Attachment 1

ENVIRONMENTAL CHECKLIST

for the proposed

Belltown 36 Development

Master Use Permit No. 3028930

prepared for

City of Seattle Department of Construction and Inspections

October 2, 2018

EA Engineering, Science, and Technology, Inc., PBC
Bumgardner
Transpo Group

PREFACE--

The purpose of this Environmental Checklist is to identify and evaluate probable environmental impacts that could result from the ***Belltown 36 Development*** and to identify measures to mitigate those impacts. The ***Belltown 36 Development*** would involve construction of a 30-story building with 203 apartment units, 19,000 sq. ft. of office space and 12,000 sq. ft. of retail space. Below-grade parking would be provided for 237 vehicles.

The State Environmental Policy Act (SEPA)[1] requires that all governmental agencies consider the environmental impacts of a proposal before the proposal is decided upon. This Environmental Checklist has been prepared in compliance with the State Environmental Policy Act; the SEPA Rules, effective April 4, 1984, as amended (Chapter 197-11, Washington Administrative Code); and the Seattle City Code (25.05), which implements SEPA.

This document is intended to serve as SEPA review for site preparation work, building construction, and operation of the proposed development comprising the ***Belltown 36 Development***. Analysis associated with the proposed project contained in this Environmental Checklist is based on Master Use Permit (MUP) plans for the project, which are on-file with the Seattle Department of Construction and Inspections (SDCI) (MUP # 3028930). While not construction-level detail, the schematic plans accurately represent the eventual size, location and configuration of the proposed structure and is considered adequate for analysis and disclosure of environmental impacts.

This Environmental Checklist is organized into three major sections. *Section A* of the Checklist (beginning on page 1) provides background information concerning the *Proposed Action* (e.g., purpose, proponent/contact person, project description, project location, etc.). *Section B* (beginning on page 8) contains the analysis of environmental impacts that could result from implementation of the proposed project, based on review of major environmental parameters. This section also identifies possible mitigation measures. *Section C* (page 30) contains the signature of the proponent, confirming the completeness of this Environmental Checklist.

Project-relevant analyses that served as a basis for this Environmental Checklist include: *Geotechnical Master Use Permit Report* (GeoEngineers, 2018); *Greenhouse Gas Emissions Worksheet* (EA, 2018); *Solar Glare Analysis* (EA, 2018); *MUP Appendix A Report* (BOLA Architecture + Planning, 2018) and the *Transportation Impact Analysis* (Transpo, 2018). These reports have been submitted as part of the Master Use Permit (MUP) applications, are on-file with SDCI, and are included as appendices to this SEPA Checklist.

[1] Chapter 43.21C. RCW

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PURPOSE

The State Environmental Policy Act (SEPA), Chapter 43.21 RCW, requires all governmental agencies to consider the environmental impacts of a proposal before making decisions. The purpose of this checklist is to provide information to help identify impacts from the proposal (and to reduce or avoid impacts, if possible) and to help the City of Seattle Department of Construction and Inspections (SDCI) to make a SEPA threshold determination.

A. BACKGROUND

1. Name of Proposed Project:

Belltown 36 Development

2. Name of Applicant:

Security Properties

3. Address and Phone Number of Applicant and Contact Person:

Mr. John Marasco
Chief Development Officer
Security Properties
701 Fifth Avenue, Suite 5700
Seattle, WA 98104

4. Date Checklist Prepared

October 2, 2018

5. Agency Requesting Checklist

City of Seattle Department of Construction and Inspections
700 Fifth Ave., Suite 2000
P.O. Box 34019
Seattle, WA 98124-4019

6. Proposed Timing or Schedule (including phasing, if applicable):

The project that is analyzed in this Environmental Checklist involves site preparation work, construction, and operation of the project referred to as the ***Belltown 36 Development***. Site preparation and construction could begin in fall 2019, with building occupancy by winter 2022.

7. Do you have any plans for future additions, expansion, or further activity related to or connected with this proposal? If yes, explain.

No future plans for further development of the project site are proposed.

8. List any environmental information you know about that has been prepared, or will be prepared, directly related to this proposal:

- *Geotechnical Master Use Permit Report* (GeoEngineers, 2017);
- *Greenhouse Gas Emissions Worksheet* (EA, 2018);
- *MUP Appendix A Report* (BOLA, 2018);
- *Viewshed Analysis Report* (EA, 2018);
- *Solar Glare Analysis Report* (EA, 2018);
- *Shadow Analysis Report* (EA, 2018); and,
- *Transportation Technical Report* (Transpo, 2018).

9. Do you know whether applications are pending for governmental approvals of other proposals directly affecting the property covered by your proposal? If yes, explain:

There are no known other applications that are pending approval for the ***Belltown 36 Development*** site.

10. List any government approvals or permits that will be needed for your proposal, if known:

State and Regional Agencies

Washington Department of Ecology
- Construction General NPDES Permit

Seattle-King County Department of Health
- Plumbing Permits

Local Agencies

City of Seattle – Department of Construction and Inspections
- Master Use Permit (including SEPA Review and Zoning Code Review)
- Building Permit
- Mechanical Permits
- Electrical Permits
- Elevator Permits
- Occupancy Permits
- Comprehensive Drainage Control Plan Approvals (includes Construction Best Management Practices, Erosion and Sediment Control approvals)

11. Give a brief, complete description of your proposal, including the proposed uses and the size of the project and site. There are several questions later in this checklist that ask you to describe certain aspects of your proposal. You do not need to repeat those answers on this page.

Existing Site Conditions

The ***Belltown 36 Development*** site is located in Seattle's Belltown neighborhood (see **Figure 1**). The 19,440 sq. ft. project site occupies the southeast portion of a block that is bounded by Battery Street on the north, Fourth Avenue on the east, Bell Street on the south and Second Avenue on the west. A north/south mid-block alley divides the block. The project site currently contains two buildings including: a one-story, approximately 7,200 sq. ft. office/warehouse constructed in 1914 (Mary's Place), and a one-story, approximately 5,030 sq. ft. retail building constructed in 1923 (Two Bells Bar and Grill). A 18-stall surface parking lot is present on the east side the Mary's Place building, bordering Fourth Avenue (see **Figure 2**).

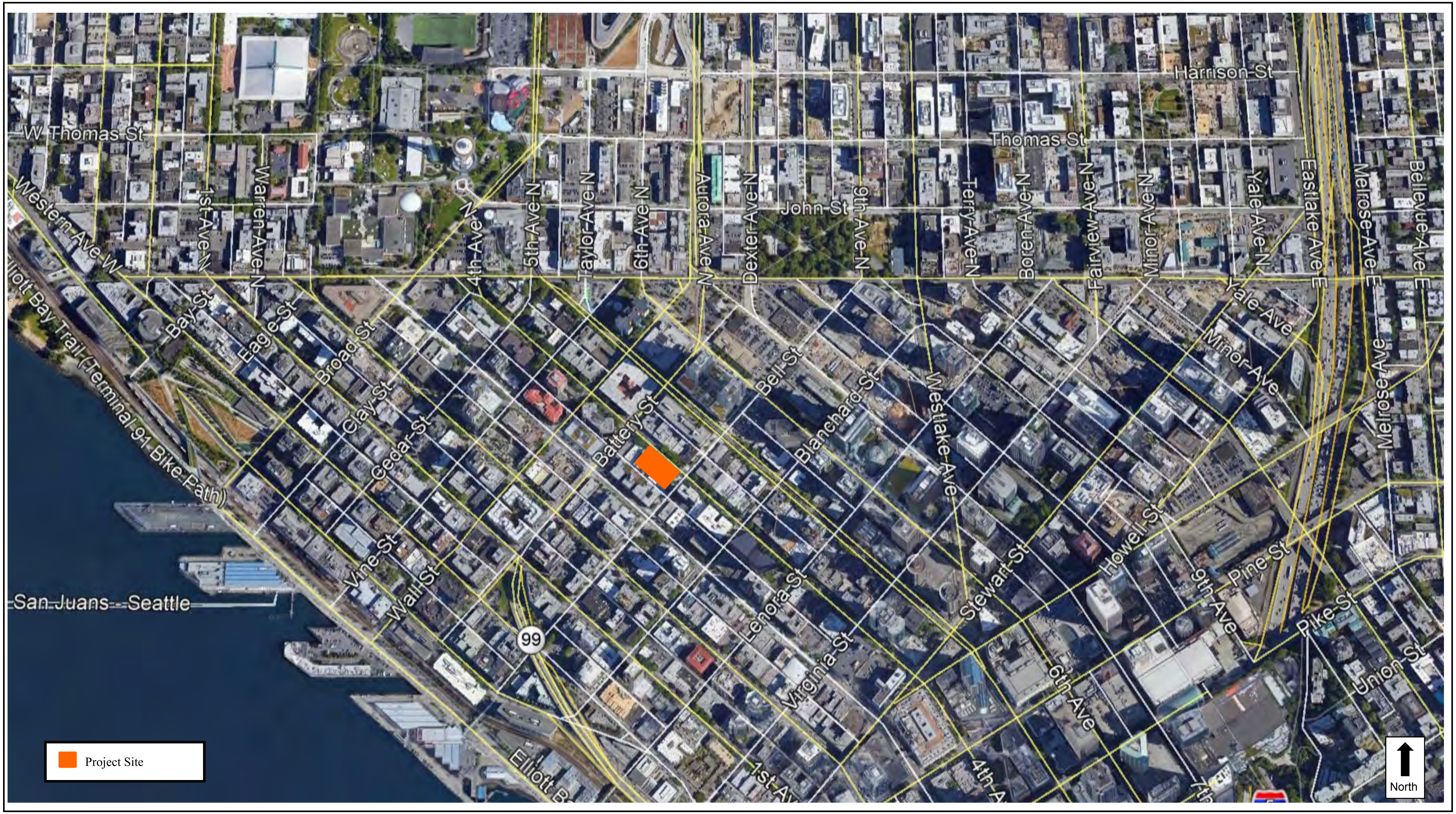
Buildings and Uses

The proposed ***Belltown 36 Development*** would consist of a 30-story mixed-use building with approximately 203 apartment units, 19,000 sq. ft. of office space, and 12,000 sq. ft. of retail space.

Parking and Loading

Parking for approximately 237 vehicles would be provided in a below-grade garage. Access to the parking garage would be provided from the mid-block alley.

See **Figure 3** for a site plan and **Figure 4** for a building rendering.



Source: EA Engineering and Google Maps, 2018

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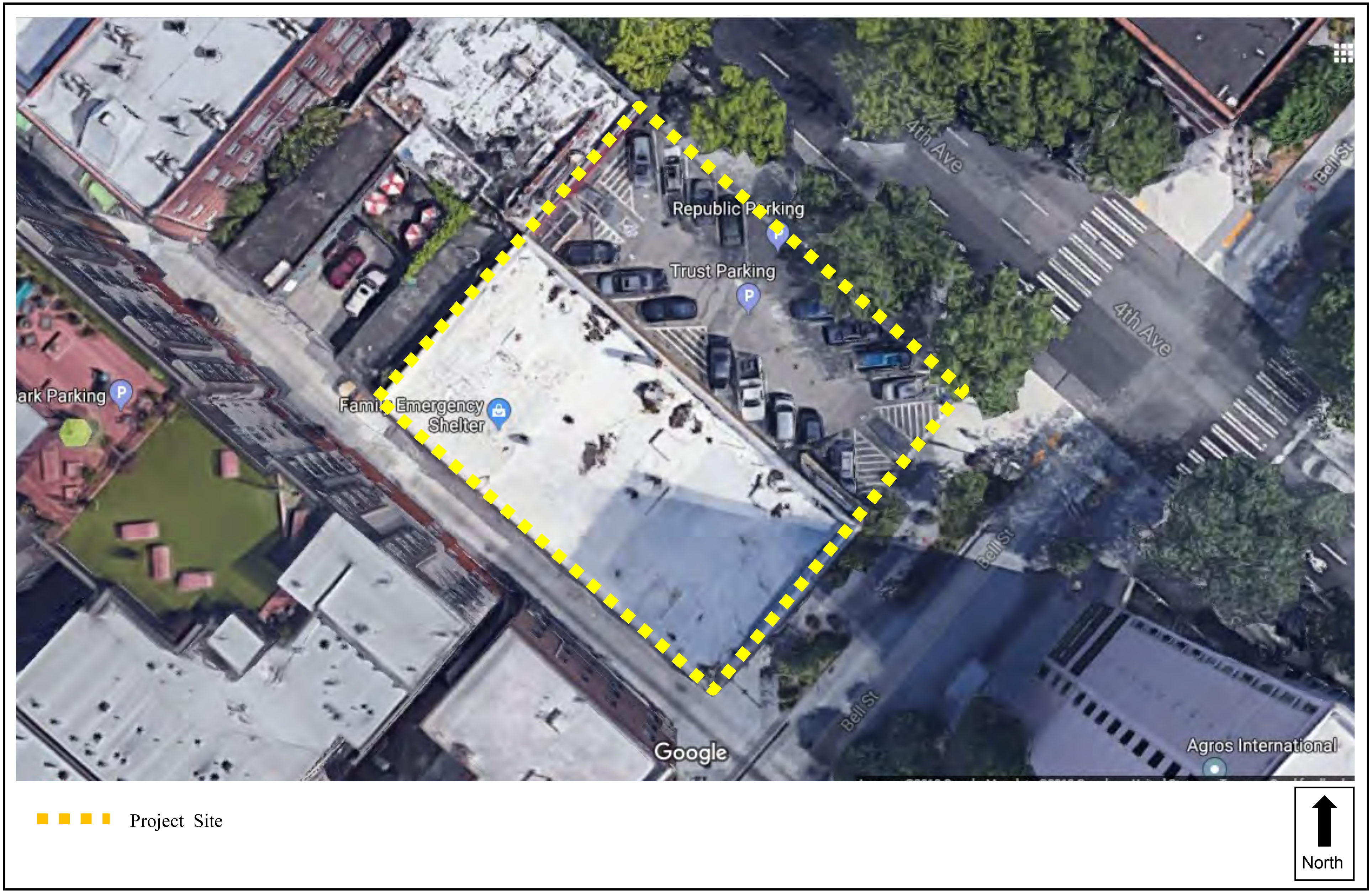
Figure 1

Vicinity Map

Belltown 36
Environmental Checklist



Source: Google Earth and EA, 2018.

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Figure 2

Existing Conditions

Belltown 36
Environmental Checklist

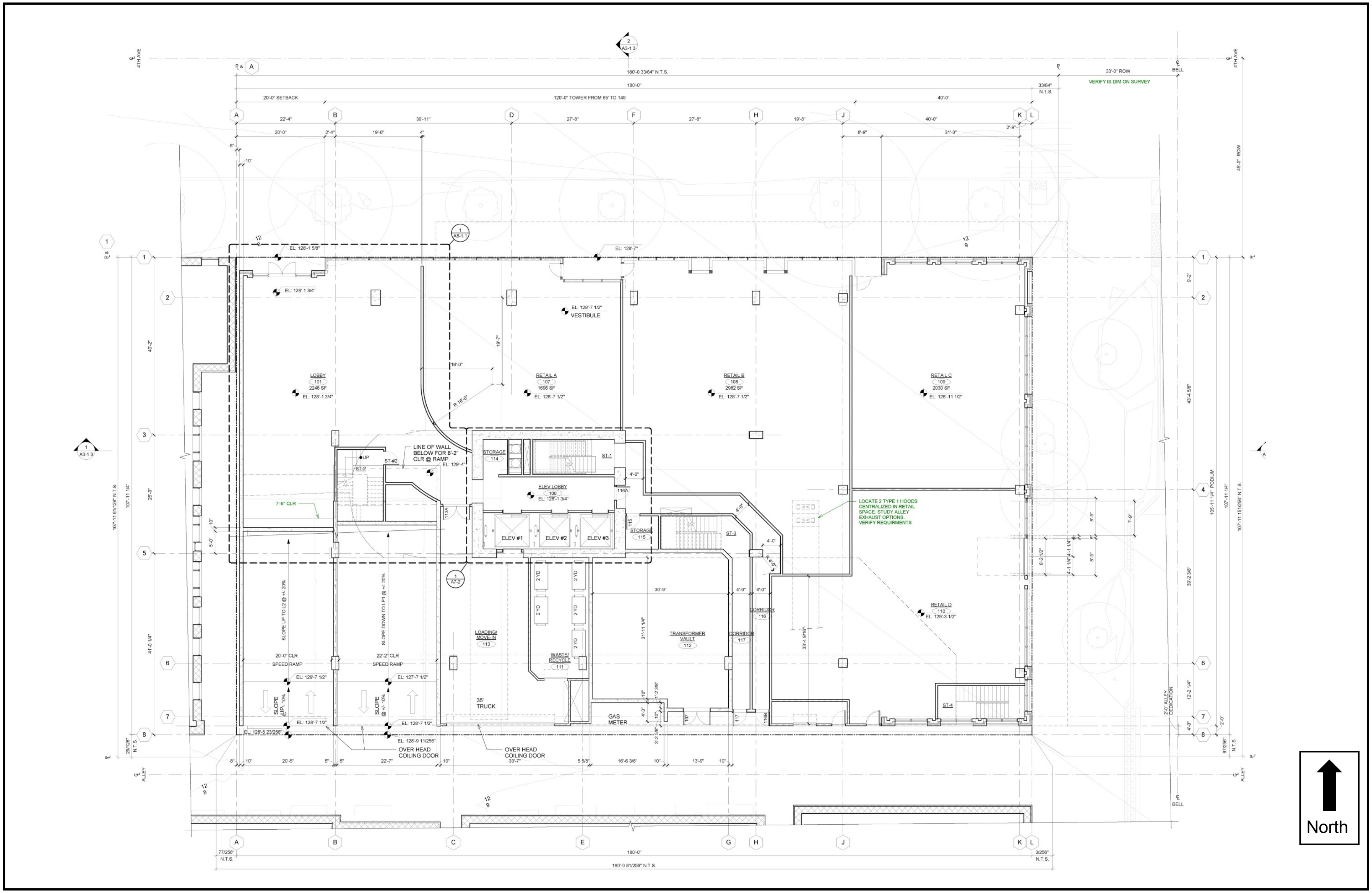

Figure 2

Site Plan

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Figure 4

Building Rendering

12. Location of the proposal. Give sufficient information for a person to understand the precise location of your proposed project, including a street address, if any. If a proposal would occur over a range of area, provide the range or boundaries of the site(s).

The project site is located in the Belltown neighborhood on the southeast portion of a block that is bounded by Battery Street on the north, Fourth Avenue on the east, Bell Street on the south and Third Avenue on the west (see **Figure 1**).

The legal description for the project site is attached to the plans that are on-file with the City of Seattle (MUP #3028930).

B. ENVIRONMENTAL ELEMENTS

1. Earth

a. **General description of the site (circle one):**
Flat, rolling, hilly, steep slopes, mountainous,
other:____

The ground surface is relatively flat with a total change in elevation of approximately two feet across the site.

b. **What is the steepest slope on the site (approximate percent slope)?**

The property is generally flat with maximum grade change from one corner to the next of 1.2 feet with a maximum approximately 1% slope.

c. **What general types of soils are found on the site (for example, clay, sand, gravel, peat, muck)? If you know the classification of agricultural soils, specify them and note any agricultural land of long-term commercial significance and whether the proposal results in removing any of these soils.**

Soils on the site generally consist of shallow fill, typically less than 5 feet below existing ground surface, overlying competent glacially consolidated soils consisting of cohesive silts and clays and sand and gravels with variable fines content. See ***Appendix A*** *for further details.*

d. **Are there surface indications or history of unstable soils in the immediate vicinity? If so, describe.**

No. There are no mapped environmental critical areas on the site, and the soils that underlie the site are considered to have a low risk of liquefying due to the density and gradation of these soils (see ***Appendix A*** *for further details).*

e. **Describe the purpose, type, and approximate quantities and total affected area of any filling, excavation, and grading proposed. Indicate source of fill.**

Approximately 46,816 cubic yards of excavation would be required for the project.

f. **Could erosion occur as a result of clearing, construction, or use? If so, generally describe.**

Erosion is possible in conjunction with any construction activity. The excavation would be shored, so off-site erosion would be contained, *and implementation of a Temporary Erosion Sedimentation Control (TESC) plan would mitigate potential impacts from excavation activity. Once the building is operational, no erosion is anticipated.*

g. About what percent of the site will be covered with impervious surfaces after project construction (for example, asphalt or buildings)?

Approximately 100 percent of the site is currently covered with impervious surfaces, and approximately 100 percent of the site would be covered with impervious surfaces after project construction.

h. Proposed measures to reduce or control erosion, or other impacts to the earth, if any:

Temporary Erosion Control Plan approvals (including Construction Best Management Practices, Erosion and Sediment Control Approvals) would be submitted as components of the building permit. Best Management Practices will be instituted to reduce soil being tracked onto the roadway and water quality will be maintained during excavation per City of Seattle and King County standards.

2. Air

a. What type of emissions to the air would result from the proposal (i.e., dust, automobile, odors, industrial wood smoke) during construction and when the project is completed? If any, generally describe and give approximate quantities if known.

The proposed project could result in localized increases in air emissions (primarily carbon monoxide) due to construction vehicles, equipment and activities. Dust could also result during construction activities. Emissions would not result in exceedance of ambient air quality standards

The proposed project has been designed to conform to the applicable regulations and standards of agencies regulating air quality in Seattle. These include the Environmental Protection Agency (EPA), Washington State Department of Ecology (DOE), and the Puget Sound Clean Air Agency (PSCAA).

In order to evaluate the climate change impacts of the proposed project, a Greenhouse Gas Emissions Worksheet has been prepared to estimate the emissions footprint for the lifecycle of the project on a gross-level basis. The emissions estimate is based on the combined emissions from the following sources:

- *Embodied Emissions* – *extraction, processing, transportation, construction and disposal of materials and landscape disturbance;*

- *Energy-related Emissions – energy demands created by the development after it is completed; and,*
- *Transportation-related Emissions – transportation demands created by the development after it is completed.*

The Worksheet estimate is based on building use and size. In total, the estimated lifespan emissions estimate for the project is approximately 310,799 $MTCO_2e$[2]. The Greenhouse Gas Emissions Worksheet used to estimate the project emissions is contained in ***Appendix B*** *of this Checklist. This emissions estimate does not take into account any sustainability measures that would be incorporated into the project, such as LEED Silver certification, which will be pursued by the proposed* ***Belltown 36 Development****.*

b. Are there any off-site sources of emissions or odor that may affect your proposal? If so, generally describe.

