3	1.1	0.0		0.2	0.3	0.1	0.0	
Delay (s)	43.6	24.4	19.7	37.4	25.0	17.0		33.6	51.2	42.9	42.4	
Level of Service	D	C	B	D	C	B		C	D	D	D	
Approach Delay (s)		24.2			25.6			45.7			42.7	
Approach LOS		C			C			D			D	

Intersection Summary			
HCM 2000 Control Delay	28.9	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.44		
Actuated Cycle Length (s)	114.7	Sum of lost time (s)	23.0
Intersection Capacity Utilization	45.5%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM 6th Edition methodology does not support non-NEMA phasing.

Intersection	
Int Delay, s/veh	5.1

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	10	210	0	0	280	320	0	0	5	160	0	10
Future Vol, veh/h	10	210	0	0	280	320	0	0	5	160	0	10
Conflicting Peds, #/hr	7	0	20	19	0	6	20	0	19	6	0	7
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	Free	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	95	95	95	95	95	95	95	95	95	95	95	95
Heavy Vehicles, %	7	7	7	3	3	3	0	0	0	5	5	5
Mvmt Flow	11	221	0	0	295	337	0	0	5	168	0	11

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	302	0	0	241	0	0	584	565	260	567	565	322
Stage 1	-	-	-	-	-	-	263	263	-	302	302	-
Stage 2	-	-	-	-	-	-	321	302	-	265	263	-
Critical Hdwy	4.17	-	-	4.13	-	-	7.1	6.5	6.2	7.15	6.55	6.25
Critical Hdwy Stg 1	-	-	-	-	-	-	6.1	5.5	-	6.15	5.55	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.1	5.5	-	6.15	5.55	-
Follow-up Hdwy	2.263	-	-	2.227	-	-	3.5	4	3.3	3.545	4.045	3.345
Pot Cap-1 Maneuver	1231	-	-	1320	-	0	426	437	784	430	430	712
Stage 1	-	-	-	-	-	0	747	694	-	701	659	-
Stage 2	-	-	-	-	-	0	695	668	-	734	685	-
Platoon blocked, %		-	-		-							
Mov Cap-1 Maneuver	1223	-	-	1295	-	-	400	421	755	413	415	694
Mov Cap-2 Maneuver	-	-	-	-	-	-	400	421	-	413	415	-
Stage 1	-	-	-	-	-	-	725	674	-	689	654	-
Stage 2	-	-	-	-	-	-	671	663	-	709	665	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.4	0	9.8	19.6
HCM LOS			A	C

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	SBLn1
Capacity (veh/h)	755	1223	-	-	1295	-	423
HCM Lane V/C Ratio	0.007	0.009	-	-	-	-	0.423
HCM Control Delay (s)	9.8	8	0	-	0	-	19.6
HCM Lane LOS	A	A	A	-	A	-	C
HCM 95th %tile Q(veh)	0	0	-	-	0	-	2.1

Movement	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Lane Configurations												
Traffic Volume (veh/h)	55	1405	5	25	10	1640	385	5	5	5	265	5
Future Volume (veh/h)	55	1405	5	25	10	1640	385	5	5	5	265	5
Initial Q (Qb), veh	0	0	0		0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00		1.00		1.00	1.00		0.93	1.00	
Parking Bus, Adj	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No				No			No			No
Adj Sat Flow, veh/h/ln	1856	1856	1856		1885	1885	1885	1900	1900	1900	1856	1856
Adj Flow Rate, veh/h	59	1495	5		11	1745	0	5	5	5	176	154
Peak Hour Factor	0.94	0.94	0.94		0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Percent Heavy Veh, %	3	3	3		1	1	1	0	0	0	3	3
Cap, veh/h	76	2452	8		37	2356		6	6	6	275	193
Arrive On Green	0.03	0.46	0.46		0.02	0.66	0.00	0.01	0.01	0.01	0.16	0.16
Sat Flow, veh/h	1767	3604	12		1795	3582	1598	572	572	572	1767	1240
Grp Volume(v), veh/h	59	731	769		11	1745	0	15	0	0	176	0
Grp Sat Flow(s),veh/h/ln	1767	1763	1853		1795	1791	1598	1716	0	0	1767	0
Q Serve(g_s), s	4.0	37.5	37.5		0.7	39.0	0.0	1.0	0.0	0.0	11.2	0.0
Cycle Q Clear(g_c), s	4.0	37.5	37.5		0.7	39.0	0.0	1.0	0.0	0.0	11.2	0.0
Prop In Lane	1.00		0.01		1.00		1.00	0.33		0.33	1.00	
Lane Grp Cap(c), veh/h	76	1199	1261		37	2356		17	0	0	275	0
V/C Ratio(X)	0.78	0.61	0.61		0.30	0.74		0.87	0.00	0.00	0.64	0.00
Avail Cap(c_a), veh/h	97	1199	1261		217	2356		43	0	0	368	0
HCM Platoon Ratio	0.67	0.67	0.67		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.83	0.83	0.83		1.00	1.00	0.00	1.00	0.00	0.00	1.00	0.00
Uniform Delay (d), s/veh	57.7	20.6	20.6		57.9	13.7	0.0	59.3	0.0	0.0	47.5	0.0
Incr Delay (d2), s/veh	16.5	1.9	1.8		1.7	2.1	0.0	35.9	0.0	0.0	3.5	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	2.1	16.9	17.8		0.3	14.8	0.0	0.6	0.0	0.0	5.2	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	74.2	22.6	22.5		59.6	15.8	0.0	95.2	0.0	0.0	51.0	0.0
LnGrp LOS	E	C	C		E	B		F	A	A	D	A
Approach Vol, veh/h		1559				1756	A		15			394
Approach Delay, s/veh		24.5				16.1			95.2			55.4
Approach LOS		C				B			F			E

Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	6.0	86.1		22.7	8.6	83.4		5.2				
Change Period (Y+Rc), s	3.5	4.5		4.0	3.5	4.5		4.0				
Max Green Setting (Gmax), s	14.5	61.5		25.0	6.6	69.4		3.0				
Max Q Clear Time (g_c+I1), s	2.7	39.5		16.4	6.0	41.0		3.0				
Green Ext Time (p_c), s	0.0	14.6		1.7	0.0	21.0		0.0				

Intersection Summary			
HCM 6th Ctrl Delay			24.1
HCM 6th LOS			C

Notes

User approved volume balancing among the lanes for turning movement.

User approved ignoring U-Turning movement.

Unsignalized Delay for [WBR] is excluded from calculations of the approach delay and intersection delay.

Movement	SBR
Lane Configurations	
Traffic Volume (veh/h)	60
Future Volume (veh/h)	60
Initial Q (Qb), veh	0
Ped-Bike Adj(A_pbT)	0.99
Parking Bus, Adj	1.00
Work Zone On Approach	
Adj Sat Flow, veh/h/ln	1856
Adj Flow Rate, veh/h	64
Peak Hour Factor	0.94
Percent Heavy Veh, %	3
Cap, veh/h	80
Arrive On Green	0.16
Sat Flow, veh/h	515
Grp Volume(v), veh/h	218
Grp Sat Flow(s),veh/h/ln	1756
Q Serve(g_s), s	14.4
Cycle Q Clear(g_c), s	14.4
Prop In Lane	0.29
Lane Grp Cap(c), veh/h	274
V/C Ratio(X)	0.80
Avail Cap(c_a), veh/h	366
HCM Platoon Ratio	1.00
Upstream Filter(I)	1.00
Uniform Delay (d), s/veh	48.8
Incr Delay (d2), s/veh	10.2
Initial Q Delay(d3),s/veh	0.0
%ile BackOfQ(50%),veh/ln	7.1
Unsig. Movement Delay, s/veh	
LnGrp Delay(d),s/veh	59.0
LnGrp LOS	E
Approach Vol, veh/h	
Approach Delay, s/veh	
Approach LOS	
Timer - Assigned Phs	

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	485	1275	1405	310	195	365
Future Volume (vph)	485	1275	1405	310	195	365
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.0	5.0	5.0	5.0	5.0	3.0
Lane Util. Factor	0.97	0.95	0.95	1.00	0.97	1.00
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	0.98
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	1.00	0.85	1.00	0.85
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	3433	3539	3574	1599	3502	1587
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	3433	3539	3574	1599	3502	1587
Peak-hour factor, PHF	0.98	0.98	0.98	0.98	0.98	0.98
Adj. Flow (vph)	495	1301	1434	316	199	372
RTOR Reduction (vph)	0	0	0	35	0	2
Lane Group Flow (vph)	495	1301	1434	281	199	370
Confl. Peds. (#/hr)						12
Heavy Vehicles (%)	2%	2%	1%	1%	0%	0%
Turn Type	Prot	NA	NA	pm+ov	Prot	pt+ov
Protected Phases	3 5	2	6	7	7	3 5
Permitted Phases				6		4
Actuated Green, G (s)	13.8	75.0	65.0	91.2	26.2	40.0
Effective Green, g (s)	13.8	75.0	65.0	91.2	26.2	40.0
Actuated g/C Ratio	0.12	0.62	0.54	0.76	0.22	0.33
Clearance Time (s)		5.0	5.0	5.0	5.0	
Vehicle Extension (s)		3.0	0.4	4.0	4.0	
Lane Grp Cap (vph)	394	2211	1935	1281	764	529
v/s Ratio Prot	c0.14	0.37	c0.40	0.05	0.06	c0.08
v/s Ratio Perm				0.13		0.15
v/c Ratio	1.26	0.59	0.74	0.22	0.26	0.70
Uniform Delay, d1	53.1	13.3	21.1	4.1	38.9	34.8
Progression Factor	0.83	1.36	0.82	0.00	0.84	0.88
Incremental Delay, d2	131.1	0.9	1.7	0.1	0.2	3.2
Delay (s)	175.1	19.1	19.1	0.1	32.9	34.0
Level of Service	F	B	B	A	C	C
Approach Delay (s)		62.1	15.6		33.6	
Approach LOS		E	B		C	

Intersection Summary			
HCM 2000 Control Delay	38.4	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.82		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	18.0
Intersection Capacity Utilization	70.3%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM 6th Edition methodology expects standard NEMA quad ring-barrier structure. Does not support multiple barriers.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	55	1735	10	10	1740	30	10	5	15	30	0	70
Future Volume (veh/h)	55	1735	10	10	1740	30	10	5	15	30	0	70
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	0.95		0.94	0.95		0.94
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1856	1856	1856	1885	1885	1885	1900	1900	1900	1900	1900	1900
Adj Flow Rate, veh/h	58	1826	11	11	1832	32	11	5	16	32	0	74
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %	3	3	3	1	1	1	0	0	0	0	0	0
Cap, veh/h	74	2766	17	23	2668	46	84	45	89	223	0	178
Arrive On Green	0.08	1.00	1.00	0.01	0.50	0.50	0.12	0.12	0.12	0.12	0.00	0.12
Sat Flow, veh/h	1767	3593	22	1795	3602	63	375	387	763	1393	0	1515
Grp Volume(v), veh/h	58	895	942	11	909	955	32	0	0	32	0	74
Grp Sat Flow(s),veh/h/ln	1767	1763	1852	1795	1791	1874	1525	0	0	1393	0	1515
Q Serve(g_s), s	3.9	0.0	0.0	0.7	46.5	46.8	0.0	0.0	0.0	0.0	0.0	5.4
Cycle Q Clear(g_c), s	3.9	0.0	0.0	0.7	46.5	46.8	2.0	0.0	0.0	2.0	0.0	5.4
Prop In Lane	1.00		0.01	1.00		0.03	0.34		0.50	1.00		1.00
Lane Grp Cap(c), veh/h	74	1357	1426	23	1327	1388	219	0	0	223	0	178
V/C Ratio(X)	0.78	0.66	0.66	0.48	0.68	0.69	0.15	0.00	0.00	0.14	0.00	0.42
Avail Cap(c_a), veh/h	162	1357	1426	165	1327	1388	390	0	0	379	0	354
HCM Platoon Ratio	2.00	2.00	2.00	0.67	0.67	0.67	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.74	0.74	0.74	0.64	0.64	0.64	1.00	0.00	0.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	54.4	0.0	0.0	59.1	19.5	19.6	47.7	0.0	0.0	47.6	0.0	49.1
Incr Delay (d2), s/veh	5.0	1.9	1.8	3.6	1.9	1.8	0.1	0.0	0.0	0.1	0.0	0.6
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.8	0.7	0.7	0.4	21.0	22.1	0.9	0.0	0.0	0.9	0.0	2.1
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	59.4	1.9	1.8	62.7	21.4	21.4	47.8	0.0	0.0	47.7	0.0	49.7
LnGrp LOS	E	A	A	E	C	C	D	A	A	D	A	D
Approach Vol, veh/h		1895			1875			32			106	
Approach Delay, s/veh		3.6			21.7			47.8			49.1	
Approach LOS		A			C			D			D	

Timer - Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	5.5	96.4		18.1	9.0	92.9		18.1
Change Period (Y+Rc), s	4.0	* 4		4.0	4.0	4.0		4.0
Max Green Setting (Gmax), s	11.0	* 70		28.0	11.0	69.0		28.0
Max Q Clear Time (g_c+I1), s	2.7	2.0		7.4	5.9	48.8		4.0
Green Ext Time (p_c), s	0.0	58.1		0.2	0.0	19.2		0.1

Intersection Summary	
HCM 6th Ctrl Delay	13.9
HCM 6th LOS	B

Notes

* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	70	1670	1550	210	160	60
Future Volume (vph)	70	1670	1550	210	160	60
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5	4.5		4.5	4.5
Lane Util. Factor	1.00	0.95	0.95		1.00	1.00
Frpb, ped/bikes	1.00	1.00	0.99		1.00	0.99
Flpb, ped/bikes	1.00	1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.98		1.00	0.85
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1736	3471	3454		1770	1562
Flt Permitted	0.95	1.00	1.00		0.95	1.00
Satd. Flow (perm)	1736	3471	3454		1770	1562
Peak-hour factor, PHF	0.99	0.99	0.99	0.99	0.99	0.99
Adj. Flow (vph)	71	1687	1566	212	162	61
RTOR Reduction (vph)	0	0	7	0	0	52
Lane Group Flow (vph)	71	1687	1771	0	162	9
Confl. Peds. (#/hr)	13			13		1
Heavy Vehicles (%)	4%	4%	2%	2%	2%	2%
Turn Type	Prot	NA	NA		Prot	Perm
Protected Phases	5	2	6		4	
Permitted Phases						4
Actuated Green, G (s)	8.5	93.6	80.6		17.4	17.4
Effective Green, g (s)	8.5	93.6	80.6		17.4	17.4
Actuated g/C Ratio	0.07	0.78	0.67		0.14	0.14
Clearance Time (s)	4.5	4.5	4.5		4.5	4.5
Vehicle Extension (s)	3.0	6.0	6.0		3.0	3.0
Lane Grp Cap (vph)	122	2707	2319		256	226
v/s Ratio Prot	0.04	c0.49	c0.51		c0.09	
v/s Ratio Perm						0.01
v/c Ratio	0.58	0.62	0.76		0.63	0.04
Uniform Delay, d1	54.0	5.7	13.3		48.3	44.1
Progression Factor	1.00	1.00	1.84		1.00	1.00
Incremental Delay, d2	6.9	1.1	1.9		5.0	0.1
Delay (s)	60.9	6.7	26.2		53.3	44.2
Level of Service	E	A	C		D	D
Approach Delay (s)		8.9	26.2		50.8	
Approach LOS		A	C		D	

Intersection Summary			
HCM 2000 Control Delay	19.6	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.74		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	13.5
Intersection Capacity Utilization	74.5%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM 6th Edition methodology does not support exclusive ped or hold phases.

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	1305	155	235	1285	355	385
Future Volume (veh/h)	1305	155	235	1285	355	385
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)		1.00	1.00		1.00	1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No	No	
Adj Sat Flow, veh/h/ln	1856	1856	1885	1885	1885	1885
Adj Flow Rate, veh/h	1388	165	250	1367	378	410
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94
Percent Heavy Veh, %	3	3	1	1	1	1
Cap, veh/h	1929	1275	295	2374	919	557
Arrive On Green	0.55	0.55	0.08	0.66	0.26	0.26
Sat Flow, veh/h	3618	1571	3483	3676	3483	1598
Grp Volume(v), veh/h	1388	165	250	1367	378	410
Grp Sat Flow(s),veh/h/ln	1763	1571	1742	1791	1742	1598
Q Serve(g_s), s	38.1	2.9	9.2	27.0	11.6	29.2
Cycle Q Clear(g_c), s	38.1	2.9	9.2	27.0	11.6	29.2
Prop In Lane		1.00	1.00		1.00	1.00
Lane Grp Cap(c), veh/h	1929	1275	295	2374	919	557
V/C Ratio(X)	0.72	0.13	0.85	0.58	0.41	0.74
Avail Cap(c_a), veh/h	1929	1275	295	2374	1879	997
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	21.9	2.6	58.5	11.9	39.4	37.0
Incr Delay (d2), s/veh	2.3	0.2	19.8	0.3	0.3	1.9
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	16.0	2.5	4.9	10.4	5.0	11.6
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	24.3	2.8	78.4	12.3	39.7	38.9
LnGrp LOS	C	A	E	B	D	D
Approach Vol, veh/h	1553			1617	788	
Approach Delay, s/veh	22.0			22.5	39.3	
Approach LOS	C			C	D	

Timer - Assigned Phs		2	3	4				8
Phs Duration (G+Y+Rc), s		39.2	15.0	75.5				90.5
Change Period (Y+Rc), s		5.0	4.0	* 4.5				4.5
Max Green Setting (Gmax), s		70.0	11.0	* 71				20.5
Max Q Clear Time (g_c+I1), s		31.2	11.2	40.1				29.0
Green Ext Time (p_c), s		3.1	0.0	14.3				0.0

Intersection Summary	
HCM 6th Ctrl Delay	25.6
HCM 6th LOS	C

Notes

* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↱		↰	↱			↑↱		↰	↑↱	
Traffic Volume (veh/h)	0	5	10	125	0	55	0	665	90	45	480	10
Future Volume (veh/h)	0	5	10	125	0	55	0	665	90	45	480	10
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.89	0.94		0.93	1.00		0.99	1.00		0.99
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	418	418	418	1885	1885	1885	0	1870	1870	1885	1885	1885
Adj Flow Rate, veh/h	0	5	10	126	0	56	0	672	91	45	485	10
Peak Hour Factor	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
Percent Heavy Veh, %	100	100	100	1	1	1	0	2	2	1	1	1
Cap, veh/h	77	7	15	154	0	120	0	2284	309	569	2807	58
Arrive On Green	0.00	0.06	0.06	0.04	0.00	0.08	0.00	0.73	0.73	0.05	1.00	1.00
Sat Flow, veh/h	398	115	230	1795	0	1479	0	3234	425	1795	3588	74
Grp Volume(v), veh/h	0	0	15	126	0	56	0	380	383	45	242	253
Grp Sat Flow(s),veh/h/ln	398	0	345	1795	0	1479	0	1777	1789	1795	1791	1871
Q Serve(g_s), s	0.0	0.0	5.1	2.3	0.0	4.3	0.0	8.9	8.9	0.7	0.0	0.0
Cycle Q Clear(g_c), s	0.0	0.0	5.1	2.3	0.0	4.3	0.0	8.9	8.9	0.7	0.0	0.0
Prop In Lane	1.00		0.67	1.00		1.00	0.00		0.24	1.00		0.04
Lane Grp Cap(c), veh/h	77	0	22	154	0	120	0	1292	1301	569	1401	1464
V/C Ratio(X)	0.00	0.00	0.67	0.82	0.00	0.47	0.00	0.29	0.29	0.08	0.17	0.17
Avail Cap(c_a), veh/h	97	0	69	216	0	296	0	1292	1301	650	1401	1464
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	2.00	2.00	2.00
Upstream Filter(I)	0.00	0.00	1.00	1.00	0.00	1.00	0.00	0.35	0.35	0.99	0.99	0.99
Uniform Delay (d), s/veh	0.0	0.0	54.9	55.7	0.0	52.7	0.0	5.7	5.7	3.7	0.0	0.0
Incr Delay (d2), s/veh	0.0	0.0	29.8	15.1	0.0	2.8	0.0	0.2	0.2	0.1	0.3	0.3
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.0	0.0	0.6	4.4	0.0	1.7	0.0	3.0	3.0	0.2	0.1	0.1
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	0.0	0.0	84.7	70.8	0.0	55.5	0.0	5.9	5.9	3.7	0.3	0.3
LnGrp LOS	A	A	F	E	A	E	A	A	A	A	A	A
Approach Vol, veh/h		15			182			763			540	
Approach Delay, s/veh		84.7			66.1			5.9			0.6	
Approach LOS		F			E			A			A	

Timer - Assigned Phs	1	2	3	4		6	7	8
Phs Duration (G+Y+Rc), s	6.6	91.8	7.8	13.8		98.4	5.9	15.7
Change Period (Y+Rc), s	3.5	4.5	3.5	6.0		4.5	3.5	6.0
Max Green Setting (Gmax), s	8.5	61.5	8.5	24.0		73.5	8.5	24.0
Max Q Clear Time (g_c+I1), s	2.7	10.9	4.3	7.1		2.0	0.0	6.3
Green Ext Time (p_c), s	0.0	5.4	0.1	0.0		3.1	0.0	0.2

Intersection Summary			
HCM 6th Ctrl Delay			12.1
HCM 6th LOS			B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	30	25	5	50	30	100	0	685	30	0	465	20
Future Volume (veh/h)	30	25	5	50	30	100	0	685	30	0	465	20
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.95		0.92	0.93		0.93	1.00		0.99	1.00		0.97
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1900	1900	1900	1900	1900	1900	0	1885	1885	0	1900	1900
Adj Flow Rate, veh/h	32	26	5	53	32	105	0	721	32	0	489	21
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %	0	0	0	0	0	0	0	1	1	0	0	0
Cap, veh/h	179	194	37	282	54	177	0	2494	111	0	2516	108
Arrive On Green	0.02	0.13	0.13	0.04	0.15	0.15	0.00	1.00	1.00	0.00	1.00	1.00
Sat Flow, veh/h	1810	1523	293	1810	368	1206	0	3586	155	0	3617	151
Grp Volume(v), veh/h	32	0	31	53	0	137	0	370	383	0	250	260
Grp Sat Flow(s),veh/h/ln	1810	0	1816	1810	0	1574	0	1791	1855	0	1805	1868
Q Serve(g_s), s	1.8	0.0	1.8	3.0	0.0	9.8	0.0	0.0	0.0	0.0	0.0	0.0
Cycle Q Clear(g_c), s	1.8	0.0	1.8	3.0	0.0	9.8	0.0	0.0	0.0	0.0	0.0	0.0
Prop In Lane	1.00		0.16	1.00		0.77	0.00		0.08	0.00		0.08
Lane Grp Cap(c), veh/h	179	0	231	282	0	231	0	1279	1325	0	1289	1335
V/C Ratio(X)	0.18	0.00	0.13	0.19	0.00	0.59	0.00	0.29	0.29	0.00	0.19	0.19
Avail Cap(c_a), veh/h	313	0	454	470	0	472	0	1279	1325	0	1289	1335
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	2.00	2.00	1.00	2.00	2.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	0.00	0.95	0.95	0.00	0.98	0.98
Uniform Delay (d), s/veh	44.5	0.0	46.5	42.0	0.0	47.8	0.0	0.0	0.0	0.0	0.0	0.0
Incr Delay (d2), s/veh	0.2	0.0	0.1	0.1	0.0	0.9	0.0	0.5	0.5	0.0	0.3	0.3
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.8	0.0	0.8	1.3	0.0	3.9	0.0	0.2	0.2	0.0	0.1	0.1
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	44.6	0.0	46.6	42.1	0.0	48.7	0.0	0.5	0.5	0.0	0.3	0.3
LnGrp LOS	D	A	D	D	A	D	A	A	A	A	A	A
Approach Vol, veh/h		63			190			753			510	
Approach Delay, s/veh		45.6			46.9			0.5			0.3	
Approach LOS		D			D			A			A	
Timer - Assigned Phs		2	3	4		6	7	8				
Phs Duration (G+Y+Rc), s		90.2	8.5	21.3		90.2	6.1	23.7				
Change Period (Y+Rc), s		4.5	3.5	6.0		4.5	3.5	6.0				
Max Green Setting (Gmax), s		58.5	17.5	30.0		58.5	11.5	36.0				
Max Q Clear Time (g_c+I1), s		2.0	5.0	3.8		2.0	3.8	11.8				
Green Ext Time (p_c), s		3.1	0.0	0.1		1.9	0.0	0.5				
Intersection Summary												
HCM 6th Ctrl Delay			8.1									
HCM 6th LOS			A									

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	60	20	10	50	40	180	30	725	45	110	435	70
Future Volume (veh/h)	60	20	10	50	40	180	30	725	45	110	435	70
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.97		0.94	0.95		0.90	0.99		0.96	0.99		0.94
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1885	1885	1885	1885	1885	1885	1885	1885	1885	1885	1885	1885
Adj Flow Rate, veh/h	62	21	10	52	42	188	31	755	47	115	453	73
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Percent Heavy Veh, %	1	1	1	1	1	1	1	1	1	1	1	1
Cap, veh/h	161	215	102	339	48	216	596	1960	122	565	1826	292
Arrive On Green	0.04	0.18	0.18	0.03	0.18	0.18	0.09	1.00	1.00	0.07	0.60	0.60
Sat Flow, veh/h	1795	1182	563	1795	275	1232	1795	3414	212	1795	3061	489
Grp Volume(v), veh/h	62	0	31	52	0	230	31	396	406	115	263	263
Grp Sat Flow(s),veh/h/ln	1795	0	1744	1795	0	1508	1795	1791	1836	1795	1791	1759
Q Serve(g_s), s	3.4	0.0	1.8	2.8	0.0	17.8	0.8	0.0	0.0	2.9	8.4	8.5
Cycle Q Clear(g_c), s	3.4	0.0	1.8	2.8	0.0	17.8	0.8	0.0	0.0	2.9	8.4	8.5
Prop In Lane	1.00		0.32	1.00		0.82	1.00		0.12	1.00		0.28
Lane Grp Cap(c), veh/h	161	0	317	339	0	265	596	1028	1054	565	1068	1049
V/C Ratio(X)	0.39	0.00	0.10	0.15	0.00	0.87	0.05	0.39	0.39	0.20	0.25	0.25
Avail Cap(c_a), veh/h	188	0	509	376	0	440	661	1028	1054	679	1068	1049
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	2.00	2.00	2.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	0.97	0.97	0.97	1.00	1.00	1.00
Uniform Delay (d), s/veh	39.7	0.0	40.9	38.7	0.0	48.1	8.7	0.0	0.0	7.9	11.5	11.5
Incr Delay (d2), s/veh	1.5	0.0	0.1	0.2	0.0	9.7	0.0	1.1	1.0	0.2	0.6	0.6
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.6	0.0	0.8	1.3	0.0	7.4	0.3	0.3	0.3	1.1	3.4	3.4
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	41.2	0.0	41.0	38.9	0.0	57.8	8.7	1.1	1.0	8.1	12.0	12.1
LnGrp LOS	D	A	D	D	A	E	A	A	A	A	B	B
Approach Vol, veh/h		93			282			833			641	
Approach Delay, s/veh		41.2			54.3			1.3			11.3	
Approach LOS		D			D			A			B	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	11.3	73.4	7.5	27.8	8.7	76.1	8.2	27.1
Change Period (Y+Rc), s	3.5	4.5	3.5	6.0	3.5	4.5	3.5	6.0
Max Green Setting (Gmax), s	15.5	45.5	6.5	35.0	9.5	51.5	6.5	35.0
Max Q Clear Time (g_c+I1), s	4.9	2.0	4.8	3.8	2.8	10.5	5.4	19.8
Green Ext Time (p_c), s	0.2	8.6	0.0	0.1	0.0	5.1	0.0	1.3

Intersection Summary	
HCM 6th Ctrl Delay	14.9
HCM 6th LOS	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	85	135	50	105	165	190	60	735	105	75	410	60
Future Volume (veh/h)	85	135	50	105	165	190	60	735	105	75	410	60
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.99		0.97	0.98		0.97	1.00		0.96	1.00		0.96
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1885	1885	1885	1900	1900	1900	1885	1885	1885	1885	1885	1885
Adj Flow Rate, veh/h	87	138	51	107	168	194	61	750	107	77	418	61
Peak Hour Factor	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Percent Heavy Veh, %	1	1	1	0	0	0	1	1	1	1	1	1
Cap, veh/h	263	410	337	449	199	230	392	832	679	217	712	104
Arrive On Green	0.06	0.22	0.22	0.09	0.25	0.25	0.04	0.44	0.44	0.04	0.45	0.45
Sat Flow, veh/h	1795	1885	1550	1810	792	915	1795	1885	1539	1795	1600	233
Grp Volume(v), veh/h	87	138	51	107	0	362	61	750	107	77	0	479
Grp Sat Flow(s),veh/h/ln	1795	1885	1550	1810	0	1707	1795	1885	1539	1795	0	1833
Q Serve(g_s), s	2.8	4.7	2.0	3.3	0.0	15.4	1.4	28.1	3.2	1.8	0.0	14.9
Cycle Q Clear(g_c), s	2.8	4.7	2.0	3.3	0.0	15.4	1.4	28.1	3.2	1.8	0.0	14.9
Prop In Lane	1.00		1.00	1.00		0.54	1.00		1.00	1.00		0.13
Lane Grp Cap(c), veh/h	263	410	337	449	0	429	392	832	679	217	0	816
V/C Ratio(X)	0.33	0.34	0.15	0.24	0.00	0.84	0.16	0.90	0.16	0.35	0.00	0.59
Avail Cap(c_a), veh/h	281	594	488	466	0	594	418	953	778	236	0	927
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	21.6	25.2	24.1	18.9	0.0	27.1	12.2	19.8	12.8	16.5	0.0	15.9
Incr Delay (d2), s/veh	0.3	0.2	0.1	0.1	0.0	5.9	0.1	10.7	0.1	0.4	0.0	0.8
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.1	2.1	0.7	1.3	0.0	6.7	0.5	13.3	1.0	0.6	0.0	5.8
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	21.8	25.3	24.2	19.0	0.0	33.0	12.3	30.4	12.9	16.9	0.0	16.6
LnGrp LOS	C	C	C	B	A	C	B	C	B	B	A	B
Approach Vol, veh/h		276			469			918			556	
Approach Delay, s/veh		24.0			29.8			27.2			16.7	
Approach LOS		C			C			C			B	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	7.2	37.6	10.8	20.6	6.9	37.9	8.2	23.1
Change Period (Y+Rc), s	4.0	4.0	4.5	4.0	4.0	4.0	4.0	4.0
Max Green Setting (Gmax), s	4.0	38.5	7.0	24.0	4.0	38.5	5.0	26.5
Max Q Clear Time (g_c+I1), s	3.8	30.1	5.3	6.7	3.4	16.9	4.8	17.4
Green Ext Time (p_c), s	0.0	3.5	0.0	0.5	0.0	3.0	0.0	1.1

Intersection Summary			
HCM 6th Ctrl Delay			24.7
HCM 6th LOS			C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	400	5	95	5	5	10	170	600	5	5	435	465
Future Volume (vph)	400	5	95	5	5	10	170	600	5	5	435	465
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0		4.0	5.3		4.5	5.3	
Lane Util. Factor	0.95	0.95	1.00	1.00	1.00		1.00	1.00		1.00	0.95	
Frpb, ped/bikes	1.00	1.00	0.97	1.00	1.00		1.00	1.00		1.00	0.98	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	0.90		1.00	1.00		1.00	0.92	
Flt Protected	0.95	0.95	1.00	0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1665	1671	1528	1805	1710		1770	1860		1784	3232	
Flt Permitted	0.95	0.95	1.00	0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1665	1671	1528	1805	1710		1770	1860		1784	3232	
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	417	5	99	5	5	10	177	625	5	5	453	484
RTOR Reduction (vph)	0	0	80	0	10	0	0	0	0	0	223	0
Lane Group Flow (vph)	213	209	19	5	5	0	177	630	0	5	714	0
Confl. Peds. (#/hr)			1	1			13		2	2		13
Confl. Bikes (#/hr)			2						5			3
Heavy Vehicles (%)	3%	3%	3%	0%	0%	0%	2%	2%	2%	1%	1%	1%
Turn Type	Split	NA	Perm	Split	NA		Prot	NA		Prot	NA	
Protected Phases	4	4		8	8		5	2		1	6	
Permitted Phases			4									
Actuated Green, G (s)	12.4	12.4	12.4	1.0	1.0		5.2	32.8		0.5	28.6	
Effective Green, g (s)	12.4	12.4	12.4	1.0	1.0		5.2	32.8		0.5	28.6	
Actuated g/C Ratio	0.19	0.19	0.19	0.02	0.02		0.08	0.51		0.01	0.44	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	5.3		4.5	5.3	
Vehicle Extension (s)	1.5	1.5	1.5	1.5	1.5		1.5	4.2		1.5	4.0	
Lane Grp Cap (vph)	320	321	293	27	26		142	945		13	1433	
v/s Ratio Prot	c0.13	0.13		0.00	c0.00		c0.10	c0.34		0.00	0.22	
v/s Ratio Perm			0.01									
v/c Ratio	0.67	0.65	0.06	0.19	0.20		1.25	0.67		0.38	0.50	
Uniform Delay, d1	24.1	24.1	21.3	31.3	31.4		29.6	11.8		31.8	12.8	
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	4.0	3.6	0.0	1.2	1.4		156.4	2.0		6.8	0.4	
Delay (s)	28.1	27.6	21.3	32.6	32.7		186.0	13.8		38.6	13.2	
Level of Service	C	C	C	C	C		F	B		D	B	
Approach Delay (s)		26.6			32.7			51.6			13.3	
Approach LOS		C			C			D			B	

Intersection Summary			
HCM 2000 Control Delay	30.0	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.76		
Actuated Cycle Length (s)	64.5	Sum of lost time (s)	17.8
Intersection Capacity Utilization	66.1%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

HCM 6th Edition methodology does not support turning movements with shared & exclusive lanes.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	395	475	130	175	710	455	310	655	165	475	720	730
Future Volume (veh/h)	395	475	130	175	710	455	310	655	165	475	720	730
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		0.98	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1856	1856	1856	1885	1885	1885	1870	1870	1870	1885	1885	1885
Adj Flow Rate, veh/h	429	516	0	190	772	0	337	712	179	516	783	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	3	3	3	1	1	1	2	2	2	1	1	1
Cap, veh/h	473	1165		214	1118		385	729	183	560	1110	
Arrive On Green	0.14	0.33	0.00	0.12	0.31	0.00	0.11	0.26	0.26	0.05	0.10	0.00
Sat Flow, veh/h	3428	3618	0	1795	3582	1598	3456	2797	703	3483	3582	1598
Grp Volume(v), veh/h	429	516	0	190	772	0	337	452	439	516	783	0
Grp Sat Flow(s),veh/h/ln	1714	1763	0	1795	1791	1598	1728	1777	1724	1742	1791	1598
Q Serve(g_s), s	17.3	16.1	0.0	14.6	26.5	0.0	13.4	35.3	35.4	20.6	29.6	0.0
Cycle Q Clear(g_c), s	17.3	16.1	0.0	14.6	26.5	0.0	13.4	35.3	35.4	20.6	29.6	0.0
Prop In Lane	1.00		0.00	1.00		1.00	1.00		0.41	1.00		1.00
Lane Grp Cap(c), veh/h	473	1165		214	1118		385	463	449	560	1110	
V/C Ratio(X)	0.91	0.44		0.89	0.69		0.87	0.98	0.98	0.92	0.71	
Avail Cap(c_a), veh/h	478	1165		250	1118		407	463	449	560	1110	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.33	0.33	0.33
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	1.00	0.81	0.81	0.00
Uniform Delay (d), s/veh	59.5	36.7	0.0	60.7	42.2	0.0	61.2	51.3	51.3	65.4	56.7	0.0
Incr Delay (d2), s/veh	21.0	1.2	0.0	26.7	3.5	0.0	18.4	35.6	36.3	17.9	1.8	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	8.9	7.2	0.0	8.3	12.3	0.0	6.8	19.8	19.3	11.1	14.5	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	80.5	38.0	0.0	87.4	45.7	0.0	79.6	86.9	87.6	83.3	58.4	0.0
LnGrp LOS	F	D		F	D		E	F	F	F	E	
Approach Vol, veh/h		945	A		962	A		1228			1299	A
Approach Delay, s/veh		57.3			54.0			85.1			68.3	
Approach LOS		E			D			F			E	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	27.0	41.0	21.2	50.8	20.1	47.9	23.8	48.2
Change Period (Y+Rc), s	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Max Green Setting (Gmax), s	22.5	36.5	19.5	43.5	16.5	42.5	19.5	43.5
Max Q Clear Time (g_c+I1), s	22.6	37.4	16.6	18.1	15.4	31.6	19.3	28.5
Green Ext Time (p_c), s	0.0	0.0	0.1	3.6	0.2	4.3	0.1	4.7

Intersection Summary	
HCM 6th Ctrl Delay	67.5
HCM 6th LOS	E

Notes

Unsignalized Delay for [EBR, WBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	295	5	795	0	0	0	0	1110	490	0	1400	795
Future Volume (vph)	295	5	795	0	0	0	0	1110	490	0	1400	795
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)	5.0	5.0	4.0					5.3	4.0		5.3	4.0
Lane Util. Factor	0.95	0.95	1.00					0.95	1.00		0.95	1.00
Frpb, ped/bikes	1.00	1.00	1.00					1.00	0.96		1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00					1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.85					1.00	0.85		1.00	0.85
Flt Protected	0.95	0.95	1.00					1.00	1.00		1.00	1.00
Satd. Flow (prot)	1593	1599	1500					3353	1433		3386	1515
Flt Permitted	0.95	0.95	1.00					1.00	1.00		1.00	1.00
Satd. Flow (perm)	1593	1599	1500					3353	1433		3386	1515
Peak-hour factor, PHF	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Adj. Flow (vph)	301	5	811	0	0	0	0	1133	500	0	1429	811
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	154	152	811	0	0	0	0	1133	500	0	1429	811
Confl. Peds. (#/hr)									49	49		
Confl. Bikes (#/hr)									1			
Heavy Vehicles (%)	2%	2%	2%	0%	0%	0%	2%	2%	2%	1%	1%	1%
Turn Type	Perm	NA	Free					NA	Free		NA	Free
Protected Phases		8						2			6	
Permitted Phases	8		Free						Free			Free
Actuated Green, G (s)	24.7	24.7	140.0					105.0	140.0		105.0	140.0
Effective Green, g (s)	24.7	24.7	140.0					105.0	140.0		105.0	140.0
Actuated g/C Ratio	0.18	0.18	1.00					0.75	1.00		0.75	1.00
Clearance Time (s)	5.0	5.0						5.3			5.3	
Vehicle Extension (s)	3.5	3.5						4.5			4.5	
Lane Grp Cap (vph)	281	282	1500					2514	1433		2539	1515
v/s Ratio Prot								0.34			0.42	
v/s Ratio Perm	0.10	0.10	c0.54						0.35			0.54
v/c Ratio	0.55	0.54	0.54					0.45	0.35		0.56	0.54
Uniform Delay, d1	52.6	52.5	0.0					6.6	0.0		7.6	0.0
Progression Factor	1.00	1.00	1.00					0.76	1.00		1.38	1.00
Incremental Delay, d2	2.4	2.2	1.4					0.1	0.1		0.4	0.5
Delay (s)	55.0	54.7	1.4					5.1	0.1		10.8	0.5
Level of Service	D	D	A					A	A		B	A
Approach Delay (s)		16.0			0.0			3.5			7.1	
Approach LOS		B			A			A			A	

Intersection Summary			
HCM 2000 Control Delay	7.9	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.58		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	10.3
Intersection Capacity Utilization	58.2%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

HCM 6th Edition methodology does not support turning movements with shared & exclusive lanes.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	575	10	1000	0	905	500	0	1590	650
Future Volume (veh/h)	0	0	0	575	10	1000	0	905	500	0	1590	650
Initial Q (Qb), veh				0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)				1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj				1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach					No			No			No	
Adj Sat Flow, veh/h/ln				1758	1758	1758	0	1744	1744	0	1786	1786
Adj Flow Rate, veh/h				599	10	0	0	943	0	0	1656	0
Peak Hour Factor				0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Percent Heavy Veh, %				3	3	3	0	4	4	0	1	1
Cap, veh/h				651	11		0	1760		0	1803	
Arrive On Green				0.40	0.40	0.00	0.00	1.00	0.00	0.00	1.00	0.00
Sat Flow, veh/h				1648	28	1490	0	3400	1478	0	3483	1514
Grp Volume(v), veh/h				609	0	0	0	943	0	0	1656	0
Grp Sat Flow(s),veh/h/ln				1675	0	1490	0	1657	1478	0	1697	1514
Q Serve(g_s), s				48.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cycle Q Clear(g_c), s				48.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Prop In Lane				0.98		1.00	0.00		1.00	0.00		1.00
Lane Grp Cap(c), veh/h				662	0		0	1760		0	1803	
V/C Ratio(X)				0.92	0.00		0.00	0.54		0.00	0.92	
Avail Cap(c_a), veh/h				778	0		0	1760		0	1803	
HCM Platoon Ratio				1.00	1.00	1.00	1.00	2.00	2.00	1.00	2.00	2.00
Upstream Filter(I)				1.00	0.00	0.00	0.00	0.88	0.00	0.00	0.38	0.00
Uniform Delay (d), s/veh				40.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Incr Delay (d2), s/veh				15.3	0.0	0.0	0.0	1.0	0.0	0.0	3.9	0.0
Initial Q Delay(d3),s/veh				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln				22.6	0.0	0.0	0.0	0.3	0.0	0.0	1.0	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh				55.6	0.0	0.0	0.0	1.0	0.0	0.0	3.9	0.0
LnGrp LOS				E	A		A	A		A	A	
Approach Vol, veh/h					609	A		943	A		1656	A
Approach Delay, s/veh					55.6			1.0			3.9	
Approach LOS					E			A			A	

Timer - Assigned Phs		2		4		6
Phs Duration (G+Y+Rc), s		79.7		60.3		79.7
Change Period (Y+Rc), s		5.3		5.0		5.3
Max Green Setting (Gmax), s		64.7		65.0		64.7
Max Q Clear Time (g_c+I1), s		2.0		50.4		2.0
Green Ext Time (p_c), s		14.1		5.0		35.4

Intersection Summary	
HCM 6th Ctrl Delay	12.8
HCM 6th LOS	B

Notes

Unsignalized Delay for [NBR, WBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBU	NBL	NBT	NBR	SBL	SBT
Lane Configurations												
Traffic Volume (vph)	80	25	310	640	15	125	5	30	1595	305	90	1210
Future Volume (vph)	80	25	310	640	15	125	5	30	1595	305	90	1210
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1900	1800	1800	1800	1800	1800
Total Lost time (s)	4.5	4.5	4.5	4.5	4.5			4.5	4.5		4.5	4.5
Lane Util. Factor	1.00	1.00	1.00	0.97	1.00			1.00	0.91		1.00	0.91
Frpb, ped/bikes	1.00	1.00	0.99	1.00	1.00			1.00	0.99		1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00			1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.87			1.00	0.98		1.00	1.00
Flt Protected	0.95	1.00	1.00	0.95	1.00			0.95	1.00		0.95	1.00
Satd. Flow (prot)	1693	1782	1492	3285	1543			1643	4580		1693	4858
Flt Permitted	0.95	1.00	1.00	0.95	1.00			0.38	1.00		0.95	1.00
Satd. Flow (perm)	1693	1782	1492	3285	1543			659	4580		1693	4858
Peak-hour factor, PHF	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
Adj. Flow (vph)	81	25	313	646	15	126	5	30	1611	308	91	1222
RTOR Reduction (vph)	0	0	123	0	101	0	0	0	17	0	0	0
Lane Group Flow (vph)	81	25	190	646	40	0	0	35	1902	0	91	1232
Confl. Peds. (#/hr)								3		9	9	
Confl. Bikes (#/hr)			2									
Heavy Vehicles (%)	1%	1%	1%	1%	1%	1%	4%	4%	4%	4%	1%	1%
Turn Type	Prot	NA	Perm	Prot	NA			Prot	NA		Prot	NA
Protected Phases	3	8		7	4			5	2		1	6
Permitted Phases			8									
Actuated Green, G (s)	10.6	21.0	21.0	17.5	27.9			10.5	73.8		9.7	73.0
Effective Green, g (s)	10.6	21.0	21.0	17.5	27.9			10.5	73.8		9.7	73.0
Actuated g/C Ratio	0.08	0.15	0.15	0.12	0.20			0.08	0.53		0.07	0.52
Clearance Time (s)	4.5	4.5	4.5	4.5	4.5			4.5	4.5		4.5	4.5
Vehicle Extension (s)	1.5	1.5	1.5	1.5	1.5			1.5	4.0		1.5	4.0
Lane Grp Cap (vph)	128	267	223	410	307			49	2414		117	2533
v/s Ratio Prot	0.05	0.01		c0.20	0.03				c0.42		c0.05	0.25
v/s Ratio Perm			c0.13					0.05				
v/c Ratio	0.63	0.09	0.85	1.58	0.13			0.71	0.79		0.78	0.49
Uniform Delay, d1	62.8	51.3	58.0	61.2	46.1			63.3	26.8		64.1	21.5
Progression Factor	1.00	1.00	1.00	1.00	1.00			1.00	0.69		1.18	0.58
Incremental Delay, d2	7.3	0.1	24.6	270.5	0.1			26.8	2.1		23.3	0.6
Delay (s)	70.1	51.4	82.6	331.8	46.2			90.0	20.5		98.8	13.0
Level of Service	E	D	F	F	D			F	C		F	B
Approach Delay (s)		78.3			280.6				21.7			18.9
Approach LOS		E			F				C			B

Intersection Summary			
HCM 2000 Control Delay	71.6	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	0.91		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	18.0
Intersection Capacity Utilization	84.5%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Movement	SBR
Lane Configurations	
Traffic Volume (vph)	10
Future Volume (vph)	10
Ideal Flow (vphpl)	1800
Total Lost time (s)	
Lane Util. Factor	
Frpb, ped/bikes	
Flpb, ped/bikes	
Frt	
Flt Protected	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Peak-hour factor, PHF	0.99
Adj. Flow (vph)	10
RTOR Reduction (vph)	0
Lane Group Flow (vph)	0
Confl. Peds. (#/hr)	3
Confl. Bikes (#/hr)	
Heavy Vehicles (%)	1%
Turn Type	
Protected Phases	
Permitted Phases	
Actuated Green, G (s)	
Effective Green, g (s)	
Actuated g/C Ratio	
Clearance Time (s)	
Vehicle Extension (s)	
Lane Grp Cap (vph)	
v/s Ratio Prot	
v/s Ratio Perm	
v/c Ratio	
Uniform Delay, d1	
Progression Factor	
Incremental Delay, d2	
Delay (s)	
Level of Service	
Approach Delay (s)	
Approach LOS	

Intersection Summary

HCM 6th Edition cannot analyze u-turn movements.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	30	5	5	265	5	445	5	1720	20	90	985	15
Future Volume (vph)	30	5	5	265	5	445	5	1720	20	90	985	15
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0	4.0	4.0	4.0	4.0	5.0		4.0	5.0	
Lane Util. Factor		1.00	1.00	0.95	0.95	1.00	1.00	0.91		1.00	0.95	
Frpb, ped/bikes		1.00	0.98	1.00	1.00	0.98	1.00	1.00		1.00	1.00	
Flpb, ped/bikes		1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frt		1.00	0.85	1.00	1.00	0.85	1.00	1.00		1.00	1.00	
Flt Protected		0.96	1.00	0.95	0.95	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1769	1538	1698	1705	1562	1787	3017		1736	3461	
Flt Permitted		0.96	1.00	0.95	0.95	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)		1769	1538	1698	1705	1562	1787	5125		1736	3461	
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	31	5	5	276	5	464	5	1792	21	94	1026	16
RTOR Reduction (vph)	0	0	5	0	0	335	0	0	0	0	0	0
Lane Group Flow (vph)	0	36	0	141	140	129	5	1813	0	94	1042	0
Confl. Peds. (#/hr)	3		5	5		3	7		4	4		7
Confl. Bikes (#/hr)						4			3			2
Heavy Vehicles (%)	3%	3%	3%	1%	1%	1%	1%	1%	1%	4%	4%	4%
Turn Type	Split	NA	Perm	Split	NA	Perm	Prot	NA		Prot	NA	
Protected Phases	4	4		8	8		5	2		1	6	
Permitted Phases			4			8						
Actuated Green, G (s)		8.1	8.1	18.2	18.2	18.2	4.5	83.8		12.9	92.2	
Effective Green, g (s)		8.1	8.1	18.2	18.2	18.2	4.5	83.8		12.9	92.2	
Actuated g/C Ratio		0.06	0.06	0.13	0.13	0.13	0.03	0.60		0.09	0.66	
Clearance Time (s)		4.0	4.0	4.0	4.0	4.0	4.0	5.0		4.0	5.0	
Vehicle Extension (s)		3.0	3.0	3.0	3.0	3.0	3.0	6.0		3.0	6.0	
Lane Grp Cap (vph)		102	88	220	221	203	57	1805		159	2279	
v/s Ratio Prot		c0.02		c0.08	0.08		0.00	c0.60		c0.05	0.30	
v/s Ratio Perm			0.00			0.08						
v/c Ratio		0.35	0.00	0.64	0.63	0.64	0.09	1.00		0.59	0.46	
Uniform Delay, d1		63.4	62.1	57.8	57.7	57.8	65.8	28.1		61.0	11.7	
Progression Factor		1.00	1.00	1.00	1.00	1.00	0.80	0.36		1.00	1.00	
Incremental Delay, d2		2.1	0.0	6.2	5.8	6.4	0.4	18.3		5.8	0.7	
Delay (s)		65.5	62.2	64.0	63.6	64.1	52.9	28.5		66.8	12.3	
Level of Service		E	E	E	E	E	D	C		E	B	
Approach Delay (s)		65.1			64.0			28.6			16.8	
Approach LOS		E			E			C			B	