There are no offsite sources of air emissions or odors that may affect the proposed project.

c. Proposed measures to reduce or control emissions or other impacts to air, if any:

The following measures could be implemented to further control emissions and/or dust during construction:

- *Best Management Practices would be instituted to minimize dust created during excavation activities.*
- *Demolition dust would be handled in accordance with PSCAA regulations and sprinkling during demolition.*

3. Water

a. Surface:

1) Is there any surface water body on or in the immediate vicinity of the site (including year-round and seasonal streams, saltwater, lakes, ponds, wetlands)? If yes, describe type and provide names. If appropriate, state what stream or river it flows into.

The nearest surface water body is Elliott Bay, located approximately 0.35 mile to the southwest of the project site.

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2 $MTCO_2e$ is defined as Metric Ton Carbon Dioxide Equivalent; equates to 2204.62 pounds of CO2. This is a standard measure of amount of CO2 emissions reduced or sequestered. Carbon is not the same as Carbon Dioxide. Sequestering 3.67 tons of CO2 is equivalent to sequester one ton of carbon.

2) **Will the project require any work over, in, or adjacent to (within 200 feet) the described waters? If yes, please describe and attach available plans.**

   No. The project will not require any work over, in, or adjacent (within 200 feet) to any water body.

3) **Estimate the amount of fill and dredge material that would be placed in or removed from surface water or wetlands and indicate the area of the site that would be affected. Indicate the source of fill material.**

   No fill or dredge material would be placed in or removed from any surface water body as a result of the proposed project.

4) **Will the proposal require surface water withdrawals or diversions? Give general description, purpose, and approximate quantities if known.**

   No. The proposed project would not require any surface water withdrawals or diversions.

5) **Does the proposal lie within a 100-year floodplain? If so, note location on the site plan.**

   No. The project site does not lie within a 100-year floodplain and is not identified as a flood prone area on the City of Seattle Environmentally Critical Areas map.

6) **Does the proposal involve any discharges of waste materials to surface waters? If so, describe the type of waste and anticipated volume of discharge.**

   No. There would be no discharge of waste materials to surface waters.

b. Ground:

1) **Will ground water be withdrawn, or will water be discharged to ground water? If so, give a general description of the well, proposed uses and approximate quantities withdrawn from the well. Will water be discharged to groundwater? Give general description, purpose, and approximate quantities if known.**

   No groundwater would be withdrawn nor water discharged to ground water.

2) **Describe waste material that will be discharged into the ground from septic tanks or other sources; industrial, containing the following chemicals; agricultural; etc.). Describe the general size of the system, the number of such systems, the number of houses to be served (if applicable), or the number of animals or humans the system(s) are expected to serve.**

Waste material would not be discharged into the ground from septic tanks or other sources. The proposed building would connect to the City's sewer system and would discharge directly to that sewer system.

c. ***Water Runoff (including storm water):***

1) **Describe the source of runoff (including storm water) and method of collection and disposal, if any (include quantities, if known). Where will this water flow? Will this water flow into other waters? If so, describe.**

Existing and new impervious surfaces constructed on the site are and would continue to be the source of runoff from the proposed project. Stormwater falling onsite would be collected through a series of drains and piping and routed to a below grade stormwater detention vault. The stormwater detention vault will be sized in accordance with city standards. The stormwater detention vault will be located within the building footprint and will slowly release stormwater to the municipal collection pipes in the public right-of-way.

2) **Could waste materials enter ground or surface waters? If so, generally describe.**

No. The proposed stormwater collection system and associated mitigation measures would prevent waste materials from entering the ground water or surface waters.

3) **Does the proposal alter or otherwise affect drainage patterns in *the vicinity of the site? If so, describe.***

No. The proposal would not alter or otherwise affect drainage patterns in the site vicinity.

d. **Proposed measures to reduce or control surface, ground, and runoff water impacts, if any:**

The proposal will comply with the applicable City requirements relating to surface water runoff control and water quality, including the City's Drainage Control Ordinance. Best Management Practices would be implemented during construction.

4. Plants

a. Check or circle types of vegetation found on the site:

__ deciduous tree: ornamental pear and plum
__evergreen tree:
__shrubs
__grass
__ pasture
__ crop or grain
__ wet soil plants: cattail, buttercup, bullrush, skunk cabbage, other
__ water plants: water lily, eelgrass, milfoil, other
__ other types of vegetation

There are no trees or vegetation on the project site. Street trees are present along Bell Street and Fourth Avenue.

b. What kind and amount of vegetation will be removed or altered?

The project would remove two multi-stem Vine Maples from the Bell Street Park.

c. List threatened or endangered species known to be on or near the site.

No known threatened or endangered species are located on or proximate to the project site.

d. Proposed landscaping, use of native plants, or other measures to preserve or enhance vegetation on the site, if any:

Street trees along Fourth Avenue (five Red Oak trees) would be preserved, and expanded planting areas would be provided. Two Flowering Pear trees along the Bell Street Park would be replaced, and a planting area adjacent to the lot line on the Bell Street Park would be replaced with sidewalk and access to ground floor retail. All landscape improvements in the right-of-way, including enlarged planting areas, will include soil amendments and native or adapted planting as require per SDOT's ROW Improvement Manual. Plantings on structure, atop the podium, at amenity decks or at the roof would align with required stormwater management.

e. List all noxious weeds and invasive species known to be on or near the site.

The site is located in an urban, developed area and no known noxious weeds or invasive species are known to be on or near the site. Noxious weeds that are known to be present in King County include giant hogweed (heracleum mantegazzianum) and English ivy.

5. Animals

a. Circle (underlined) any birds and animals that have been observed on or near the site or are known to be on or near the site:

birds: <u>songbirds,</u> hawk, heron, eagle**, other: <u>seagulls</u>, <u>pigeons,</u>**
mammals: deer, bear, elk, beaver**, other: <u>squirrels, rats</u>**
fish: bass, salmon, trout, herring, shellfish**, other: <u>None</u>.**

b. List any threatened or endangered species known to be on or near the site.

The project site is located in an urban, developed area and no threatened or endangered species are known to be on or near the site.

c. Is the site part of a migration route? If so, explain.

Yes. The entire Puget Sound area is within the Pacific Flyway, which is a major north-south flyway for migratory birds in America, extending from Alaska to Patagonia. Every year, migratory birds travel some or all of this distance both in spring and in fall, following food sources, heading to breeding grounds, or travelling to overwintering sites.

d. Proposed measures to preserve or enhance wildlife, if any:

No specific measures are proposed to enhance wildlife and/or habitat.

e. List any invasive animal species known to be on or near the site.

The site is located in an urban, developed area and no known invasive species are known to be on or near the site. Invasive species known to be located in King County include European starling, house sparrow and eastern gray squirrel.

6. Energy and Natural Resources

a. What kinds of energy (electric, natural gas, oil, wood stove, solar) will be used to meet the completed project's energy needs? Describe whether it will be used for heating, manufacturing, etc.

Electricity and natural gas are the primary sources of energy that would serve the proposed development. During operation, these energy sources would be used for project heating, cooling, hot water, cooking, and lighting.

b. Would your project affect the potential use of solar energy by adjacent properties? If so, generally describe.

No. The proposed project would not affect the potential use of solar energy by adjacent properties.

d. What kinds of energy conservation features are included in the plans of this proposal? List other proposed measures to reduce or control energy impacts, if any:

The proposed project is targeting LEED Silver Certification and all building systems would conform to the current Seattle Energy Code.

7. Environmental Health

a. Are there any environmental health hazards, including exposure to toxic chemicals, risk of fire and explosion, spill, or hazardous waste that could occur as a result of this proposal? If so, describe.

The completed project would have no known environmental health hazards that could occur as a result of this proposal.

1) Describe any known or possible contamination at the site from *present or past uses.*

A gas station was previously located on the site, and there is known residual petroleum contamination on the site associated with this prior use.

2) Describe existing hazardous chemicals/conditions that might affect project development and design. This includes underground hazardous liquid and gas transmission pipelines located within the project area and in the vicinity.

None are known.

3) Describe any toxic or hazardous chemicals that might be stored, used, or produced during the project's development or construction, or at any time during the operating life of the project.

No toxic or hazardous chemicals are anticipated to be stored, used or produced during the project's development, construction or operation.

4) ***Describe special emergency services that might be required.***

No special emergency services are anticipated to be required as a result of the project. As is typical of urban development, it is possible that normal fire, medical, and other emergency services may, on occasion, be needed from the City of Seattle.

5) **Proposed measures to reduce or control environmental health hazards, if any:**

Additional Environmental Site Assessments/Investigations are currently being conducted to identify and characterize site contamination, and associated cleanup will be conducted in accordance with state and federal regulations.

b. Noise

1) **What types of noise exist in the area that may affect your project (for example: traffic, equipment operation, other)?**

*Traffic noise associated with adjacent streets is relatively high at certain times of day. Traffic noise is not expected to adversely affect the proposed **Belltown 36 Development**.*

2) **What types and levels of noise would be created by or associated with the project on a short-term or a long-term basis (for example: traffic, construction, operation, other)? Indicate what hours noise would come from site.**

Construction-related noise would occur as a result of on-site construction activities associated with the project, primarily related to demolition and excavation. Construction noise would be short-term and would be the most noticeable noise generated by the proposed project. It is expected that primary construction hours would occur from 7 AM to 5 PM Monday through Friday. Some excavation work could occur during evenings or weekends to reduce truck trips during peak traffic. The proposed project would comply with provisions of Seattle's Noise Ordinance (SMC, Chapter 25.08). Once the building is operational, no significant long-term noise impacts are anticipated.

3) **Proposed measures to reduce or control noise impacts, if any:**

As noted, the project would comply with provisions of the City's Noise Ordinance (SMC 25.08); specifically: construction hours would be limited to standard construction hours (non-holiday) from 7 AM to 6 PM and Saturdays and Sundays from 9 AM to 7 PM. If extended construction hours are necessary, the applicant would apply for a noise variance.

8. Land and Shoreline Use

a. What is the current use of the site and adjacent properties? Will the proposal affect current land uses on nearby or adjacent properties? If so, describe.

Both buildings on the project site are currently vacant.

Surrounding adjacent land uses within the same block as the project site include:

- *a 3-story, 35-unit apartment building to the north (Fleming Apartments);*
- *a 7-story, 251-unit apartment building to the west (Moda Apartments); and,*
- *a 3-story, 24-unit apartment building to the east (Adams Apartments).*

Surrounding nearby land uses to the east and south include:

- *East – a 3-story, 36-unit apartment building (Franklin Apartments) and two one-story retail buildings; and*
- *South – a 13-story, 107-unit subsidized apartment building (Security House).*

b. Has the site been used as working farmlands or working forest lands? If so, describe. How much agricultural or forest land of long-term commercial significance will be converted to other uses as a result of the proposal, if any? If resource lands have not been designated, how many acres in farmland or forest land tax status will be converted to nonfarm or nonforest use?

No, the site has not been used as working farmland or forest land for over 100 years.

1) Will the proposal affect or be affected by surrounding working farm or forest land normal business operations, such as oversize equipment access, the application of pesticides, tilling, and harvesting? If so, how:

No. The site is located in an urban area and would not affect or be affected by working farm or forest land; no working farm or forest land is located in the vicinity of this urban site.

c. Describe any structures on the site.

The site is currently occupied by a one-story, 5,030 sq. ft. building constructed in 1923 (formerly Two Bells Tavern), and a one-story 7,200 sq. ft. office/warehouse constructed in 1914. Both buildings are presently vacant.

d. Will any structures be demolished? If so, what?

The two existing building on the site would be demolished.

e. What is the current zoning classification of the site?

The site is currently zoned DMR/C 280/125.

f. What is the current comprehensive plan designation of the site?

The Future Land Use Map in the Seattle Comprehensive Plan identifies the site as an Urban Center.

g. If applicable, what is the current shoreline master program designation of the site?

The project site is not located within the City's designated shoreline boundary.

h. Has any part of the site been classified as a critical area by the city or county? If so, specify.

No part of the site has been classified as a critical area by the city or county.

i. Approximately how many people would reside or work in the completed project?

Approximately 203-285 people could reside in the building's 203 residential units and approximately 116 retail and office employees could work in the completed project, as detailed below.

	Total Square Feet	***Square Feet/Employee****	***Total Employees***
Retail/Restaurant	*12,000*	*300*	*40*
Office	*19,000*	*250*	*76*

Source: King County Buildable Lands Report, 2014.

j. Approximately how many people would the completed project displace?

No permanent housing is located on the project site, and no people would be displaced by the project.

k. Proposed measures to avoid or reduce displacement impacts, if any:

No displacement impacts would occur and no mitigation measures are necessary.

l. Proposed measures to ensure the proposal is compatible with existing and projected land uses and plans, if any:

No significant adverse land use impacts are anticipated. The proposed project would be consistent with the provisions of the City's Comprehensive Plan, the Belltown Neighborhood Plan, and existing zoning requirements.

m. Proposed measures to ensure the proposal is compatible with nearby agricultural and forest lands of long-term commercial significance, if any:

The project site is not located near agricultural or forest lands and no mitigation measures are necessary.

9. Housing

a. Approximately how many units would be provided, if any? Indicate whether high, middle, or low-income housing.

Approximately 203 market rate housing units would be provided in the ***Belltown 36 Development***.

b. Approximately how many units, if any, would be eliminated? Indicate whether high, middle, or low-income housing.

No housing units presently exists on-site and none would be eliminated.

c. Proposed measures to reduce or control housing impacts, if any:

The proposed project would contribute to the City's Mandatory Housing Affordability fund.

10. Aesthetics

a. What is the tallest height of any proposed structure(s), not including antennas; what is the principal exterior building material(s) proposed?

The tallest height of the proposed building would be approximately 325 feet, including mechanical space.

Principal exterior building materials would include wood, pigmented board-form concrete, brick, fiber cement and glass.

b. What views in the immediate vicinity would be altered or obstructed?

Views of the two existing one-story buildings and surface parking lot on the site would change with the introduction of a new, modern 30-level mixed-use building. Therefore, views toward the existing site would be altered from featuring two low-rise buildings and open surface parking area to include a modern, high-rise structure covering the majority of the site.

No significant view impacts from protected public viewpoints are anticipated. The proposed ***Belltown 36 Development*** *would be consistent with existing and proposed buildings in the Belltown area and as allowed by the City's Land Use Code. See* ***Appendix C*** *for a complete viewshed analysis.*

c. Proposed measures to reduce or control aesthetic impacts, if any:

No significant adverse aesthetic impacts are anticipated. The proposed project has completed the Early Design Guidance phase of Design Review.

11. Light and Glare

a. What type of light or glare will the proposal produce? What time of day would it mainly occur?

The proposed project is not expected to result in light or glare-related impacts from stationary sources or mobile sources (vehicles). At times during the construction process, area lighting of the job site (to meet safety requirements) may be necessary, which would be noticeable proximate to the project site. In general, however, light and glare from construction of the proposed project are not anticipated to adversely affect adjacent land uses.

Once operational, interior and exterior building lighting could at times be visible from adjacent land uses and streets. Solar glare reflected from the facades of the proposed development could occasionally be *visible to traffic on Third Avenue and Fourth Avenue, however, such glare would be outside the cone-of-influence and would not be expected to cause problems for motorists nor differ substantially from periodic glare from stationary and mobile sources that motorists typically experience.*

Reflected solar glare could also potentially be noticeable to residents within a few blocks of the project site. While noticeable, no significant long-term impact is anticipated, partly due to mitigating effects, such as less-reflective building materials and building modulation, as well as the fact that reflected glare, if it occurs, would be limited in duration.

See ***Appendix E*** *for a complete solar glare analysis.*

New shadows would be cast by the proposed building, and would periodically contribute to shading portions of the Bell Street Park during evening time hours. Shading would mainly occur to the area of the park between Fourth and Fifth Avenues. The Bell Street Park contains one lane of traffic, bike lanes, sidewalks, seating elements and landscaping and is used for both passive recreation and programmed activities. Overall, 25 percent or less of the four-block park area would be affected by shading from the proposed project, and existing buildings also contribute to shading other areas of the park in evening time hours. In general, anticipated shadow impacts are typical of Downtown development and no impacts would occur to Downtown areas where shadow impacts may be mitigated (i.e. Westlake Park and Plaza, Freeway Park, Steinbrueck Park, Convention Center Park and Kobe Terrace Park). See ***Appendix D*** *for shadow graphics and additional details.*

While some shadow impacts to nearby private property could also occur, the impacts are not expected to be significant. SEPA substantive policies in SMC 25.05.675Q do not authorize mitigation of shadow impacts on private property.

b. Could light or glare from the finished project be a safety hazard or interfere with views?

No. Light and glare associated with the proposed project is not expected to cause a safety hazard nor interfere with views.

c. What existing off-site sources of light or glare may affect your proposal?

No off-site sources of light or glare are anticipated to affect the proposed ***Belltown 36 Development****.*

d. Proposed measures to reduce or control light and glare impacts, if any:

*No significant long term, reflected solar glare-related environmental impacts are anticipated for motorists on Third Avenue or Fourth Avenue as a result of the proposed **Belltown 36 Development** and no mitigation measures are necessary. The following measures, however, would help to reduce overall light and glare from the project as it relates to the neighborhood surrounding the site.*

- *Building façade materials are still in the process of being finalized, and the facades of the proposed building could include metal and glass window wall structure with glass spandrel panels or the like. The City's Downtown Design Review Board is currently reviewing project-related design elements. Reflectivity of the glazing will be dictated by the nature of glass that is employed and the requirements set forth by the City's Energy Code and the LEED energy requirements. It is anticipated, however, that no excessively-reflective surfaces (i.e. mirrored glass, or polished metals) that go beyond what is required to meet energy-related code provisions are proposed anywhere on the exterior of the project buildings.*

- *Building façade modulation would reduce the effect of any potential reflected solar glare.*

- *The proposed street trees, as well as the use of building materials with relatively low-reflectivity at street level would minimize reflective glare-related impacts to pedestrians, motorists and nearby residents.*

- *Pedestrian-scale lighting would be provided consistent with code, function and safety requirements. Exterior lighting would include fixtures to direct the light downward and/or upward and away from off-site land uses.*

12. Recreation

a. What designated and informal recreational opportunities are in the immediate vicinity?

There are three parks in the general vicinity (i.e. within three to four blocks) of the project site – Bell Street Park, Regrade Park and Denny Park.

  - ***Bell Street Park** – is located adjacent to the site, to the south. This is a four block park with one lane of traffic that contains landscaping, seating, and open space.*

- ***Regrade Park** - is located approximately a half-block to the south. This is a fenced off-leash dog park.*

- ***Denny Park** - is located approximately four blocks to the north of the site. The 4.63-acre park contains paths, mature trees, landscaping, a dog off-leash area, play area and passive open space.*

b. Would the proposed project displace any existing recreational uses? If so, describe.

The project would not displace any existing recreational uses.

c. Proposed measures to reduce or control impacts on recreation, including recreation opportunities to be provided by the project or applicant, if any:

No significant adverse recreation impacts would occur and no mitigation is necessary.

13. Historic and Cultural Preservation

a. Are there any buildings, structures, or sites, located on or near the site that are over 45 years old listed in or eligible for listing in national, state, or local preservation registers located on or near the site? If so, specifically describe.

*As indicated previously, the **Belltown 36 Development** site contains two buildings: a one-story warehouse/office built in 1914 (Mary's Place – 314 Bell Street) and one-story former tavern built in 1923 (Two Bells Bar and Grill – 2315 Fourth Avenue). Due to age of construction, both buildings meet the City's threshold criterion for historical consideration under SEPA. However, the 1914 office building was included in the City's Downtown Historic Resources Survey (2007) and was assigned a status classification of "No Altered" by the City's Department of Neighborhoods. This means the property is considered to have physical features so altered that there is a loss of integrity and physical fabric that no further study is warranted. This classification means, the applicant is not required to submit an Appendix A Report for that building. This will be confirmed with the Seattle Department of Neighborhoods.*

As part of the Proposed Action, a MUP Appendix A report has been prepared for the Department of Neighborhoods relative to the other building on the site (2315 Fourth Avenue – Two Bells Bar and Grill). In general, the Appendix A submittal provides a brief description of the history and architecture of the building and summarizes the development of the neighborhood. As part of the Appendix A review process, the City's Historic Preservation Officer will review the Appendix A report to determine whether the building would meet the *standards for landmark designation. See **Appendix F** for the MUP Appendix A report.*

As part of the Proposed Action, both existing buildings on the site would be demolished. Assuming that DON review of the 1923 building concludes that it does not meet the criteria for Landmark designation, demolition of the buildings on-site would not result in a significant impact to historic resources.

The closest City-designated landmarks to the project site include:

- ***Franklin Apartments** – 2302 Fourth Avenue – This building is located to the east of the project site, on the east side of Fourth Avenue; and,*

- ***Fire Station #2** – 2318 Fourth Avenue - This building is located to the north of the project site, at the corner of Battery Street and Fourth Avenue.*

b. Are there any landmarks, features, or other evidence of Indian or historic use or occupation? This may include human burials or old cemeteries. Are there any material evidence, artifacts, or areas of cultural importance on or near the site? Please list any professional studies conducted at the site to identify such resources.

*The **Belltown 36 Development** site is not located within an area that is designated as the Government Meander Line Buffer area. This is an area that extends a distance of 200 feet from the location of the U.S. Government Meander Line. The meander line was a line established by government survey in the late 1800's for the purpose of defining the shoreline (or mean high water mark) of what became Lake Union. Only properties that are located within the Government Meander Line Buffer are required to prepare an archaeological investigation as part of the SEPA and MUP processes.*

c. Describe the methods used to assess the potential impacts to cultural and historic resources on or near the project site. Examples include consultation with tribes and the department of archeology and historic preservation, archaeological surveys, historic maps, GIS data, etc.

Potential impacts to historic resources on or near the site were evaluated by consulting the City of Seattle database of historic properties, and the 'My Neighborhood Map' (http://web6.seattle.gov/mnm/), and the Seattle Historic Resources Survey (http://www.seattle.gov/neighborhoods/programs-and-services/historic-preservation/historic-resources-survey#historicresourcessurveydatabase).

d. **Proposed measures to avoid, minimize, or compensate for loss, changes to, and disturbance to resources. Please include plans for the above and any permits that may be required.**

No impacts are anticipated and no mitigation is proposed.