Intersection Summary			
HCM 2000 Control Delay	32.5	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.86		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	17.0
Intersection Capacity Utilization	80.5%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

HCM 6th Edition methodology does not support turning movements with shared & exclusive lanes.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	440	375	135	190	385	195	290	1570	470	160	725	270
Future Volume (vph)	440	375	135	190	385	195	290	1570	470	160	725	270
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.1	4.1	4.1	4.1	4.1	4.1	4.3	4.5	4.5	4.0	4.5	4.5
Lane Util. Factor	0.97	0.95	1.00	0.91	0.91	1.00	0.97	0.95	1.00	1.00	0.95	1.00
Frpb, ped/bikes	1.00	1.00	0.97	1.00	1.00	0.98	1.00	1.00	0.96	1.00	1.00	0.97
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1542	1610	3382	1544	2634	2716	1215	1770	3539	1543
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1542	1610	3382	1544	3467	3574	1528	1770	3539	1543
Peak-hour factor, PHF	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Adj. Flow (vph)	449	383	138	194	393	199	296	1602	480	163	740	276
RTOR Reduction (vph)	0	0	115	0	0	101	0	0	144	0	0	167
Lane Group Flow (vph)	449	383	23	175	412	98	296	1602	336	163	740	109
Confl. Peds. (#/hr)	9		10	10		9	8		20	20		8
Confl. Bikes (#/hr)									5			4
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	1%	1%	1%	2%	2%	2%
Turn Type	Split	NA	Perm	Split	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	4	4		8	8		5	2		1	6	
Permitted Phases			4			8			2			6
Actuated Green, G (s)	22.4	22.4	22.4	21.4	21.4	21.4	19.5	63.6	63.6	9.0	52.8	52.8
Effective Green, g (s)	22.4	22.4	22.4	21.4	21.4	21.4	19.5	63.6	63.6	9.0	52.8	52.8
Actuated g/C Ratio	0.17	0.17	0.17	0.16	0.16	0.16	0.15	0.48	0.48	0.07	0.40	0.40
Clearance Time (s)	4.1	4.1	4.1	4.1	4.1	4.1	4.3	4.5	4.5	4.0	4.5	4.5
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	6.0	6.0	3.0	6.0	6.0
Lane Grp Cap (vph)	577	595	259	258	543	248	385	1297	730	119	1403	612
v/s Ratio Prot	c0.13	0.11		0.11	c0.12		0.11	c0.59		c0.09	0.21	
v/s Ratio Perm			0.02			0.06			0.22			0.07
v/c Ratio	0.78	0.64	0.09	0.68	0.76	0.40	0.77	1.24	0.46	1.37	0.53	0.18
Uniform Delay, d1	53.0	51.6	46.7	52.6	53.4	50.1	54.6	34.7	23.3	62.0	30.6	26.1
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	6.6	2.4	0.2	6.9	6.0	1.0	8.9	112.7	1.3	210.6	0.9	0.4
Delay (s)	59.5	54.0	46.9	59.5	59.4	51.1	63.6	147.4	24.6	272.7	31.5	26.5
Level of Service	E	D	D	E	E	D	E	F	C	F	C	C
Approach Delay (s)		55.6			57.3			112.2			63.7	
Approach LOS		E			E			F			E	

Intersection Summary			
HCM 2000 Control Delay	83.0	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.07		
Actuated Cycle Length (s)	133.1	Sum of lost time (s)	17.0
Intersection Capacity Utilization	95.8%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

HCM 6th Edition methodology does not support turning movements with shared & exclusive lanes.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	590	180	395	20	115	35	175	285	40	25	190	250
Future Volume (veh/h)	590	180	395	20	115	35	175	285	40	25	190	250
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		0.98	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1885	1885	1885	1870	1870	1870	1870	1870	1870	1885	1885	1885
Adj Flow Rate, veh/h	621	189	416	21	121	37	175	312	42	26	200	263
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %	1	1	1	2	2	2	2	2	2	1	1	1
Cap, veh/h	714	944	796	39	158	48	228	413	55	41	314	303
Arrive On Green	0.66	0.84	0.84	0.02	0.12	0.12	0.13	0.13	0.13	0.19	0.19	0.19
Sat Flow, veh/h	1795	1885	1591	1781	1368	418	1781	3232	431	216	1659	1598
Grp Volume(v), veh/h	621	189	416	21	0	158	175	179	175	226	0	263
Grp Sat Flow(s),veh/h/ln	1795	1885	1591	1781	0	1786	1781	1870	1793	1874	0	1598
Q Serve(g_s), s	27.5	2.0	7.6	1.2	0.0	8.6	9.5	9.2	9.4	11.1	0.0	16.0
Cycle Q Clear(g_c), s	27.5	2.0	7.6	1.2	0.0	8.6	9.5	9.2	9.4	11.1	0.0	16.0
Prop In Lane	1.00		1.00	1.00		0.23	1.00		0.24	0.12		1.00
Lane Grp Cap(c), veh/h	714	944	796	39	0	206	228	239	229	355	0	303
V/C Ratio(X)	0.87	0.20	0.52	0.53	0.00	0.77	0.77	0.75	0.76	0.64	0.00	0.87
Avail Cap(c_a), veh/h	714	944	796	194	0	395	410	430	412	506	0	431
HCM Platoon Ratio	1.67	1.67	1.67	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.70	0.70	0.70	1.00	0.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	14.8	4.3	4.7	48.4	0.0	42.9	42.2	42.1	42.1	37.4	0.0	39.3
Incr Delay (d2), s/veh	8.3	0.3	1.7	4.1	0.0	2.3	2.1	1.8	2.0	0.7	0.0	9.6
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	8.3	0.8	2.0	0.6	0.0	3.9	4.3	4.4	4.3	5.1	0.0	7.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	23.0	4.6	6.4	52.5	0.0	45.2	44.2	43.8	44.1	38.1	0.0	48.9
LnGrp LOS	C	A	A	D	A	D	D	D	D	D	A	D
Approach Vol, veh/h		1226			179			529			489	
Approach Delay, s/veh		14.5			46.1			44.1			43.9	
Approach LOS		B			D			D			D	
Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	5.7	54.6		16.8	44.3	16.0		22.9				
Change Period (Y+Rc), s	3.5	4.5		4.0	4.5	4.5		4.0				
Max Green Setting (Gmax), s	10.9	23.1		23.0	10.9	22.1		27.0				
Max Q Clear Time (g_c+I1), s	3.2	9.6		11.5	29.5	10.6		18.0				
Green Ext Time (p_c), s	0.0	1.3		1.3	0.0	0.4		1.0				

Intersection Summary			
HCM 6th Ctrl Delay			29.2
HCM 6th LOS			C

Notes

User approved volume balancing among the lanes for turning movement.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	205	1085	185	25	545	30	405	70	105	65	80	670
Future Volume (veh/h)	205	1085	185	25	545	30	405	70	105	65	80	670
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.99	1.00		0.99	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1885	1885	1885	1870	1870	1870	1885	1885	1885	1900	1900	1900
Adj Flow Rate, veh/h	211	1119	191	26	562	31	418	72	108	67	0	746
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Percent Heavy Veh, %	1	1	1	2	2	2	1	1	1	0	0	0
Cap, veh/h	243	1518	671	46	1109	61	507	229	343	88	0	770
Arrive On Green	0.14	0.42	0.42	0.03	0.32	0.32	0.15	0.34	0.34	0.05	0.00	0.24
Sat Flow, veh/h	1795	3582	1584	1781	3422	188	3483	680	1020	1810	0	3207
Grp Volume(v), veh/h	211	1119	191	26	291	302	418	0	180	67	0	746
Grp Sat Flow(s),veh/h/ln	1795	1791	1584	1781	1777	1834	1742	0	1699	1810	0	1603
Q Serve(g_s), s	11.5	26.2	7.9	1.4	13.3	13.3	11.7	0.0	7.9	3.7	0.0	23.0
Cycle Q Clear(g_c), s	11.5	26.2	7.9	1.4	13.3	13.3	11.7	0.0	7.9	3.7	0.0	23.0
Prop In Lane	1.00		1.00	1.00		0.10	1.00		0.60	1.00		1.00
Lane Grp Cap(c), veh/h	243	1518	671	46	576	594	507	0	572	88	0	770
V/C Ratio(X)	0.87	0.74	0.28	0.57	0.51	0.51	0.82	0.00	0.31	0.76	0.00	0.97
Avail Cap(c_a), veh/h	260	1518	671	240	576	594	714	0	572	371	0	770
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.81	0.81	0.81	0.76	0.76	0.76	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	42.4	24.1	18.9	48.2	27.3	27.3	41.5	0.0	24.6	47.0	0.0	37.6
Incr Delay (d2), s/veh	20.6	2.6	0.9	8.1	2.4	2.3	5.5	0.0	0.3	12.6	0.0	25.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	6.4	11.2	3.0	0.7	5.9	6.1	5.3	0.0	3.2	1.9	0.0	11.5
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	63.0	26.8	19.7	56.3	29.7	29.7	47.0	0.0	24.9	59.6	0.0	62.6
LnGrp LOS	E	C	B	E	C	C	D	A	C	E	A	E
Approach Vol, veh/h		1521			619			598			813	
Approach Delay, s/veh		30.9			30.8			40.3			62.4	
Approach LOS		C			C			D			E	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	7.1	46.9	18.1	28.0	17.0	36.9	8.4	37.7
Change Period (Y+Rc), s	4.5	4.5	3.5	4.0	3.5	4.5	3.5	4.0
Max Green Setting (Gmax), s	13.5	25.5	20.5	24.0	14.5	25.5	20.5	24.0
Max Q Clear Time (g_c+I1), s	3.4	28.2	13.7	25.0	13.5	15.3	5.7	9.9
Green Ext Time (p_c), s	0.0	0.0	0.9	0.0	0.1	3.4	0.1	0.8

Intersection Summary	
HCM 6th Ctrl Delay	39.7
HCM 6th LOS	D

Notes

User approved pedestrian interval to be less than phase max green.

User approved volume balancing among the lanes for turning movement.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	145	675	0	0	1085	510	150	70	890	0	0	0
Future Volume (veh/h)	145	675	0	0	1085	510	150	70	890	0	0	0
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0			
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		0.96	1.00		1.00			
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00			
Work Zone On Approach		No			No			No				
Adj Sat Flow, veh/h/ln	1870	1870	0	0	1885	1885	1885	1885	1885			
Adj Flow Rate, veh/h	146	682	0	0	1096	515	152	578	561			
Peak Hour Factor	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99			
Percent Heavy Veh, %	2	2	0	0	1	1	1	1	1			
Cap, veh/h	242	1978	0	0	1575	675	128	487	525			
Arrive On Green	0.06	0.56	0.00	0.00	0.44	0.44	0.33	0.33	0.33			
Sat Flow, veh/h	1781	3647	0	0	3676	1536	388	1477	1593			
Grp Volume(v), veh/h	146	682	0	0	1096	515	730	0	561			
Grp Sat Flow(s),veh/h/ln	1781	1777	0	0	1791	1536	1866	0	1593			
Q Serve(g_s), s	4.5	11.0	0.0	0.0	25.8	29.5	34.4	0.0	34.4			
Cycle Q Clear(g_c), s	4.5	11.0	0.0	0.0	25.8	29.5	34.4	0.0	34.4			
Prop In Lane	1.00		0.00	0.00		1.00	0.21		1.00			
Lane Grp Cap(c), veh/h	242	1978	0	0	1575	675	615	0	525			
V/C Ratio(X)	0.60	0.34	0.00	0.00	0.70	0.76	1.19	0.00	1.07			
Avail Cap(c_a), veh/h	546	1978	0	0	1842	790	615	0	525			
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00			
Upstream Filter(I)	1.00	1.00	0.00	0.00	1.00	1.00	1.00	0.00	1.00			
Uniform Delay (d), s/veh	19.8	12.7	0.0	0.0	23.6	24.7	35.0	0.0	35.0			
Incr Delay (d2), s/veh	1.8	0.1	0.0	0.0	1.1	4.3	100.1	0.0	59.0			
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			
%ile BackOfQ(50%),veh/ln	1.9	4.2	0.0	0.0	10.8	11.2	32.3	0.0	21.6			
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	21.6	12.8	0.0	0.0	24.8	28.9	135.2	0.0	94.0			
LnGrp LOS	C	B	A	A	C	C	F	A	F			
Approach Vol, veh/h		828			1611			1291				
Approach Delay, s/veh		14.4			26.1			117.3				
Approach LOS		B			C			F				
Timer - Assigned Phs		2			5	6		8				
Phs Duration (G+Y+Rc), s		64.4			12.2	52.2		40.0				
Change Period (Y+Rc), s		6.3			5.6	6.3		5.6				
Max Green Setting (Gmax), s		53.7			24.4	53.7		34.4				
Max Q Clear Time (g_c+I1), s		13.0			6.5	31.5		36.4				
Green Ext Time (p_c), s		7.9			0.2	14.4		0.0				

Intersection Summary	
HCM 6th Ctrl Delay	55.1
HCM 6th LOS	E

Notes

User approved volume balancing among the lanes for turning movement.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	510	95	610	640	0	0	0	0	295	5	140
Future Volume (veh/h)	0	510	95	610	640	0	0	0	0	295	5	140
Initial Q (Qb), veh	0	0	0	0	0	0				0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.99	1.00		1.00				1.00		0.98
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00				1.00	1.00	1.00
Work Zone On Approach		No			No						No	
Adj Sat Flow, veh/h/ln	0	1841	1841	1885	1885	0				1870	1870	1870
Adj Flow Rate, veh/h	0	526	98	629	660	0				226	113	144
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97				0.97	0.97	0.97
Percent Heavy Veh, %	0	4	4	1	1	0				2	2	2
Cap, veh/h	0	853	158	774	1121	0				402	166	212
Arrive On Green	0.00	0.29	0.29	0.22	0.59	0.00				0.23	0.23	0.23
Sat Flow, veh/h	0	3029	545	3483	1885	0				1781	736	938
Grp Volume(v), veh/h	0	312	312	629	660	0				226	0	257
Grp Sat Flow(s),veh/h/ln	0	1749	1733	1742	1885	0				1781	0	1674
Q Serve(g_s), s	0.0	10.5	10.6	11.7	14.8	0.0				7.7	0.0	9.6
Cycle Q Clear(g_c), s	0.0	10.5	10.6	11.7	14.8	0.0				7.7	0.0	9.6
Prop In Lane	0.00		0.31	1.00		0.00				1.00		0.56
Lane Grp Cap(c), veh/h	0	508	503	774	1121	0				402	0	378
V/C Ratio(X)	0.00	0.62	0.62	0.81	0.59	0.00				0.56	0.00	0.68
Avail Cap(c_a), veh/h	0	1381	1368	1250	1488	0				893	0	839
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00				1.00	1.00	1.00
Upstream Filter(I)	0.00	1.00	1.00	1.00	1.00	0.00				1.00	0.00	1.00
Uniform Delay (d), s/veh	0.0	20.9	20.9	25.1	8.6	0.0				23.3	0.0	24.1
Incr Delay (d2), s/veh	0.0	1.7	1.8	1.6	0.7	0.0				1.2	0.0	2.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0				0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.0	4.2	4.2	4.7	5.1	0.0				3.2	0.0	3.8
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	0.0	22.6	22.7	26.7	9.3	0.0				24.6	0.0	26.2
LnGrp LOS	A	C	C	C	A	A				C	A	C
Approach Vol, veh/h		624			1289						483	
Approach Delay, s/veh		22.6			17.8						25.5	
Approach LOS		C			B						C	

Timer - Assigned Phs	1	2		4		6						
Phs Duration (G+Y+Rc), s	20.7	26.0		21.3		46.8						
Change Period (Y+Rc), s	5.6	6.3		5.9		6.3						
Max Green Setting (Gmax), s	24.4	53.7		34.1		53.7						
Max Q Clear Time (g_c+I1), s	13.7	12.6		11.6		16.8						
Green Ext Time (p_c), s	1.5	6.5		2.3		7.8						

Intersection Summary			
HCM 6th Ctrl Delay			20.6
HCM 6th LOS			C

Notes

User approved volume balancing among the lanes for turning movement.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	5	430	35	35	570	10	55	5	125	25	5	15
Future Volume (vph)	5	430	35	35	570	10	55	5	125	25	5	15
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	3.0	3.0	4.0	3.0	3.0		4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	
Frpb, ped/bikes	1.00	1.00	0.96	1.00	1.00	0.97		1.00	1.00	1.00	0.98	
Flpb, ped/bikes	1.00	1.00	1.00	0.99	1.00	1.00		1.00	1.00	1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85		1.00	0.85	1.00	0.89	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00		0.96	1.00	0.95	1.00	
Satd. Flow (prot)	1699	1792	1462	1743	1845	1518		1558	1392	1805	1650	
Flt Permitted	0.44	1.00	1.00	0.50	1.00	1.00		0.77	1.00	0.95	1.00	
Satd. Flow (perm)	787	1792	1462	924	1845	1518		1249	1392	1805	1650	
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	5	448	36	36	594	10	57	5	130	26	5	16
RTOR Reduction (vph)	0	0	20	0	0	5	0	0	122	0	14	0
Lane Group Flow (vph)	5	448	16	36	594	5	0	62	8	26	7	0
Confl. Peds. (#/hr)	4		8	8		4	2					2
Heavy Vehicles (%)	6%	6%	6%	3%	3%	3%	16%	16%	16%	0%	0%	0%
Turn Type	custom	NA	Perm	custom	NA	Perm	Perm	NA	custom	custom	NA	
Protected Phases	5	2 9		1	6 10			3 8	3	7	7	
Permitted Phases	9		2 9	10		6 10	3 8			7		
Actuated Green, G (s)	18.1	52.6	52.6	27.7	57.0	57.0		29.1	7.1	16.1	16.1	
Effective Green, g (s)	18.1	52.6	52.6	27.7	57.0	57.0		29.1	7.1	16.1	16.1	
Actuated g/C Ratio	0.15	0.44	0.44	0.23	0.48	0.48		0.24	0.06	0.14	0.14	
Clearance Time (s)	4.0			4.0					4.0	4.0	4.0	
Vehicle Extension (s)	3.0			3.0					2.5	2.0	2.0	
Lane Grp Cap (vph)	127	790	645	251	882	725		304	82	243	222	
v/s Ratio Prot	0.00	0.25		c0.01	c0.32				0.01	c0.01	0.00	
v/s Ratio Perm	0.01		0.01	0.03		0.00		c0.05				
v/c Ratio	0.04	0.57	0.02	0.14	0.67	0.01		0.20	0.09	0.11	0.03	
Uniform Delay, d1	43.0	24.8	18.8	35.9	23.9	16.3		35.8	53.0	45.2	44.8	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.1	0.6	0.0	0.3	1.6	0.0		0.2	0.4	0.1	0.0	
Delay (s)	43.1	25.4	18.8	36.1	25.5	16.3		36.1	53.4	45.3	44.8	
Level of Service	D	C	B	D	C	B		D	D	D	D	
Approach Delay (s)		25.1			26.0			47.8			45.1	
Approach LOS		C			C			D			D	

Intersection Summary			
HCM 2000 Control Delay	29.4	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.48		
Actuated Cycle Length (s)	119.2	Sum of lost time (s)	23.0
Intersection Capacity Utilization	46.6%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM 6th Edition methodology does not support non-NEMA phasing.

Intersection	
Int Delay, s/veh	7.9

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	10	270	0	0	320	345	0	0	5	200	0	10
Future Vol, veh/h	10	270	0	0	320	345	0	0	5	200	0	10
Conflicting Peds, #/hr	7	0	20	19	0	6	20	0	19	6	0	7
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	Free	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	95	95	95	95	95	95	95	95	95	95	95	95
Heavy Vehicles, %	7	7	7	3	3	3	0	0	0	5	5	5
Mvmt Flow	11	284	0	0	337	363	0	0	5	211	0	11

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	344	0	0	304	0	0	689	670	323	672	670	364
Stage 1	-	-	-	-	-	-	326	326	-	344	344	-
Stage 2	-	-	-	-	-	-	363	344	-	328	326	-
Critical Hdwy	4.17	-	-	4.13	-	-	7.1	6.5	6.2	7.15	6.55	6.25
Critical Hdwy Stg 1	-	-	-	-	-	-	6.1	5.5	-	6.15	5.55	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.1	5.5	-	6.15	5.55	-
Follow-up Hdwy	2.263	-	-	2.227	-	-	3.5	4	3.3	3.545	4.045	3.345
Pot Cap-1 Maneuver	1188	-	-	1251	-	0	363	381	723	365	374	674
Stage 1	-	-	-	-	-	0	691	652	-	665	631	-
Stage 2	-	-	-	-	-	0	660	640	-	679	643	-
Platoon blocked, %		-	-		-							
Mov Cap-1 Maneuver	1180	-	-	1227	-	-	341	367	696	350	360	657
Mov Cap-2 Maneuver	-	-	-	-	-	-	341	367	-	350	360	-
Stage 1	-	-	-	-	-	-	670	632	-	653	627	-
Stage 2	-	-	-	-	-	-	637	636	-	654	624	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.3	0	10.2	30
HCM LOS			B	D

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	SBLn1
Capacity (veh/h)	696	1180	-	-	1227	-	358
HCM Lane V/C Ratio	0.008	0.009	-	-	-	-	0.617
HCM Control Delay (s)	10.2	8.1	0	-	0	-	30
HCM Lane LOS	B	A	A	-	A	-	D
HCM 95th %tile Q(veh)	0	0	-	-	0	-	3.9

Movement	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Lane Configurations												
Traffic Volume (veh/h)	60	1645	5	30	10	1905	435	5	5	5	300	5
Future Volume (veh/h)	60	1645	5	30	10	1905	435	5	5	5	300	5
Initial Q (Qb), veh	0	0	0		0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00		1.00		1.00	1.00		0.93	1.00	
Parking Bus, Adj	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No				No			No			No
Adj Sat Flow, veh/h/ln	1856	1856	1856		1885	1885	1885	1900	1900	1900	1856	1856
Adj Flow Rate, veh/h	64	1750	5		11	2027	0	5	5	5	196	176
Peak Hour Factor	0.94	0.94	0.94		0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Percent Heavy Veh, %	3	3	3		1	1	1	0	0	0	3	3
Cap, veh/h	81	2406	7		37	2299		6	6	6	298	214
Arrive On Green	0.03	0.45	0.45		0.02	0.64	0.00	0.01	0.01	0.01	0.17	0.17
Sat Flow, veh/h	1767	3606	10		1795	3582	1598	572	572	572	1767	1264
Grp Volume(v), veh/h	64	855	900		11	2027	0	15	0	0	196	0
Grp Sat Flow(s),veh/h/ln	1767	1763	1854		1795	1791	1598	1716	0	0	1767	0
Q Serve(g_s), s	4.3	47.7	47.7		0.7	56.0	0.0	1.0	0.0	0.0	12.4	0.0
Cycle Q Clear(g_c), s	4.3	47.7	47.7		0.7	56.0	0.0	1.0	0.0	0.0	12.4	0.0
Prop In Lane	1.00		0.01		1.00		1.00	0.33		0.33	1.00	
Lane Grp Cap(c), veh/h	81	1176	1237		37	2299		17	0	0	298	0
V/C Ratio(X)	0.79	0.73	0.73		0.30	0.88		0.87	0.00	0.00	0.66	0.00
Avail Cap(c_a), veh/h	81	1176	1237		157	2299		43	0	0	368	0
HCM Platoon Ratio	0.67	0.67	0.67		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.75	0.75	0.75		1.00	1.00	0.00	1.00	0.00	0.00	1.00	0.00
Uniform Delay (d), s/veh	57.6	24.2	24.2		57.9	17.7	0.0	59.3	0.0	0.0	46.6	0.0
Incr Delay (d2), s/veh	29.4	3.0	2.8		1.7	5.3	0.0	35.9	0.0	0.0	4.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	2.6	21.7	22.8		0.3	22.3	0.0	0.6	0.0	0.0	5.8	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	87.0	27.2	27.1		59.6	23.0	0.0	95.2	0.0	0.0	50.6	0.0
LnGrp LOS	F	C	C		E	C		F	A	A	D	A
Approach Vol, veh/h		1819				2038	A		15			441
Approach Delay, s/veh		29.2				23.2			95.2			56.5
Approach LOS		C				C			F			E

Timer - Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	6.0	84.6		24.3	9.0	81.5		5.2
Change Period (Y+Rc), s	3.5	4.5		4.0	3.5	4.5		4.0
Max Green Setting (Gmax), s	10.5	65.5		25.0	5.5	70.5		3.0
Max Q Clear Time (g_c+I1), s	2.7	49.7		18.1	6.3	58.0		3.0
Green Ext Time (p_c), s	0.0	12.9		1.6	0.0	11.3		0.0

Intersection Summary	
HCM 6th Ctrl Delay	29.4
HCM 6th LOS	C

Notes

User approved volume balancing among the lanes for turning movement.