Excavation would occur during onsite demolition activity and construction of the proposed building foundation and below-grade parking. If resources of potential archaeological significance are encountered during excavation or construction associated with the project, the following measures would apply:

- *Work would be stopped immediately; SDCI and the Washington State Archaeologist at the State Office of Archaeology and Historic Preservation (OAHP) would be contacted; and,*

- *Applicable regulations would be abided by pertaining to discovery and excavation of archaeological resources, including but not limited to, Chapters 27.34, 27.53, 27.44, and 79.01 RCW and Chapter 25.48 WAC, as applicable or as revised.*

14. Transportation

*A Transportation Impact Analysis (September, 2018) has been prepared for this project and is included as **Appendix G** to this checklist.*

a. **Identify public streets and highways serving the site or affected geographic area and describe the proposed access to the existing street system. Show on site plans, if any.**

The project is located on the northwest corner of the Bell Street and Fourth Avenue intersection. Access to the below-grade parking garage would be provided via the alley between Bell Street and Battery Street.

b. **Is the site or affected geographic area currently served by public transit? If not, what is the approximate distance to the nearest transit stop?**

The site is well served by transit with service provided by King County Metro Transit, Community Transit, and Sound Transit. There are many bus stops within less than a quarter mile walking distance of the site. Service is provided along Fourth Avenue and Third Avenue within a block of the site. The primary transit corridor in the vicinity of the site is along Third Avenue, with the nearest bus stop on the north side of Third Avenue between Battery and Bell Street. This corridor is served by approximately 30 different bus routes including service by Rapid Ride

C, D, and E lines, as well as multiple frequent transit lines to North, Central and South Seattle neighborhoods.

c. How many additional parking spaces would the completed project or non-project proposal have? How many would the project or proposal eliminate?

*The completed **Belltown 36 Development** would have 237 parking spaces. The proposal would eliminate approximately 18 existing surface parking spaces.*

d. Will the proposal require any new or improvements to existing roads, streets, pedestrian, bicycle or state transportation facilities, not including driveways? If so, generally describe (indicate whether public or private).

The project would not require any new street or related facilities, or improvements to existing facilities. The project proposes to provide frontage improvements along both Bell Street and Fourth Avenue.

e. Will the project or proposal use (or occur in the immediate vicinity of) water, rail, or air transportation? If so, generally describe.

Employees and residents of the proposal may utilize the Seattle Monorail (elevated tracks are located on Fifth Avenue, and the nearest station is Westlake Center Station, located at Fifth and Pine) and the Link Light Rail (the nearest station is at Fourth and Pine Street - Westlake Station).

f. How many vehicular trips per day would be generated by the completed project or proposal? If known, indicate when peak volumes would occur and what percentage of the volume would be trucks (such as commercial and nonpassenger vehicles). What data or transportation models were used to make these estimates?

*After accounting for the existing site uses, the development is anticipated to generate 367 net new daily vehicle trips with 40 net new vehicle trips during the AM peak hour and 34 net new vehicle trips during the PM peak hour. See **Appendix G** for details.*

g. Will the proposal interfere with, affect or be affected by the movement of agricultural and forest products on roads or streets in the area? If so, generally describe.

The project would not interfere with or be affected by the movement of agricultural and forest products on the roadway network near the site area.

h. Proposed measures to reduce or control transportation impacts, if any.

The project would provide construction planning information as required in the City's Construction Hub-Coordination Program for the Westlake/Uptown/Belltown Hub.

15. Public Services

a. Would the project result in an increased need for public services (for example: fire protection, police protection, health care, schools, other)? If so, generally describe.

It is anticipated that the Proposed Action would generate an incremental need for increased public services due to the addition of office and retail employees and visitors associated with the site. To the extent that emergency service providers have planned for gradual increases in service demands, no significant impacts are anticipated.

b. Proposed measures to reduce or control direct impacts on public services, if any.

While the increase in employees and visitors associated with the proposed project may result in incrementally greater demand for emergency services, it is anticipated that adequate service capacity is available within the Belltown Neighborhood area to preclude the need for additional public facilities/services.

16. Utilities

a. Circle utilities currently available at the site: <u>electricity</u>, <u>natural gas</u>, <u>water</u>, <u>refuse service</u>, <u>telephone</u>, <u>sanitary sewer</u>, septic system, other.

All utilities are currently available at the site.

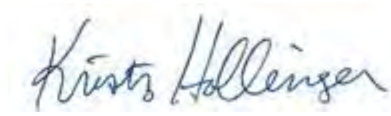
b. Describe the utilities that are proposed for the project, the utility providing the service, and the general construction activities on the site or in immediate vicinity that might be needed.

Utilities and providers (in parentheses) that currently serve the site will be reconnected to the proposed as follows:

- *Water – (Seattle Public Utilities)*
- *Sewer – (Seattle Public Utilities)*
- *Natural Gas – (Puget Sound Energy)*
- *Telecommunications – (Century Link, Comcast)*
- *Electrical – (Seattle City Light)*
- *Refuse/Recycling Service (Cleanscapes/Recology)*

C. SIGNATURES

The above answers are true and complete to the best of my knowledge. I understand the lead agency is relying on them to make its decision.



Signature:___________ ____

Name of Signee:__ __Kristy Hollinger___________________________

Position & Agency/Organization: Planner, EA Engineering, Science, & Technology, Inc., PBC

Date Submitted: October 2, 2018

This checklist was reviewed by:

____

Land Use Planner, City of Seattle Department of Construction and Inspections

Any comments or changes made by the Department are entered in the body of the checklist and contain the initials of the reviewer.

APPENDICES

APPENDIX A

Geotechnical Master Use Permit Report

Geotechnical Master Use Permit Report

314 Bell Street Tower
Seattle, Washington

for
[redacted]

March 3, 2017

GeoEngineers
Earth Science + Technology

Geotechnical Master Use Permit Report

314 Bell Street Tower
Seattle, Washington

for
[redacted]

March 3, 2017

GeoEngineers

8410 154th Avenue NE
Redmond, Washington 98052
425.861.6000

Geotechnical Master Use Permit Report

314 Bell Street Tower
Seattle, Washington

File No. 21572-002-00

March 3, 2017

[redacted]

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GEOENGINEERS

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INTRODUCTION

This report presents the preliminary results of GeoEngineers' geotechnical engineering services for the proposed high-rise development located at the northwest corner of the intersection of 4th Avenue and Bell Street in Seattle, Washington. The site is rectangular in shape and is bounded the three-story masonry Fleming Apartments building to the north, 4th Avenue to the east. Bell Street to the south and an alley to the west. The site is shown relative to surrounding physical features on the Vicinity Map (Figure 1) and the Site Plan (Figure 2).

The purpose of this report is to provide preliminary geotechnical engineering conclusions and recommendations for the early design and construction planning for the proposed development. [redacted]. GeoEngineers' geotechnical engineering services have been completed in general accordance with our Master Services Agreement executed on November 9, 2016. Our scope of work includes:

- reviewing existing subsurface information available for the site and surrounding area;
- observing the completing of explorations at the site by others to further characterize subsurface and groundwater information;
- providing recommendations for seismic design in accordance with the 2015 International Building Code (IBC);
- providing preliminary recommendations for earthwork;
- providing preliminary foundation, temporary shoring, slab-on-grade and permanent below-grade wall recommendations; and
- preparing this report.

PROJECT DESCRIPTION

GeoEngineers understands that [redacted] is interested in developing a 240-foot high-rise development with four below-grade parking levels. Excavation depths for the planned development are anticipated to extend up to 45 feet below existing site grades.

Temporary shoring will be required on each of the four sides of the planned excavation. Competent soil conditions are present at the anticipated foundation elevation; therefore, spread or mat foundations are considered to be feasible.

FIELD EXPLORATIONS AND LABORATORY TESTING

Field Explorations

The subsurface conditions at the site were evaluated by observing the completion of three borings, FB-01, FB-08 and [redacted], by the environmental consultant (Farallon Consulting). The borings were jointly logged with the environmental consultant. The explorations extended to approximately 50½ and 51 feet below site grades. The approximate locations of the explorations are shown in Figure 2. Descriptions of the field exploration program and the boring logs are presented in Appendix A, Field Explorations.

Laboratory Testing

Soil samples were obtained during drilling and were taken to GeoEngineers' laboratory for further evaluation. Selected samples were tested for the determination of moisture content, fines content, and Atterberg limits. A description of the laboratory testing and the test results are presented in Appendix B, Laboratory Testing.

PREVIOUS SITE EVALUATIONS

In addition to the explorations completed as part of this evaluation, the logs of selected explorations from previous site evaluations in the project vicinity were reviewed. The logs of explorations from previous projects referenced for this study are presented in Appendix C, Boring Logs from Previous Studies.

SITE CONDITIONS

Surface Conditions

The site is occupied by a 5,030-square-foot masonry building located in the northern portion of the site, a 7,200-square foot masonry building located in the western portion of the site and surface parking lots on the remainder of the site. The parking lots are surfaced with asphalt concrete. The site grades are relatively flat, with a total change in elevation of approximately 2 feet across the site.

The alignment of the SR-99 Tunnel runs underneath the 314 Bell Street Tower site and the depth to the crown of the tunnel is on the order of 140 feet below the ground surface.

Numerous buried utilities are located within and near the project site and within the public right-of-way along the adjacent streets. These utilities include, but are not limited to, electrical, telecommunication, fiber optic, gas, overhead power, water, and combined sanitary sewer and storm drain.

Subsurface Conditions

GeoEngineers' understanding of the subsurface conditions is based on review of existing geotechnical information in the project vicinity and observing the completion of three explorations by the environmental consultant (Farallon Consulting). The approximate locations of the explorations are shown in the attached site Plan (Figure 2).

The subsurface conditions generally consist of shallow fill overlying competent glacially consolidated soils.

- The borings completed at the site (FB-01, FB-08, and [redacted]) encountered asphalt and concrete pavement thicknesses of approximately 4 inches.
- Fill was not observed below the pavement sections in the borings we observed, but previous borings completed adjacent to the project site encountered fill that extended typically less than 5 feet below existing ground surface. The fill encountered in adjacent borings consisted of silts and clays with variable sand, gravel, and construction debris content.

- The glacially consolidated soils were encountered below the pavement or fill, where encountered, and extended to the depths explored. The glacially consolidated soils completed at the project site consisted of cohesive silts and clays and sand and gravels with variable fines content.
    - The cohesive silts and clays extended between 28 and 48 feet below site grades, with the thickest deposit encountered in boring FB-01 in the northwest corner of the site. The layer consists of hard silt and clay with variable sand and gravel content.
    - The sand and gravels were encountered below the cohesive silts and clays and extended to the depths explored for the borings completed at the project site. The layer consists of interbedded very dense sand with silt, silty sand with gravel, and silty gravel with sand.

Although not encountered in the explorations completed at the project site, fill associated with previous site development will likely be present at or near the ground surface. Occasional cobbles and boulders are typical of glacially consolidated soils and may be present at the site and have been encountered in nearby construction projects.

Groundwater Conditions

[redacted] The regional groundwater table is interpreted to be located well below the base of the planned excavation.

The regional groundwater table in the vicinity of 314 Bell Street project is estimated to be located below Elevation 20 feet based on groundwater measurements in deep monitoring wells installed as part of nearby projects and observations made on nearby deep excavations.

As with most sites in Seattle, perched groundwater will be present within isolated soil layers at elevations above the regional groundwater table. On the 314 Bell Street site, perched groundwater within cleaner sand layers or layers of non-plastic silt are anticipated above less permeable soil layers. Significant face instability and migration of fine sand/coarse silt soils has been observed in nearby excavations where perched groundwater is present. Similar perched groundwater conditions should be anticipated for the 314 Bell Street project.

CONCLUSIONS AND RECOMMENDATIONS

A summary of the primary geotechnical considerations is provided below. The summary is presented for introductory purposes only and should be used in conjunction with the complete recommendations presented in this report.

- The site is designated as Soil Profile Type C per the 2015 IBC.
- The lowest finished floor elevation is anticipated to be located above the regional groundwater table in the site vicinity. Perched groundwater seepage was observed in nearby deep excavations and should be anticipated on the 314 Bell Street project. Temporary dewatering by means of local sumps and pumps within the excavation is anticipated to be sufficient to remove perched groundwater seepage. Where perched groundwater is present, the contractor should take measures to reduce the potential

for loss of ground resulting from perched groundwater seepage and face instability during lagging installation.

- Excavation support can be completed using soldier pile and tieback shoring. The shoring design should take into account [redacted] below grade basement levels for the buildings located across the alley to the west. Temporary easements will be required for anchors extending onto these adjacent properties to the [redacted] west. For the east and south, the ground anchors will extend into the public right-of-way and these elements will be required to be temporary. The permanent below-grade building walls will be required to resist the permanent lateral earth pressures. The City of Seattle requires that tiebacks extending into the public right-of-way be de-stressed once the temporary shoring is no longer required, and the below-grade building walls should be designed and constructed to facilitate de-stressing of temporary tieback anchors.
- Shallow foundations may be used and should bear on undisturbed glacially consolidated soils. For shallow foundations bearing directly on undisturbed very stiff to hard or very dense glacially consolidated soils, an allowable soil bearing pressure of 9,400 pounds per square foot (psf) may be used. The recommended allowable soil bearing pressure takes into account the restrictions imposed by the presence of the SR 99 tunnel below the site. If the depth of excavation/lowest finished floor elevation changes, then this allowable soil bearing pressure may need to be revised.
- Conventional slabs-on-grade are considered appropriate for this site and should be underlain by a 6-inch-thick layer of clean crushed rock (for example, City of Seattle Mineral Aggregate Type 22). The underslab drainage system is anticipated to consist of a perimeter foundation drain and one longitudinal drain.

Our specific geotechnical recommendations are presented in the following sections of this report.

Earthquake Engineering

Liquefaction

Liquefaction refers to the condition by which vibration or shaking of the ground, usually from earthquake forces, results in the development of excess pore pressures in saturated soils with subsequent loss of strength. In general, soils that are susceptible to liquefaction include very loose to medium dense, clean to silty sands that are below the water table.

Groundwater levels at the site are generally within the dense to very dense glacially consolidated soils. Our analysis indicates that the soils that underlie the proposed building area have a low risk of liquefying because of the density and gradation of these soils.

Other Seismic Hazards

Due to the location of the site and the site's topography, the risk of adverse impacts resulting from seismically induced slope instability, differential settlement, or surface displacement due to faulting is considered to be low.

2015 IBC Seismic Design Information

We recommend the use of the following 2015 IBC parameters for soil profile type, short period spectral response acceleration (S_S), 1-second period spectral response acceleration (S_1) and seismic coefficients (F_A and F_V) for the project site.

2015 IBC Parameter	Recommended Value
Soil Profile Type	C
Short Period Spectral Response Acceleration, S_S (percent g)	136
1-Second Period Spectral Response Acceleration, S_1 (percent g)	53
Seismic Coefficient, F_A	1.0
Seismic Coefficient, F_V	1.3

Temporary Dewatering

The regional groundwater table in the site vicinity is anticipated to be located below the base of the planned excavation. Perched groundwater is expected to be present at higher elevations. Several saturated clean sand layers were observed in the borings jointly logged for this project. Provided the depth of the planned development does not increase, the need for an active dewatering system will not be required and temporary dewatering may be completed through the use of local sumps and pumps.

For planning purposes, groundwater flow rates of up to 5 gallons per minute (gpm) can be assumed for excavations ranging up to 45 feet below site grades. Surface water from rainfall will likely contribute significantly to the volume of water that needs to be removed from the excavation during construction and will vary as a function of season and precipitation.

Recent excavations completed at downtown Seattle sites with similar glacially consolidated silt and clay soils have encountered localized layers of saturated fine sand/coarse silt. Where encountered, these saturated fine sand/coarse silt soils are prone to migrate into the excavation through the lagging boards or at the base of the lagging (and at the temporary lowest level of lagging as the excavation progresses). This condition can result in significant loss of ground behind the temporary lagging if left unchecked. Potential measures to mitigate this loss of ground condition include sealing the gaps between lagging boards locally, use of controlled density fill (CDF) backfill for the lagging boards, and other means. During construction, this condition should be mitigated promptly in order to reduce the risk of settlement of existing improvements situated behind the shoring walls and to provide reliable support for construction surcharge loading, such as crane and pump truck outriggers.

Excavation Support

We understand that the planned building will have up to four below-grade levels and that the excavation will extend up to 45 feet below site grades. Soldier pile and tieback shoring is the preferred excavation support system for the site because of the depth of the planned excavation, control of face stability in the interbedded soils, and better deflection control of this system for deep excavation.

The City of Seattle typically requires that shoring walls be designed to limit deflections to 1 inch or less. [redacted]

Both the east and south shoring walls will need to coordinate with existing utilities located within the right-of-way. Additionally, right-of-way use permits will be required for tiebacks extending into the public right-of-way (4th Avenue, Bell Street, and the alley).

The west shoring wall will be located across the alley from Moda Apartments (2312 3rd Avenue) which is an 8-story wood frame building with three below-grade levels (according to the King County assessor's database). The depth of Moda Apartment's basement and parking levels will need to be considered during design of the ground anchors. Also across the alley west of the west shoring wall is the Adams Apartment building (304 Bell Street). The 304 Bell Street Building was constructed circa 1916 and has three stories and a partial below grade level. Temporary shoring for the west wall should be designed to limit deformations of both the Moda Apartments and the 304 Bell Street building to ½ inch or less. Additionally, if ground anchors extend below the adjacent buildings to the west, an easement will be required from the adjacent property owners.

We provide geotechnical design and construction recommendations for conventional soldier pile and tieback walls below. The City of Seattle will require that GeoEngineers review shoring design completed by others.

Excavation Considerations

The site soils may be excavated with conventional excavation equipment, such as trackhoes or dozers. The contractor should be prepared for occasional cobbles and boulders in the site soils. Likewise, the surficial fill may contain foundation elements and/or utilities from previous site development, debris, rubble and/or cobbles and boulders. We recommend that procedures be identified in the project specifications for measurement and payment of work associated with obstructions.

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 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 diagram presented in Figure 3. The earth pressures presented in Figure 3 are for full-height cantilever soldier pile walls and soldier pile walls with single or multiple levels of tiebacks, and the pressures represent the estimated loads that will be applied to the wall system for various wall heights.

The earth pressures presented in Figure 3 include the loading from traffic surcharge. Other surcharge loads, such as cranes, construction equipment or construction staging areas, should be considered by GeoEngineers on a case-by-case basis. No seismic pressures have been included in Figure 3 because it is assumed that the shoring 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

The following table presents GeoEngineers’ recommended lagging thicknesses (roughcut) as a function of soldier pile clear span and depth.

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 soil 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. The City of Seattle requires that voids be backfilled immediately or within a single shift, depending on the selected method of backfill. Placement of this material will help reduce the risk of voids developing behind the wall and damage to existing improvements located behind the wall.

Lean concrete is a suitable option for the use of backfill behind the walls. Lean concrete will reduce the volume of voids present behind the wall. Based on our experience, the voids between each lean concrete lift are sufficient for preventing the buildup of hydrostatic pressure behind the wall.

As discussed above in Temporary Dewatering, saturated fine sand/coarse silt soils, where present behind the timber lagging, are prone to migrating into the excavation through the lagging boards or at the base of the lagging (and at the temporary lowest level of lagging as the excavation progresses). This condition can result in significant loss of ground behind the temporary lagging if left unchecked. Potential measures to mitigate this loss of ground condition include sealing the gaps between lagging boards locally, use of CDF backfill for the lagging boards, and other means. During construction, this condition should be mitigated promptly in order to reduce the risk of settlement of existing improvements situated behind the shoring walls and to provide reliable support for construction surcharge loading, such as crane and pump truck outriggers. For budgeting purposes we recommend a contingency be considered for the use of lean mix or CDF backfill, if these soil conditions are encountered.

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.

The no-load zone shown in Figure 3 is truncated in order to provide a practical limit on tieback lengths. Truncated no-load zones have been used successfully in previous downtown Seattle excavations (for example, 9th and Lenora, Madison Centre, 2021 7th Avenue, 2101 7th Avenue, 815 Pine, Olive 8, Virginia Mason Medical Center Jones Pavilion, and 1918 8th Avenue).

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 glacially consolidated soils. 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 glacially consolidated soils and 1.5 kips per foot for fill deposits.

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 four 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 and Shoring Monitoring Program.

Care should be taken if post-grouting is implemented to enhance tieback capacities. The glacially consolidated clay and silt soils present at the site have low permeability and will not consolidate under high grout pressure. It is possible that high pressure post-grouting or large volume post grouting will result in wall deformation or ground heave, or both. Where post-grouting is implemented, careful review of survey monitoring should be completed to inform the project team if wall deformation exceeds tolerable limits. It may be necessary to reduce the pressure/volume used when post-grouting, or to stop post grouting altogether if excessive deformations are observed. In this situation, alternative measures may be required to enhance tieback capacities such as a larger diameter borehole.

The installation of tiebacks located within fine-grained soils (silts and clays) should be drilled with care. The air used during drilling to flush the cuttings should be carefully controlled so that no choke points occur and the air is forced into the soil formation. The post-grouting of tiebacks after installation should also be completed with care to avoid displacements within the soil formation.

The tieback layout and inclination should be checked to confirm that the tiebacks do not interfere with adjacent buried utilities. The City of Seattle minimum clearances between ground anchors and existing utilities should be maintained.

Drainage

Drainage for soldier pile and lagging walls is achieved through seepage through the timber lagging. Seepage flows at the bottom of the excavation should be contained and controlled in order to prevent loss of soil from behind the lagging. Drainage should be provided for permanent below-grade walls as described below in the "Below-Grade Walls" section of this report.

Construction Considerations

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

- loose fill is present;
- the native soils do not have adequate cementation or cohesion to prevent caving or raveling; and/or
- groundwater 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.

Lateral Earth Pressures Resulting from Adjacent Surcharge Loading

[redacted] Likewise, surcharge loading from the existing buildings to the west of the alley should be evaluated for the west shoring wall. The diagrams of recommended surcharge pressures presented in Figure 5 can be used to estimate the lateral earth pressures acting on below-grade walls as a result of point, line and uniform surcharge loading.

Support of Adjacent Structures

[redacted], and the Moda Apartments and Adams Apartments to the west should be protected during shoring installation. The [redacted] and west shoring walls should be designed for the surcharge loading from the existing buildings and to limit lateral deflections to less than ½ inch. [redacted] For the west shoring wall, the Moda and Adams Apartments loading should be taken as lateral surcharges. [redacted]

- [redacted]

[redacted]

[redacted]

[redacted]

Shoring Wall Performance

Temporary shoring walls typically move on the order of 0.1 to 0.2 percent of H, where H is the vertical distance between the existing ground surface and the base of excavation.

The deflections and settlements are usually highest at the excavation face and decrease to negligible amounts beyond a distance behind the wall equal to the height of the excavation. Localized deflections may exceed the above estimates and may reflect local variations in soil conditions (such as around side sewers) or may be the result of the workmanship used to construct the shoring wall. Given that some movement is expected, existing improvements located adjacent to the temporary shoring system will also experience movement. The deformations discussed above are not likely to cause structural damage to structurally sound existing improvements; however, some cosmetic damage should be expected (for instance, cracks in drywall finishes; widening of existing cracks; minor cracking of slabs-on-grade/hardscapes; cracking of sidewalks, curbs/gutter, and pavements/pavement panels; etc.). For this reason, it is important to complete a pre-construction survey and photo documentation of existing buildings and improvements prior to shoring construction. Refer to Appendix C for more detailed recommendations for shoring monitoring and preconstruction survey.

Shallow Foundations

Based on the data obtained from the borings completed at the site and the anticipated depth of excavation, the foundation levels will extend well into the glacially consolidated soils. We recommend that the building be supported on shallow spread or mat foundations bearing on the very dense/hard glacially consolidated soils.

Allowable Bearing Pressure

Based on the Warranty Deed provided to GeoEngineers by [redacted], the Washington State Department of Transportation (WSDOT) provides guidance for determining allowable soil bearing pressures for new developments located above the alignment of the SR 99 tunnel. For foundations constructed as recommended in this report, we recommend using an allowable bearing pressure of

9,400 psf for mat foundations and isolated spread footing foundations bearing on the dense to very dense or hard glacially consolidated soils located below existing site grades. The allowable soil bearing pressure applies to the total of dead and long-term live loads and may be increased by up to one-third for wind or seismic loads. The allowable soil bearing pressures are net values.

The allowable bearing pressure presented above assumes a 45-foot-deep excavation. If the excavation is less than 45 feet deep, then the allowable bearing pressure may be required to be reduced. Likewise, if the excavation extends deeper, a higher allowable bearing pressure may be used.

Modulus of Subgrade Reaction

For mat foundations designed as a beam on an elastic foundation, a modulus of subgrade reaction of 65 pounds per cubic inch (pci) may be used for structural mat foundation bearing on glacially consolidated soils. GeoEngineers should review the structural engineers' estimated deformation and applied bearing pressures to confirm that this subgrade modulus is appropriate and is consistent with our foundation design.

Settlement

Provided that all loose soil is removed and that the subgrade is prepared as recommended under "Construction Considerations" below, we estimate that the total settlement of shallow foundations will be about 1 inch or less. The settlements will occur rapidly, essentially as loads are applied. Differential settlements between footings could be half of the total settlement. Note that smaller settlements will result from lower applied loads.

Lateral Resistance

Lateral foundation loads may be resisted by passive resistance on the sides of footings and by friction on the base of the shallow foundations. For shallow foundations supported on native soils, the allowable frictional resistance may be computed using a coefficient of friction of 0.4 applied to vertical dead-load forces.

The allowable passive resistance may be computed using an equivalent fluid density of 400 pounds per cubic foot (pcf) (triangular distribution). These values are appropriate for foundation elements that are poured directly against undisturbed glacially consolidated soils or surrounded by structural fill.

The above coefficient of friction and passive equivalent fluid density values incorporate a factor of safety of about 1.5.

Construction Considerations

We recommend that the condition of all subgrade areas be observed by GeoEngineers to evaluate whether the work is completed in accordance with our recommendations and whether the subsurface conditions are as anticipated.

If foundation construction is completed during periods of wet weather, foundation subgrades are recommended to be protected with a rat slab consisting of 2 to 4 inches of lean or structural concrete.

If soft areas are present at the footing subgrade elevation, the soft areas should be removed and replaced with lean concrete or structural fill at the direction of GeoEngineers.

We recommend that the contractor consider leaving the subgrade for the foundations as much as 6 to 12 inches high, depending on soil and weather conditions, until excavation to final subgrade is required for foundation reinforcement. Leaving subgrade high will help reduce damage to the subgrade resulting from construction traffic for other activities.

Slab-on-Grade Floors

Slab-on-grade floors may be required if the structural mat foundation does not cover the full site footprint. Recommendations are provided below in the event that slab-on-grade floors are planned.

Subgrade Preparation

The exposed subgrade should be evaluated after site grading is complete. Proof-rolling with heavy, rubber-tired construction equipment should be used for this purpose during dry weather and if access for this equipment is practical. Probing should be used to evaluate the subgrade during periods of wet weather or if access is not feasible for construction equipment. The exposed soil should be firm and unyielding, and without significant groundwater. Disturbed areas should be recompacted if possible or removed and replaced with compacted structural fill.

The site should be rough graded to approximately 1 foot above slab subgrade elevation prior to foundation construction in order to protect the slab subgrade soils from deterioration from wet weather or construction traffic. After the foundations and below slab drainage system have been constructed, the remaining soils can be removed to final subgrade elevation followed by immediate placement of the capillary break material.

Design Parameters

Conventional slabs may be supported on-grade, provided the subgrade soils are prepared as recommended in the "Subgrade Preparation" section above. We recommend that the slab be founded on either undisturbed glacially consolidated soils or on structural fill placed over the undisturbed glacially consolidated soils. For slabs designed as a beam on an elastic foundation, a modulus of subgrade reaction of 150 pci may be used for subgrade soils prepared as recommended.

We recommend that the slab-on-grade floors be underlain by a 6-inch-thick capillary break consisting of material meeting the requirements of Mineral Aggregate Type 22 (¾-inch crushed gravel), City of Seattle Standard Specification 9-03.16.

Provided that loose soil is removed and the subgrade is prepared as recommended, we estimate that slabs-on-grade will not settle appreciably.

Below-Slab Drainage

We expect the static groundwater level to be located below the slab-on-grade level for the proposed building, and perched groundwater may be present above the slab subgrade elevation. We recommend installing an underslab drainage system to remove water from below the slab-on-grade. The underslab drainage system should include an interior perimeter drain. The drains should consist of perforated

Schedule 40 polyvinyl chloride (PVC) pipes with a minimum diameter of 4 inches placed in a trench at least 12 inches deep. The top of the underslab drainage system trenches should coincide with the base of the capillary break layer. The underslab drainage system pipes should have adequate slope to allow positive drainage to the sump/gravity drain.

The drainage pipe should be perforated. Perforated pipe should have two rows of ½-inch holes spaced 120 degrees apart and at 4 inches on center. If the perimeter underslab drain will also be used to collect weep pipes from the below grade walls, it is recommended that the holes of the perforated pipe be oriented up. The underslab drainage system trenches should be backfilled with Mineral Aggregate Type 22 or Type 5 (1-inch washed gravel), City of Seattle Standard Specification 9-03.16, or an alternative approved by GeoEngineers. The Type 22 or Type 5 material should be wrapped with a geotextile filter fabric meeting the requirements of construction geotextile for underground drainage, WSDOT Standard Specification 9-33. The underslab drainage system pipes should be connected to a header pipe and routed to a sump or gravity drain. Appropriate cleanouts for drainpipe maintenance should be installed. A larger diameter pipe will allow for easier maintenance of drainage systems. The flow rate for the planned excavation in the below slab drainage and below grade wall drainage systems is anticipated to be less than 5 gpm.

If no special waterproofing measures are taken, leaks and/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 vapor barrier should be used below slab-on-grade floors located in occupied portions of the building. Specification of the vapor barrier requires consideration of the performance expectations of the occupied space, the type of flooring planned and other factors, and is typically completed by other members of the project team.

Below-Grade Walls

Permanent Below-Grade Walls

Permanent below-grade walls constructed adjacent to temporary shoring walls should be designed for the earth pressures presented in Figure 4. Surcharge loads (floor slabs, etc.) can be evaluated using the surcharge pressure in Figure 5. Other surcharge loads, such as from construction equipment or construction staging areas, should be considered on a case-by-case basis. 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 above in the “Excavation Support” section of this report, and tied to permanent drains to remove water to suitable discharge points.

Other Cast-in-Place Walls

Conventional cast-in-place walls may be necessary for small retaining structures located on-site. The lateral soil pressures acting on conventional cast-in-place subsurface walls will depend on the nature, density and configuration of the soil behind the wall and the amount of lateral wall movement that can occur as backfill is placed.

For walls that are free to yield at the top at least 0.1 percent of the height of the wall, soil pressures will be less than if movement is limited by such factors as wall stiffness or bracing. Assuming that the walls are backfilled and drainage is provided as outlined in the following paragraphs, we recommend that yielding walls supporting horizontal backfill be designed using an equivalent fluid density of 35 pcf (triangular distribution), while non-yielding walls supporting horizontal backfill be designed using an equivalent fluid density of 55 pcf (triangular distribution). For seismic loading conditions, a rectangular earth pressure equal to 7H psf (where H is the height of the wall in feet) should be added to the active/at-rest pressures. Other surcharge loading should be applied as appropriate.

Lateral resistance for conventional cast-in-place walls can be provided by frictional resistance along the base of the wall and passive resistance in front of the wall. For walls founded on native soils, the allowable frictional resistance may be computed using a coefficient of friction of 0.4 applied to vertical dead-load forces. The allowable passive resistance may be computed using an equivalent fluid density of 400 pcf (triangular distribution). The above coefficient of friction and passive equivalent fluid density values incorporate a factor of safety of about 1.5.

The above soil pressures assume that wall drains will be installed to prevent the buildup of hydrostatic pressure behind the walls, as discussed below.

Drainage

Drainage behind the permanent below-grade walls is typically provided using prefabricated drainage board attached to the temporary shoring walls. Weep pipes that extend through the permanent below-grade wall should be installed around the perimeter of the building at the footing elevation. The weep pipes should have a minimum diameter of 4 inches. The weep pipes through the permanent below-grade wall should be spaced no more than 20 feet on center and should be hydraulically connected to the sump. These weep pipes may be designed for a hard connection to the perimeter drains discussed above in the "Below-Slab Drainage" section of this report.

The earth pressures for permanent below-grade walls assume that adequate drainage is provided behind the wall. Prefabricated geocomposite drainage material, such as Aquadrain 15X, should be installed vertically to the face of the lagging/shotcrete. The Aquadrain 15x drainage material should terminate at the base of the shoring wall into a base drain product such as Aquadrain 100DB. The weep pipes that penetrate the basement wall should be located in the base drain layer. For soldier pile or soil nail shoring walls, the drainage material should be installed on the excavation side of the lagging/shotcrete facing, with the fabric adjacent to the lagging/shotcrete facing.

Full wall face coverage is recommended to minimize seepage and/or wet areas at the face of the permanent wall. Full wall face coverage should extend from the weep pipe elevation up to about 3 to 5 feet below the top of the wall to reduce the potential for surface water to enter the wall drainage system. Although the use of full wall face coverage will reduce the likelihood of seepage and/or wet areas at the face of the permanent wall, the potential still exists for these conditions to occur. If this is a concern, waterproofing should be specified.

Positive drainage should be provided behind cast-in-place retaining walls by placing a minimum 2-foot-wide zone of Mineral Aggregate Type 17 (bank run gravel), City of Seattle Standard Specification 9-03.16, with the exception that the percent passing the U.S. No. 200 sieve is to be less than 3 percent. A perforated drainpipe should be placed near the base of the retaining wall to provide drainage. The drainpipe should be surrounded by a minimum of 6 inches of Mineral Aggregate Type 22 (¾-inch crushed gravel) or Type 5

(1-inch washed gravel), City of Seattle Standard Specification 9-03.16, or an alternative approved by GeoEngineers. The Type 22 or Type 5 material should be wrapped with a geotextile filter fabric meeting the requirements of construction geotextile for underground drainage, WSDOT Standard Specification 9-33. The wall drainpipe should be connected to a header pipe and routed to a sump or gravity drain. Appropriate cleanouts for drainpipe maintenance should be installed. A larger-diameter pipe will allow for easier maintenance of drainage systems.

Earthwork

Subgrade Preparation

The exposed subgrade in structure and hardscape areas should be evaluated after site excavation is complete. Disturbed areas below slabs should be recompacted if the subgrade soil consists of granular material. If the subgrade soils consist of disturbed soils, it will likely be necessary to remove and replace the disturbed soil with structural fill unless the soil can be adequately moisture-conditioned and compacted.

Structural Fill

Fill placed to support structures, placed behind retaining structures, and placed below pavements and sidewalks will need to be specified as structural fill as described below:

- If structural fill is necessary beneath building slabs, the fill should meet the requirements of Mineral Aggregate Type 2 or Type 17 (1¼-inch minus crushed rock or bank run gravel), City of Seattle Standard Specification 9-03.16.
- If structural fill is necessary beneath building foundations, the fill should consist of CDF or structural concrete.
- Structural fill placed behind retaining walls should meet the requirements of Mineral Aggregate Type 17 (bank run gravel), City of Seattle Standard Specification 9-03.16.
- Structural fill placed within utility trenches and below pavement and sidewalk areas should consist of CDF, or fill meeting the requirements of Mineral Aggregate Type 17 (bank run gravel), City of Seattle Standard Specification 9-03.16.
- Structural fill placed around perimeter footing drains, underslab drains and cast-in-place wall drains should meet the requirements of Mineral Aggregate Type 5 (1-inch washed gravel) or Type 22 (¾-inch crushed gravel), City of Seattle Standard Specification 9-03.16, with the exception that the percent fines be less than 3 percent.
- Structural fill placed as capillary break material should meet the requirements of Type 22 (¾-inch crushed gravel), City of Seattle Standard Specification 9-03.16.
- Structural fill placed as crushed surfacing base course below pavements and sidewalks should meet the requirements of Mineral Aggregate Type 2 (1¼-inch minus crushed rock), City of Seattle Standard Specification 9-03.16.

On-site Soils

The on-site soils are moisture-sensitive and may have natural moisture contents higher than the anticipated optimum moisture content for compaction. As a result, the on-site soils may require moisture conditioning in order to meet the required compaction criteria during dry weather conditions and will not be suitable for reuse during wet weather. Furthermore, most of the fill soils required for the project have specific gradation requirements, and the on-site soils do not meet these gradation requirements. If the contractor wants to use on-site soils for structural fill, GeoEngineers can evaluate the on-site soils for suitability as structural fill, as required.

It may be feasible to reuse on-site soils with the addition of cement treatment. If cement treatment is considered, GeoEngineers can work with the contractor to determine the soil/cement ratio and placement procedures.

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 1 foot in thickness. Each lift should be conditioned to the proper moisture content and compacted to the specified density before placing subsequent lifts. Structural fill should be compacted to the following criteria:

- Structural fill placed in building areas (supporting foundations or slab-on-grade floors) and in pavement and sidewalk areas (including utility trench backfill) should be compacted to at least 95 percent of the maximum dry density (MDD) estimated in general accordance with ASTM D 1557.
- Structural fill placed against subgrade walls should be compacted to between 90 and 92 percent. Care should be taken when compacting fill against subsurface walls to avoid over-compaction and hence overstressing the walls.

We recommend that GeoEngineers be present during probing of the exposed subgrade soils in building and pavement areas, and during placement of structural fill. We will evaluate the adequacy of the subgrade soils and identify areas needing further work, perform in-place moisture-density tests in the fill to verify compliance with the compaction specifications, and advise on any modifications to the procedures that may be appropriate for the prevailing conditions.

Weather Considerations

The on-site soils contain a sufficient percentage of fines (silt and clay) to be moisture-sensitive. When the moisture content of these soils is more than a few percent above the optimum moisture content, these soils become muddy and unstable, and operation of equipment on these soils is difficult. Additionally, disturbance of near-surface soils should be expected if earthwork is completed during periods of wet weather. During wet weather, we recommend that:

- 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 such that areas of ponded water do not develop. The contractor should take measures to prevent surface water from collecting in excavations and trenches. Measures should be implemented to remove surface water from the work area;
- slopes with exposed soils should be covered with plastic sheeting or similar means;
- 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 reduce the extent to which these soils become wet or unstable;
- construction traffic should be restricted to specific areas of the site, preferably areas that are surfaced with materials not susceptible to wet weather disturbance; and

- construction activities should be scheduled so that the length of time that soils are left exposed to moisture is reduced to the extent practicable.

Temporary Slopes

Temporary slopes may be used around the site to facilitate early installation of shoring or in the transition between levels at the base of the excavation. We recommend that temporary slopes constructed in the fill be inclined at 1½H:1V (horizontal to vertical) and that temporary slopes in the glacially consolidated soils be inclined at 1H:1V. Flatter slopes may be necessary if seepage is present on the face of the cut slopes or if localized sloughing occurs. For open cuts at the site, we recommend that:

- no traffic, construction equipment, stockpiles or building supplies be allowed at the top of the cut slopes within a distance of at least 5 feet from the top of the cut;
- exposed soil along the slope be protected from surface erosion by using waterproof tarps or plastic sheeting;
- construction activities be scheduled so that the length of time the temporary cut is left open is reduced to the extent practicable;
- erosion control measures be implemented as appropriate such that runoff from the site is reduced to the extent practicable;
- surface water be diverted away from the slope; and
- the general condition of the slopes be observed periodically by the geotechnical engineer to confirm adequate stability.

Because the contractor has control of the construction operations, the contractor should be made responsible for the stability of cut slopes, as well as the safety of the excavations. Shoring and temporary slopes must conform to applicable local, state and federal safety regulations.

Recommended Additional Geotechnical Services

GeoEngineers will complete a design-level geotechnical engineering evaluation for the project, which is anticipated to confirm or modify as appropriate the preliminary design recommendations presented in this report. 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 the installation of the shoring system, review/collect shoring monitoring data, evaluate the suitability of the foundation subgrades, observe installation of subsurface drainage measures, evaluate structural backfill, observe the condition of temporary cut slopes, 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 or Use.

LIMITATIONS

We have prepared this report for the exclusive use of [redacted] and their authorized agents for the 314 Bell Street Tower project in Seattle, Washington.

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

REFERENCES

City of Seattle, 2014, "Standard Specifications for Road, Bridge and Municipal Construction."

Farallon Consulting, 2017, "[redacted] Belltown Property, 314 Bell and 2315 4th Avenue, Seattle, Washington Site Plan and Boring Logs."

Hart Crowser, 1990, "Queensgate III Site Plan and Boring Logs."

International Code Council, 2015, "International Building Code."

Roger Lowe Associates, 1976, "Report, Foundation Investigation, Proposed Security Tower Building, Fourth and Bell Street, Seattle, Washington."

U.S. Department of Transportation, Federal Highways Administration, 1999, "Geotechnical Engineering Circular No. 4, Ground Anchors and Anchored Systems," FHWA Report No. FHWA-IF-99-015.

U.S. Geological Survey – U.S. Seismic Design Maps, National Seismic hazard Mapping project Software, 2012/2015 IBC, 2008 data, 2016.

Washington State Department of Transportation, 2016, "Standard Specifications for Road, Bridge and Municipal Construction."

Washington State Department of Transportation, 2010, "SR 99 Bored Tunnel Alternative Design-Build Project, Appendix G2."

FIGURES

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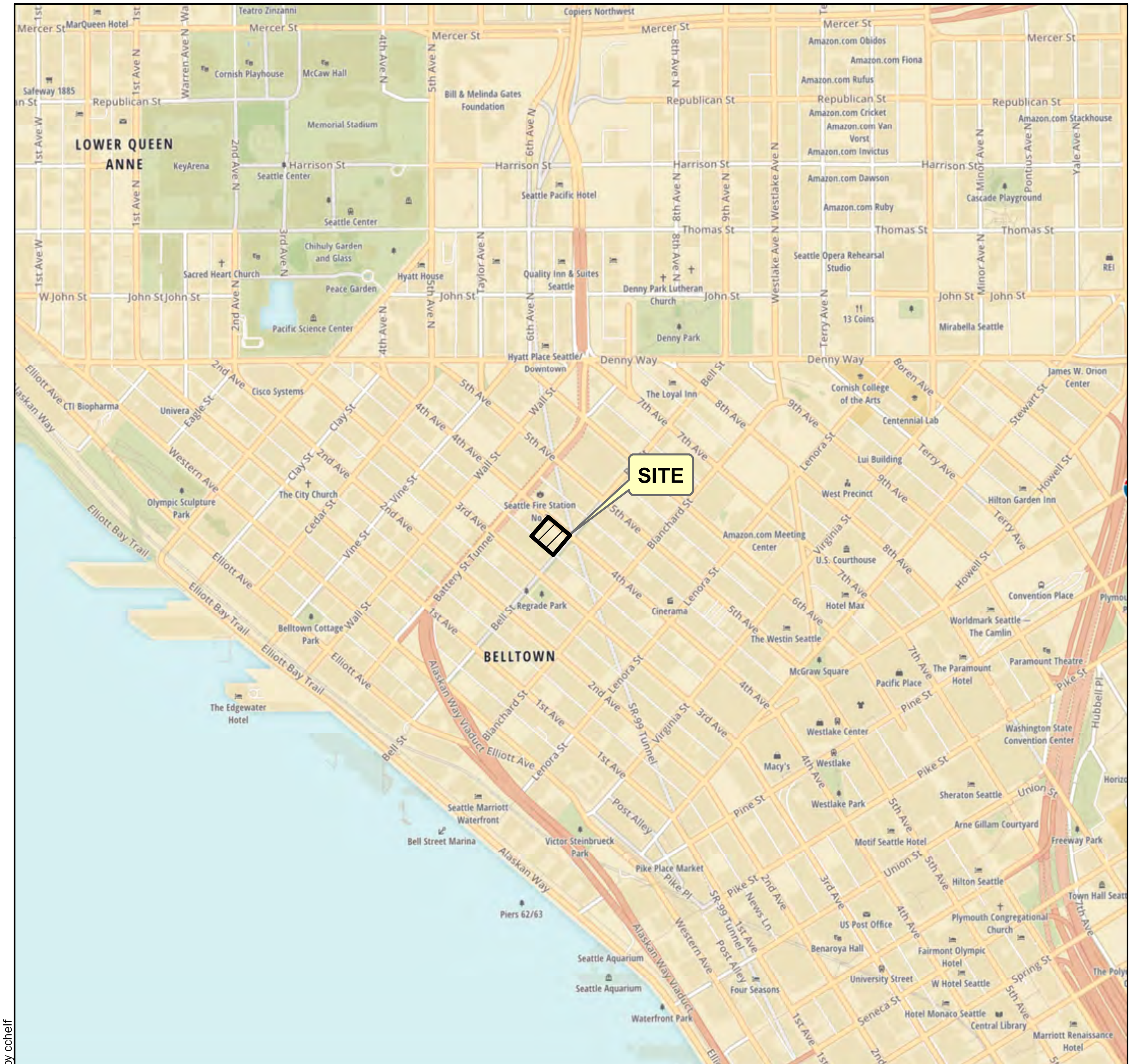

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Feet

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: Mapbox Open Street Map, 2016