User approved ignoring U-Turning movement.

Unsignalized Delay for [WBR] is excluded from calculations of the approach delay and intersection delay.

Movement	SBR
Lane Configurations	
Traffic Volume (veh/h)	65
Future Volume (veh/h)	65
Initial Q (Qb), veh	0
Ped-Bike Adj(A_pbT)	0.99
Parking Bus, Adj	1.00
Work Zone On Approach	
Adj Sat Flow, veh/h/ln	1856
Adj Flow Rate, veh/h	69
Peak Hour Factor	0.94
Percent Heavy Veh, %	3
Cap, veh/h	84
Arrive On Green	0.17
Sat Flow, veh/h	496
Grp Volume(v), veh/h	245
Grp Sat Flow(s),veh/h/ln	1760
Q Serve(g_s), s	16.1
Cycle Q Clear(g_c), s	16.1
Prop In Lane	0.28
Lane Grp Cap(c), veh/h	297
V/C Ratio(X)	0.82
Avail Cap(c_a), veh/h	367
HCM Platoon Ratio	1.00
Upstream Filter(I)	1.00
Uniform Delay (d), s/veh	48.1
Incr Delay (d2), s/veh	13.2
Initial Q Delay(d3),s/veh	0.0
%ile BackOfQ(50%),veh/ln	8.2
Unsig. Movement Delay, s/veh	
LnGrp Delay(d),s/veh	61.3
LnGrp LOS	E
Approach Vol, veh/h	
Approach Delay, s/veh	
Approach LOS	
Timer - Assigned Phs	

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	680	1465	1590	395	255	500
Future Volume (vph)	680	1465	1590	395	255	500
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.0	5.0	5.0	5.0	5.0	3.0
Lane Util. Factor	0.97	0.95	0.95	1.00	0.97	1.00
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	0.98
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	1.00	0.85	1.00	0.85
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	3433	3539	3574	1599	3502	1587
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	3433	3539	3574	1599	3502	1587
Peak-hour factor, PHF	0.98	0.98	0.98	0.98	0.98	0.98
Adj. Flow (vph)	694	1495	1622	403	260	510
RTOR Reduction (vph)	0	0	0	15	0	1
Lane Group Flow (vph)	694	1495	1622	388	260	509
Confl. Peds. (#/hr)						12
Heavy Vehicles (%)	2%	2%	1%	1%	0%	0%
Turn Type	Prot	NA	NA	pm+ov	Prot	pt+ov
Protected Phases	3 5	2	6	7	7	3 5
Permitted Phases				6		4
Actuated Green, G (s)	13.8	74.2	64.2	91.2	27.0	40.8
Effective Green, g (s)	13.8	74.2	64.2	91.2	27.0	40.8
Actuated g/C Ratio	0.12	0.62	0.54	0.76	0.22	0.34
Clearance Time (s)		5.0	5.0	5.0	5.0	
Vehicle Extension (s)		3.0	0.4	4.0	4.0	
Lane Grp Cap (vph)	394	2188	1912	1281	787	539
v/s Ratio Prot	c0.20	0.42	c0.45	0.07	0.07	c0.11
v/s Ratio Perm				0.17		0.21
v/c Ratio	1.76	0.68	0.85	0.30	0.33	0.94
Uniform Delay, d1	53.1	15.1	23.8	4.5	38.9	38.5
Progression Factor	0.80	1.19	0.94	0.09	1.00	1.00
Incremental Delay, d2	349.4	1.2	2.4	0.1	0.3	25.3
Delay (s)	392.1	19.1	24.6	0.5	39.3	63.8
Level of Service	F	B	C	A	D	E
Approach Delay (s)		137.4	19.8		55.5	
Approach LOS		F	B		E	

Intersection Summary			
HCM 2000 Control Delay	76.9	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.02		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	18.0
Intersection Capacity Utilization	83.6%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM 6th Edition methodology expects standard NEMA quad ring-barrier structure. Does not support multiple barriers.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	60	2120	10	10	2055	35	10	5	15	35	0	80
Future Volume (veh/h)	60	2120	10	10	2055	35	10	5	15	35	0	80
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	0.95		0.94	0.95		0.94
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1856	1856	1856	1885	1885	1885	1900	1900	1900	1900	1900	1900
Adj Flow Rate, veh/h	63	2232	11	11	2163	37	11	5	16	37	0	84
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %	3	3	3	1	1	1	0	0	0	0	0	0
Cap, veh/h	74	2753	14	23	2653	45	87	47	93	230	0	185
Arrive On Green	0.08	1.00	1.00	0.01	0.74	0.74	0.12	0.12	0.12	0.12	0.00	0.12
Sat Flow, veh/h	1767	3597	18	1795	3604	61	379	382	761	1393	0	1519
Grp Volume(v), veh/h	63	1093	1150	11	1072	1128	32	0	0	37	0	84
Grp Sat Flow(s),veh/h/ln	1767	1763	1852	1795	1791	1874	1522	0	0	1393	0	1519
Q Serve(g_s), s	4.2	0.0	0.0	0.7	47.2	47.9	0.0	0.0	0.0	0.4	0.0	6.2
Cycle Q Clear(g_c), s	4.2	0.0	0.0	0.7	47.2	47.9	2.0	0.0	0.0	2.4	0.0	6.2
Prop In Lane	1.00		0.01	1.00		0.03	0.34		0.50	1.00		1.00
Lane Grp Cap(c), veh/h	74	1349	1417	23	1319	1380	226	0	0	230	0	185
V/C Ratio(X)	0.86	0.81	0.81	0.48	0.81	0.82	0.14	0.00	0.00	0.16	0.00	0.45
Avail Cap(c_a), veh/h	74	1349	1417	75	1319	1380	389	0	0	379	0	354
HCM Platoon Ratio	2.00	2.00	2.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.56	0.56	0.56	0.43	0.43	0.43	1.00	0.00	0.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	54.6	0.0	0.0	58.8	10.4	10.5	47.1	0.0	0.0	47.3	0.0	49.0
Incr Delay (d2), s/veh	37.7	3.1	3.0	2.5	2.5	2.4	0.1	0.0	0.0	0.1	0.0	0.6
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	2.6	1.2	1.2	0.3	16.1	17.1	0.9	0.0	0.0	1.0	0.0	2.4
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	92.3	3.1	3.0	61.3	12.9	12.9	47.2	0.0	0.0	47.4	0.0	49.6
LnGrp LOS	F	A	A	E	B	B	D	A	A	D	A	D
Approach Vol, veh/h		2306			2211			32			121	
Approach Delay, s/veh		5.5			13.1			47.2			48.9	
Approach LOS		A			B			D			D	
Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	5.5	95.8		18.6	9.0	92.4		18.6				
Change Period (Y+Rc), s	4.0	* 4		4.0	4.0	4.0		4.0				
Max Green Setting (Gmax), s	5.0	* 76		28.0	5.0	75.0		28.0				
Max Q Clear Time (g_c+I1), s	2.7	2.0		8.2	6.2	49.9		4.0				
Green Ext Time (p_c), s	0.0	70.6		0.2	0.0	24.7		0.1				
Intersection Summary												
HCM 6th Ctrl Delay			10.5									
HCM 6th LOS			B									

Notes

* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	80	2050	1845	235	180	65
Future Volume (vph)	80	2050	1845	235	180	65
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5	4.5		4.5	4.5
Lane Util. Factor	1.00	0.95	0.95		1.00	1.00
Frpb, ped/bikes	1.00	1.00	0.99		1.00	0.99
Flpb, ped/bikes	1.00	1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.98		1.00	0.85
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1736	3471	3459		1770	1562
Flt Permitted	0.95	1.00	1.00		0.95	1.00
Satd. Flow (perm)	1736	3471	3459		1770	1562
Peak-hour factor, PHF	0.99	0.99	0.99	0.99	0.99	0.99
Adj. Flow (vph)	81	2071	1864	237	182	66
RTOR Reduction (vph)	0	0	7	0	0	56
Lane Group Flow (vph)	81	2071	2094	0	182	10
Confl. Peds. (#/hr)	13			13		1
Heavy Vehicles (%)	4%	4%	2%	2%	2%	2%
Turn Type	Prot	NA	NA		Prot	Perm
Protected Phases	5	2	6		4	
Permitted Phases						4
Actuated Green, G (s)	10.3	92.6	77.8		18.4	18.4
Effective Green, g (s)	10.3	92.6	77.8		18.4	18.4
Actuated g/C Ratio	0.09	0.77	0.65		0.15	0.15
Clearance Time (s)	4.5	4.5	4.5		4.5	4.5
Vehicle Extension (s)	3.0	6.0	6.0		3.0	3.0
Lane Grp Cap (vph)	149	2678	2242		271	239
v/s Ratio Prot	0.05	c0.60	c0.61		c0.10	
v/s Ratio Perm						0.01
v/c Ratio	0.54	0.77	0.93		0.67	0.04
Uniform Delay, d1	52.6	7.8	18.8		47.9	43.3
Progression Factor	1.00	1.00	1.70		1.00	1.00
Incremental Delay, d2	4.0	2.2	5.6		6.4	0.1
Delay (s)	56.6	10.0	37.5		54.4	43.4
Level of Service	E	B	D		D	D
Approach Delay (s)		11.8	37.5		51.4	
Approach LOS		B	D		D	

Intersection Summary			
HCM 2000 Control Delay	25.9	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.89		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	13.5
Intersection Capacity Utilization	84.4%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM 6th Edition methodology does not support exclusive ped or hold phases.

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	1635	175	265	1545	400	435
Future Volume (veh/h)	1635	175	265	1545	400	435
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)		1.00	1.00		1.00	1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No	No	
Adj Sat Flow, veh/h/ln	1856	1856	1885	1885	1885	1885
Adj Flow Rate, veh/h	1739	186	282	1644	426	463
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94
Percent Heavy Veh, %	3	3	1	1	1	1
Cap, veh/h	1993	1294	327	2449	899	562
Arrive On Green	0.57	0.57	0.09	0.68	0.26	0.26
Sat Flow, veh/h	3618	1571	3483	3676	3483	1598
Grp Volume(v), veh/h	1739	186	282	1644	426	463
Grp Sat Flow(s),veh/h/ln	1763	1571	1742	1791	1742	1598
Q Serve(g_s), s	68.9	3.9	13.0	43.7	16.8	42.0
Cycle Q Clear(g_c), s	68.9	3.9	13.0	43.7	16.8	42.0
Prop In Lane		1.00	1.00		1.00	1.00
Lane Grp Cap(c), veh/h	1993	1294	327	2449	899	562
V/C Ratio(X)	0.87	0.14	0.86	0.67	0.47	0.82
Avail Cap(c_a), veh/h	1993	1294	385	2497	899	562
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	30.4	2.9	72.7	15.1	51.1	48.1
Incr Delay (d2), s/veh	5.6	0.2	15.9	0.7	0.4	9.6
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	30.3	3.6	6.6	17.6	7.5	18.7
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	36.0	3.1	88.6	15.8	51.4	57.8
LnGrp LOS	D	A	F	B	D	E
Approach Vol, veh/h	1925			1926	889	
Approach Delay, s/veh	32.8			26.4	54.7	
Approach LOS	C			C	D	

Timer - Assigned Phs		2	3	4			8
Phs Duration (G+Y+Rc), s		47.0	19.3	96.5			115.8
Change Period (Y+Rc), s		5.0	4.0	* 4.5			4.5
Max Green Setting (Gmax), s		42.0	18.0	* 92			113.5
Max Q Clear Time (g_c+I1), s		44.0	15.0	70.9			45.7
Green Ext Time (p_c), s		0.0	0.3	14.8			23.3

Intersection Summary			
HCM 6th Ctrl Delay			34.3
HCM 6th LOS			C

Notes

* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	5	10	155	0	65	0	895	135	55	655	10
Future Volume (veh/h)	0	5	10	155	0	65	0	895	135	55	655	10
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.89	1.00		0.94	1.00		0.99	1.00		0.99
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	418	418	418	1885	1885	1885	0	1870	1870	1885	1885	1885
Adj Flow Rate, veh/h	0	5	10	157	0	66	0	904	136	56	662	10
Peak Hour Factor	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
Percent Heavy Veh, %	100	100	100	1	1	1	0	2	2	1	1	1
Cap, veh/h	84	0	0	177	0	143	0	2010	302	457	2684	41
Arrive On Green	0.00	0.00	0.00	0.13	0.00	0.10	0.00	0.65	0.65	0.04	0.74	0.74
Sat Flow, veh/h	398	114	229	1795	0	1497	0	3185	465	1795	3611	55
Grp Volume(v), veh/h	0	0	15	157	0	66	0	519	521	56	328	344
Grp Sat Flow(s),veh/h/ln	398	0	343	1795	0	1497	0	1777	1780	1795	1791	1875
Q Serve(g_s), s	0.0	0.0	0.1	7.9	0.0	2.7	0.0	9.4	9.4	0.6	3.7	3.7
Cycle Q Clear(g_c), s	0.0	0.0	0.1	7.9	0.0	2.7	0.0	9.4	9.4	0.6	3.7	3.7
Prop In Lane	1.00		0.67	1.00		1.00	0.00		0.26	1.00		0.03
Lane Grp Cap(c), veh/h	84	0	1	177	0	143	0	1155	1158	457	1331	1393
V/C Ratio(X)	0.00	0.00	28.40	0.89	0.00	0.46	0.00	0.45	0.45	0.12	0.25	0.25
Avail Cap(c_a), veh/h	111	0	106	177	0	461	0	1155	1158	498	1331	1393
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.00	0.00	1.00	1.00	0.00	1.00	0.00	0.09	0.09	0.97	0.97	0.97
Uniform Delay (d), s/veh	0.0	0.0	32.5	36.8	0.0	27.8	0.0	5.6	5.6	3.7	2.6	2.6
Incr Delay (d2), s/veh	0.0	0.0	13051.3	37.3	0.0	2.3	0.0	0.1	0.1	0.1	0.4	0.4
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.0	0.0	1.9	3.8	0.0	1.0	0.0	2.4	2.4	0.1	0.8	0.8
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	0.0	0.0	13083.8	74.1	0.0	30.2	0.0	5.7	5.7	3.9	3.1	3.0
LnGrp LOS	A	A	F	E	A	C	A	A	A	A	A	A
Approach Vol, veh/h		15			223			1040			728	
Approach Delay, s/veh		13083.8			61.1			5.7			3.1	
Approach LOS		F			E			A			A	

Timer - Assigned Phs	1	2	3	4		6	7	8
Phs Duration (G+Y+Rc), s	6.0	46.8	12.2	0.0		52.8	0.0	12.2
Change Period (Y+Rc), s	3.5	4.5	3.5	6.0		4.5	3.5	6.0
Max Green Setting (Gmax), s	4.0	19.0	4.5	20.0		26.5	4.5	20.0
Max Q Clear Time (g_c+I1), s	2.6	11.4	9.9	0.0		5.7	0.0	4.7
Green Ext Time (p_c), s	0.0	3.8	0.0	0.0		3.9	0.0	0.2

Intersection Summary	
HCM 6th Ctrl Delay	108.7
HCM 6th LOS	F

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	5	10	155	0	65	0	895	135	55	655	10
Future Volume (veh/h)	0	5	10	155	0	65	0	895	135	55	655	10
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.89	1.00		0.94	1.00		0.99	1.00		0.99
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1885	1885	1885	0	1870	1870	1885	1885	1885
Adj Flow Rate, veh/h	0	5	10	157	0	66	0	904	136	56	662	10
Peak Hour Factor	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
Percent Heavy Veh, %	2	2	2	1	1	1	0	2	2	1	1	1
Cap, veh/h	0	1	2	177	0	143	0	2010	302	457	2684	41
Arrive On Green	0.00	0.00	0.00	0.13	0.00	0.10	0.00	0.65	0.65	0.04	0.74	0.74
Sat Flow, veh/h	1781	512	1024	1795	0	1497	0	3185	465	1795	3611	55
Grp Volume(v), veh/h	0	0	15	157	0	66	0	519	521	56	328	344
Grp Sat Flow(s),veh/h/ln	1781	0	1536	1795	0	1497	0	1777	1780	1795	1791	1875
Q Serve(g_s), s	0.1	0.0	0.1	7.9	0.0	2.7	0.0	9.4	9.4	0.6	3.7	3.7
Cycle Q Clear(g_c), s	0.1	0.0	0.1	7.9	0.0	2.7	0.0	9.4	9.4	0.6	3.7	3.7
Prop In Lane	1.00		0.67	1.00		1.00	0.00		0.26	1.00		0.03
Lane Grp Cap(c), veh/h	-10	0	2	177	0	143	0	1155	1158	457	1331	1393
V/C Ratio(X)	0.00	0.00	6.35	0.89	0.00	0.46	0.00	0.45	0.45	0.12	0.25	0.25
Avail Cap(c_a), veh/h	111	0	473	177	0	461	0	1155	1158	498	1331	1393
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.00	0.00	1.00	1.00	0.00	1.00	0.00	0.09	0.09	0.97	0.97	0.97
Uniform Delay (d), s/veh	0.0	0.0	32.5	36.8	0.0	27.8	0.0	5.6	5.6	3.7	2.6	2.6
Incr Delay (d2), s/veh	0.0	0.0	2588.3	37.3	0.0	2.3	0.0	0.1	0.1	0.1	0.4	0.4
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.0	0.0	1.7	3.8	0.0	1.0	0.0	2.4	2.4	0.1	0.8	0.8
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	0.0	0.0	2620.8	74.1	0.0	30.2	0.0	5.7	5.7	3.9	3.1	3.0
LnGrp LOS	A	A	F	E	A	C	A	A	A	A	A	A
Approach Vol, veh/h		15			223			1040			728	
Approach Delay, s/veh		2620.8			61.1			5.7			3.1	
Approach LOS		F			E			A			A	

Timer - Assigned Phs	1	2	3	4		6	7	8
Phs Duration (G+Y+Rc), s	6.0	46.8	12.2	0.0		52.8	0.0	12.2
Change Period (Y+Rc), s	3.5	4.5	3.5	6.0		4.5	3.5	6.0
Max Green Setting (Gmax), s	4.0	19.0	4.5	20.0		26.5	4.5	20.0
Max Q Clear Time (g_c+I1), s	2.6	11.4	9.9	0.0		5.7	0.0	4.7
Green Ext Time (p_c), s	0.0	3.8	0.0	0.0		3.9	0.0	0.2

Intersection Summary	
HCM 6th Ctrl Delay	30.5
HCM 6th LOS	C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	55	30	30	55	35	110	0	900	35	0	615	35
Future Volume (veh/h)	55	30	30	55	35	110	0	900	35	0	615	35
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.96		0.94	0.95		0.95	1.00		0.98	1.00		0.97
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1900	1900	1900	1900	1900	1900	0	1885	1885	0	1900	1900
Adj Flow Rate, veh/h	58	32	32	58	37	116	0	947	37	0	647	37
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %	0	0	0	0	0	0	0	1	1	0	0	0
Cap, veh/h	355	161	161	445	84	262	0	1791	70	0	1767	101
Arrive On Green	0.04	0.19	0.19	0.07	0.22	0.22	0.00	0.51	0.51	0.00	0.51	0.51
Sat Flow, veh/h	1810	845	845	1810	389	1218	0	3606	137	0	3560	198
Grp Volume(v), veh/h	58	0	64	58	0	153	0	483	501	0	337	347
Grp Sat Flow(s),veh/h/ln	1810	0	1690	1810	0	1607	0	1791	1858	0	1805	1858
Q Serve(g_s), s	1.5	0.0	1.9	1.5	0.0	5.0	0.0	10.9	10.9	0.0	6.7	6.8
Cycle Q Clear(g_c), s	1.5	0.0	1.9	1.5	0.0	5.0	0.0	10.9	10.9	0.0	6.7	6.8
Prop In Lane	1.00		0.50	1.00		0.76	0.00		0.07	0.00		0.11
Lane Grp Cap(c), veh/h	355	0	322	445	0	346	0	913	948	0	921	948
V/C Ratio(X)	0.16	0.00	0.20	0.13	0.00	0.44	0.00	0.53	0.53	0.00	0.37	0.37
Avail Cap(c_a), veh/h	404	0	563	450	0	536	0	913	948	0	921	948
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	0.00	0.80	0.80	0.00	0.87	0.87
Uniform Delay (d), s/veh	18.4	0.0	20.4	17.2	0.0	20.4	0.0	9.9	9.9	0.0	8.9	8.9
Incr Delay (d2), s/veh	0.1	0.0	0.1	0.0	0.0	0.3	0.0	1.8	1.7	0.0	1.0	1.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.6	0.0	0.7	0.6	0.0	1.8	0.0	3.8	3.9	0.0	2.3	2.4
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	18.5	0.0	20.5	17.2	0.0	20.7	0.0	11.6	11.6	0.0	9.8	9.8
LnGrp LOS	B	A	C	B	A	C	A	B	B	A	A	A
Approach Vol, veh/h		122			211			984			684	
Approach Delay, s/veh		19.6			19.8			11.6			9.8	
Approach LOS		B			B			B			A	
Timer - Assigned Phs		2	3	4		6	7	8				
Phs Duration (G+Y+Rc), s		35.1	7.5	17.4		35.1	6.0	18.9				
Change Period (Y+Rc), s		4.5	3.5	6.0		4.5	3.5	6.0				
Max Green Setting (Gmax), s		21.9	4.1	20.0		21.9	4.1	20.0				
Max Q Clear Time (g_c+I1), s		12.9	3.5	3.9		8.8	3.5	7.0				
Green Ext Time (p_c), s		1.8	0.0	0.1		1.3	0.0	0.3				
Intersection Summary												
HCM 6th Ctrl Delay			12.3									
HCM 6th LOS			B									

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	115	30	85	55	45	205	135	860	55	140	520	155
Future Volume (veh/h)	115	30	85	55	45	205	135	860	55	140	520	155
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.98		0.96	0.97		0.95	0.99		0.94	1.00		0.92
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1885	1885	1885	1885	1885	1885	1885	1885	1885	1885	1885	1885
Adj Flow Rate, veh/h	120	31	89	57	47	214	141	896	57	146	542	161
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Percent Heavy Veh, %	1	1	1	1	1	1	1	1	1	1	1	1
Cap, veh/h	269	102	292	382	64	291	449	1377	88	376	1079	319
Arrive On Green	0.06	0.24	0.24	0.04	0.22	0.22	0.10	0.40	0.40	0.10	0.40	0.40
Sat Flow, veh/h	1795	416	1193	1795	284	1295	1795	3404	217	1795	2665	787
Grp Volume(v), veh/h	120	0	120	57	0	261	141	471	482	146	363	340
Grp Sat Flow(s),veh/h/ln	1795	0	1609	1795	0	1579	1795	1791	1829	1795	1791	1661
Q Serve(g_s), s	4.1	0.0	4.9	1.9	0.0	12.3	3.4	17.0	17.0	3.5	12.1	12.2
Cycle Q Clear(g_c), s	4.1	0.0	4.9	1.9	0.0	12.3	3.4	17.0	17.0	3.5	12.1	12.2
Prop In Lane	1.00		0.74	1.00		0.82	1.00		0.12	1.00		0.47
Lane Grp Cap(c), veh/h	269	0	394	382	0	355	449	724	740	376	725	673
V/C Ratio(X)	0.45	0.00	0.30	0.15	0.00	0.74	0.31	0.65	0.65	0.39	0.50	0.51
Avail Cap(c_a), veh/h	269	0	543	419	0	533	468	724	740	394	725	673
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	0.92	0.92	0.92	1.00	1.00	1.00
Uniform Delay (d), s/veh	23.2	0.0	24.6	22.7	0.0	28.8	12.0	19.3	19.3	13.3	17.8	17.8
Incr Delay (d2), s/veh	1.2	0.0	0.4	0.2	0.0	3.0	0.4	4.2	4.1	0.7	2.5	2.7
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.8	0.0	1.9	0.8	0.0	4.8	1.3	7.3	7.5	1.3	5.1	4.8
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	24.3	0.0	25.1	22.8	0.0	31.8	12.4	23.4	23.3	13.9	20.2	20.5
LnGrp LOS	C	A	C	C	A	C	B	C	C	B	C	C
Approach Vol, veh/h		240			318			1094			849	
Approach Delay, s/veh		24.7			30.2			22.0			19.3	
Approach LOS		C			C			C			B	
Timer - Assigned Phs	1	2	3	4	5	6	7	8				
Phs Duration (G+Y+Rc), s	11.2	36.9	6.4	25.6	11.2	36.9	8.0	24.0				
Change Period (Y+Rc), s	3.5	4.5	3.5	6.0	3.5	4.5	3.5	6.0				
Max Green Setting (Gmax), s	8.5	22.5	4.5	27.0	8.5	22.5	4.5	27.0				
Max Q Clear Time (g_c+I1), s	5.5	19.0	3.9	6.9	5.4	14.2	6.1	14.3				
Green Ext Time (p_c), s	0.1	1.9	0.0	0.6	0.1	2.8	0.0	1.3				
Intersection Summary												
HCM 6th Ctrl Delay			22.3									
HCM 6th LOS			C									

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	95	150	60	130	185	215	70	910	125	85	560	65
Future Volume (veh/h)	95	150	60	130	185	215	70	910	125	85	560	65
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.99		0.97	0.98		0.98	1.00		0.96	1.00		0.97
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1885	1885	1885	1900	1900	1900	1885	1885	1885	1885	1885	1885
Adj Flow Rate, veh/h	97	153	61	133	189	219	71	929	128	87	571	66
Peak Hour Factor	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Percent Heavy Veh, %	1	1	1	0	0	0	1	1	1	1	1	1
Cap, veh/h	234	445	367	440	208	242	285	848	692	161	751	87
Arrive On Green	0.06	0.24	0.24	0.08	0.26	0.26	0.04	0.45	0.45	0.04	0.45	0.45
Sat Flow, veh/h	1795	1885	1554	1810	791	917	1795	1885	1539	1795	1652	191
Grp Volume(v), veh/h	97	153	61	133	0	408	71	929	128	87	0	637
Grp Sat Flow(s),veh/h/ln	1795	1885	1554	1810	0	1708	1795	1885	1539	1795	0	1843
Q Serve(g_s), s	3.4	5.8	2.7	4.5	0.0	19.8	1.8	38.5	4.3	2.2	0.0	24.7
Cycle Q Clear(g_c), s	3.4	5.8	2.7	4.5	0.0	19.8	1.8	38.5	4.3	2.2	0.0	24.7
Prop In Lane	1.00		1.00	1.00		0.54	1.00		1.00	1.00		0.10
Lane Grp Cap(c), veh/h	234	445	367	440	0	450	285	848	692	161	0	838
V/C Ratio(X)	0.41	0.34	0.17	0.30	0.00	0.91	0.25	1.10	0.18	0.54	0.00	0.76
Avail Cap(c_a), veh/h	237	529	436	446	0	529	301	848	692	168	0	838
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	23.9	27.2	26.0	21.0	0.0	30.5	15.5	23.5	14.1	20.2	0.0	19.4
Incr Delay (d2), s/veh	0.4	0.2	0.1	0.1	0.0	16.3	0.2	60.3	0.1	1.5	0.0	4.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.4	2.6	1.0	1.9	0.0	9.9	0.7	29.6	1.4	0.9	0.0	10.5
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	24.3	27.3	26.1	21.1	0.0	46.8	15.6	83.9	14.3	21.7	0.0	23.5
LnGrp LOS	C	C	C	C	A	D	B	F	B	C	A	C
Approach Vol, veh/h		311			541			1128			724	
Approach Delay, s/veh		26.1			40.5			71.7			23.3	
Approach LOS		C			D			E			C	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	7.7	42.5	11.2	24.2	7.3	42.9	8.9	26.6
Change Period (Y+Rc), s	4.0	4.0	4.5	4.0	4.0	4.0	4.0	4.0
Max Green Setting (Gmax), s	4.0	38.5	7.0	24.0	4.0	38.5	5.0	26.5
Max Q Clear Time (g_c+I1), s	4.2	40.5	6.5	7.8	3.8	26.7	5.4	21.8
Green Ext Time (p_c), s	0.0	0.0	0.0	0.4	0.0	2.3	0.0	0.5

Intersection Summary	
HCM 6th Ctrl Delay	47.3
HCM 6th LOS	D

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	430	5	125	5	5	10	205	695	5	5	535	500
Future Volume (vph)	430	5	125	5	5	10	205	695	5	5	535	500
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0		4.0	5.3		4.5	5.3	
Lane Util. Factor	0.95	0.95	1.00	1.00	1.00		1.00	1.00		1.00	0.95	
Frpb, ped/bikes	1.00	1.00	0.97	1.00	1.00		1.00	1.00		1.00	0.98	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	0.90		1.00	1.00		1.00	0.93	
Flt Protected	0.95	0.95	1.00	0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1665	1671	1528	1805	1710		1770	1860		1785	3253	
Flt Permitted	0.95	0.95	1.00	0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1665	1671	1528	1805	1710		1770	1860		1785	3253	
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	448	5	130	5	5	10	214	724	5	5	557	521
RTOR Reduction (vph)	0	0	105	0	10	0	0	0	0	0	193	0
Lane Group Flow (vph)	228	225	25	5	5	0	214	729	0	5	885	0
Confl. Peds. (#/hr)			1	1			13		2	2		13
Confl. Bikes (#/hr)			2						5			3
Heavy Vehicles (%)	3%	3%	3%	0%	0%	0%	2%	2%	2%	1%	1%	1%
Turn Type	Split	NA	Perm	Split	NA		Prot	NA		Prot	NA	
Protected Phases	4	4		8	8		5	2		1	6	
Permitted Phases			4									
Actuated Green, G (s)	13.0	13.0	13.0	1.0	1.0		5.2	34.0		0.5	29.8	
Effective Green, g (s)	13.0	13.0	13.0	1.0	1.0		5.2	34.0		0.5	29.8	
Actuated g/C Ratio	0.20	0.20	0.20	0.02	0.02		0.08	0.51		0.01	0.45	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	5.3		4.5	5.3	
Vehicle Extension (s)	1.5	1.5	1.5	1.5	1.5		1.5	4.2		1.5	4.0	
Lane Grp Cap (vph)	326	327	299	27	25		138	953		13	1462	
v/s Ratio Prot	c0.14	0.13		0.00	c0.00		c0.12	c0.39		0.00	0.27	
v/s Ratio Perm			0.02									
v/c Ratio	0.70	0.69	0.09	0.19	0.21		1.55	0.76		0.38	0.61	
Uniform Delay, d1	24.8	24.8	21.8	32.2	32.3		30.5	12.9		32.7	13.8	
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	5.2	4.7	0.0	1.2	1.5		280.3	4.0		6.8	0.8	
Delay (s)	30.0	29.5	21.8	33.5	33.7		310.8	17.0		39.5	14.6	
Level of Service	C	C	C	C	C		F	B		D	B	
Approach Delay (s)		28.0			33.7			83.7			14.7	
Approach LOS		C			C			F			B	

Intersection Summary			
HCM 2000 Control Delay	42.5	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.87		
Actuated Cycle Length (s)	66.3	Sum of lost time (s)	17.8
Intersection Capacity Utilization	72.6%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

HCM 6th Edition methodology does not support turning movements with shared & exclusive lanes.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	430	505	140	200	755	485	340	745	185	505	825	795
Future Volume (veh/h)	430	505	140	200	755	485	340	745	185	505	825	795
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		0.98	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1856	1856	1856	1885	1885	1885	1870	1870	1870	1885	1885	1885
Adj Flow Rate, veh/h	467	549	0	217	821	0	370	810	201	549	897	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	3	3	3	1	1	1	2	2	2	1	1	1
Cap, veh/h	541	1121		240	1053		443	762	189	531	1060	
Arrive On Green	0.16	0.32	0.00	0.13	0.29	0.00	0.13	0.27	0.27	0.15	0.30	0.00
Sat Flow, veh/h	3428	3618	0	1795	3582	1598	3456	2806	696	3483	3582	1598
Grp Volume(v), veh/h	467	549	0	217	821	0	370	513	498	549	897	0
Grp Sat Flow(s),veh/h/ln	1714	1763	0	1795	1791	1598	1728	1777	1725	1742	1791	1598
Q Serve(g_s), s	19.3	18.2	0.0	17.3	30.4	0.0	15.2	39.4	39.4	22.1	34.1	0.0
Cycle Q Clear(g_c), s	19.3	18.2	0.0	17.3	30.4	0.0	15.2	39.4	39.4	22.1	34.1	0.0
Prop In Lane	1.00		0.00	1.00		1.00	1.00		0.40	1.00		1.00
Lane Grp Cap(c), veh/h	541	1121		240	1053		443	483	469	531	1060	
V/C Ratio(X)	0.86	0.49		0.90	0.78		0.84	1.06	1.06	1.03	0.85	
Avail Cap(c_a), veh/h	674	1121		261	1053		643	483	469	531	1060	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	1.00	0.50	0.50	0.00
Uniform Delay (d), s/veh	59.5	40.0	0.0	61.9	46.9	0.0	61.7	52.8	52.8	61.5	47.9	0.0
Incr Delay (d2), s/veh	9.9	1.5	0.0	30.2	5.7	0.0	7.2	58.5	59.1	36.8	3.4	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	9.1	8.2	0.0	9.9	14.4	0.0	7.0	24.9	24.3	12.3	15.3	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	69.5	41.5	0.0	92.1	52.6	0.0	68.9	111.3	111.9	98.3	51.4	0.0
LnGrp LOS	E	D		F	D		E	F	F	F	D	
Approach Vol, veh/h		1016	A		1038	A		1381			1446	A
Approach Delay, s/veh		54.4			60.9			100.2			69.2	
Approach LOS		D			E			F			E	
Timer - Assigned Phs	1	2	3	4	5	6	7	8				
Phs Duration (G+Y+Rc), s	26.6	43.9	23.9	50.6	23.1	47.4	27.4	47.1				
Change Period (Y+Rc), s	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5				
Max Green Setting (Gmax), s	22.1	39.4	21.1	44.4	27.0	34.5	28.5	37.0				
Max Q Clear Time (g_c+I1), s	24.1	41.4	19.3	20.2	17.2	36.1	21.3	32.4				
Green Ext Time (p_c), s	0.0	0.0	0.1	2.6	1.4	0.0	1.6	1.8				
Intersection Summary												
HCM 6th Ctrl Delay			73.1									
HCM 6th LOS			E									

Notes

Unsignalized Delay for [EBR, WBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	315	5	865	0	0	0	0	1230	530	0	1550	845
Future Volume (vph)	315	5	865	0	0	0	0	1230	530	0	1550	845
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)	5.0	5.0	4.0					5.3	4.0		5.3	4.0
Lane Util. Factor	0.95	0.95	1.00					0.95	1.00		0.95	1.00
Frpb, ped/bikes	1.00	1.00	1.00					1.00	0.96		1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00					1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.85					1.00	0.85		1.00	0.85
Flt Protected	0.95	0.95	1.00					1.00	1.00		1.00	1.00
Satd. Flow (prot)	1593	1599	1500					3353	1433		3386	1515
Flt Permitted	0.95	0.95	1.00					1.00	1.00		1.00	1.00
Satd. Flow (perm)	1593	1599	1500					3353	1433		3386	1515
Peak-hour factor, PHF	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Adj. Flow (vph)	321	5	883	0	0	0	0	1255	541	0	1582	862
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	164	162	883	0	0	0	0	1255	541	0	1582	862
Confl. Peds. (#/hr)									49	49		
Confl. Bikes (#/hr)									1			
Heavy Vehicles (%)	2%	2%	2%	0%	0%	0%	2%	2%	2%	1%	1%	1%
Turn Type	Perm	NA	Free					NA	Free		NA	Free
Protected Phases		8						2			6	
Permitted Phases	8		Free						Free			Free
Actuated Green, G (s)	24.0	24.0	70.0					35.7	70.0		35.7	70.0
Effective Green, g (s)	24.0	24.0	70.0					35.7	70.0		35.7	70.0
Actuated g/C Ratio	0.34	0.34	1.00					0.51	1.00		0.51	1.00
Clearance Time (s)	5.0	5.0						5.3			5.3	
Vehicle Extension (s)	3.5	3.5						4.5			4.5	
Lane Grp Cap (vph)	546	548	1500					1710	1433		1726	1515
v/s Ratio Prot								0.37			c0.47	
v/s Ratio Perm	0.10	0.10	c0.59						0.38			0.57
v/c Ratio	0.30	0.30	0.59					0.73	0.38		0.92	0.57
Uniform Delay, d1	16.8	16.8	0.0					13.4	0.0		15.8	0.0
Progression Factor	1.00	1.00	1.00					1.00	1.00		1.00	1.00
Incremental Delay, d2	0.4	0.4	1.7					2.8	0.8		9.2	1.6
Delay (s)	17.2	17.2	1.7					16.3	0.8		25.0	1.6
Level of Service	B	B	A					B	A		C	A
Approach Delay (s)		5.9			0.0			11.6			16.7	
Approach LOS		A			A			B			B	

Intersection Summary			
HCM 2000 Control Delay	12.6	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.83		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	10.3
Intersection Capacity Utilization	63.2%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

HCM 6th Edition methodology does not support turning movements with shared & exclusive lanes.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations					↰	↱		↑↑	↱		↑↑	↱
Traffic Volume (veh/h)	0	0	0	610	10	1060	0	970	575	0	1700	690
Future Volume (veh/h)	0	0	0	610	10	1060	0	970	575	0	1700	690
Initial Q (Qb), veh				0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)				1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj				1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach					No			No			No	
Adj Sat Flow, veh/h/ln				1758	1758	1758	0	1744	1744	0	1786	1786
Adj Flow Rate, veh/h				635	10	0	0	1010	0	0	1771	0
Peak Hour Factor				0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Percent Heavy Veh, %				3	3	3	0	4	4	0	1	1
Cap, veh/h				605	10		0	1719		0	1761	
Arrive On Green				0.37	0.37	0.00	0.00	0.52	0.00	0.00	0.52	0.00
Sat Flow, veh/h				1649	26	1490	0	3400	1478	0	3483	1514
Grp Volume(v), veh/h				645	0	0	0	1010	0	0	1771	0
Grp Sat Flow(s),veh/h/ln				1675	0	1490	0	1657	1478	0	1697	1514
Q Serve(g_s), s				33.0	0.0	0.0	0.0	19.0	0.0	0.0	46.7	0.0
Cycle Q Clear(g_c), s				33.0	0.0	0.0	0.0	19.0	0.0	0.0	46.7	0.0
Prop In Lane				0.98		1.00	0.00		1.00	0.00		1.00
Lane Grp Cap(c), veh/h				614	0		0	1719		0	1761	
V/C Ratio(X)				1.05	0.00		0.00	0.59		0.00	1.01	
Avail Cap(c_a), veh/h				614	0		0	1719		0	1761	
HCM Platoon Ratio				1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)				1.00	0.00	0.00	0.00	0.67	0.00	0.00	0.53	0.00
Uniform Delay (d), s/veh				28.5	0.0	0.0	0.0	15.0	0.0	0.0	21.6	0.0
Incr Delay (d2), s/veh				50.1	0.0	0.0	0.0	1.0	0.0	0.0	17.0	0.0
Initial Q Delay(d3),s/veh				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln				21.1	0.0	0.0	0.0	6.4	0.0	0.0	19.6	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh				78.6	0.0	0.0	0.0	16.0	0.0	0.0	38.7	0.0
LnGrp LOS				F	A		A	B		A	F	
Approach Vol, veh/h					645	A		1010	A		1771	A
Approach Delay, s/veh					78.6			16.0			38.7	
Approach LOS					E			B			D	

Timer - Assigned Phs		2		4		6						
Phs Duration (G+Y+Rc), s		52.0		38.0		52.0						
Change Period (Y+Rc), s		5.3		5.0		5.3						
Max Green Setting (Gmax), s		46.7		33.0		46.7						
Max Q Clear Time (g_c+I1), s		21.0		35.0		48.7						
Green Ext Time (p_c), s		9.2		0.0		0.0						

Intersection Summary	
HCM 6th Ctrl Delay	39.5
HCM 6th LOS	D

Notes

Unsignalized Delay for [NBR, WBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBU	NBL	NBT	NBR	SBL	SBT
Lane Configurations												
Traffic Volume (vph)	85	25	330	680	15	135	5	30	1705	325	95	1300
Future Volume (vph)	85	25	330	680	15	135	5	30	1705	325	95	1300
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1900	1800	1800	1800	1800	1800
Total Lost time (s)	4.5	4.5	4.5	4.5	4.5			4.5	4.5		4.5	4.5
Lane Util. Factor	1.00	1.00	1.00	0.97	1.00			1.00	0.91		1.00	0.91
Frpb, ped/bikes	1.00	1.00	0.98	1.00	1.00			1.00	1.00		1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00			1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.86			1.00	0.98		1.00	1.00
Flt Protected	0.95	1.00	1.00	0.95	1.00			0.95	1.00		0.95	1.00
Satd. Flow (prot)	1693	1782	1491	3285	1541			1643	4593		1693	4859
Flt Permitted	0.95	1.00	1.00	0.95	1.00			0.22	1.00		0.95	1.00
Satd. Flow (perm)	1693	1782	1491	3285	1541			389	4593		1693	4859
Peak-hour factor, PHF	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
Adj. Flow (vph)	86	25	333	687	15	136	5	30	1722	328	96	1313
RTOR Reduction (vph)	0	0	189	0	103	0	0	0	17	0	0	1
Lane Group Flow (vph)	86	25	144	687	48	0	0	35	2033	0	96	1322
Confl. Peds. (#/hr)								3		9	9	
Confl. Bikes (#/hr)			2									
Heavy Vehicles (%)	1%	1%	1%	1%	1%	1%	4%	4%	4%	4%	1%	1%
Turn Type	Prot	NA	Perm	Prot	NA		custom	Prot	NA		Prot	NA
Protected Phases	3	8		7	4			5	2		1	6
Permitted Phases			8				5					
Actuated Green, G (s)	10.8	16.7	16.7	29.5	35.4			17.8	71.9		8.9	63.0
Effective Green, g (s)	10.8	16.7	16.7	29.5	35.4			17.8	71.9		8.9	63.0
Actuated g/C Ratio	0.07	0.12	0.12	0.20	0.24			0.12	0.50		0.06	0.43
Clearance Time (s)	4.5	4.5	4.5	4.5	4.5			4.5	4.5		4.5	4.5
Vehicle Extension (s)	1.5	1.5	1.5	1.5	1.5			1.5	4.0		1.5	4.0
Lane Grp Cap (vph)	126	205	171	668	376			47	2277		103	2111
v/s Ratio Prot	0.05	0.01		c0.21	0.03				c0.44		c0.06	0.27
v/s Ratio Perm			c0.10					0.09				
v/c Ratio	0.68	0.12	0.84	1.03	0.13			0.74	0.89		0.93	0.63
Uniform Delay, d1	65.4	57.6	62.8	57.8	42.8			61.4	33.1		67.7	31.9
Progression Factor	1.00	1.00	1.00	1.00	1.00			1.00	1.00		1.00	1.00
Incremental Delay, d2	11.5	0.1	28.3	42.3	0.1			42.4	5.9		66.2	1.4
Delay (s)	76.9	57.7	91.1	100.0	42.8			103.8	38.9		133.9	33.3
Level of Service	E	E	F	F	D			F	D		F	C
Approach Delay (s)		86.5			89.7				40.0			40.1
Approach LOS		F			F				D			D

Intersection Summary			
HCM 2000 Control Delay	53.1	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.92		
Actuated Cycle Length (s)	145.0	Sum of lost time (s)	18.0
Intersection Capacity Utilization	87.1%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Movement	SBR
Lane Configurations	
Traffic Volume (vph)	10
Future Volume (vph)	10
Ideal Flow (vphpl)	1800
Total Lost time (s)	
Lane Util. Factor	
Frpb, ped/bikes	
Flpb, ped/bikes	
Frt	
Flt Protected	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Peak-hour factor, PHF	0.99
Adj. Flow (vph)	10
RTOR Reduction (vph)	0
Lane Group Flow (vph)	0
Confl. Peds. (#/hr)	3
Confl. Bikes (#/hr)	
Heavy Vehicles (%)	1%
Turn Type	
Protected Phases	
Permitted Phases	
Actuated Green, G (s)	
Effective Green, g (s)	
Actuated g/C Ratio	
Clearance Time (s)	
Vehicle Extension (s)	
Lane Grp Cap (vph)	
v/s Ratio Prot	
v/s Ratio Perm	
v/c Ratio	
Uniform Delay, d1	
Progression Factor	
Incremental Delay, d2	
Delay (s)	
Level of Service	
Approach Delay (s)	
Approach LOS	

Intersection Summary

HCM 6th Edition cannot analyze u-turn movements.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	30	5	5	280	5	470	5	1835	20	95	1060	15
Future Volume (vph)	30	5	5	280	5	470	5	1835	20	95	1060	15
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0	4.0	4.0	4.0	4.0	5.0		4.0	5.0	
Lane Util. Factor		1.00	1.00	0.95	0.95	1.00	1.00	0.91		1.00	0.95	
Frpb, ped/bikes		1.00	0.97	1.00	1.00	0.98	1.00	1.00		1.00	1.00	
Flpb, ped/bikes		1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frt		1.00	0.85	1.00	1.00	0.85	1.00	1.00		1.00	1.00	
Flt Protected		0.96	1.00	0.95	0.95	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1769	1517	1698	1705	1564	1787	3017		1736	3462	
Flt Permitted		0.96	1.00	0.95	0.95	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)		1769	1517	1698	1705	1564	1787	5125		1736	3462	
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	31	5	5	292	5	490	5	1911	21	99	1104	16
RTOR Reduction (vph)	0	0	5	0	0	290	0	0	0	0	0	0
Lane Group Flow (vph)	0	36	0	149	148	200	5	1932	0	99	1120	0
Confl. Peds. (#/hr)	3		5	5		3	7		4	4		7
Confl. Bikes (#/hr)						4			3			2
Heavy Vehicles (%)	3%	3%	3%	1%	1%	1%	1%	1%	1%	4%	4%	4%
Turn Type	Split	NA	Perm	Split	NA	Perm	Prot	NA		Prot	NA	
Protected Phases	4	4		8	8		5	2		1	6	
Permitted Phases			4			8						
Actuated Green, G (s)		11.1	11.1	23.0	23.0	23.0	1.4	92.9		6.0	97.5	
Effective Green, g (s)		11.1	11.1	23.0	23.0	23.0	1.4	92.9		6.0	97.5	
Actuated g/C Ratio		0.07	0.07	0.15	0.15	0.15	0.01	0.62		0.04	0.65	
Clearance Time (s)		4.0	4.0	4.0	4.0	4.0	4.0	5.0		4.0	5.0	
Vehicle Extension (s)		3.0	3.0	3.0	3.0	3.0	3.0	6.0		3.0	6.0	
Lane Grp Cap (vph)		130	112	260	261	239	16	1868		69	2250	
v/s Ratio Prot		c0.02		0.09	0.09		0.00	c0.64		c0.06	0.32	
v/s Ratio Perm			0.00			c0.13						
v/c Ratio		0.28	0.00	0.57	0.57	0.84	0.31	1.03		1.43	0.50	
Uniform Delay, d1		65.7	64.3	58.9	58.9	61.7	73.8	28.5		72.0	13.6	
Progression Factor		1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2		1.2	0.0	3.0	2.8	21.5	10.9	30.2		260.3	0.8	
Delay (s)		66.8	64.3	62.0	61.7	83.2	84.7	58.7		332.3	14.4	
Level of Service		E	E	E	E	F	F	E		F	B	
Approach Delay (s)		66.5			75.1			58.8			40.2	
Approach LOS		E			E			E			D	

Intersection Summary			
HCM 2000 Control Delay	56.4	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	0.95		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	17.0
Intersection Capacity Utilization	84.2%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