Projection: NAD 1983 UTM Zone 10N

Vicinity Map

314 Bell Street Tower
Seattle, Washington

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Figure 1

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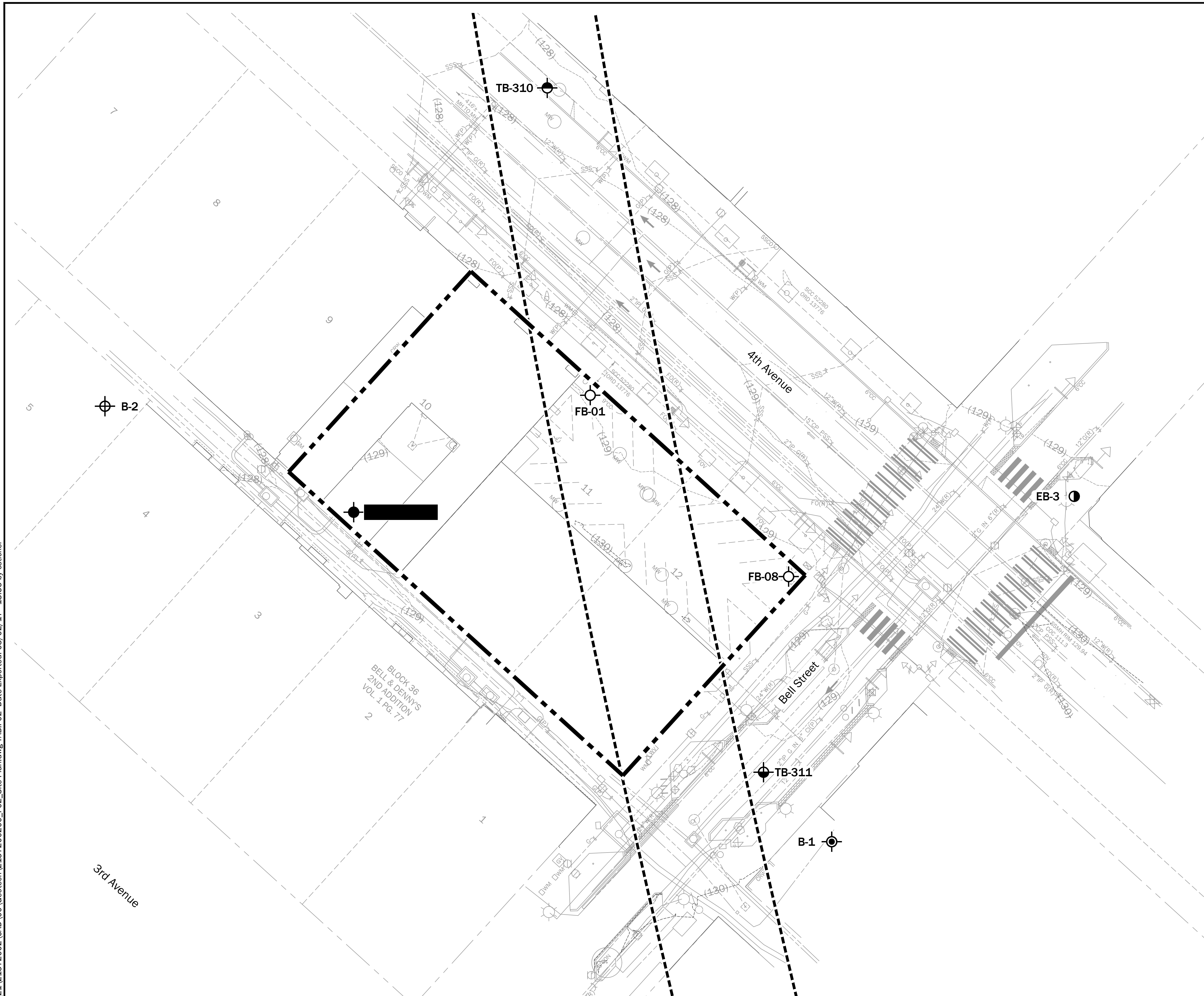
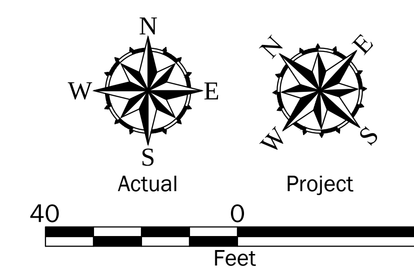


Legend

- Site Boundary
- SR 99 Bored Tunnel
- FB-01 Boring by Farallon, 2017 (Current Study)
- [redacted]
- TB-310 Boring by Shannon & Wilson, 2010
- TB-311 Sonic Core Boring by Shannon & Wilson, 2010
- EB-3 Boring with Monitoring Well by Shannon & Wilson, 2002
- B-2 Boring by Hart Crowser, 1990
- B-1 Boring by Roger Lowe Associates, 1976



Notes:

1. The locations of all features shown are approximate.
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Data Source:
Base survey by Bush, Roed and Hitchings, dated 01-18-2017.

Site Plan

314 Bell Street Tower
Seattle, Washington

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Figure 2

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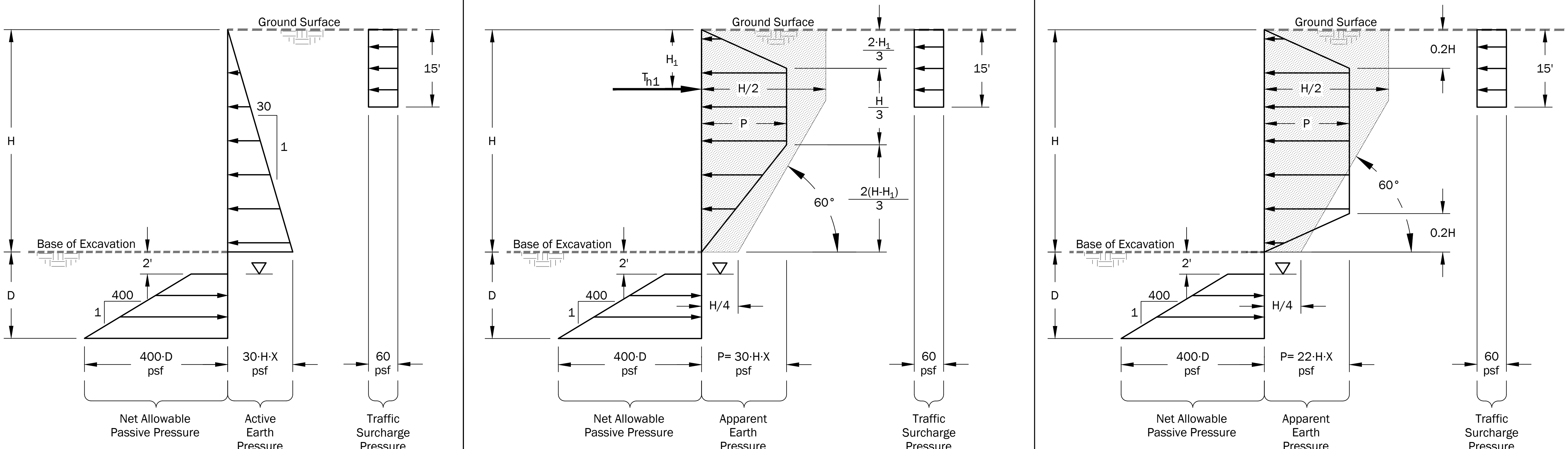
Cantilever Soldier Pile | Conventional Soldier Pile Wall with One Level of Tiebacks | Conventional Soldier Pile Wall with Multiple Levels of Tiebacks



Wall	Earth Pressure Coefficient, X
North,West	1.25
East,South	1.00

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
- ▽ Design Groundwater Elevation for Drained Walls/ Passive Resistance Design

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. Additional surcharge from footings of adjacent buildings should be included in accordance with recommendations provided on Figure 5.
5. 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

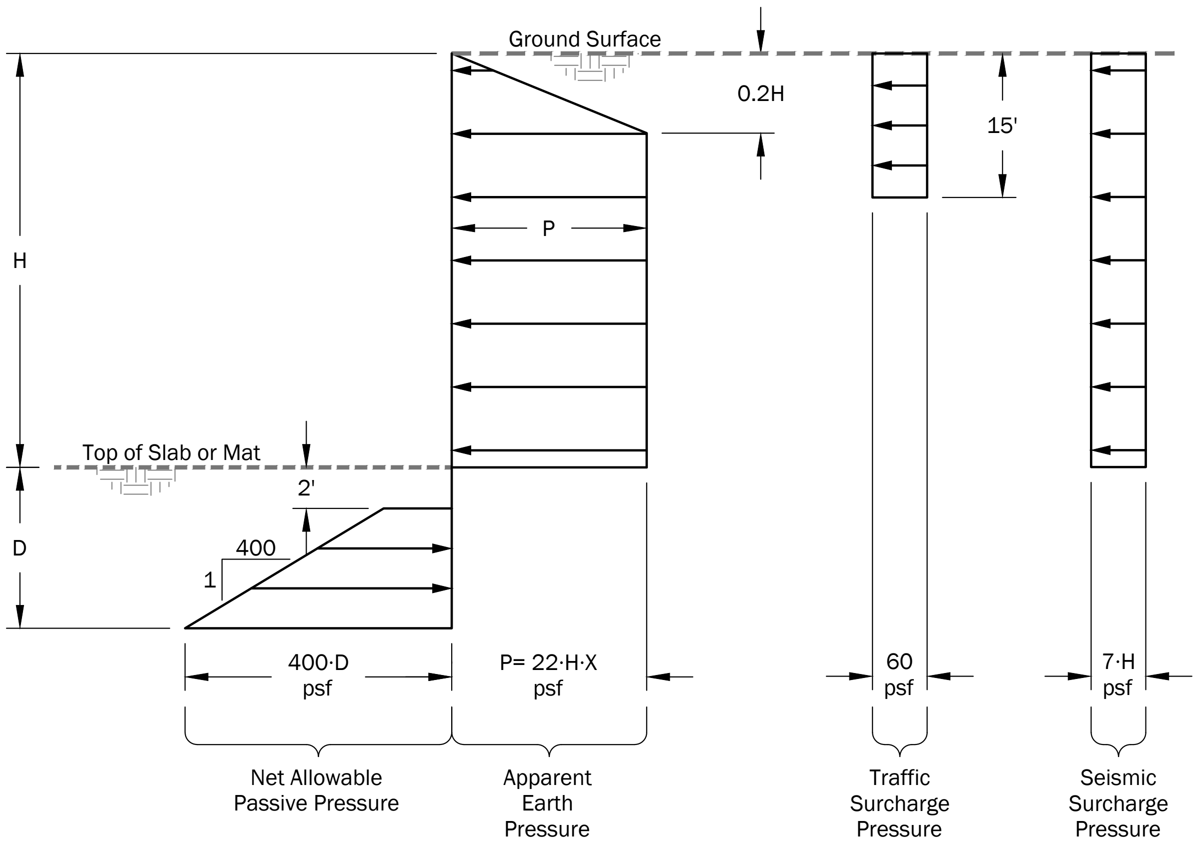
Earth Pressure Diagrams - Temporary Soldier Pile & Tieback Wall

314 Bell Street Tower
Seattle, Washington

GeoEngineers

Figure 3

Permanent Basement Wall Against Temporary Shoring



Legend

H = Height of Basement Wall, Feet

D = Foundation Embedment Depth, Feet

P = Maximum Apparent Earth Pressure, Pounds per Square Foot

Wall	Earth, Pressure, X
North,West	1.25
East,South	1.00

Not To Scale

Notes:

1. Passive earth pressure includes a factor of safety of 1.5
2. Additional surcharge from footings of adjacent buildings should be included in accordance with recommendations provided on Figure 5.
3. This pressure diagram is appropriate for permanent basement walls constructed in front of temporary shoring walls with tieback or soil nail anchors. 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.
4. The static earth pressure does not include a factor of safety and represents the actual anticipated static earth pressure.

Earth Pressure Diagram
Permanent Below Grade Walls

314 Bell Street Tower
Seattle, Washington

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Figure 4

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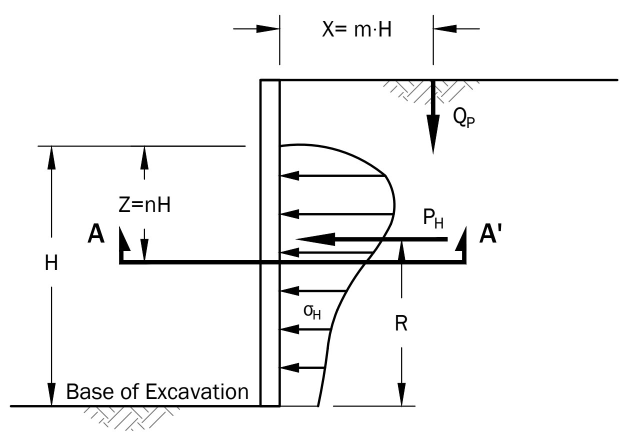
Lateral Earth Pressure from Point Load, Q_P (Spread Footing)



For $m \le 0.4$

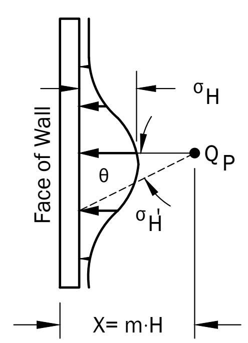
$$\sigma_H = \frac{0.28 Q_P n^2}{H^2(0.16+n^2)^3}$$

For $m > 0.4$

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

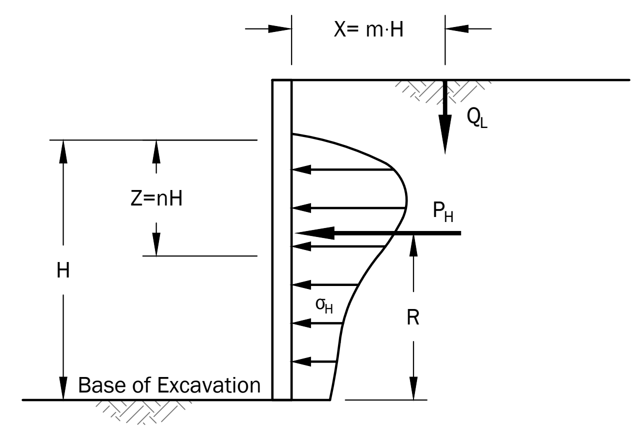
$$\sigma'_H = \sigma \, COS^2 (1.1\theta)$$

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 $m \le 0.4$

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

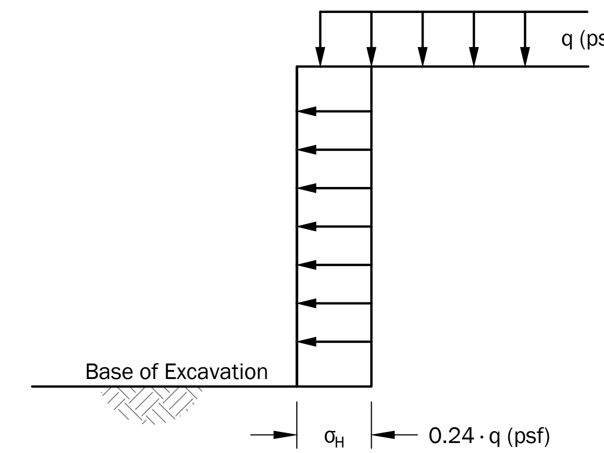
For $m > 0.4$

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

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

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. Lateral earth pressures from surcharge should be added to earth pressures presented on Figures 3 and 4.
3. See report text for where surcharge pressures are appropriate.

Not To Scale

Recommended Surcharge Pressure

314 Bell Street Tower
Seattle, Washington

GEOENGINEERS

Figure 5

APPENDICES

APPENDIX A
Field Explorations

APPENDIX A
FIELD EXPLORATIONS

Subsurface conditions were explored at the site by observing the explorations completed by the environmental consultant, Farallon Consulting. GeoEngineers observed the completion of FB-01, FB-08, and [redacted] The borings were completed to depths of approximately 50½ and 51 feet below the existing ground surface. The borings were completed by Holocene Drilling, Inc. on January 25 and 30, 2017.

The locations of the explorations were estimated by taping/pacing from existing site features. The approximate exploration locations are shown on the Site Plan, Figure 2.

Borings

The borings were completed using truck and trailer-mounted, continuous-flight, hollow-stem auger drilling equipment. The borings were continuously monitored by a geotechnical engineer or geologist from our firm who examined and classified the soils encountered, obtained representative soil samples, observed groundwater conditions and prepared a detailed log of each exploration.

The soils encountered in the borings were generally sampled at 2½- and 5-foot vertical intervals with a modified California split-barrel standard penetration test (SPT) sampler. The disturbed samples were obtained by driving the sampler 18 inches into the soil with a 140-pound automatic hammer free-falling 30 inches. The number of blows required for each 6 inches of penetration was recorded. The blow count ("N-value") of the soil was 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 precluded driving the full 18 inches, the penetration resistance for the partial penetration was entered on the logs. The blow counts are shown on the boring logs at the respective sample depths.

Soils encountered in the borings were visually classified in general accordance with the classification system described in Figure A-1. A key to the boring log symbols is also presented in Figure A-1. The logs of the borings are presented in Figures A-2 through A-4. The boring logs are based on our interpretation of the field and laboratory data and indicate the various types of soils and groundwater conditions encountered. The logs also indicate the depths at which these soils or their characteristics change, although the change may actually be gradual. If the change occurred between samples, it was interpreted. The densities noted on the boring logs are based on the blow count data obtained in the borings and judgment based on the conditions encountered.

Observations of groundwater conditions were made during drilling. The groundwater conditions encountered during drilling are presented on the boring logs. Groundwater conditions observed during drilling represent a short-term condition and may or may not be representative of the long-term groundwater conditions at the site. Groundwater conditions observed during drilling should be considered approximate.

[redacted]

[redacted]

[redacted]

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
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

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Figure A-1

Drilled	Start 1/25/2017	End 1/25/2017	Total Depth (ft)	50.5	Logged By SLG, Checked By CWM	Driller	Holocene Drilling, Inc.	Drilling Method	Hollow-stem Auger

Surface Elevation (ft) / Vertical Datum	129 / NAVD88	Hammer Data	Automatic 140 (lbs) / 30 (in) Drop	Drilling Equipment	Mobile B-59
Easting (X) / Northing (Y)	1267722 / 228185	System Datum	WA State Plane North NAD83 (feet)	Groundwater not observed at time of exploration	

Notes: Boring jointly logged with environmental consultant (Farallon Consulting), modified California sampler used.

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							AC	4 inches asphalt concrete pavement			Air knife/vactor to 5 feet. Soil description based on visual observation.
								ML	Gray silt with trace sand and trace gravel (hard, moist) (glacially consolidated soils)			
125												
	5		18	57		1						
120												
	10		18	71		2						
115												
	15		18	55		3						
110												
	20		17	84/11"		4						
								CL-ML	Gray silty clay with sand (hard, moist)			
105												
	25		12	50/6"		5 AL				14		AL (LL = 23; PI = 5)
100												
	30		4	50/4"		6						
95												
	35											

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

Log of Boring FB-01

GeoEngineers

Project: 314 Bell Street Tower
Project Location: Seattle, Washington
Project Number: 21572-002-00

Figure A-2
Sheet 1 of 2

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
	35		5	50/5"		7						
90												
	40		2	50/4"		8						
85												
	45		0	50/4"		9						
80								SP-SM	Gray fine to medium sand with gray silt interbeds (very dense, moist)			
	50		5	50/5"		10						

Log of Boring FB-01 (continued)

GeoEngineers

Project: 314 Bell Street Tower
Project Location: Seattle, Washington
Project Number: 21572-002-00

Drilled	Start 1/25/2017	End 1/25/2017	Total Depth (ft)	50.75	Logged By SLG / Checked By CWM	Driller	Holocene Drilling, Inc.	Drilling Method	Hollow-stem Auger

Surface Elevation (ft) / Vertical Datum	129 / NAVD88	Hammer Data	Automatic 140 (lbs) / 30 (in) Drop	Drilling Equipment	Diedrich D-50
Easting (X) / Northing (Y)	1267801 / 228113	System Datum	WA State Plane North NAD83 (feet)	Groundwater not observed at time of exploration	

Notes: Boring jointly logged with environmental consultant (Farallon Consulting), modified California sampler used.

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							AC	4 inches asphalt concrete pavement			Air knife/vactor to 5 feet. Soil description based on visual observation.
								ML	Gray silt with trace sand and trace gravel (hard, moist) (glacially consolidated soils)			
125												
	5		12	50/6"		1						
120												
	10		17	95/11"		2						
115												
	15		18	72		3						
								CL	Gray clay (hard, moist)			
110												
	20		18	88		4						
105												
	25		18	75		5						
								SM	Gray silty fine to medium sand with gray silt interbeds (very dense, moist)			
100												
	30		12	50/6"		6						
95												
	35											

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

Log of Boring FB-08

GeoEngineers

Project: 314 Bell Street Tower
Project Location: Seattle, Washington
Project Number: 21572-002-00

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
	35		4	50/1"		7						
90												
	40		8	50/6"		8 %F			Grades to without silt interbeds	10	24	
85												
	45		2	50/2"		9						
80												
	50		3	50/2"		10						

FIELD DATA

Log of Boring FB-08 (continued)

GeoEngineers

Project: 314 Bell Street Tower
Project Location: Seattle, Washington
Project Number: 21572-002-00

Figure A-3
Sheet 2 of 2

APPENDIX B
Laboratory Testing

APPENDIX B
LABORATORY TESTING

Soil samples obtained from the explorations were transported to GeoEngineers' laboratory and evaluated to confirm or modify field classifications, as well as to evaluate engineering properties of the soil samples. Representative samples were selected for laboratory testing to determine the moisture content and percent fines (material passing the U.S. No. 200 sieve). The tests were performed in general accordance with test methods of ASTM International (ASTM) or other applicable procedures.

The Atterberg Limit test results are presented in Figure B-1. The results of the moisture content and percent fines determinations are presented at the respective sample depths on the exploration logs in Appendix A.

Moisture Content

Moisture content tests were completed in general accordance with ASTM D 2216 for representative samples obtained from the explorations. The results of these tests are presented on the exploration logs in Appendix A at the depths at which the samples were obtained.

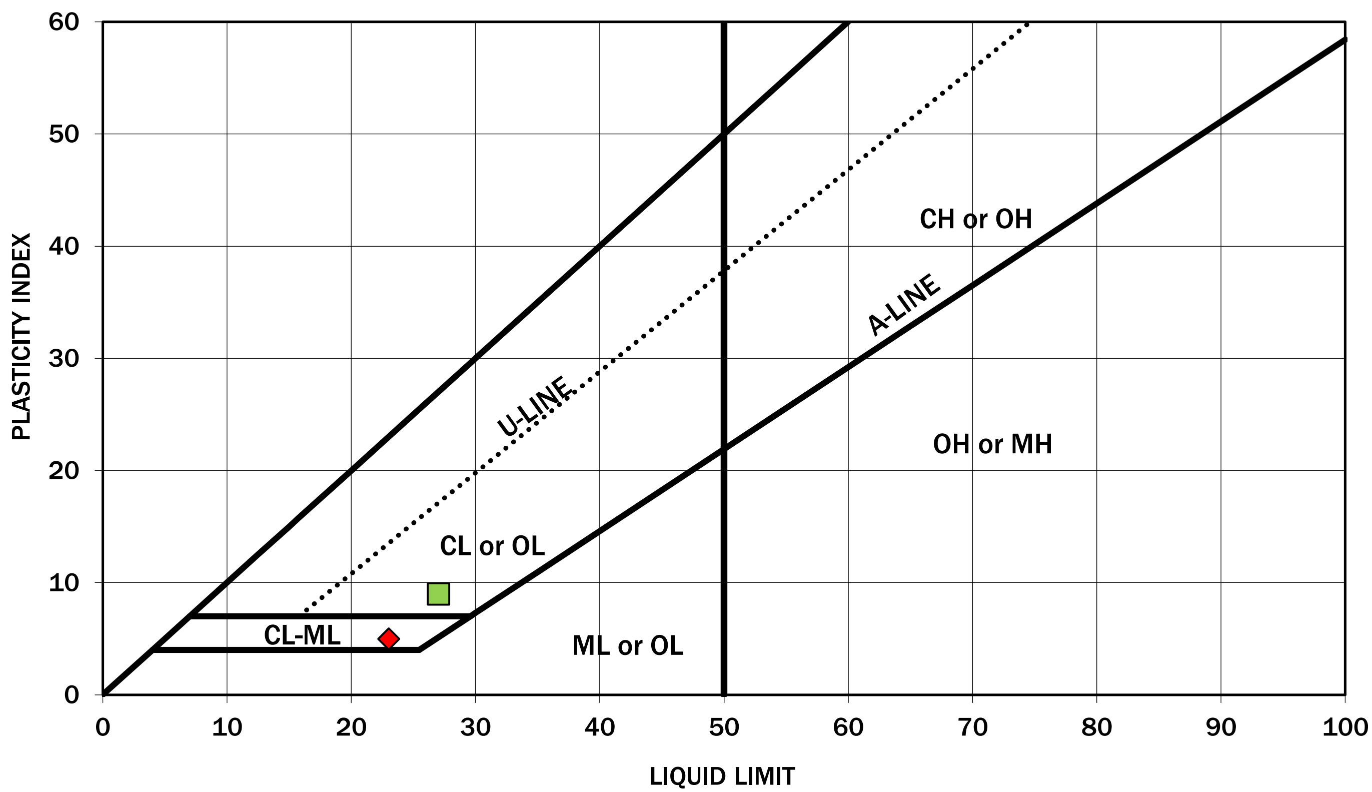
Percent Passing U.S. No. 200 Sieve (%F)

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.

Atterberg Limits Testing

Atterberg limits testing was performed on selected fine-grained soil samples. The tests were used to classify the soil as well as to evaluate index properties. The liquid limit and the plastic limit were estimated through a procedure performed in general accordance with ASTM D 4318. The results of the Atterberg limits testing are summarized in Figure B-1.

PLASTICITY CHART



Symbol	Boring Number	Depth (feet)	Moisture Content (%)	Liquid Limit (%)	Plasticity Index (%)	Soil Description
◆ (red diamond)	FB-01	25	14.3	23	5	Silty clay with sand (CL-ML)
■ (green square)	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

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

Atterberg Limits Test Results

314 Bell Street Tower
Seattle, Washington

GEOENGINEERS

Figure B-1

APPENDIX C
Boring Logs from Previous Studies

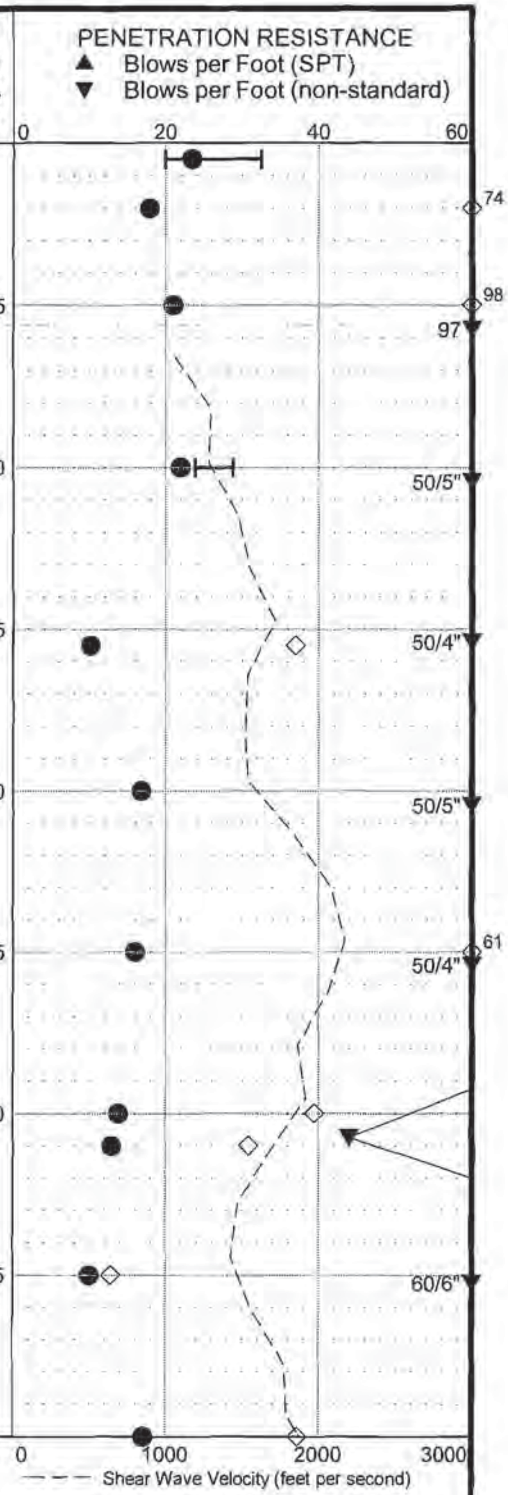
APPENDIX C
BORING LOGS FROM PREVIOUS STUDIES

Included in this section are logs from previous studies completed in the immediate vicinity of the project site.

- The logs of one boring (TB-310) and one sonic core boring (TB-311) completed by Shannon & Wilson in 2010 for the SR-99 Bored Tunnel project;
- The logs of one boring with a monitoring well (EB-3) completed by Shannon & Wilson in 2002 for the Alaskan Way Viaduct and Seawall project;
- The logs of one boring (B-2) completed by Hart Crowser in 1990 for the Queensgate III project; and
- The logs of one boring (B-1) completed by Roger Lowe Associates in 1976 for the Security Tower Building project.

SOIL DESCRIPTION Coordinates: N: 228,307 E: 1,267,709 Surface Elevation: 127.8 Ft. (NAVD88)	Depth, Ft.	PID, ppm	Samples
CONCRETE.	0.5	0	1 G
Gray, sandy, silty CLAY, trace of gravel; wet; abundant organics, abundant till chunks; CL. (Hf)	1.5	0	2
Gray, slightly gravelly, sandy, clayey SILT; wet; diamict; ML. (Qpgt)			
Very dense, gray, trace of clay to slightly clayey SILT, trace of fine sand; moist; trace of organics, scattered slickensides; ML. (Qpgl)	5.0	0	3
- Layer of clayey silt with slickensides at 10.0 feet.		0	4
Very dense, gray, slightly gravelly, silty SAND; moist; diamict; scattered slightly gravelly seams, slightly clayey with trace of organics toward bottom, scattered slickensides; SM/ML. (Qpgt) - Slightly gravelly at 15.5 feet.	13.0	0	5 E
		0	6
- Slightly clayey, slightly fine gravelly, sandy silt below 25.0 feet.		0	7 E
Very dense, gray, silty SAND, trace of gravel and clay; wet; diamict; SM. (Qpgd)	25.4		
Very dense, gray, slightly clayey, fine gravelly, silty SAND; moist; diamict; SM/ML. (Qpgt)	28.5	0	8
Very dense, gray, silty, gravelly SAND; wet; diamict; SM/GM. (Qpgd)	33.0	0	9
Very dense, green-gray and blue-gray, gravelly, silty SAND, trace of clay to slightly clayey, gravelly, sandy SILT; moist; diamict; SM/ML.	38.0		

CONTINUED NEXT SHEET



— — — Shear Wave Velocity (feet per second)

◇ % Fines (<0.075mm)

● % Water Content (use scale at top)

Plastic Limit ├─●─┤ Liquid Limit

LEGEND

- * Sample Not Recovered
- E Environmental Sample Obtained
- G Grab Sample
- 3.25" O.D. Split Spoon Sample
- 2" O.D. Split Spoon (SPT)
- P 3" O.D. Pitcher Sample
- Piezometer Screen and Sand Filter
- Bentonite-Cement Grout
- Bentonite Chips/Pellets
- Bentonite Grout
- Ground Water Level in Well
- Ground Water Level in VWP shallow = 1, deep = 2, 3, etc.

NOTES

1. The boring was performed using Mud Rotary drilling methods.
2. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
3. Refer to the report text for a proper understanding of the subsurface materials.
4. Groundwater level, if indicated above, is for the date specified and may vary.
5. Refer to KEY for explanation of symbols, codes and definitions.
6. USCS designation is based on visual-manual classification and selected lab testing.

Alaskan Way Viaduct and Seawall Program
SR 99 Bored Tunnel Project
Seattle, Washington

LOG OF BORING TB-310

May 2010 21-1-20840-075

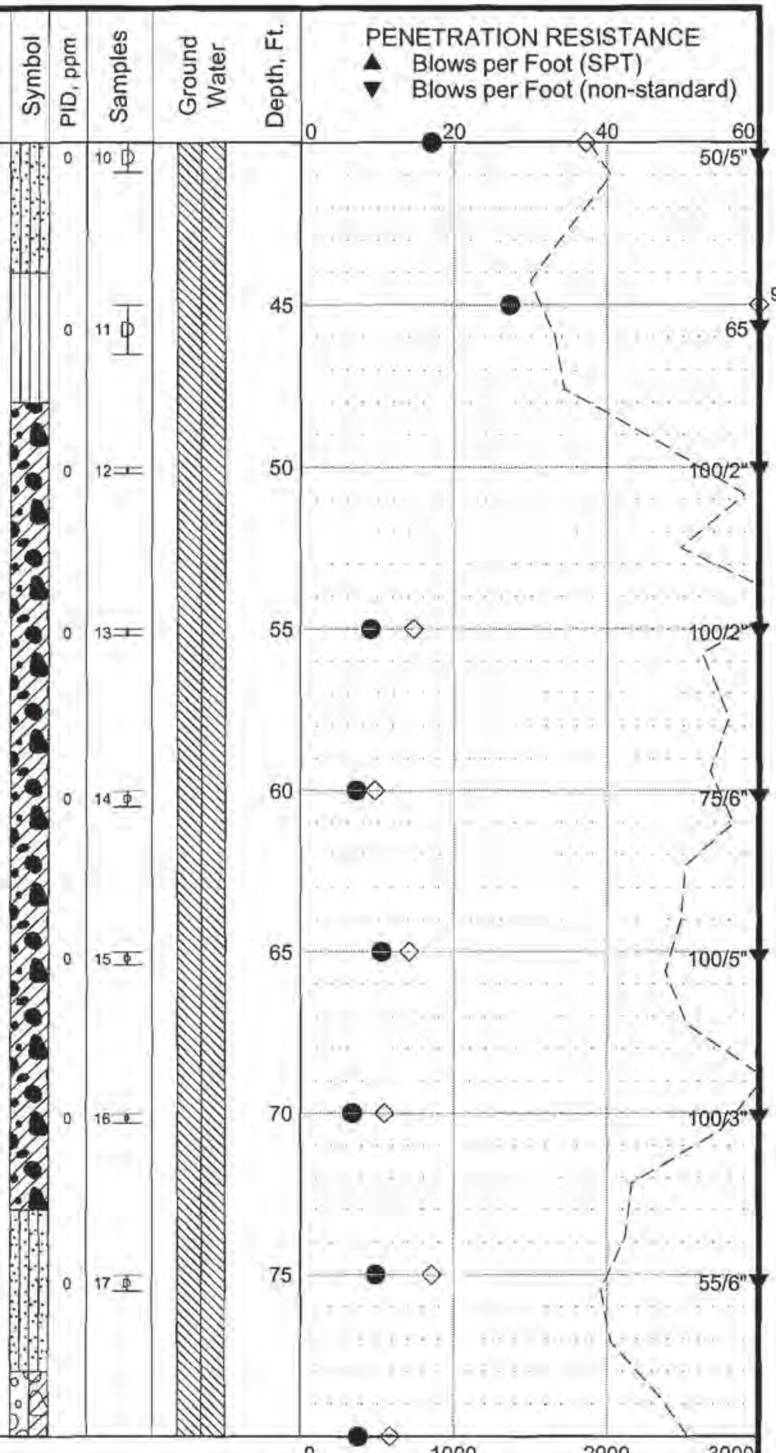
SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A.1-87
Sheet 1 of 7

REV 3

ML FINE AWW 21-09490.GPJ 21-09490.GPJ 5/18/10 Log: LNS Rev: WDN Typ: LKN

SOIL DESCRIPTION Coordinates: N: 228,307 E: 1,267,709 Surface Elevation: 127.8 Ft. (NAVD88)	Depth, Ft.
(Qpgt)	
Hard, green-gray to orange- and yellow-brown, fine to medium sandy, clayey SILT, trace of gravel; moist; oxidized, locally silty clay at top, abundant organic-rich seams; ML/CL. (Qpnl)	44.0
Very dense, yellow-brown, trace of silt to slightly silty, slightly clayey to clayey, sandy GRAVEL; wet; highly weathered; GC/GP-GC. (Qpgd)	48.0
Very dense, brown, silty, gravelly SAND, trace of clay; wet; SM/GM. (Qpgo)	73.0
Very dense, yellow-brown, gray, and orange, slightly clayey, sandy GRAVEL, trace of silt; moist; highly weathered, diamict; GP-GC. (Qpgd)	78.0



CONTINUED NEXT SHEET

LEGEND

- * Sample Not Recovered
- E Environmental Sample Obtained
- G Grab Sample
- 3.25" O.D. Split Spoon Sample
- 2" O.D. Split Spoon (SPT)
- 3" O.D. Pitcher Sample
- Piezometer Screen and Sand Filter
- Bentonite-Cement Grout
- Bentonite Chips/Pellets
- Bentonite Grout
- Ground Water Level in Well
- Ground Water Level in VWP shallow = 1, deep = 2, 3, etc.

NOTES

1. The boring was performed using Mud Rotary drilling methods.
2. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
3. Refer to the report text for a proper understanding of the subsurface materials.
4. Groundwater level, if indicated above, is for the date specified and may vary.
5. Refer to KEY for explanation of symbols, codes and definitions.
6. USCS designation is based on visual-manual classification and selected lab testing.

Alaskan Way Viaduct and Seawall Program
SR 99 Bored Tunnel Project
Seattle, Washington

LOG OF BORING TB-310

May 2010 21-1-20840-075

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A.1-87
Sheet 2 of 7

REV 3

Log: LNS Rev: WDN Typ: LKN

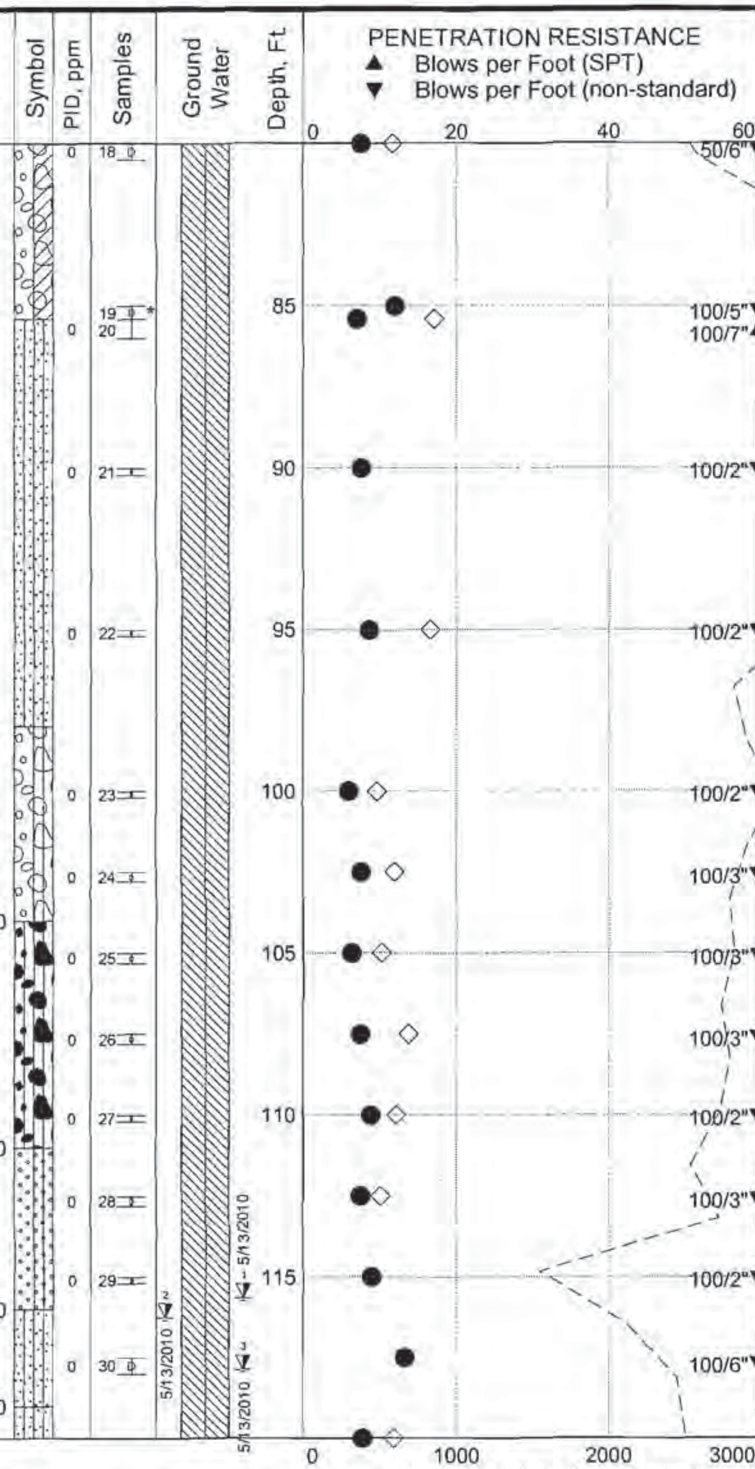
ML_FINE_AWV 21-09490.GPJ 21-09490.GPJ 5/18/10

SOIL DESCRIPTION

Coordinates: N: 228,307 E: 1,267,709

Surface Elevation: 127.8 Ft. (NAVD88)

Depth, Ft	Soil Description
85.4	Very dense, yellow-brown and gray-brown, slightly clayey to clayey, silty, gravelly SAND; moist; weathered, locally gravelly sand; SM/GM. (Qpgd)
98.0	Very dense, gray-brown, slightly silty, sandy GRAVEL, trace of clay to slightly silty, gravelly SAND, trace of clay; moist; weathered; GP-GM/SP-SM. (Qpgd)
104.0	Very dense, gray-brown, slightly silty to silty, sandy GRAVEL, trace of clay to silty, gravelly SAND, trace of clay; wet; weathered, dirty outwash, diamict; GM/GP-GM. (Qpgd) - Locally silty, gravelly sand, trace of clay below 110.0 feet.
111.0	Very dense, gray to green-gray, slightly silty, gravelly SAND, trace of clay; moist; weathered; SW-SM. (Qpgd)
116.0	Very dense, green-gray, silty, fine to medium SAND, trace of clay; moist; slightly weathered, scattered clayey sand seams; SM. (Qpgo)
119.0	



CONTINUED NEXT SHEET

LEGEND

- * Sample Not Recovered
- E Environmental Sample Obtained
- Grab Sample
- 3.25" O.D. Split Spoon Sample
- 2" O.D. Split Spoon (SPT)
- 3" O.D. Pitcher Sample
- Piezometer Screen and Sand Filter
- Bentonite-Cement Grout
- Bentonite Chips/Pellets
- Bentonite Grout
- Ground Water Level in Well
- Ground Water Level in VWP shallow = 1, deep = 2, 3, etc.

◇ % Fines (<0.075mm)

● % Water Content (use scale at top)

Plastic Limit ├──●──┤ Liquid Limit

NOTES

1. The boring was performed using Mud Rotary drilling methods.
2. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
3. Refer to the report text for a proper understanding of the subsurface materials.
4. Groundwater level, if indicated above, is for the date specified and may vary.
5. Refer to KEY for explanation of symbols, codes and definitions.
6. USCS designation is based on visual-manual classification and selected lab testing.