HCM 6th Edition methodology does not support turning movements with shared & exclusive lanes.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	465	400	145	200	410	205	310	1680	500	170	785	285
Future Volume (vph)	465	400	145	200	410	205	310	1680	500	170	785	285
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.1	4.1	4.1	4.1	4.1	4.1	4.3	4.5	4.5	4.0	4.5	4.5
Lane Util. Factor	0.97	0.95	1.00	0.91	0.91	1.00	0.97	0.95	1.00	1.00	0.95	1.00
Frpb, ped/bikes	1.00	1.00	0.97	1.00	1.00	0.98	1.00	1.00	0.96	1.00	1.00	0.97
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1542	1610	3382	1544	2634	2716	1215	1770	3539	1543
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1542	1610	3382	1544	3467	3574	1528	1770	3539	1543
Peak-hour factor, PHF	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Adj. Flow (vph)	474	408	148	204	418	209	316	1714	510	173	801	291
RTOR Reduction (vph)	0	0	123	0	0	97	0	0	145	0	0	172
Lane Group Flow (vph)	474	408	25	184	438	112	316	1714	365	173	801	119
Confl. Peds. (#/hr)	9		10	10		9	8		20	20		8
Confl. Bikes (#/hr)									5			4
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	1%	1%	1%	2%	2%	2%
Turn Type	Split	NA	Perm	Split	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	4	4		8	8		5	2		1	6	
Permitted Phases			4			8			2			6
Actuated Green, G (s)	23.2	23.2	23.2	22.3	22.3	22.3	20.7	63.6	63.6	9.0	51.6	51.6
Effective Green, g (s)	23.2	23.2	23.2	22.3	22.3	22.3	20.7	63.6	63.6	9.0	51.6	51.6
Actuated g/C Ratio	0.17	0.17	0.17	0.17	0.17	0.17	0.15	0.47	0.47	0.07	0.38	0.38
Clearance Time (s)	4.1	4.1	4.1	4.1	4.1	4.1	4.3	4.5	4.5	4.0	4.5	4.5
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	6.0	6.0	3.0	6.0	6.0
Lane Grp Cap (vph)	590	609	265	266	559	255	404	1281	720	118	1354	590
v/s Ratio Prot	c0.14	0.12		0.11	c0.13		0.12	c0.63		c0.10	0.23	
v/s Ratio Perm			0.02			0.07			0.24			0.08
v/c Ratio	0.80	0.67	0.10	0.69	0.78	0.44	0.78	1.34	0.51	1.47	0.59	0.20
Uniform Delay, d1	53.6	52.2	47.0	53.0	53.9	50.6	54.9	35.6	24.7	62.9	33.2	27.8
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	7.8	2.8	0.2	7.5	7.1	1.2	9.5	157.5	1.6	250.0	1.3	0.5
Delay (s)	61.4	55.0	47.1	60.6	61.0	51.8	64.4	193.1	26.3	312.9	34.5	28.3
Level of Service	E	E	D	E	E	D	E	F	C	F	C	C
Approach Delay (s)		56.8			58.6			143.6			71.1	
Approach LOS		E			E			F			E	

Intersection Summary			
HCM 2000 Control Delay	99.2	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.14		
Actuated Cycle Length (s)	134.8	Sum of lost time (s)	17.0
Intersection Capacity Utilization	100.4%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

HCM 6th Edition methodology does not support turning movements with shared & exclusive lanes.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	595	180	395	20	115	35	175	285	40	25	190	254
Future Volume (veh/h)	595	180	395	20	115	35	175	285	40	25	190	254
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		0.98	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1885	1885	1885	1870	1870	1870	1870	1870	1870	1885	1885	1885
Adj Flow Rate, veh/h	626	189	416	21	121	37	175	312	42	26	200	267
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %	1	1	1	2	2	2	2	2	2	1	1	1
Cap, veh/h	709	939	793	39	158	48	228	413	55	41	318	306
Arrive On Green	0.66	0.83	0.83	0.02	0.12	0.12	0.13	0.13	0.13	0.19	0.19	0.19
Sat Flow, veh/h	1795	1885	1591	1781	1368	418	1781	3232	431	216	1659	1598
Grp Volume(v), veh/h	626	189	416	21	0	158	175	179	175	226	0	267
Grp Sat Flow(s),veh/h/ln	1795	1885	1591	1781	0	1786	1781	1870	1793	1874	0	1598
Q Serve(g_s), s	28.4	2.0	7.8	1.2	0.0	8.6	9.5	9.2	9.4	11.1	0.0	16.2
Cycle Q Clear(g_c), s	28.4	2.0	7.8	1.2	0.0	8.6	9.5	9.2	9.4	11.1	0.0	16.2
Prop In Lane	1.00		1.00	1.00		0.23	1.00		0.24	0.12		1.00
Lane Grp Cap(c), veh/h	709	939	793	39	0	206	228	239	229	360	0	306
V/C Ratio(X)	0.88	0.20	0.52	0.53	0.00	0.77	0.77	0.75	0.76	0.63	0.00	0.87
Avail Cap(c_a), veh/h	709	939	793	194	0	395	410	430	412	506	0	431
HCM Platoon Ratio	1.67	1.67	1.67	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.70	0.70	0.70	1.00	0.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	15.1	4.4	4.9	48.4	0.0	42.9	42.2	42.1	42.1	37.1	0.0	39.2
Incr Delay (d2), s/veh	9.3	0.3	1.7	4.1	0.0	2.3	2.1	1.8	2.0	0.7	0.0	10.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	8.7	0.8	2.1	0.6	0.0	3.9	4.3	4.4	4.3	5.1	0.0	7.1
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	24.4	4.7	6.6	52.5	0.0	45.2	44.2	43.8	44.1	37.8	0.0	49.3
LnGrp LOS	C	A	A	D	A	D	D	D	D	D	A	D
Approach Vol, veh/h		1231			179			529			493	
Approach Delay, s/veh		15.3			46.1			44.1			44.1	
Approach LOS		B			D			D			D	

Timer - Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	5.7	54.3		16.8	44.0	16.0		23.2
Change Period (Y+Rc), s	3.5	4.5		4.0	4.5	4.5		4.0
Max Green Setting (Gmax), s	10.9	23.1		23.0	10.9	22.1		27.0
Max Q Clear Time (g_c+I1), s	3.2	9.8		11.5	30.4	10.6		18.2
Green Ext Time (p_c), s	0.0	1.3		1.3	0.0	0.4		1.0

Intersection Summary	
HCM 6th Ctrl Delay	29.7
HCM 6th LOS	C

Notes

User approved volume balancing among the lanes for turning movement.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	205	1090	185	25	549	30	405	70	105	65	80	670
Future Volume (veh/h)	205	1090	185	25	549	30	405	70	105	65	80	670
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.99	1.00		0.99	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1885	1885	1885	1870	1870	1870	1885	1885	1885	1900	1900	1900
Adj Flow Rate, veh/h	211	1124	191	26	566	31	418	72	108	67	0	746
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Percent Heavy Veh, %	1	1	1	2	2	2	1	1	1	0	0	0
Cap, veh/h	243	1518	671	46	1110	61	507	229	343	88	0	770
Arrive On Green	0.14	0.42	0.42	0.03	0.32	0.32	0.15	0.34	0.34	0.05	0.00	0.24
Sat Flow, veh/h	1795	3582	1584	1781	3424	187	3483	680	1020	1810	0	3207
Grp Volume(v), veh/h	211	1124	191	26	293	304	418	0	180	67	0	746
Grp Sat Flow(s),veh/h/ln	1795	1791	1584	1781	1777	1834	1742	0	1699	1810	0	1603
Q Serve(g_s), s	11.5	26.4	7.9	1.4	13.4	13.4	11.7	0.0	7.9	3.7	0.0	23.0
Cycle Q Clear(g_c), s	11.5	26.4	7.9	1.4	13.4	13.4	11.7	0.0	7.9	3.7	0.0	23.0
Prop In Lane	1.00		1.00	1.00		0.10	1.00		0.60	1.00		1.00
Lane Grp Cap(c), veh/h	243	1518	671	46	576	595	507	0	572	88	0	770
V/C Ratio(X)	0.87	0.74	0.28	0.57	0.51	0.51	0.82	0.00	0.31	0.76	0.00	0.97
Avail Cap(c_a), veh/h	260	1518	671	240	576	595	714	0	572	371	0	770
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.81	0.81	0.81	0.76	0.76	0.76	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	42.4	24.2	18.9	48.2	27.4	27.4	41.5	0.0	24.6	47.0	0.0	37.6
Incr Delay (d2), s/veh	20.6	2.7	0.9	8.1	2.4	2.4	5.5	0.0	0.3	12.6	0.0	25.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	6.4	11.3	3.0	0.7	6.0	6.2	5.3	0.0	3.2	1.9	0.0	11.5
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	63.0	26.9	19.7	56.3	29.8	29.7	47.0	0.0	24.9	59.6	0.0	62.6
LnGrp LOS	E	C	B	E	C	C	D	A	C	E	A	E
Approach Vol, veh/h		1526			623			598			813	
Approach Delay, s/veh		31.0			30.9			40.3			62.4	
Approach LOS		C			C			D			E	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	7.1	46.9	18.1	28.0	17.0	36.9	8.4	37.7
Change Period (Y+Rc), s	4.5	4.5	3.5	4.0	3.5	4.5	3.5	4.0
Max Green Setting (Gmax), s	13.5	25.5	20.5	24.0	14.5	25.5	20.5	24.0
Max Q Clear Time (g_c+I1), s	3.4	28.4	13.7	25.0	13.5	15.4	5.7	9.9
Green Ext Time (p_c), s	0.0	0.0	0.9	0.0	0.1	3.4	0.1	0.8

Intersection Summary	
HCM 6th Ctrl Delay	39.7
HCM 6th LOS	D

Notes

User approved pedestrian interval to be less than phase max green.

User approved volume balancing among the lanes for turning movement.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	153	680	0	0	1089	510	162	70	890	0	0	0
Future Volume (veh/h)	153	680	0	0	1089	510	162	70	890	0	0	0
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0			
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		0.96	1.00		1.00			
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00			
Work Zone On Approach		No			No			No				
Adj Sat Flow, veh/h/ln	1870	1870	0	0	1885	1885	1885	1885	1885			
Adj Flow Rate, veh/h	155	687	0	0	1100	515	164	569	567			
Peak Hour Factor	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99			
Percent Heavy Veh, %	2	2	0	0	1	1	1	1	1			
Cap, veh/h	246	1985	0	0	1573	674	137	475	522			
Arrive On Green	0.07	0.56	0.00	0.00	0.44	0.44	0.33	0.33	0.33			
Sat Flow, veh/h	1781	3647	0	0	3676	1536	417	1447	1593			
Grp Volume(v), veh/h	155	687	0	0	1100	515	733	0	567			
Grp Sat Flow(s),veh/h/ln	1781	1777	0	0	1791	1536	1864	0	1593			
Q Serve(g_s), s	4.8	11.1	0.0	0.0	26.1	29.7	34.4	0.0	34.4			
Cycle Q Clear(g_c), s	4.8	11.1	0.0	0.0	26.1	29.7	34.4	0.0	34.4			
Prop In Lane	1.00		0.00	0.00		1.00	0.22		1.00			
Lane Grp Cap(c), veh/h	246	1985	0	0	1573	674	611	0	522			
V/C Ratio(X)	0.63	0.35	0.00	0.00	0.70	0.76	1.20	0.00	1.09			
Avail Cap(c_a), veh/h	543	1985	0	0	1834	786	611	0	522			
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00			
Upstream Filter(I)	1.00	1.00	0.00	0.00	1.00	1.00	1.00	0.00	1.00			
Uniform Delay (d), s/veh	20.2	12.7	0.0	0.0	23.8	24.8	35.3	0.0	35.3			
Incr Delay (d2), s/veh	2.0	0.1	0.0	0.0	1.2	4.3	104.7	0.0	64.5			
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			
%ile BackOfQ(50%),veh/ln	2.0	4.3	0.0	0.0	10.9	11.2	33.0	0.0	22.3			
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	22.1	12.8	0.0	0.0	25.0	29.2	140.0	0.0	99.7			
LnGrp LOS	C	B	A	A	C	C	F	A	F			
Approach Vol, veh/h		842			1615			1300				
Approach Delay, s/veh		14.5			26.3			122.4				
Approach LOS		B			C			F				
Timer - Assigned Phs		2			5	6		8				
Phs Duration (G+Y+Rc), s		64.9			12.5	52.4		40.0				
Change Period (Y+Rc), s		6.3			5.6	6.3		5.6				
Max Green Setting (Gmax), s		53.7			24.4	53.7		34.4				
Max Q Clear Time (g_c+I1), s		13.1			6.8	31.7		36.4				
Green Ext Time (p_c), s		8.0			0.3	14.4		0.0				
Intersection Summary												
HCM 6th Ctrl Delay			56.9									
HCM 6th LOS			E									

Notes

User approved volume balancing among the lanes for turning movement.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	523	113	610	656	0	0	0	0	295	5	145
Future Volume (veh/h)	0	523	113	610	656	0	0	0	0	295	5	145
Initial Q (Qb), veh	0	0	0	0	0	0				0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.99	1.00		1.00				1.00		0.98
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00				1.00	1.00	1.00
Work Zone On Approach		No			No						No	
Adj Sat Flow, veh/h/ln	0	1841	1841	1885	1885	0				1870	1870	1870
Adj Flow Rate, veh/h	0	539	116	629	676	0				229	110	149
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97				0.97	0.97	0.97
Percent Heavy Veh, %	0	4	4	1	1	0				2	2	2
Cap, veh/h	0	853	183	769	1131	0				402	160	217
Arrive On Green	0.00	0.30	0.30	0.22	0.60	0.00				0.23	0.23	0.23
Sat Flow, veh/h	0	2949	612	3483	1885	0				1781	709	960
Grp Volume(v), veh/h	0	329	326	629	676	0				229	0	259
Grp Sat Flow(s),veh/h/ln	0	1749	1720	1742	1885	0				1781	0	1669
Q Serve(g_s), s	0.0	11.4	11.5	12.0	15.6	0.0				8.0	0.0	9.9
Cycle Q Clear(g_c), s	0.0	11.4	11.5	12.0	15.6	0.0				8.0	0.0	9.9
Prop In Lane	0.00		0.36	1.00		0.00				1.00		0.58
Lane Grp Cap(c), veh/h	0	522	514	769	1131	0				402	0	377
V/C Ratio(X)	0.00	0.63	0.63	0.82	0.60	0.00				0.57	0.00	0.69
Avail Cap(c_a), veh/h	0	1344	1322	1217	1449	0				870	0	815
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00				1.00	1.00	1.00
Upstream Filter(I)	0.00	1.00	1.00	1.00	1.00	0.00				1.00	0.00	1.00
Uniform Delay (d), s/veh	0.0	21.2	21.2	25.9	8.7	0.0				24.0	0.0	24.8
Incr Delay (d2), s/veh	0.0	1.8	1.9	1.9	0.7	0.0				1.3	0.0	2.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0				0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.0	4.6	4.6	4.9	5.4	0.0				3.3	0.0	4.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	0.0	22.9	23.0	27.8	9.4	0.0				25.3	0.0	27.0
LnGrp LOS	A	C	C	C	A	A				C	A	C
Approach Vol, veh/h		655			1305						488	
Approach Delay, s/veh		23.0			18.3						26.2	
Approach LOS		C			B						C	

Timer - Assigned Phs	1	2	4	6
Phs Duration (G+Y+Rc), s	21.0	27.2	21.7	48.2
Change Period (Y+Rc), s	5.6	6.3	5.9	6.3
Max Green Setting (Gmax), s	24.4	53.7	34.1	53.7
Max Q Clear Time (g_c+I1), s	14.0	13.5	11.9	17.6
Green Ext Time (p_c), s	1.4	6.9	2.3	8.1

Intersection Summary	
HCM 6th Ctrl Delay	21.1
HCM 6th LOS	C

Notes

User approved volume balancing among the lanes for turning movement.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	5	430	35	56	570	10	55	5	156	25	5	15
Future Volume (vph)	5	430	35	56	570	10	55	5	156	25	5	15
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	3.0	3.0	4.0	3.0	3.0		4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	
Frpb, ped/bikes	1.00	1.00	0.96	1.00	1.00	0.97		1.00	1.00	1.00	0.98	
Flpb, ped/bikes	1.00	1.00	1.00	0.99	1.00	1.00		1.00	1.00	1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85		1.00	0.85	1.00	0.89	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00		0.96	1.00	0.95	1.00	
Satd. Flow (prot)	1699	1792	1462	1743	1845	1518		1558	1392	1805	1650	
Flt Permitted	0.44	1.00	1.00	0.50	1.00	1.00		0.77	1.00	0.95	1.00	
Satd. Flow (perm)	787	1792	1462	924	1845	1518		1250	1392	1805	1650	
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	5	448	36	58	594	10	57	5	162	26	5	16
RTOR Reduction (vph)	0	0	21	0	0	5	0	0	153	0	14	0
Lane Group Flow (vph)	5	448	15	58	594	5	0	62	10	26	7	0
Confl. Peds. (#/hr)	4		8	8		4	2					2
Heavy Vehicles (%)	6%	6%	6%	3%	3%	3%	16%	16%	16%	0%	0%	0%
Turn Type	custom	NA	Perm	custom	NA	Perm	Perm	NA	custom	custom	NA	
Protected Phases	5	2 9		1	6 10			3 8	3	7	7	
Permitted Phases	9		2 9	10		6 10	3 8			7		
Actuated Green, G (s)	18.0	51.0	51.0	29.4	56.2	56.2		29.4	7.5	15.9	15.9	
Effective Green, g (s)	18.0	51.0	51.0	29.4	56.2	56.2		29.4	7.5	15.9	15.9	
Actuated g/C Ratio	0.15	0.43	0.43	0.25	0.47	0.47		0.25	0.06	0.13	0.13	
Clearance Time (s)	4.0			4.0					4.0	4.0	4.0	
Vehicle Extension (s)	3.0			3.0					2.5	2.0	2.0	
Lane Grp Cap (vph)	127	771	629	272	875	719		310	88	242	221	
v/s Ratio Prot	0.00	0.25		c0.01	c0.32				0.01	c0.01	0.00	
v/s Ratio Perm	0.01		0.01	0.04		0.00		c0.05				
v/c Ratio	0.04	0.58	0.02	0.21	0.68	0.01		0.20	0.12	0.11	0.03	
Uniform Delay, d1	42.7	25.6	19.4	34.6	24.2	16.4		35.2	52.4	45.1	44.6	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.1	0.7	0.0	0.4	1.7	0.0		0.2	0.4	0.1	0.0	
Delay (s)	42.9	26.4	19.4	35.0	25.8	16.4		35.5	52.8	45.1	44.6	
Level of Service	D	C	B	D	C	B		D	D	D	D	
Approach Delay (s)		26.0			26.5			48.0			44.9	
Approach LOS		C			C			D			D	

Intersection Summary			
HCM 2000 Control Delay	30.3	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.48		
Actuated Cycle Length (s)	118.5	Sum of lost time (s)	23.0
Intersection Capacity Utilization	53.3%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM 6th Edition methodology does not support non-NEMA phasing.

Intersection	
Int Delay, s/veh	8.5

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	10	285	0	0	342	345	0	0	5	200	0	10
Future Vol, veh/h	10	285	0	0	342	345	0	0	5	200	0	10
Conflicting Peds, #/hr	7	0	20	19	0	6	20	0	19	6	0	7
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	Free	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	95	95	95	95	95	95	95	95	95	95	95	95
Heavy Vehicles, %	7	7	7	3	3	3	0	0	0	5	5	5
Mvmt Flow	11	300	0	0	360	363	0	0	5	211	0	11

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	367	0	0	320	0	0	728	709	339	711	709	387
Stage 1	-	-	-	-	-	-	342	342	-	367	367	-
Stage 2	-	-	-	-	-	-	386	367	-	344	342	-
Critical Hdwy	4.17	-	-	4.13	-	-	7.1	6.5	6.2	7.15	6.55	6.25
Critical Hdwy Stg 1	-	-	-	-	-	-	6.1	5.5	-	6.15	5.55	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.1	5.5	-	6.15	5.55	-
Follow-up Hdwy	2.263	-	-	2.227	-	-	3.5	4	3.3	3.545	4.045	3.345
Pot Cap-1 Maneuver	1164	-	-	1234	-	0	341	362	708	344	355	654
Stage 1	-	-	-	-	-	0	677	642	-	646	617	-
Stage 2	-	-	-	-	-	0	641	626	-	665	633	-
Platoon blocked, %		-	-		-							
Mov Cap-1 Maneuver	1156	-	-	1210	-	-	320	349	682	330	342	637
Mov Cap-2 Maneuver	-	-	-	-	-	-	320	349	-	330	342	-
Stage 1	-	-	-	-	-	-	657	623	-	634	613	-
Stage 2	-	-	-	-	-	-	618	622	-	641	614	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.3	0	10.3	33.7
HCM LOS			B	D

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	SBLn1
Capacity (veh/h)	682	1156	-	-	1210	-	338
HCM Lane V/C Ratio	0.008	0.009	-	-	-	-	0.654
HCM Control Delay (s)	10.3	8.1	0	-	0	-	33.7
HCM Lane LOS	B	A	A	-	A	-	D
HCM 95th %tile Q(veh)	0	0	-	-	0	-	4.4

Movement	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Lane Configurations												
Traffic Volume (veh/h)	60	1654	5	30	10	1918	435	5	5	5	300	5
Future Volume (veh/h)	60	1654	5	30	10	1918	435	5	5	5	300	5
Initial Q (Qb), veh	0	0	0		0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00		1.00		1.00	1.00		0.93	1.00	
Parking Bus, Adj	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No				No			No			No
Adj Sat Flow, veh/h/ln	1856	1856	1856		1885	1885	1885	1900	1900	1900	1856	1856
Adj Flow Rate, veh/h	64	1760	5		11	2040	0	5	5	5	196	176
Peak Hour Factor	0.94	0.94	0.94		0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Percent Heavy Veh, %	3	3	3		1	1	1	0	0	0	3	3
Cap, veh/h	81	2407	7		37	2299		6	6	6	298	214
Arrive On Green	0.03	0.45	0.45		0.02	0.64	0.00	0.01	0.01	0.01	0.17	0.17
Sat Flow, veh/h	1767	3606	10		1795	3582	1598	572	572	572	1767	1264
Grp Volume(v), veh/h	64	860	905		11	2040	0	15	0	0	196	0
Grp Sat Flow(s),veh/h/ln	1767	1763	1854		1795	1791	1598	1716	0	0	1767	0
Q Serve(g_s), s	4.3	48.1	48.1		0.7	56.8	0.0	1.0	0.0	0.0	12.4	0.0
Cycle Q Clear(g_c), s	4.3	48.1	48.1		0.7	56.8	0.0	1.0	0.0	0.0	12.4	0.0
Prop In Lane	1.00		0.01		1.00		1.00	0.33		0.33	1.00	
Lane Grp Cap(c), veh/h	81	1176	1237		37	2299		17	0	0	298	0
V/C Ratio(X)	0.79	0.73	0.73		0.30	0.89		0.87	0.00	0.00	0.66	0.00
Avail Cap(c_a), veh/h	81	1176	1237		157	2299		43	0	0	368	0
HCM Platoon Ratio	0.67	0.67	0.67		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.75	0.75	0.75		1.00	1.00	0.00	1.00	0.00	0.00	1.00	0.00
Uniform Delay (d), s/veh	57.6	24.3	24.3		57.9	17.9	0.0	59.3	0.0	0.0	46.6	0.0
Incr Delay (d2), s/veh	29.4	3.0	2.9		1.7	5.5	0.0	35.9	0.0	0.0	4.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	2.6	21.9	23.0		0.3	22.7	0.0	0.6	0.0	0.0	5.8	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	87.0	27.4	27.2		59.6	23.4	0.0	95.2	0.0	0.0	50.6	0.0
LnGrp LOS	F	C	C		E	C		F	A	A	D	A
Approach Vol, veh/h		1829				2051	A		15			441
Approach Delay, s/veh		29.4				23.6			95.2			56.5
Approach LOS		C				C			F			E

Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	6.0	84.6		24.3	9.0	81.5		5.2				
Change Period (Y+Rc), s	3.5	4.5		4.0	3.5	4.5		4.0				
Max Green Setting (Gmax), s	10.5	65.5		25.0	5.5	70.5		3.0				
Max Q Clear Time (g_c+I1), s	2.7	50.1		18.1	6.3	58.8		3.0				
Green Ext Time (p_c), s	0.0	12.7		1.6	0.0	10.7		0.0				

Intersection Summary			
HCM 6th Ctrl Delay			29.6
HCM 6th LOS			C

Notes

User approved volume balancing among the lanes for turning movement.
User approved ignoring U-Turning movement.
Unsignalized Delay for [WBR] is excluded from calculations of the approach delay and intersection delay.