Alaskan Way Viaduct and Seawall Program
SR 99 Bored Tunnel Project
Seattle, Washington

LOG OF BORING TB-310

May 2010 21-1-20840-075

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

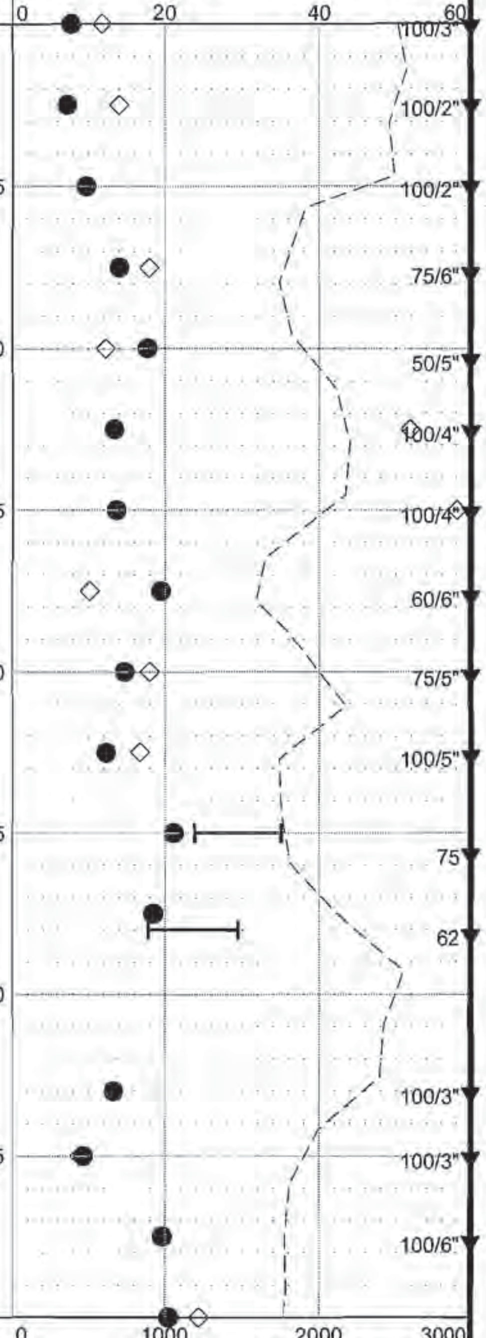
FIG. A.1-87
Sheet 3 of 7

REV 3

ML FINE AWV 21-09490.GPJ 21-09490.GPJ 5/19/10 Log: LNS Rev: WDN Typ: LKN

SOIL DESCRIPTION Coordinates: N: 228,307 E: 1,267,709 Surface Elevation: 127.8 Ft. (NAVD88)	Depth, Ft.
Very dense, gray-brown to yellow-brown, slightly silty to silty, gravelly SAND, trace of clay; moist; slightly weathered to weathered; SM/SP-SM. (Qpgd)	
Very dense, yellow-brown, silty, fine to medium SAND, trace of gravel and clay; wet; oxidized; SM/SP-SM. (Qpgo)	126.0
Very dense, slightly gravelly to gravelly, slightly sandy to sandy SILT, trace of clay; moist; diamict; ML. (Qpgt)	132.0
Very dense, gray, slightly silty to silty, fine to medium SAND; wet; siltier toward bottom; SP-SM/SP. (Qpgo)	137.0
Very dense, gray, slightly gravelly, silty SAND, trace of clay; moist; scattered diamict pockets; SM. (Qpgd)	142.0
Hard, gray, silty CLAY, trace of sand; moist; abundant peat seams and disseminated organics; CL. (Qpnl)	144.0
Hard, dark brown to gray-brown, slightly sandy to sandy, silty CLAY, trace of gravel; moist; white flecks, scattered charcoal and pumice, weathered; CL. (Qpnm)	146.3
Very dense, yellow-brown, slightly silty, sandy GRAVEL, trace of clay to slightly silty, gravelly SAND, trace of clay; moist; locally sandy towards bottom, slightly weathered, oxidized; GP-GM/SP-SM. (Qpgo)	152.0
Very dense, yellow-brown, silty, fine SAND; moist; scattered slightly clayey silt layers with vertical bedding, oxidized; SM. (Qpgo)	156.0

Sample	PID, ppm
31	0
32	0
33	0
34	0
35	0
36	0
37	0
38	0
39	0
40	0
41	0
42	0
43	0
44	0
45	0
46	0



CONTINUED NEXT SHEET

LEGEND

- * Sample Not Recovered
- E Environmental Sample Obtained
- G Grab Sample
- 3.25" O.D. Split Spoon Sample
- 2" O.D. Split Spoon (SPT)
- 3" O.D. Pitcher Sample
- Piezometer Screen and Sand Filter
- Bentonite-Cement Grout
- Bentonite Chips/Pellets
- Bentonite Grout
- Ground Water Level in Well
- Ground Water Level in VWP shallow = 1, deep = 2, 3, etc.

– – – Shear Wave Velocity (feet per second)
◇ % Fines (<0.075mm)
● % Water Content ← (use scale at top)
Plastic Limit ├──●──┤ Liquid Limit

NOTES

1. The boring was performed using Mud Rotary drilling methods.
2. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
3. Refer to the report text for a proper understanding of the subsurface materials.
4. Groundwater level, if indicated above, is for the date specified and may vary.
5. Refer to KEY for explanation of symbols, codes and definitions.
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Alaskan Way Viaduct and Seawall Program
SR 99 Bored Tunnel Project
Seattle, Washington

LOG OF BORING TB-310

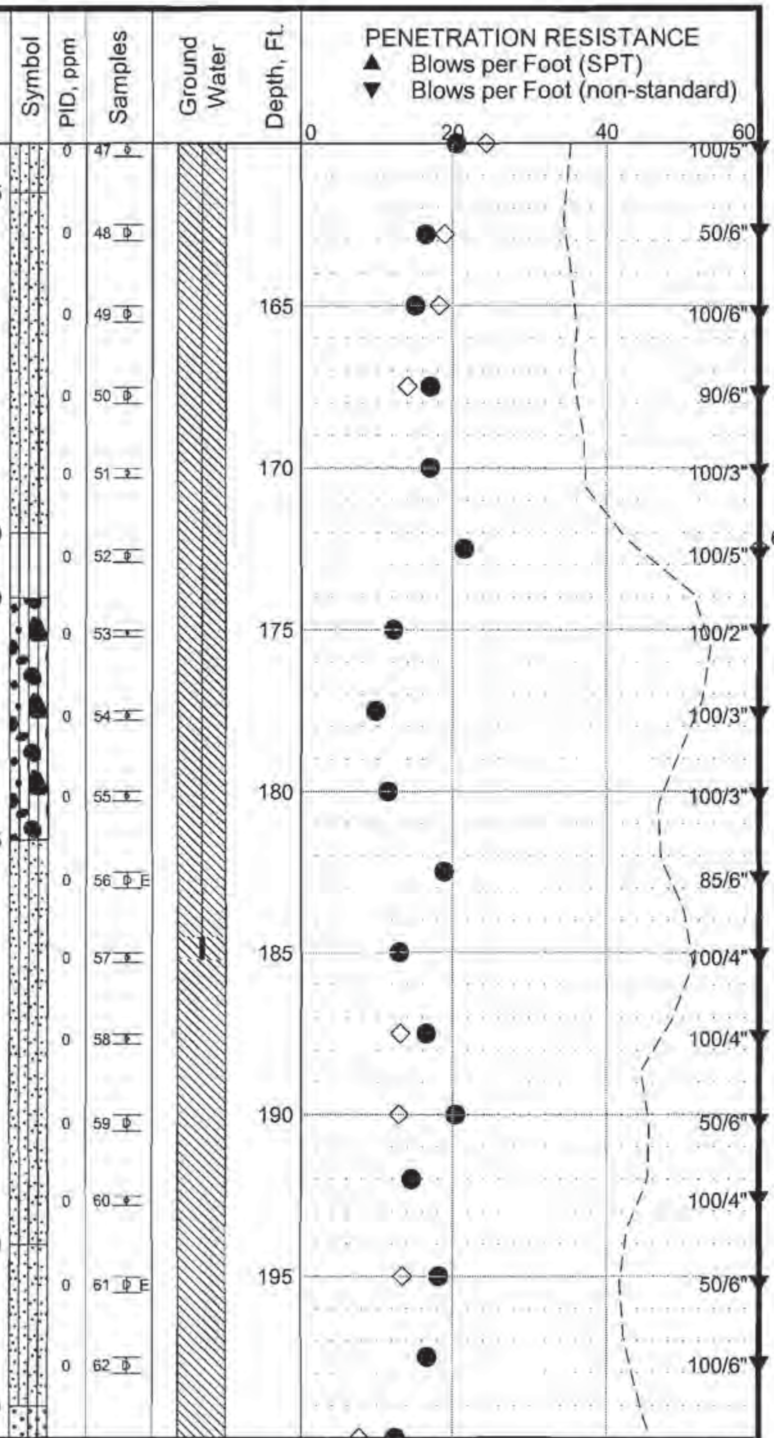
May 2010 21-1-20840-075

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A.1-87
Sheet 4 of 7

REV 3

SOIL DESCRIPTION Coordinates: N: 228,307 E: 1,267,709 Surface Elevation: 127.8 Ft. (NAVD88)	Depth, Ft.
Very dense, yellow-brown, silty, fine to medium SAND, trace of clay; moist; oxidized, scattered silty, fine sand seams toward bottom; SM. (Qpgo)	161.5
Very dense, light brown, fine sandy SILT; moist; ML. (Qpgl)	172.0
Very dense, yellow-brown, slightly clayey, silty, sandy GRAVEL; wet; weathered, diamict, less gravel toward bottom; GM/SM. (Qpgd)	174.0
Very dense, gray-brown, slightly silty to silty, fine to medium SAND, trace of fine gravel; moist to wet; locally gravelly; SM/SP-SM. (Qpgo)	181.5
Very dense, yellow-brown, silty, fine to medium SAND, trace of fine gravel; wet; interbedded with fine sand seams toward bottom; SM/SP-SM. (Qpgo)	194.0
	199.0



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SR 99 Bored Tunnel Project
Seattle, Washington

LOG OF BORING TB-310

May 2010 21-1-20840-075

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A.1-87
Sheet 5 of 7

REV 3

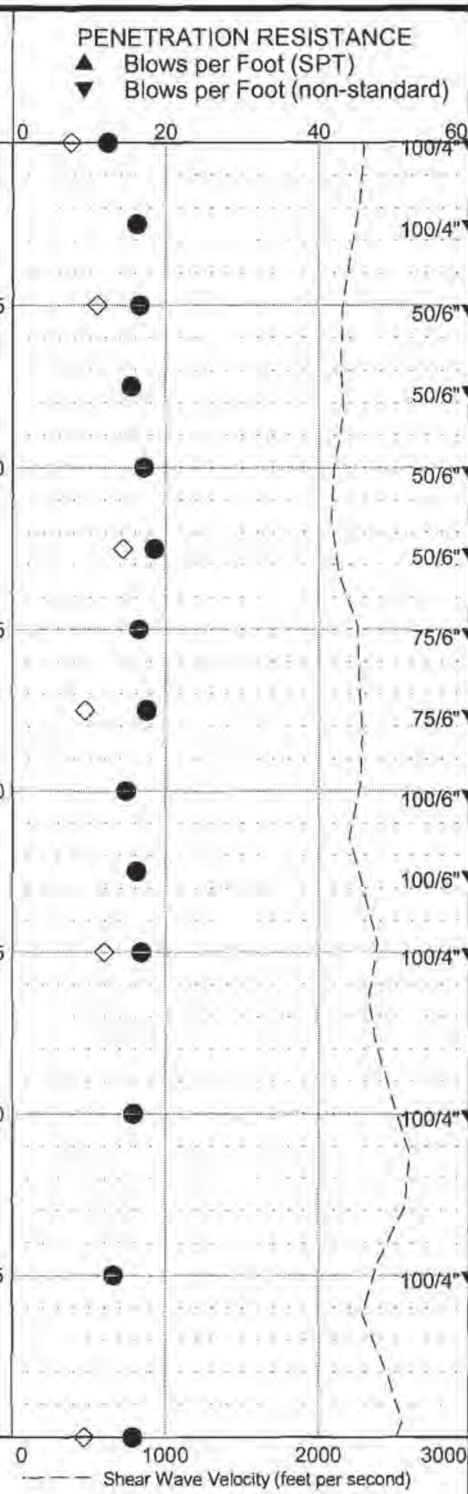
SOIL DESCRIPTION

Coordinates: N: 228,307 E: 1,267,709

Surface Elevation: 127.8 Ft. (NAVD88)

Depth, Ft.	Soil Description
	Very dense, yellow-brown, slightly silty, gravelly SAND; wet; oxidized; SW-SM. (Qpgo)
202.0	Very dense, yellow-brown to brown, slightly silty to silty, fine to medium SAND; wet; locally trace of gravel and clay, oxidized; SP-SM. (Qpgo)
221.0	Very dense, brown to gray-brown, slightly silty, fine to medium SAND; wet; locally trace of clay and fine gravel, less silt toward bottom; SP-SM/SM. (Qpgo)

PID, ppm	Samples	Blows per Foot
0	63	100/4"
0	64	100/4"
0	65	50/6"
0	66	50/6"
0	67	50/6"
0	68	50/6"
0	69	75/6"
0	70	75/6"
0	71	100/6"
0	72	100/6"
0	73	100/4"
0	74	100/4"
0	75	100/4"



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SR 99 Bored Tunnel Project
Seattle, Washington

LOG OF BORING TB-310

May 2010 21-1-20840-075

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A.1-87
Sheet 6 of 7

REV 3

SOIL DESCRIPTION Coordinates: N: 228,307 E: 1,267,709 Surface Elevation: 127.8 Ft. (NAVD88)	Depth, Ft.	Symbol	PID, ppm.	Samples	Ground Water	Depth, Ft.
			0	76		
Very dense, gray-brown, slightly silty, fine to medium SAND; wet; SP-SM. (Qpgo)	243.0		0	77		245
- *After completion of soil sampling at a depth of 250.3 feet, an additional 15 feet was drilled without soil sampling to accommodate downhole testing equipment.*	250.3		0	78		250
						255
						260
BOTTOM OF BORING COMPLETED 2/5/2010 NOTE: *Boring was vacuum-excavated to 2.2 feet on January 15, 2010.*	265.0					265
						270
						275

PENETRATION RESISTANCE
▲ Blows per Foot (SPT)
▼ Blows per Foot (non-standard)

Shear Wave Velocity (feet per second)

◇ % Fines (<0.075mm)
● % Water Content (use scale at top)
Plastic Limit ├──●──┤ Liquid Limit

LEGEND

- * Sample Not Recovered
- E Environmental Sample Obtained
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SR 99 Bored Tunnel Project
Seattle, Washington

LOG OF BORING TB-310

May 2010 21-1-20840-075

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A.1-87
Sheet 7 of 7

REV 3

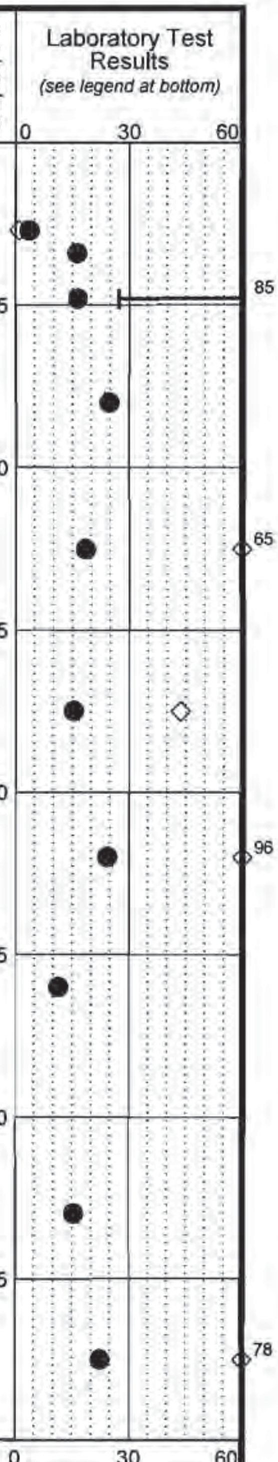
SOIL DESCRIPTION

Coordinates: N: 228,039 E: 1,267,796

Surface Elevation: 129.4 Ft. (NAVD88)

Soil Description	Depth, Ft.
ASPHALT.	0.5
Red BRICK.	0.9
CONCRETE.	1.6
Brown SAND, trace of fine gravel and silt; moist; scattered roots; SP. (Hf)	3.4
Gray-brown, slightly gravelly, clayey, sandy SILT; moist; ML. (Hf)	4.3
Gray, slightly gravelly, silty CLAY, trace of fine sand; moist; scattered slickensides; CH. (Hf)	6.0
Gray-brown, slightly gravelly, slightly sandy to sandy, slightly clayey to clayey SILT; moist; slightly oxidized, trace of roots, mottled texture; ML. (Hf)	15.0
Gray-brown, slightly gravelly to gravelly, slightly clayey to clayey, sandy SILT to slightly clayey, slightly gravelly, silty SAND; moist; mottled, scattered organics; ML/SM. (Hf) - Piece of cut lumber from 19.4 to 20.0 feet.	20.0
Green-gray SILT, trace of fine sand and clay; moist; ML. (Qpgl)	23.5
Green-gray, slightly silty, fine to medium SAND; moist; SP-SM. (Qpgo)	26.6
Green-gray, slightly gravelly, silty SAND; moist; diamict; SM. (Qpgd)	28.3
Green-gray SILT, trace of fine sand and clay; moist; scattered oxidized pockets; ML. (Qpgl)	30.0
Green, trace to slightly clayey SILT, trace of fine sand; moist; scattered organics; ML. (Qpgl)	31.0
Gray-brown, slightly silty, fine to medium SAND; moist; iron-oxide staining at upper contact; SP-SM. (Qpgo)	31.6
Gray SILT, trace of fine sand and gravel; moist; ML. (Qpgl)	32.5
Gray, slightly sandy to sandy SILT, trace of gravel; moist; diamict clasts; ML. (Qpgd)	35.9
Gray-brown, silty, gravelly SAND; moist; SM/ML. (Qpgd) - Layer of moist, fine sandy silt from 37.5 to 38.3 feet.	

Sample	PID, ppm
1 G	0
2 G	0
3 G	0
4 G	0
5 G	0
6 G	0.2
6A G E / 7 G	0.7
8 G	0.2
8A G E	
9 G	0
10 G	0



CONTINUED NEXT SHEET

LEGEND

- E Environmental Sample Obtained
- G Grab Sample
- Ground Water Level in Well
- Ground Water Level in VWP shallow = 1, deep = 2, 3, etc.
- Piezometer Screen and Sand Filter
- Bentonite-Cement Grout
- Bentonite Chips/Pellets
- Bentonite Grout
- Vibrating Wire Piezometer (VWP)

◇ % Fines (<0.075mm)
● % Water Content
Plastic Limit ⊢●⊣ Liquid Limit
Natural Water Content

NOTES

1. The boring was performed using Sonic Core drilling methods.
2. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
3. The discussion in the text of this report is necessary for a proper understanding of the nature of the subsurface materials.
4. Groundwater level, if indicated above, is for the date specified and may vary.
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7. Descriptions are based on visual examination of the soil core. Grab samples were obtained from the core for testing at the depths indicated.

Alaskan Way Viaduct and Seawall Program
SR 99 Bored Tunnel Project
Seattle, Washington

LOG OF SONIC CORE TB-311

May 2010 21-1-20840-075

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A.1-88
Sheet 1 of 7

REV 3

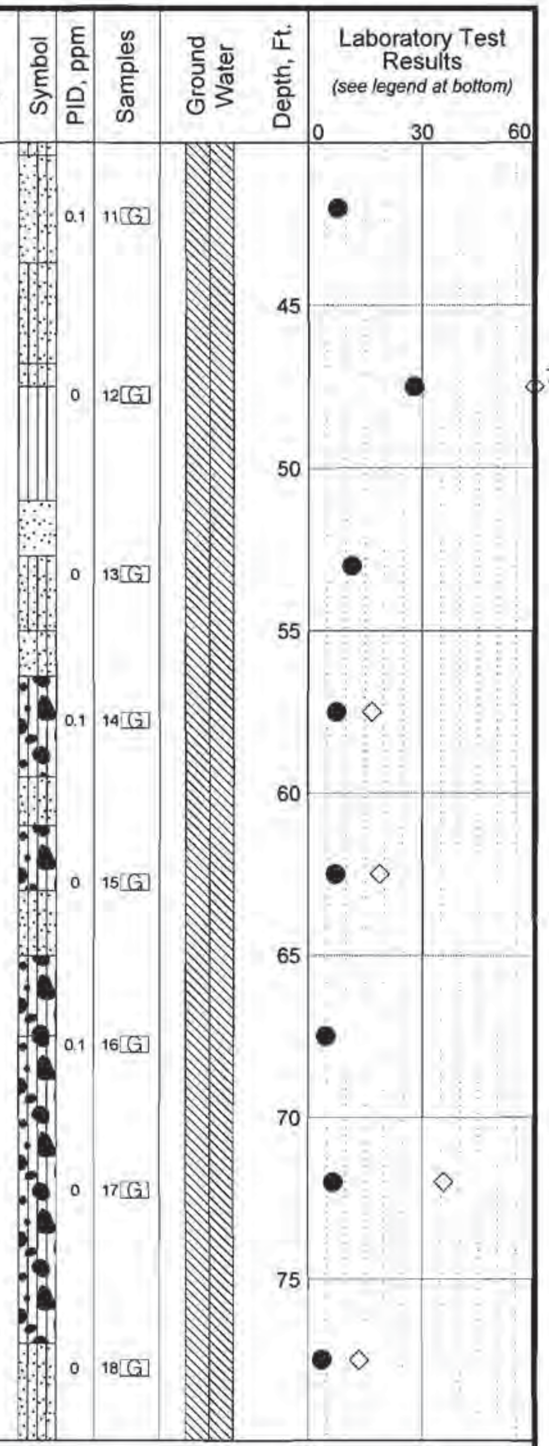
ML SONIC FINE AWV 21-09490.GPJ 21-09490.GPJ 5/18/10 Log: MSR Rev: EAS Typ: LKN

SOIL DESCRIPTION

Coordinates: N: 228,039 E: 1,267,796

Surface Elevation: 129.4 Ft. (NAVD88)

Depth, Ft.	Soil Description	PID, ppm	Samples
40.4	- Layer of moist, gray-brown, silty sand, oxidized from 39.6 to 40.4 feet.		
	Gray, slightly silty, fine to medium SAND; moist; SP-SM. (Qpgo)	0.1	11 G
43.7	Gray-brown, silty SAND, trace of clay; moist; trace of organics; SM. (Qpgo)		
46.8	Dark green-gray, silty SAND, trace of gravel; moist; highly oxidized, black oxidation; SM. (Qpns)		
47.5	Green-gray, fine sandy SILT, trace of clay and silty, fine SAND; wet; trace of organics; ML/SM. (Qpnl)	0	12 G
51.0	Gray, trace of slightly silty, slightly gravelly SAND; wet; SP/SP-SM. (Qpgo)		
52.7	Gray, slightly gravelly, silty SAND; moist; SM. (Qpgd)	0	13 G
55.0	Gray, slightly silty SAND, trace of gravel; moist; SP-SM. (Qpgo)		
56.4	Gray, silty, sandy GRAVEL, trace of clay; moist; diamict-like; GM/SM. (Qpgd)	0.1	14 G
59.5	Gray, silty, gravelly SAND; moist; SM. (Qpgd)		
61.0	Slightly green-gray, slightly clayey, silty, sandy GRAVEL; moist; diamict; GM/GC. (Qpgt)	0	15 G
63.0	Gray, gravelly, silty SAND; moist; diamict; SM. (Qpgt)		
65.0	Gray-brown, slightly clayey to clayey, silty, sandy GRAVEL; moist; diamict-like; GM. (Qpgm)		
67.5	Gray-brown, silty, sandy GRAVEL; moist; diamict clasts, slight iron-oxide staining; GM. (Qpgt)	0.1	16 G
	- Seam of fine gravelly, silty sand at 72.0 feet.	0	17 G
77.0	Gray-brown, silty, sandy GRAVEL; moist; GM/SM. (Qpgd)	0	18 G



CONTINUED NEXT SHEET

LEGEND

- E Environmental Sample Obtained
- G Grab Sample
- Ground Water Level in Well
- Ground Water Level in VWP shallow = 1, deep = 2, 3, etc.
- Piezometer Screen and Sand Filter
- Bentonite-Cement Grout
- Bentonite Chips/Pellets
- Bentonite Grout
- Vibrating Wire Piezometer (VWP)

0 30 60

◇ % Fines (<0.075mm)

● % Water Content

Plastic Limit ├●┤ Liquid Limit

Natural Water Content

NOTES

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SR 99 Bored Tunnel Project
Seattle, Washington

LOG OF SONIC CORE TB-311

May 2010 21-1-20840-075

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A.1-88
Sheet 2 of 7

REV 3

SOIL DESCRIPTION Coordinates: N: 228,039 E: 1,267,796 Surface Elevation: 129.4 Ft. (NAVD88)	Depth, Ft.	PID, ppm	Samples	Ground Water	Depth, Ft.
Gray-brown, silty, sandy GRAVEL; moist; scattered diamict clasts; GM/SM. (Qpgd)	80.0	0	19 G		
- Layer of moist, slightly clayey, silty, sandy gravel, scattered diamict clasts from 84.5 to 85.0 feet.					85
- Iron-oxide staining below 87.5 feet.		0	20 G		
Orange-gray-brown, trace to slightly clayey, silty, gravelly SAND; moist; diamict-like; SM. (Qpgd)	90.0				90
Gray-brown, silty, gravelly SAND; moist; diamict clasts; SM. (Qpgd)	93.0	0	21 G		95
Gray-brown, slightly clayey, slightly silty, gravelly SAND and clayey, silty, sandy GRAVEL; moist to wet; diamict-like, iron-oxide staining; SP-SM/GM. (Qpgd)	96.5	0	22 G		
Orange-gray-brown, slightly silty, sandy GRAVEL, trace of clay; wet; GP-GM. (Qpgo)	100.0				100
Gray-brown, silty, sandy, clayey GRAVEL; wet; GC. (Qpgd)	102.5				
Gray-brown, slightly silty, sandy GRAVEL, trace of clay; moist; oxidized; GP-GM/GM. (Qpgd)	103.4	0	23 G		
Green-gray, silty, gravelly SAND, trace of clay; moist; oxidized; SM/GM. (Qpgd)	105.0				105
- Layer of wet, silty, sandy gravel from 107.5 to 107.9 feet.		0	24 G		110
Green-gray, silty, sandy GRAVEL; moist; diamict, slightly oxidized; GM. (Qpgt)	112.0	0	25 G		
Orange-brown, slightly clayey to clayey, silty, gravelly SAND; moist; iron-oxide staining; SM. (Qpgd) - Layer of wet, slightly silty, gravelly sand from 115.5 to 116.0 feet.	115.0	0	26 G	▼ = 5/11/2010	115
- Layer of wet, slightly silty, gravelly sand from 119.0 to 119.6 feet.					