Movement	SBR
Lane Configurations	
Traffic Volume (veh/h)	65
Future Volume (veh/h)	65
Initial Q (Qb), veh	0
Ped-Bike Adj(A_pbT)	0.99
Parking Bus, Adj	1.00
Work Zone On Approach	
Adj Sat Flow, veh/h/ln	1856
Adj Flow Rate, veh/h	69
Peak Hour Factor	0.94
Percent Heavy Veh, %	3
Cap, veh/h	84
Arrive On Green	0.17
Sat Flow, veh/h	496
Grp Volume(v), veh/h	245
Grp Sat Flow(s),veh/h/ln	1760
Q Serve(g_s), s	16.1
Cycle Q Clear(g_c), s	16.1
Prop In Lane	0.28
Lane Grp Cap(c), veh/h	297
V/C Ratio(X)	0.82
Avail Cap(c_a), veh/h	367
HCM Platoon Ratio	1.00
Upstream Filter(I)	1.00
Uniform Delay (d), s/veh	48.1
Incr Delay (d2), s/veh	13.2
Initial Q Delay(d3),s/veh	0.0
%ile BackOfQ(50%),veh/ln	8.2
Unsig. Movement Delay, s/veh	
LnGrp Delay(d),s/veh	61.3
LnGrp LOS	E
Approach Vol, veh/h	
Approach Delay, s/veh	
Approach LOS	
Timer - Assigned Phs	

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	680	1474	1603	395	255	500
Future Volume (vph)	680	1474	1603	395	255	500
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.0	5.0	5.0	5.0	5.0	3.0
Lane Util. Factor	0.97	0.95	0.95	1.00	0.97	1.00
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	0.98
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	1.00	0.85	1.00	0.85
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	3433	3539	3574	1599	3502	1587
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	3433	3539	3574	1599	3502	1587
Peak-hour factor, PHF	0.98	0.98	0.98	0.98	0.98	0.98
Adj. Flow (vph)	694	1504	1636	403	260	510
RTOR Reduction (vph)	0	0	0	15	0	1
Lane Group Flow (vph)	694	1504	1636	388	260	509
Confl. Peds. (#/hr)						12
Heavy Vehicles (%)	2%	2%	1%	1%	0%	0%
Turn Type	Prot	NA	NA	pm+ov	Prot	pt+ov
Protected Phases	3 5	2	6	7	7	3 5
Permitted Phases				6		4
Actuated Green, G (s)	13.8	74.2	64.2	91.2	27.0	40.8
Effective Green, g (s)	13.8	74.2	64.2	91.2	27.0	40.8
Actuated g/C Ratio	0.12	0.62	0.54	0.76	0.22	0.34
Clearance Time (s)		5.0	5.0	5.0	5.0	
Vehicle Extension (s)		3.0	0.4	4.0	4.0	
Lane Grp Cap (vph)	394	2188	1912	1281	787	539
v/s Ratio Prot	c0.20	0.42	c0.46	0.07	0.07	c0.11
v/s Ratio Perm				0.17		0.21
v/c Ratio	1.76	0.69	0.86	0.30	0.33	0.94
Uniform Delay, d1	53.1	15.2	23.9	4.5	38.9	38.5
Progression Factor	0.80	1.18	0.94	0.09	1.00	1.00
Incremental Delay, d2	349.4	1.2	2.4	0.1	0.3	25.3
Delay (s)	392.1	19.1	24.9	0.5	39.3	63.8
Level of Service	F	B	C	A	D	E
Approach Delay (s)		136.9	20.1		55.5	
Approach LOS		F	C		E	

Intersection Summary			
HCM 2000 Control Delay	76.8	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.03		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	18.0
Intersection Capacity Utilization	84.0%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM 6th Edition methodology expects standard NEMA quad ring-barrier structure. Does not support multiple barriers.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	60	2129	10	10	2068	35	10	5	15	35	0	80
Future Volume (veh/h)	60	2129	10	10	2068	35	10	5	15	35	0	80
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	0.95		0.94	0.95		0.94
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1856	1856	1856	1885	1885	1885	1900	1900	1900	1900	1900	1900
Adj Flow Rate, veh/h	63	2241	11	11	2177	37	11	5	16	37	0	84
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %	3	3	3	1	1	1	0	0	0	0	0	0
Cap, veh/h	74	2753	14	23	2654	45	87	47	93	230	0	185
Arrive On Green	0.08	1.00	1.00	0.01	0.74	0.74	0.12	0.12	0.12	0.12	0.00	0.12
Sat Flow, veh/h	1767	3597	18	1795	3604	61	379	382	761	1393	0	1519
Grp Volume(v), veh/h	63	1097	1155	11	1079	1135	32	0	0	37	0	84
Grp Sat Flow(s),veh/h/ln	1767	1763	1852	1795	1791	1874	1522	0	0	1393	0	1519
Q Serve(g_s), s	4.2	0.0	0.0	0.7	47.9	48.6	0.0	0.0	0.0	0.4	0.0	6.2
Cycle Q Clear(g_c), s	4.2	0.0	0.0	0.7	47.9	48.6	2.0	0.0	0.0	2.4	0.0	6.2
Prop In Lane	1.00		0.01	1.00		0.03	0.34		0.50	1.00		1.00
Lane Grp Cap(c), veh/h	74	1349	1417	23	1319	1380	226	0	0	230	0	185
V/C Ratio(X)	0.86	0.81	0.81	0.48	0.82	0.82	0.14	0.00	0.00	0.16	0.00	0.45
Avail Cap(c_a), veh/h	74	1349	1417	75	1319	1380	389	0	0	379	0	354
HCM Platoon Ratio	2.00	2.00	2.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.55	0.55	0.55	0.42	0.42	0.42	1.00	0.00	0.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	54.6	0.0	0.0	58.8	10.5	10.6	47.1	0.0	0.0	47.3	0.0	49.0
Incr Delay (d2), s/veh	37.2	3.1	3.0	2.4	2.5	2.5	0.1	0.0	0.0	0.1	0.0	0.6
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	2.6	1.2	1.2	0.3	16.3	17.3	0.9	0.0	0.0	1.0	0.0	2.4
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	91.8	3.1	3.0	61.2	13.0	13.1	47.2	0.0	0.0	47.4	0.0	49.6
LnGrp LOS	F	A	A	E	B	B	D	A	A	D	A	D
Approach Vol, veh/h		2315			2225			32			121	
Approach Delay, s/veh		5.4			13.3			47.2			48.9	
Approach LOS		A			B			D			D	

Timer - Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	5.5	95.8		18.6	9.0	92.4		18.6
Change Period (Y+Rc), s	4.0	* 4		4.0	4.0	4.0		4.0
Max Green Setting (Gmax), s	5.0	* 76		28.0	5.0	75.0		28.0
Max Q Clear Time (g_c+I1), s	2.7	2.0		8.2	6.2	50.6		4.0
Green Ext Time (p_c), s	0.0	70.7		0.2	0.0	24.0		0.1

Intersection Summary	
HCM 6th Ctrl Delay	10.6
HCM 6th LOS	B

Notes

* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	80	2059	1858	235	180	65
Future Volume (vph)	80	2059	1858	235	180	65
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5	4.5		4.5	4.5
Lane Util. Factor	1.00	0.95	0.95		1.00	1.00
Frpb, ped/bikes	1.00	1.00	0.99		1.00	0.99
Flpb, ped/bikes	1.00	1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.98		1.00	0.85
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1736	3471	3459		1770	1562
Flt Permitted	0.95	1.00	1.00		0.95	1.00
Satd. Flow (perm)	1736	3471	3459		1770	1562
Peak-hour factor, PHF	0.99	0.99	0.99	0.99	0.99	0.99
Adj. Flow (vph)	81	2080	1877	237	182	66
RTOR Reduction (vph)	0	0	7	0	0	56
Lane Group Flow (vph)	81	2080	2107	0	182	10
Confl. Peds. (#/hr)	13			13		1
Heavy Vehicles (%)	4%	4%	2%	2%	2%	2%
Turn Type	Prot	NA	NA		Prot	Perm
Protected Phases	5	2	6		4	
Permitted Phases						4
Actuated Green, G (s)	10.3	92.6	77.8		18.4	18.4
Effective Green, g (s)	10.3	92.6	77.8		18.4	18.4
Actuated g/C Ratio	0.09	0.77	0.65		0.15	0.15
Clearance Time (s)	4.5	4.5	4.5		4.5	4.5
Vehicle Extension (s)	3.0	6.0	6.0		3.0	3.0
Lane Grp Cap (vph)	149	2678	2242		271	239
v/s Ratio Prot	0.05	c0.60	c0.61		c0.10	
v/s Ratio Perm						0.01
v/c Ratio	0.54	0.78	0.94		0.67	0.04
Uniform Delay, d1	52.6	7.8	19.0		47.9	43.3
Progression Factor	1.00	1.00	1.71		1.00	1.00
Incremental Delay, d2	4.0	2.3	5.9		6.4	0.1
Delay (s)	56.6	10.1	38.3		54.4	43.4
Level of Service	E	B	D		D	D
Approach Delay (s)		11.8	38.3		51.4	
Approach LOS		B	D		D	

Intersection Summary			
HCM 2000 Control Delay	26.4	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.89		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	13.5
Intersection Capacity Utilization	84.4%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM 6th Edition methodology does not support exclusive ped or hold phases.

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	1643	175	266	1557	400	436
Future Volume (veh/h)	1643	175	266	1557	400	436
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)		1.00	1.00		1.00	1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No	No	
Adj Sat Flow, veh/h/ln	1856	1856	1885	1885	1885	1885
Adj Flow Rate, veh/h	1748	186	283	1656	426	464
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94
Percent Heavy Veh, %	3	3	1	1	1	1
Cap, veh/h	1992	1293	328	2449	898	563
Arrive On Green	0.57	0.57	0.09	0.68	0.26	0.26
Sat Flow, veh/h	3618	1571	3483	3676	3483	1598
Grp Volume(v), veh/h	1748	186	283	1656	426	464
Grp Sat Flow(s),veh/h/ln	1763	1571	1742	1791	1742	1598
Q Serve(g_s), s	69.7	3.9	13.0	44.3	16.8	42.0
Cycle Q Clear(g_c), s	69.7	3.9	13.0	44.3	16.8	42.0
Prop In Lane		1.00	1.00		1.00	1.00
Lane Grp Cap(c), veh/h	1992	1293	328	2449	898	563
V/C Ratio(X)	0.88	0.14	0.86	0.68	0.47	0.82
Avail Cap(c_a), veh/h	1992	1293	385	2497	898	563
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	30.6	2.9	72.7	15.1	51.1	48.2
Incr Delay (d2), s/veh	5.9	0.2	16.0	0.7	0.4	9.7
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	30.7	3.6	6.6	17.8	7.5	18.8
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	36.4	3.1	88.7	15.9	51.5	57.9
LnGrp LOS	D	A	F	B	D	E
Approach Vol, veh/h	1934			1939	890	
Approach Delay, s/veh	33.2			26.5	54.8	
Approach LOS	C			C	D	

Timer - Assigned Phs		2	3	4				8
Phs Duration (G+Y+Rc), s		47.0	19.3	96.5				115.8
Change Period (Y+Rc), s		5.0	4.0	* 4.5				4.5
Max Green Setting (Gmax), s		42.0	18.0	* 92				113.5
Max Q Clear Time (g_c+I1), s		44.0	15.0	71.7				46.3
Green Ext Time (p_c), s		0.0	0.3	14.4				23.5

Intersection Summary	
HCM 6th Ctrl Delay	34.5
HCM 6th LOS	C

Notes

* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	5	10	155	0	87	0	895	135	70	655	10
Future Volume (veh/h)	0	5	10	155	0	87	0	895	135	70	655	10
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.89	1.00		0.95	1.00		0.99	1.00		0.99
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1885	1885	1885	0	1870	1870	1885	1885	1885
Adj Flow Rate, veh/h	0	5	10	157	0	88	0	904	136	71	662	10
Peak Hour Factor	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
Percent Heavy Veh, %	2	2	2	1	1	1	0	2	2	1	1	1
Cap, veh/h	0	1	2	206	0	168	0	1945	293	451	2627	40
Arrive On Green	0.00	0.00	0.00	0.15	0.00	0.11	0.00	0.63	0.63	0.04	0.73	0.73
Sat Flow, veh/h	1781	512	1024	1795	0	1511	0	3185	465	1795	3611	55
Grp Volume(v), veh/h	0	0	15	157	0	88	0	519	521	71	328	344
Grp Sat Flow(s),veh/h/ln	1781	0	1536	1795	0	1511	0	1777	1780	1795	1791	1875
Q Serve(g_s), s	0.1	0.0	0.1	7.8	0.0	3.6	0.0	10.0	10.0	0.8	4.0	4.0
Cycle Q Clear(g_c), s	0.1	0.0	0.1	7.8	0.0	3.6	0.0	10.0	10.0	0.8	4.0	4.0
Prop In Lane	1.00		0.67	1.00		1.00	0.00		0.26	1.00		0.03
Lane Grp Cap(c), veh/h	-7	0	2	206	0	168	0	1118	1120	451	1303	1364
V/C Ratio(X)	0.00	0.00	6.35	0.76	0.00	0.52	0.00	0.46	0.46	0.16	0.25	0.25
Avail Cap(c_a), veh/h	113	0	473	206	0	465	0	1118	1120	481	1303	1364
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.00	0.00	1.00	1.00	0.00	1.00	0.00	0.09	0.09	0.97	0.97	0.97
Uniform Delay (d), s/veh	0.0	0.0	32.5	35.7	0.0	27.3	0.0	6.3	6.3	4.2	3.0	3.0
Incr Delay (d2), s/veh	0.0	0.0	2588.3	15.5	0.0	2.5	0.0	0.1	0.1	0.2	0.5	0.4
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.0	0.0	1.7	2.8	0.0	1.3	0.0	2.7	2.7	0.2	0.9	0.9
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	0.0	0.0	2620.8	51.2	0.0	29.8	0.0	6.4	6.4	4.4	3.4	3.4
LnGrp LOS	A	A	F	D	A	C	A	A	A	A	A	A
Approach Vol, veh/h		15			245			1040			743	
Approach Delay, s/veh		2620.8			43.5			6.4			3.5	
Approach LOS		F			D			A			A	

Timer - Assigned Phs	1	2	3	4		6	7	8
Phs Duration (G+Y+Rc), s	6.4	45.4	13.2	0.0		51.8	0.0	13.2
Change Period (Y+Rc), s	3.5	4.5	3.5	6.0		4.5	3.5	6.0
Max Green Setting (Gmax), s	4.0	19.0	4.5	20.0		26.5	4.5	20.0
Max Q Clear Time (g_c+I1), s	2.8	12.0	9.8	0.0		6.0	0.0	5.6
Green Ext Time (p_c), s	0.0	3.6	0.0	0.0		3.9	0.0	0.2

Intersection Summary	
HCM 6th Ctrl Delay	29.0
HCM 6th LOS	C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	55	30	30	55	35	110	0	922	35	0	630	35
Future Volume (veh/h)	55	30	30	55	35	110	0	922	35	0	630	35
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.96		0.94	0.95		0.95	1.00		0.98	1.00		0.97
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1900	1900	1900	1900	1900	1900	0	1885	1885	0	1900	1900
Adj Flow Rate, veh/h	58	32	32	58	37	116	0	971	37	0	663	37
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %	0	0	0	0	0	0	0	1	1	0	0	0
Cap, veh/h	355	161	161	445	84	262	0	1793	68	0	1770	99
Arrive On Green	0.04	0.19	0.19	0.07	0.22	0.22	0.00	0.51	0.51	0.00	0.51	0.51
Sat Flow, veh/h	1810	845	845	1810	389	1218	0	3610	134	0	3565	193
Grp Volume(v), veh/h	58	0	64	58	0	153	0	495	513	0	345	355
Grp Sat Flow(s),veh/h/ln	1810	0	1690	1810	0	1607	0	1791	1859	0	1805	1859
Q Serve(g_s), s	1.5	0.0	1.9	1.5	0.0	5.0	0.0	11.2	11.2	0.0	6.9	7.0
Cycle Q Clear(g_c), s	1.5	0.0	1.9	1.5	0.0	5.0	0.0	11.2	11.2	0.0	6.9	7.0
Prop In Lane	1.00		0.50	1.00		0.76	0.00		0.07	0.00		0.10
Lane Grp Cap(c), veh/h	355	0	322	445	0	346	0	913	948	0	921	948
V/C Ratio(X)	0.16	0.00	0.20	0.13	0.00	0.44	0.00	0.54	0.54	0.00	0.37	0.37
Avail Cap(c_a), veh/h	404	0	563	450	0	536	0	913	948	0	921	948
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	0.00	0.80	0.80	0.00	0.86	0.86
Uniform Delay (d), s/veh	18.4	0.0	20.4	17.2	0.0	20.4	0.0	9.9	9.9	0.0	8.9	8.9
Incr Delay (d2), s/veh	0.1	0.0	0.1	0.0	0.0	0.3	0.0	1.8	1.8	0.0	1.0	1.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.6	0.0	0.7	0.6	0.0	1.8	0.0	3.9	4.0	0.0	2.4	2.5
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	18.5	0.0	20.5	17.2	0.0	20.7	0.0	11.8	11.7	0.0	9.9	9.9
LnGrp LOS	B	A	C	B	A	C	A	B	B	A	A	A
Approach Vol, veh/h		122			211			1008			700	
Approach Delay, s/veh		19.6			19.8			11.8			9.9	
Approach LOS		B			B			B			A	

Timer - Assigned Phs		2	3	4		6	7	8				
Phs Duration (G+Y+Rc), s		35.1	7.5	17.4		35.1	6.0	18.9				
Change Period (Y+Rc), s		4.5	3.5	6.0		4.5	3.5	6.0				
Max Green Setting (Gmax), s		21.9	4.1	20.0		21.9	4.1	20.0				
Max Q Clear Time (g_c+I1), s		13.2	3.5	3.9		9.0	3.5	7.0				
Green Ext Time (p_c), s		1.8	0.0	0.1		1.3	0.0	0.3				

Intersection Summary			
HCM 6th Ctrl Delay			12.4
HCM 6th LOS			B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	115	30	85	55	45	205	135	882	55	140	535	155
Future Volume (veh/h)	115	30	85	55	45	205	135	882	55	140	535	155
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.98		0.96	0.97		0.95	0.99		0.94	1.00		0.92
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1885	1885	1885	1885	1885	1885	1885	1885	1885	1885	1885	1885
Adj Flow Rate, veh/h	120	31	89	57	47	214	141	919	57	146	557	161
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Percent Heavy Veh, %	1	1	1	1	1	1	1	1	1	1	1	1
Cap, veh/h	269	102	292	382	64	291	444	1379	86	370	1087	313
Arrive On Green	0.06	0.24	0.24	0.04	0.22	0.22	0.10	0.40	0.40	0.10	0.40	0.40
Sat Flow, veh/h	1795	416	1193	1795	284	1295	1795	3410	212	1795	2685	772
Grp Volume(v), veh/h	120	0	120	57	0	261	141	483	493	146	371	347
Grp Sat Flow(s),veh/h/ln	1795	0	1609	1795	0	1579	1795	1791	1831	1795	1791	1666
Q Serve(g_s), s	4.1	0.0	4.9	1.9	0.0	12.3	3.4	17.6	17.6	3.5	12.4	12.5
Cycle Q Clear(g_c), s	4.1	0.0	4.9	1.9	0.0	12.3	3.4	17.6	17.6	3.5	12.4	12.5
Prop In Lane	1.00		0.74	1.00		0.82	1.00		0.12	1.00		0.46
Lane Grp Cap(c), veh/h	269	0	394	382	0	355	444	724	740	370	725	674
V/C Ratio(X)	0.45	0.00	0.30	0.15	0.00	0.74	0.32	0.67	0.67	0.39	0.51	0.52
Avail Cap(c_a), veh/h	269	0	543	419	0	533	463	724	740	388	725	674
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	0.91	0.91	0.91	1.00	1.00	1.00
Uniform Delay (d), s/veh	23.2	0.0	24.6	22.7	0.0	28.8	12.1	19.4	19.4	13.4	17.9	17.9
Incr Delay (d2), s/veh	1.2	0.0	0.4	0.2	0.0	3.0	0.4	4.4	4.3	0.7	2.6	2.8
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.8	0.0	1.9	0.8	0.0	4.8	1.3	7.6	7.7	1.3	5.3	5.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	24.3	0.0	25.1	22.8	0.0	31.8	12.4	23.8	23.7	14.1	20.4	20.7
LnGrp LOS	C	A	C	C	A	C	B	C	C	B	C	C
Approach Vol, veh/h		240			318			1117			864	
Approach Delay, s/veh		24.7			30.2			22.3			19.5	
Approach LOS		C			C			C			B	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	11.2	36.9	6.4	25.6	11.2	36.9	8.0	24.0
Change Period (Y+Rc), s	3.5	4.5	3.5	6.0	3.5	4.5	3.5	6.0
Max Green Setting (Gmax), s	8.5	22.5	4.5	27.0	8.5	22.5	4.5	27.0
Max Q Clear Time (g_c+I1), s	5.5	19.6	3.9	6.9	5.4	14.5	6.1	14.3
Green Ext Time (p_c), s	0.1	1.7	0.0	0.6	0.1	2.8	0.0	1.3

Intersection Summary	
HCM 6th Ctrl Delay	22.6
HCM 6th LOS	C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑	↱	↰	↑↱		↰	↑	↱	↰	↑↱	
Traffic Volume (veh/h)	95	150	60	130	185	215	70	932	125	85	575	65
Future Volume (veh/h)	95	150	60	130	185	215	70	932	125	85	575	65
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.99		0.97	0.98		0.98	1.00		0.96	1.00		0.97
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1885	1885	1885	1900	1900	1900	1885	1885	1885	1885	1885	1885
Adj Flow Rate, veh/h	97	153	61	133	189	219	71	951	128	87	587	66
Peak Hour Factor	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Percent Heavy Veh, %	1	1	1	0	0	0	1	1	1	1	1	1
Cap, veh/h	234	445	367	440	208	242	275	848	692	161	754	85
Arrive On Green	0.06	0.24	0.24	0.08	0.26	0.26	0.04	0.45	0.45	0.04	0.45	0.45
Sat Flow, veh/h	1795	1885	1554	1810	791	917	1795	1885	1539	1795	1657	186
Grp Volume(v), veh/h	97	153	61	133	0	408	71	951	128	87	0	653
Grp Sat Flow(s),veh/h/ln	1795	1885	1554	1810	0	1708	1795	1885	1539	1795	0	1844
Q Serve(g_s), s	3.4	5.8	2.7	4.5	0.0	19.8	1.8	38.5	4.3	2.2	0.0	25.6
Cycle Q Clear(g_c), s	3.4	5.8	2.7	4.5	0.0	19.8	1.8	38.5	4.3	2.2	0.0	25.6
Prop In Lane	1.00		1.00	1.00		0.54	1.00		1.00	1.00		0.10
Lane Grp Cap(c), veh/h	234	445	367	440	0	450	275	848	692	161	0	838
V/C Ratio(X)	0.41	0.34	0.17	0.30	0.00	0.91	0.26	1.12	0.18	0.54	0.00	0.78
Avail Cap(c_a), veh/h	237	529	436	446	0	529	290	848	692	168	0	838
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	23.9	27.2	26.0	21.0	0.0	30.5	15.8	23.5	14.1	20.2	0.0	19.7
Incr Delay (d2), s/veh	0.4	0.2	0.1	0.1	0.0	16.3	0.2	70.0	0.1	1.5	0.0	4.7
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.4	2.6	1.0	1.9	0.0	9.9	0.7	31.8	1.4	0.9	0.0	11.1
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	24.3	27.3	26.1	21.1	0.0	46.8	15.9	93.5	14.3	21.7	0.0	24.4
LnGrp LOS	C	C	C	C	A	D	B	F	B	C	A	C
Approach Vol, veh/h		311			541			1150			740	
Approach Delay, s/veh		26.1			40.5			79.9			24.1	
Approach LOS		C			D			E			C	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	7.7	42.5	11.2	24.2	7.3	42.9	8.9	26.6
Change Period (Y+Rc), s	4.0	4.0	4.5	4.0	4.0	4.0	4.0	4.0
Max Green Setting (Gmax), s	4.0	38.5	7.0	24.0	4.0	38.5	5.0	26.5
Max Q Clear Time (g_c+I1), s	4.2	40.5	6.5	7.8	3.8	27.6	5.4	21.8
Green Ext Time (p_c), s	0.0	0.0	0.0	0.4	0.0	2.3	0.0	0.5

Intersection Summary	
HCM 6th Ctrl Delay	51.0
HCM 6th LOS	D

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	430	5	128	5	5	10	209	713	5	5	547	500
Future Volume (vph)	430	5	128	5	5	10	209	713	5	5	547	500
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0		4.0	5.3		4.5	5.3	
Lane Util. Factor	0.95	0.95	1.00	1.00	1.00		1.00	1.00		1.00	0.95	
Frpb, ped/bikes	1.00	1.00	0.97	1.00	1.00		1.00	1.00		1.00	0.98	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	0.90		1.00	1.00		1.00	0.93	
Flt Protected	0.95	0.95	1.00	0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1665	1671	1528	1805	1710		1770	1861		1785	3257	
Flt Permitted	0.95	0.95	1.00	0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1665	1671	1528	1805	1710		1770	1861		1785	3257	
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	448	5	133	5	5	10	218	743	5	5	570	521
RTOR Reduction (vph)	0	0	107	0	10	0	0	0	0	0	188	0
Lane Group Flow (vph)	228	225	26	5	5	0	218	748	0	5	903	0
Confl. Peds. (#/hr)			1	1			13		2	2		13
Confl. Bikes (#/hr)			2						5			3
Heavy Vehicles (%)	3%	3%	3%	0%	0%	0%	2%	2%	2%	1%	1%	1%
Turn Type	Split	NA	Perm	Split	NA		Prot	NA		Prot	NA	
Protected Phases	4	4		8	8		5	2		1	6	
Permitted Phases			4									
Actuated Green, G (s)	13.0	13.0	13.0	1.0	1.0		5.2	34.0		0.5	29.8	
Effective Green, g (s)	13.0	13.0	13.0	1.0	1.0		5.2	34.0		0.5	29.8	
Actuated g/C Ratio	0.20	0.20	0.20	0.02	0.02		0.08	0.51		0.01	0.45	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	5.3		4.5	5.3	
Vehicle Extension (s)	1.5	1.5	1.5	1.5	1.5		1.5	4.2		1.5	4.0	
Lane Grp Cap (vph)	326	327	299	27	25		138	954		13	1463	
v/s Ratio Prot	c0.14	0.13		0.00	c0.00		c0.12	c0.40		0.00	0.28	
v/s Ratio Perm			0.02									
v/c Ratio	0.70	0.69	0.09	0.19	0.21		1.58	0.78		0.38	0.62	
Uniform Delay, d1	24.8	24.8	21.8	32.2	32.3		30.5	13.2		32.7	13.9	
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	5.2	4.7	0.0	1.2	1.5		292.6	4.6		6.8	0.9	
Delay (s)	30.0	29.5	21.8	33.5	33.7		323.1	17.8		39.5	14.8	
Level of Service	C	C	C	C	C		F	B		D	B	
Approach Delay (s)		28.0			33.7			86.7			14.9	
Approach LOS		C			C			F			B	

Intersection Summary			
HCM 2000 Control Delay	43.9	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.88		
Actuated Cycle Length (s)	66.3	Sum of lost time (s)	17.8
Intersection Capacity Utilization	73.2%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

HCM 6th Edition methodology does not support turning movements with shared & exclusive lanes.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	430	505	140	200	755	485	340	763	185	505	837	795
Future Volume (veh/h)	430	505	140	200	755	485	340	763	185	505	837	795
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		0.98	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1856	1856	1856	1885	1885	1885	1870	1870	1870	1885	1885	1885
Adj Flow Rate, veh/h	467	549	0	217	821	0	370	829	201	549	910	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	3	3	3	1	1	1	2	2	2	1	1	1
Cap, veh/h	541	1121		240	1053		443	767	186	531	1060	
Arrive On Green	0.16	0.32	0.00	0.13	0.29	0.00	0.13	0.27	0.27	0.15	0.30	0.00
Sat Flow, veh/h	3428	3618	0	1795	3582	1598	3456	2821	684	3483	3582	1598
Grp Volume(v), veh/h	467	549	0	217	821	0	370	522	508	549	910	0
Grp Sat Flow(s),veh/h/ln	1714	1763	0	1795	1791	1598	1728	1777	1728	1742	1791	1598
Q Serve(g_s), s	19.3	18.2	0.0	17.3	30.4	0.0	15.2	39.4	39.4	22.1	34.8	0.0
Cycle Q Clear(g_c), s	19.3	18.2	0.0	17.3	30.4	0.0	15.2	39.4	39.4	22.1	34.8	0.0
Prop In Lane	1.00		0.00	1.00		1.00	1.00		0.40	1.00		1.00
Lane Grp Cap(c), veh/h	541	1121		240	1053		443	483	470	531	1060	
V/C Ratio(X)	0.86	0.49		0.90	0.78		0.84	1.08	1.08	1.03	0.86	
Avail Cap(c_a), veh/h	674	1121		261	1053		643	483	470	531	1060	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	1.00	0.49	0.49	0.00
Uniform Delay (d), s/veh	59.5	40.0	0.0	61.9	46.9	0.0	61.7	52.8	52.8	61.5	48.2	0.0
Incr Delay (d2), s/veh	9.9	1.5	0.0	30.2	5.7	0.0	7.2	64.7	65.3	36.5	3.8	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	9.1	8.2	0.0	9.9	14.4	0.0	7.0	25.7	25.1	12.3	15.7	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	69.5	41.5	0.0	92.1	52.6	0.0	68.9	117.5	118.1	98.0	51.9	0.0
LnGrp LOS	E	D		F	D		E	F	F	F	D	
Approach Vol, veh/h		1016	A		1038	A		1400			1459	A
Approach Delay, s/veh		54.4			60.9			104.9			69.3	
Approach LOS		D			E			F			E	
Timer - Assigned Phs	1	2	3	4	5	6	7	8				
Phs Duration (G+Y+Rc), s	26.6	43.9	23.9	50.6	23.1	47.4	27.4	47.1				
Change Period (Y+Rc), s	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5				
Max Green Setting (Gmax), s	22.1	39.4	21.1	44.4	27.0	34.5	28.5	37.0				
Max Q Clear Time (g_c+I1), s	24.1	41.4	19.3	20.2	17.2	36.8	21.3	32.4				
Green Ext Time (p_c), s	0.0	0.0	0.1	2.6	1.4	0.0	1.6	1.8				

Intersection Summary			
HCM 6th Ctrl Delay			74.6
HCM 6th LOS			E

Notes

Unsignalized Delay for [EBR, WBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	315	5	865	0	0	0	0	1248	530	0	1562	845
Future Volume (vph)	315	5	865	0	0	0	0	1248	530	0	1562	845
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)	5.0	5.0	4.0					5.3	4.0		5.3	4.0
Lane Util. Factor	0.95	0.95	1.00					0.95	1.00		0.95	1.00
Frpb, ped/bikes	1.00	1.00	1.00					1.00	0.96		1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00					1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.85					1.00	0.85		1.00	0.85
Flt Protected	0.95	0.95	1.00					1.00	1.00		1.00	1.00
Satd. Flow (prot)	1593	1599	1500					3353	1433		3386	1515
Flt Permitted	0.95	0.95	1.00					1.00	1.00		1.00	1.00
Satd. Flow (perm)	1593	1599	1500					3353	1433		3386	1515
Peak-hour factor, PHF	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Adj. Flow (vph)	321	5	883	0	0	0	0	1273	541	0	1594	862
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	164	162	883	0	0	0	0	1273	541	0	1594	862
Confl. Peds. (#/hr)									49	49		
Confl. Bikes (#/hr)									1			
Heavy Vehicles (%)	2%	2%	2%	0%	0%	0%	2%	2%	2%	1%	1%	1%
Turn Type	Perm	NA	Free					NA	Free		NA	Free
Protected Phases		8						2			6	
Permitted Phases	8		Free						Free			Free
Actuated Green, G (s)	24.0	24.0	70.0					35.7	70.0		35.7	70.0
Effective Green, g (s)	24.0	24.0	70.0					35.7	70.0		35.7	70.0
Actuated g/C Ratio	0.34	0.34	1.00					0.51	1.00		0.51	1.00
Clearance Time (s)	5.0	5.0						5.3			5.3	
Vehicle Extension (s)	3.5	3.5						4.5			4.5	
Lane Grp Cap (vph)	546	548	1500					1710	1433		1726	1515
v/s Ratio Prot								0.38			c0.47	
v/s Ratio Perm	0.10	0.10	c0.59						0.38			0.57
v/c Ratio	0.30	0.30	0.59					0.74	0.38		0.92	0.57
Uniform Delay, d1	16.8	16.8	0.0					13.5	0.0		15.9	0.0
Progression Factor	1.00	1.00	1.00					1.00	1.00		1.00	1.00
Incremental Delay, d2	0.4	0.4	1.7					3.0	0.8		9.8	1.6
Delay (s)	17.2	17.2	1.7					16.5	0.8		25.7	1.6
Level of Service	B	B	A					B	A		C	A
Approach Delay (s)		5.9			0.0			11.8			17.2	
Approach LOS		A			A			B			B	

Intersection Summary			
HCM 2000 Control Delay	12.9	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.84		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	10.3
Intersection Capacity Utilization	63.5%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

HCM 6th Edition methodology does not support turning movements with shared & exclusive lanes.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	610	10	1060	0	988	575	0	1712	690
Future Volume (veh/h)	0	0	0	610	10	1060	0	988	575	0	1712	690
Initial Q (Qb), veh				0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)				1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj				1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach					No			No			No	
Adj Sat Flow, veh/h/ln				1758	1758	1758	0	1744	1744	0	1786	1786
Adj Flow Rate, veh/h				635	10	0	0	1029	0	0	1783	0
Peak Hour Factor				0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Percent Heavy Veh, %				3	3	3	0	4	4	0	1	1
Cap, veh/h				605	10		0	1719		0	1761	
Arrive On Green				0.37	0.37	0.00	0.00	0.52	0.00	0.00	0.52	0.00
Sat Flow, veh/h				1649	26	1490	0	3400	1478	0	3483	1514
Grp Volume(v), veh/h				645	0	0	0	1029	0	0	1783	0
Grp Sat Flow(s),veh/h/ln				1675	0	1490	0	1657	1478	0	1697	1514
Q Serve(g_s), s				33.0	0.0	0.0	0.0	19.5	0.0	0.0	46.7	0.0
Cycle Q Clear(g_c), s				33.0	0.0	0.0	0.0	19.5	0.0	0.0	46.7	0.0
Prop In Lane				0.98		1.00	0.00		1.00	0.00		1.00
Lane Grp Cap(c), veh/h				614	0		0	1719		0	1761	
V/C Ratio(X)				1.05	0.00		0.00	0.60		0.00	1.01	
Avail Cap(c_a), veh/h				614	0		0	1719		0	1761	
HCM Platoon Ratio				1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)				1.00	0.00	0.00	0.00	0.66	0.00	0.00	0.53	0.00
Uniform Delay (d), s/veh				28.5	0.0	0.0	0.0	15.1	0.0	0.0	21.6	0.0
Incr Delay (d2), s/veh				50.1	0.0	0.0	0.0	1.0	0.0	0.0	18.8	0.0
Initial Q Delay(d3),s/veh				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln				21.1	0.0	0.0	0.0	6.6	0.0	0.0	20.1	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh				78.6	0.0	0.0	0.0	16.1	0.0	0.0	40.5	0.0
LnGrp LOS				F	A		A	B		A	F	
Approach Vol, veh/h					645	A		1029	A		1783	A
Approach Delay, s/veh					78.6			16.1			40.5	
Approach LOS					E			B			D	

Timer - Assigned Phs		2		4		6						
Phs Duration (G+Y+Rc), s		52.0		38.0		52.0						
Change Period (Y+Rc), s		5.3		5.0		5.3						
Max Green Setting (Gmax), s		46.7		33.0		46.7						
Max Q Clear Time (g_c+I1), s		21.5		35.0		48.7						
Green Ext Time (p_c), s		9.4		0.0		0.0						

Intersection Summary	
HCM 6th Ctrl Delay	40.3
HCM 6th LOS	D

Notes

Unsignalized Delay for [NBR, WBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBU	NBL	NBT	NBR	SBL	SBT
Lane Configurations												
Traffic Volume (vph)	85	25	330	680	15	135	5	30	1723	325	95	1312
Future Volume (vph)	85	25	330	680	15	135	5	30	1723	325	95	1312
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1900	1800	1800	1800	1800	1800
Total Lost time (s)	4.5	4.5	4.5	4.5	4.5			4.5	4.5		4.5	4.5
Lane Util. Factor	1.00	1.00	1.00	0.97	1.00			1.00	0.91		1.00	0.91
Frpb, ped/bikes	1.00	1.00	0.98	1.00	1.00			1.00	1.00		1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00			1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.86			1.00	0.98		1.00	1.00
Flt Protected	0.95	1.00	1.00	0.95	1.00			0.95	1.00		0.95	1.00
Satd. Flow (prot)	1693	1782	1491	3285	1541			1643	4594		1693	4859
Flt Permitted	0.95	1.00	1.00	0.95	1.00			0.22	1.00		0.95	1.00
Satd. Flow (perm)	1693	1782	1491	3285	1541			389	4594		1693	4859
Peak-hour factor, PHF	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
Adj. Flow (vph)	86	25	333	687	15	136	5	30	1740	328	96	1325
RTOR Reduction (vph)	0	0	188	0	103	0	0	0	17	0	0	1
Lane Group Flow (vph)	86	25	145	687	48	0	0	35	2051	0	96	1334
Confl. Peds. (#/hr)								3		9	9	
Confl. Bikes (#/hr)			2									
Heavy Vehicles (%)	1%	1%	1%	1%	1%	1%	4%	4%	4%	4%	1%	1%
Turn Type	Prot	NA	Perm	Prot	NA		custom	Prot	NA		Prot	NA
Protected Phases	3	8		7	4			5	2		1	6
Permitted Phases			8				5					
Actuated Green, G (s)	10.8	16.8	16.8	29.5	35.5			17.8	71.8		8.9	62.9
Effective Green, g (s)	10.8	16.8	16.8	29.5	35.5			17.8	71.8		8.9	62.9
Actuated g/C Ratio	0.07	0.12	0.12	0.20	0.24			0.12	0.50		0.06	0.43
Clearance Time (s)	4.5	4.5	4.5	4.5	4.5			4.5	4.5		4.5	4.5
Vehicle Extension (s)	1.5	1.5	1.5	1.5	1.5			1.5	4.0		1.5	4.0
Lane Grp Cap (vph)	126	206	172	668	377			47	2274		103	2107
v/s Ratio Prot	0.05	0.01		c0.21	0.03				c0.45		c0.06	0.27
v/s Ratio Perm			c0.10					0.09				
v/c Ratio	0.68	0.12	0.84	1.03	0.13			0.74	0.90		0.93	0.63
Uniform Delay, d1	65.4	57.5	62.8	57.8	42.7			61.4	33.4		67.7	32.0
Progression Factor	1.00	1.00	1.00	1.00	1.00			1.00	1.00		1.00	1.00
Incremental Delay, d2	11.5	0.1	28.3	42.3	0.1			42.4	6.4		66.2	1.5
Delay (s)	76.9	57.6	91.1	100.0	42.7			103.8	39.8		133.9	33.5
Level of Service	E	E	F	F	D			F	D		F	C
Approach Delay (s)		86.4			89.7				40.8			40.2
Approach LOS		F			F				D			D

Intersection Summary			
HCM 2000 Control Delay	53.4	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.92		
Actuated Cycle Length (s)	145.0	Sum of lost time (s)	18.0
Intersection Capacity Utilization	87.4%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Movement	SBR
Lane Configurations	
Traffic Volume (vph)	10
Future Volume (vph)	10
Ideal Flow (vphpl)	1800
Total Lost time (s)	
Lane Util. Factor	
Frpb, ped/bikes	
Flpb, ped/bikes	
Frt	
Flt Protected	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Peak-hour factor, PHF	0.99
Adj. Flow (vph)	10
RTOR Reduction (vph)	0
Lane Group Flow (vph)	0
Confl. Peds. (#/hr)	3
Confl. Bikes (#/hr)	
Heavy Vehicles (%)	1%
Turn Type	
Protected Phases	
Permitted Phases	
Actuated Green, G (s)	
Effective Green, g (s)	
Actuated g/C Ratio	
Clearance Time (s)	
Vehicle Extension (s)	
Lane Grp Cap (vph)	
v/s Ratio Prot	
v/s Ratio Perm	
v/c Ratio	
Uniform Delay, d1	
Progression Factor	
Incremental Delay, d2	
Delay (s)	
Level of Service	
Approach Delay (s)	
Approach LOS	

Intersection Summary

HCM 6th Edition cannot analyze u-turn movements.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	30	5	5	280	5	470	5	1853	20	95	1072	15
Future Volume (vph)	30	5	5	280	5	470	5	1853	20	95	1072	15
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0	4.0	4.0	4.0	4.0	5.0		4.0	5.0	
Lane Util. Factor		1.00	1.00	0.95	0.95	1.00	1.00	0.91		1.00	0.95	
Frpb, ped/bikes		1.00	0.97	1.00	1.00	0.98	1.00	1.00		1.00	1.00	
Flpb, ped/bikes		1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frt		1.00	0.85	1.00	1.00	0.85	1.00	1.00		1.00	1.00	
Flt Protected		0.96	1.00	0.95	0.95	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1769	1517	1698	1705	1563	1787	3017		1736	3462	
Flt Permitted		0.96	1.00	0.95	0.95	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)		1769	1517	1698	1705	1563	1787	5126		1736	3462	
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	31	5	5	292	5	490	5	1930	21	99	1117	16
RTOR Reduction (vph)	0	0	5	0	0	291	0	0	0	0	0	0
Lane Group Flow (vph)	0	36	0	149	148	199	5	1951	0	99	1133	0
Confl. Peds. (#/hr)	3		5	5		3	7		4	4		7
Confl. Bikes (#/hr)						4			3			2
Heavy Vehicles (%)	3%	3%	3%	1%	1%	1%	1%	1%	1%	4%	4%	4%
Turn Type	Split	NA	Perm	Split	NA	Perm	Prot	NA		Prot	NA	
Protected Phases	4	4		8	8		5	2		1	6	
Permitted Phases			4			8						
Actuated Green, G (s)		11.1	11.1	22.8	22.8	22.8	1.4	93.1		6.0	97.7	
Effective Green, g (s)		11.1	11.1	22.8	22.8	22.8	1.4	93.1		6.0	97.7	
Actuated g/C Ratio		0.07	0.07	0.15	0.15	0.15	0.01	0.62		0.04	0.65	
Clearance Time (s)		4.0	4.0	4.0	4.0	4.0	4.0	5.0		4.0	5.0	
Vehicle Extension (s)		3.0	3.0	3.0	3.0	3.0	3.0	6.0		3.0	6.0	
Lane Grp Cap (vph)		130	112	258	259	237	16	1872		69	2254	
v/s Ratio Prot		c0.02		0.09	0.09		0.00	c0.65		c0.06	0.33	
v/s Ratio Perm			0.00			c0.13						
v/c Ratio		0.28	0.00	0.58	0.57	0.84	0.31	1.04		1.43	0.50	
Uniform Delay, d1		65.7	64.3	59.1	59.1	61.8	73.8	28.5		72.0	13.6	
Progression Factor		1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2		1.2	0.0	3.1	3.0	22.6	10.9	32.7		260.3	0.8	
Delay (s)		66.8	64.3	62.2	62.1	84.4	84.7	61.1		332.3	14.4	
Level of Service		E	E	E	E	F	F	E		F	B	
Approach Delay (s)		66.5			76.0			61.2			39.9	
Approach LOS		E			E			E			D	

Intersection Summary			
HCM 2000 Control Delay	57.6	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	0.96		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	17.0
Intersection Capacity Utilization	84.6%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

HCM 6th Edition methodology does not support turning movements with shared & exclusive lanes.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	465	400	145	200	410	205	310	1698	500	170	797	285
Future Volume (vph)	465	400	145	200	410	205	310	1698	500	170	797	285
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.1	4.1	4.1	4.1	4.1	4.1	4.3	4.5	4.5	4.0	4.5	4.5
Lane Util. Factor	0.97	0.95	1.00	0.91	0.91	1.00	0.97	0.95	1.00	1.00	0.95	1.00
Frpb, ped/bikes	1.00	1.00	0.97	1.00	1.00	0.98	1.00	1.00	0.96	1.00	1.00	0.97
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1542	1610	3382	1544	2634	2716	1215	1770	3539	1543
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1542	1610	3382	1544	3467	3574	1528	1770	3539	1543
Peak-hour factor, PHF	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Adj. Flow (vph)	474	408	148	204	418	209	316	1733	510	173	813	291
RTOR Reduction (vph)	0	0	123	0	0	97	0	0	143	0	0	170
Lane Group Flow (vph)	474	408	25	184	438	112	316	1733	367	173	813	121
Confl. Peds. (#/hr)	9		10	10		9	8		20	20		8
Confl. Bikes (#/hr)									5			4
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	1%	1%	1%	2%	2%	2%
Turn Type	Split	NA	Perm	Split	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	4	4		8	8		5	2		1	6	
Permitted Phases			4			8			2			6
Actuated Green, G (s)	23.2	23.2	23.2	22.3	22.3	22.3	20.7	63.6	63.6	9.0	51.6	51.6
Effective Green, g (s)	23.2	23.2	23.2	22.3	22.3	22.3	20.7	63.6	63.6	9.0	51.6	51.6
Actuated g/C Ratio	0.17	0.17	0.17	0.17	0.17	0.17	0.15	0.47	0.47	0.07	0.38	0.38
Clearance Time (s)	4.1	4.1	4.1	4.1	4.1	4.1	4.3	4.5	4.5	4.0	4.5	4.5
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	6.0	6.0	3.0	6.0	6.0
Lane Grp Cap (vph)	590	609	265	266	559	255	404	1281	720	118	1354	590
v/s Ratio Prot	c0.14	0.12		0.11	c0.13		0.12	c0.64		c0.10	0.23	
v/s Ratio Perm			0.02			0.07			0.24			0.08
v/c Ratio	0.80	0.67	0.10	0.69	0.78	0.44	0.78	1.35	0.51	1.47	0.60	0.21
Uniform Delay, d1	53.6	52.2	47.0	53.0	53.9	50.6	54.9	35.6	24.8	62.9	33.3	27.9
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	7.8	2.8	0.2	7.5	7.1	1.2	9.5	164.0	1.6	250.0	1.3	0.5
Delay (s)	61.4	55.0	47.1	60.6	61.0	51.8	64.4	199.6	26.4	312.9	34.7	28.4
Level of Service	E	E	D	E	E	D	E	F	C	F	C	C
Approach Delay (s)		56.8			58.6			148.4			70.9	
Approach LOS		E			E			F			E	

Intersection Summary			
HCM 2000 Control Delay	101.4	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.15		
Actuated Cycle Length (s)	134.8	Sum of lost time (s)	17.0
Intersection Capacity Utilization	100.9%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

HCM 6th Edition methodology does not support turning movements with shared & exclusive lanes.

Intersection	
Int Delay, s/veh	2.2

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	45	5	55	0	0	10	20	630	5	0	505	30
Future Vol, veh/h	45	5	55	0	0	10	20	630	5	0	505	30
Conflicting Peds, #/hr	10	0	10	3	0	3	10	0	3	3	0	10
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	0	-	-	0	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	90	90	90	90	90	90	90	90	90	90	90	90
Heavy Vehicles, %	0	0	0	0	0	0	2	2	2	1	1	1
Mvmt Flow	50	6	61	0	0	11	22	700	6	0	561	33

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	992	1341	317	1044	1354	366	604	0	0	709	0	0
Stage 1	588	588	-	750	750	-	-	-	-	-	-	-
Stage 2	404	753	-	294	604	-	-	-	-	-	-	-
Critical Hdwy	7.5	6.5	6.9	7.5	6.5	6.9	4.14	-	-	4.12	-	-
Critical Hdwy Stg 1	6.5	5.5	-	6.5	5.5	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.5	5.5	-	6.5	5.5	-	-	-	-	-	-	-
Follow-up Hdwy	3.5	4	3.3	3.5	4	3.3	2.22	-	-	2.21	-	-
Pot Cap-1 Maneuver	203	154	685	186	151	637	970	-	-	893	-	-
Stage 1	467	499	-	374	422	-	-	-	-	-	-	-
Stage 2	600	420	-	695	491	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	192	148	672	159	146	629	961	-	-	890	-	-
Mov Cap-2 Maneuver	192	148	-	159	146	-	-	-	-	-	-	-
Stage 1	452	494	-	364	411	-	-	-	-	-	-	-
Stage 2	570	409	-	619	486	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	24.4	10.8	0.3	0
HCM LOS	C	B		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	961	-	-	300	629	890	-	-
HCM Lane V/C Ratio	0.023	-	-	0.389	0.018	-	-	-
HCM Control Delay (s)	8.8	-	-	24.4	10.8	0	-	-
HCM Lane LOS	A	-	-	C	B	A	-	-
HCM 95th %tile Q(veh)	0.1	-	-	1.8	0.1	0	-	-

Appendix D: Trip Generation

Trip Generation - STEM Building

FTE	650	
	Trip Rate/FTE	% Inbound
AM Peak Hour	0.18	84%
PM Peak Hour	0.20	40%
Daily	1.70	

	AM Peak Hour Trip Gen			PM Peak Hour Trip Gen		
Daily	In	Out	Total	In	Out	Total
1,107	98	19	117	52	78	130

Peak Parking Demand - STEM Building

Parking Demand Rate/FTE	Parking Demand
0.27	176