Laboratory Test Results (see legend at bottom): 0 30 60

CONTINUED NEXT SHEET

LEGEND

- E Environmental Sample Obtained
- G Grab Sample
- ▼ Ground Water Level in Well
- ▽ Ground Water Level in VWP shallow = 1, deep = 2, 3, etc.
- Piezometer Screen and Sand Filter
- Bentonite-Cement Grout
- Bentonite Chips/Pellets
- Bentonite Grout
- Vibrating Wire Piezometer (VWP)

0 30 60

◇ % Fines (<0.075mm)
● % Water Content
Plastic Limit |—●—| Liquid Limit
Natural Water Content

NOTES

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LOG OF SONIC CORE TB-311

May 2010 21-1-20840-075

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A.1-88
Sheet 3 of 7

REV 3

ML SONIC FINE AWV 21-09490.GPJ 21-09490.GPJ 5/19/10 Log: MSR Rev: EAS Typ: LKN

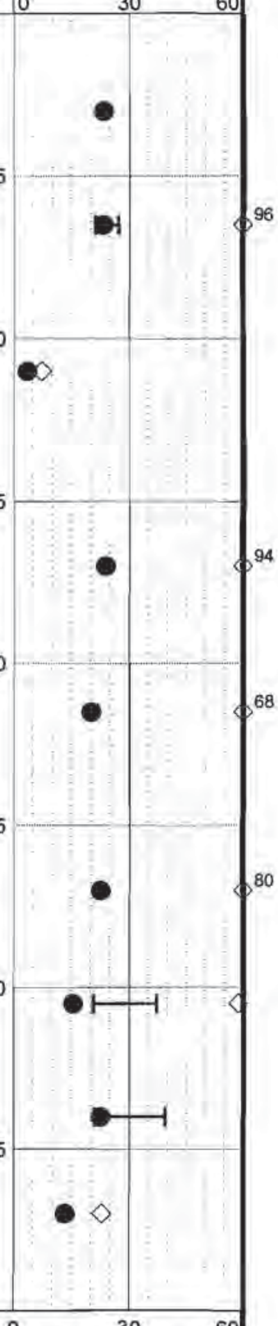
SOIL DESCRIPTION

Coordinates: N: 228,039 E: 1,267,796

Surface Elevation: 129.4 Ft. (NAVD88)

Soil Description	Depth, Ft.	PID, ppm	Samples
Orange-brown, slightly silty, sandy GRAVEL; wet; iron-oxide staining; GP-GM. (Qpgo)	120.0		
Orange-brown, slightly clayey, silty, sandy GRAVEL; moist to wet; iron-oxide staining, weathered; GM. (Qpgd)	121.9		
Blue-gray, slightly silty to silty, sandy GRAVEL, trace of clay; wet; GP-GM. (Qpgo)	122.6	0	27 G
Brown, clayey SILT, trace of sand and gravel; moist; CL-ML. (Qpgl) - *No recovery from 127.0 to 130.0 feet.*	125.0	0	28 G
Brown, trace to slightly clayey SILT, trace of fine sand; moist; laminated; ML. (Qpgl)	128.4		
Gray-brown, slightly silty to slightly sandy GRAVEL, trace of clay; wet; GP-GM/GM. (Qpgo)	130.0	0	29 G
Gray-brown, clayey SILT to silty CLAY; moist; scattered organics; ML/CL. (Qpnl)	133.5		
Brown, slightly fine sandy to fine sandy SILT, trace of clay; wet; scattered organics; ML. (Qpnl) - Layer of moist, dark brown, silty clay, abundant organics from 140.0 to 140.5 feet. - Layer of moist, green, fine sandy silt, trace of clay from 140.5 to 141.4 feet.	135.0	0 0	30 G 31 G
Gray-brown, interbedded, fine sandy SILT and silty, fine SAND; moist; scattered organics; ML/SM. (Qpnl)	145.0	0	32 G
Brown, slightly gravelly, sandy, silty CLAY; moist; diamict, scattered organics; CL/CH. (Qpnm) - Layer of moist, gray-brown, silty clay, trace of sand and gravel from 149.2 to 150.0 feet.	147.9	0	32A G E 33 G
Gray, silty CLAY to clayey SILT, trace of sand; moist; scattered organics, scattered fine sandy silt pockets; CL/ML. (Qpnl)	151.2	0	34 G 34A G
Blue, silty SAND, trace of gravel; moist; oxidized; SM. (Qpgo) - Layer of blue-gray, silty clay from 155.8 to 156.0 feet.	155.0		
Blue, silty, sandy GRAVEL, trace of clay; wet; oxidized; GM. (Qpgo)	156.0		
Green, slightly clayey, gravelly, silty SAND; moist; scattered pockets of slightly silty, fine sand; oxidized; SM. (Qpgo)	156.7	0	35 G 35A

Laboratory Test Results (see legend at bottom)



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- G Grab Sample
- Ground Water Level in Well
- Ground Water Level in VWP shallow = 1, deep = 2, 3, etc.
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● % Water Content
Plastic Limit |—●—| Liquid Limit
Natural Water Content

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Seattle, Washington

LOG OF SONIC CORE TB-311

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Geotechnical and Environmental Consultants

FIG. A.1-88
Sheet 4 of 7

REV 3

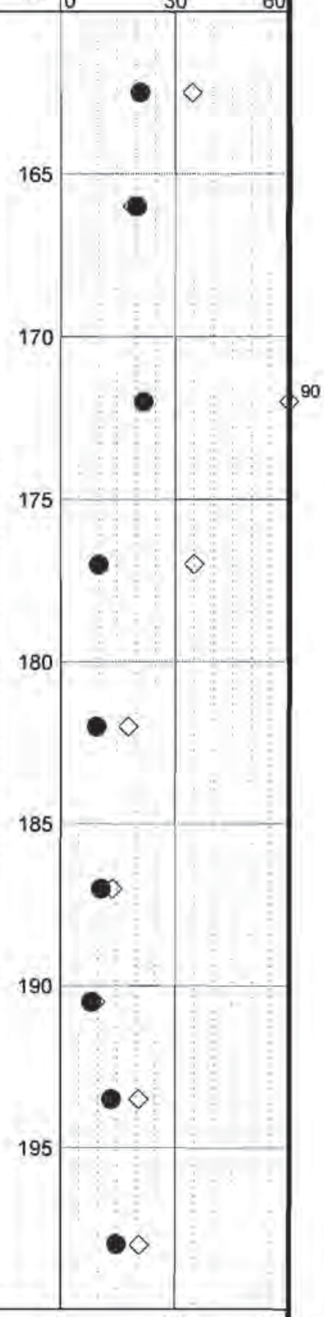
ML_SONIC_FINE_AWV 21-09490.GPJ 21-09490.GPJ 5/18/10 Log: MSR Rev: EAS Typ: LKN

SOIL DESCRIPTION

Coordinates: N: 228,039 E: 1,267,796

Surface Elevation: 129.4 Ft. (NAVD88)

Depth, Ft.	Soil Description	PID, ppm	Samples
160.0	Orange-brown, slightly silty, gravelly SAND; wet; oxidized, weathered; SP-SM. (Qpgo)		
161.2	Orange-brown SILT, trace of sand, clay and fine gravel; moist; scattered organics, oxidized; ML. (Qpgo)		
162.2	Slightly orange-brown, slightly silty to silty, fine to medium SAND, trace of gravel; wet; oxidized; SM/SP-SM. (Qpgo) - Layer of moist, silty sand, trace of clay, oxidized from 163.5 to 164.2 feet.	0	36 G
165.0	Brown to slightly orange-brown, slightly silty to silty, fine to medium SAND; wet; oxidized; SP-SM/SM. (Qpgo) - Pocket of moist, sandy silt at 166.9 feet.	0	37 G
168.0	Mottled gray and brown, silty, fine to medium SAND, trace of gravel; wet; oxidized; SM. (Qpgo)		
171.5	Brown, slightly clayey, slightly fine sandy SILT, trace of gravel to silty, fine SAND, trace of gravel and clay; moist; oxidized; ML/SM. (Qpgd)	0	38 G
173.5	Orange-brown and gray, silty, sandy GRAVEL; moist; iron-oxide staining, scattered gray, silty sand interbeds; SM. (Qpgd)		
175.0	Mottled orange-brown and gray, gravelly, silty, clayey SAND; moist to wet; highly weathered, oxidized, scattered yellow-brown silty sand and silt pockets, diamict-like pockets; SC/SM. (Qpgd)	0 0	39 G 40 G
184.0	Orange-brown, trace to slightly clayey, silty SAND, trace of gravel; moist; abundant iron-oxide staining; SM. (Qpgd)		40A G
185.0	Orange-brown, slightly gravelly to gravelly, slightly silty to silty SAND, trace of clay locally; wet; abundant iron-oxide staining, weathered; SP-SM/SM. (Qpgd)	0	41 G
188.3	Orange-brown, slightly silty to silty, fine to medium SAND; wet; iron-oxide staining; SP-SM/SM. (Qpgo)		
190.0	Orange-brown, slightly silty, gravelly SAND; wet; iron-oxide staining; SW-SM/GP-GM. (Qpgo)	0	42 G
192.2	Orange-gray-brown, slightly clayey, silty, sandy GRAVEL; wet; diamict, oxidized, weathered; GM. (Qpgd)		
193.1	Orange-brown, slightly gravelly, silty SAND, trace of clay; wet; oxidized; SM. (Qpgo)	0	43 G
195.9	Gray-brown, silty SAND, trace of gravel and clay; moist to wet; SM. (Qpgd)		
197.7	Brown, silty SAND, trace of gravel and clay; moist; oxidized, diamict; SM. (Qpgd)	0	44 G 44A G



CONTINUED NEXT SHEET

LEGEND

- E Environmental Sample Obtained
- G Grab Sample
- Ground Water Level in Well
- Ground Water Level in VWP shallow = 1, deep = 2, 3, etc.
- Piezometer Screen and Sand Filter
- Bentonite-Cement Grout
- Bentonite Chips/Pellets
- Bentonite Grout
- Vibrating Wire Piezometer (VWP)

◇ % Fines (<0.075mm)
● % Water Content
Plastic Limit ├●┤ Liquid Limit
Natural Water Content

NOTES

1. The boring was performed using Sonic Core drilling methods.
2. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
3. The discussion in the text of this report is necessary for a proper understanding of the nature of the subsurface materials.
4. Groundwater level, if indicated above, is for the date specified and may vary.
5. Refer to KEY for explanation of symbols, codes and definitions.
6. USCS designation is based on visual-manual classification and selected lab testing.
7. Descriptions are based on visual examination of the soil core. Grab samples were obtained from the core for testing at the depths indicated.

Alaskan Way Viaduct and Seawall Program
SR 99 Bored Tunnel Project
Seattle, Washington

LOG OF SONIC CORE TB-311

May 2010 — 21-1-20840-075

SHANNON & WILSON, INC. Geotechnical and Environmental Consultants

FIG. A.1-88 Sheet 5 of 7

REV 3

SOIL DESCRIPTION

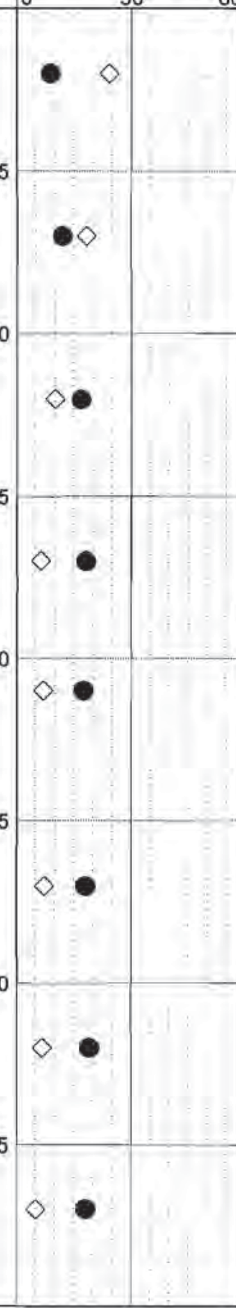
Coordinates: N: 228,039 E: 1,267,796

Surface Elevation: 129.4 Ft. (NAVD88)

Depth, Ft.	Soil Description	PID, ppm	Samples
201.5	Brown to orange-brown, slightly clayey, silty, gravelly SAND; moist; oxidized; SM. (Qpgd)	0	45 G
203.4	Orange-brown to gray-brown, silty SAND, trace of clay and gravel; moist; SM. (Qpgd)		45A G E
205.0	Orange-gray-brown, slightly gravelly, silty SAND; moist to wet; trace of clay locally, oxidized; SM/SP-SM. (Qpgo)	0	46 G
210.0	Orange-gray-brown, slightly silty, fine to medium SAND, trace of fine gravel; wet; oxidized; SP-SM/SP. (Qpgo)	0	47 G
			47A G
		0	48 G
219.6	Gray-brown, slightly gravelly, silty SAND; moist; diamict; SM. (Qpgd)		
220.0	Orange to gray-brown, slightly silty, fine to medium SAND, trace of gravel; wet; oxidized; SP-SM/SP. (Qpgo)	0	49 G
224.0	Gray-brown, silty SAND; moist; oxidized; SM. (Qpgo)		
225.0	Gray-brown, slightly silty, fine to medium SAND; wet; oxidized; SP-SM/SP. (Qpgo)	0	50 G
227.6	Gray-brown, slightly silty, fine to medium SAND, trace of gravel; wet; oxidized, scattered seams with iron-oxide staining; SP-SM. (Qpgo)	0	51 G
235.0	Gray, clean to slightly silty, fine to medium SAND; wet; scattered silty sand pockets; SP/SP-SM. (Qpgo)	0.3	52 G

Depth, Ft.: 205, 210, 215, 220, 225, 230, 235

Laboratory Test Results (see legend at bottom)



CONTINUED NEXT SHEET

LEGEND

- E Environmental Sample Obtained
- G Grab Sample
- Ground Water Level in Well
- Ground Water Level in VWP shallow = 1, deep = 2, 3, etc.
- Piezometer Screen and Sand Filter
- Bentonite-Cement Grout
- Bentonite Chips/Pellets
- Bentonite Grout
- Vibrating Wire Piezometer (VWP)

◇ % Fines (<0.075mm)
● % Water Content
Plastic Limit ├●┤ Liquid Limit
Natural Water Content

NOTES

1. The boring was performed using Sonic Core drilling methods.
2. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
3. The discussion in the text of this report is necessary for a proper understanding of the nature of the subsurface materials.
4. Groundwater level, if indicated above, is for the date specified and may vary.
5. Refer to KEY for explanation of symbols, codes and definitions.
6. USCS designation is based on visual-manual classification and selected lab testing.
7. Descriptions are based on visual examination of the soil core. Grab samples were obtained from the core for testing at the depths indicated.

Alaskan Way Viaduct and Seawall Program
SR 99 Bored Tunnel Project
Seattle, Washington

LOG OF SONIC CORE TB-311

May 2010 | 21-1-20840-075

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FIG. A.1-88
Sheet 6 of 7

REV 3

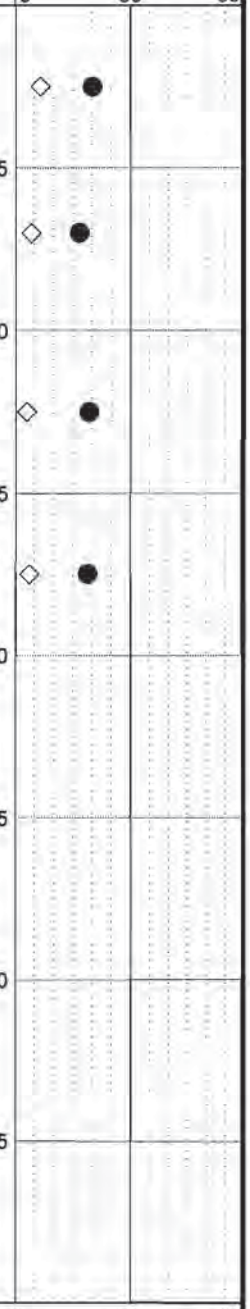
ML_SONIC_FINE_AWV 21-09490.GPJ 21-09490.GPJ 5/18/10 Log: MSR Rev: EAS Typ: LKN

SOIL DESCRIPTION

Coordinates: N: 228,039 E: 1,267,796
Surface Elevation: 129.4 Ft. (NAVD88)

Soil Description	Depth, Ft.	PID, ppm	Samples
Green-gray, clean to slightly silty SAND, trace of gravel; wet; SP/SP-SM. (Qpgo)	241.0	0.6	53 G
Gray, fine to medium SAND, trace of silt and gravel; wet; SP. (Qpgo)	247.0	0.7	54 G
		0.4	55 G
- Pockets of cemented, wet, green sand from 253.5 to 254.5 feet.			
		1.7	56 G
BOTTOM OF BORING COMPLETED 2/3/2010	260.0		

Laboratory Test Results (see legend at bottom)



NOTES:
1 Boring was vacuum-excavated to 5.4 feet on January 28, 2010.
2 Hard Lexan liners were used to collect the soil core between depths of 110 and 235 feet. Flexible plastic liners were used above and below this zone.
3 VWP1 and VWP2 may be malfunctioning. Measurements from these VWPs should not be relied on.

LEGEND

- E Environmental Sample Obtained
- G Grab Sample
- Ground Water Level in Well
- Ground Water Level in VWP shallow = 1, deep = 2, 3, etc.
- Piezometer Screen and Sand Filter
- Bentonite-Cement Grout
- Bentonite Chips/Pellets
- Bentonite Grout
- Vibrating Wire Piezometer (VWP)

◇ % Fines (<0.075mm)
● % Water Content
Plastic Limit |—●—| Liquid Limit
Natural Water Content

NOTES

1. The boring was performed using Sonic Core drilling methods.
2. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
3. The discussion in the text of this report is necessary for a proper understanding of the nature of the subsurface materials.
4. Groundwater level, if indicated above, is for the date specified and may vary.
5. Refer to KEY for explanation of symbols, codes and definitions.
6. USCS designation is based on visual-manual classification and selected lab testing.
7. Descriptions are based on visual examination of the soil core. Grab samples were obtained from the core for testing at the depths indicated.

Alaskan Way Viaduct and Seawall Program
SR 99 Bored Tunnel Project
Seattle, Washington

LOG OF SONIC CORE TB-311

May 2010 21-1-20840-075

SHANNON & WILSON, INC.
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FIG. A.1-88
Sheet 7 of 7

REV 3

ML SONIC FINE AWV 21-09490.GPJ 21-09490.GPJ 5/18/10 Log: MSR Rev: EAS Typ: LKN

SOIL DESCRIPTION Coordinates: N: 228,156 E: 1,267,918 Surface Elevation: 128.6 Ft. (NAVD-88)	Depth, Ft.
3" asphalt over 3" brick, over 3" concrete, over 6" controlled density fill (CDF)..	1.3
Very dense, gray, trace of gravel to slightly gravelly, slightly clayey, sandy SILT; moist; massive, abundant fractures, scattered peat pockets, scattered pumice at bottom; (Qpgt) ML.	26.0
Very dense, gray, slightly silty, clayey, sandy GRAVEL; moist; massive, scattered pumice; (Qpgm) GC.	38.0
Very dense, green-gray, slightly gravelly, silty, fine to medium SAND; moist; massive; (Qpnf) SM.	42.0
Very dense, gray, silty, gravelly SAND, trace of clay; moist; massive, weathered, scattered green-gray pockets; (Qpnf) SM.	47.0
Very dense, gray, slightly silty to silty, fine to medium SAND; moist; massive; (Qpnf) SM/SP-SM.	58.0

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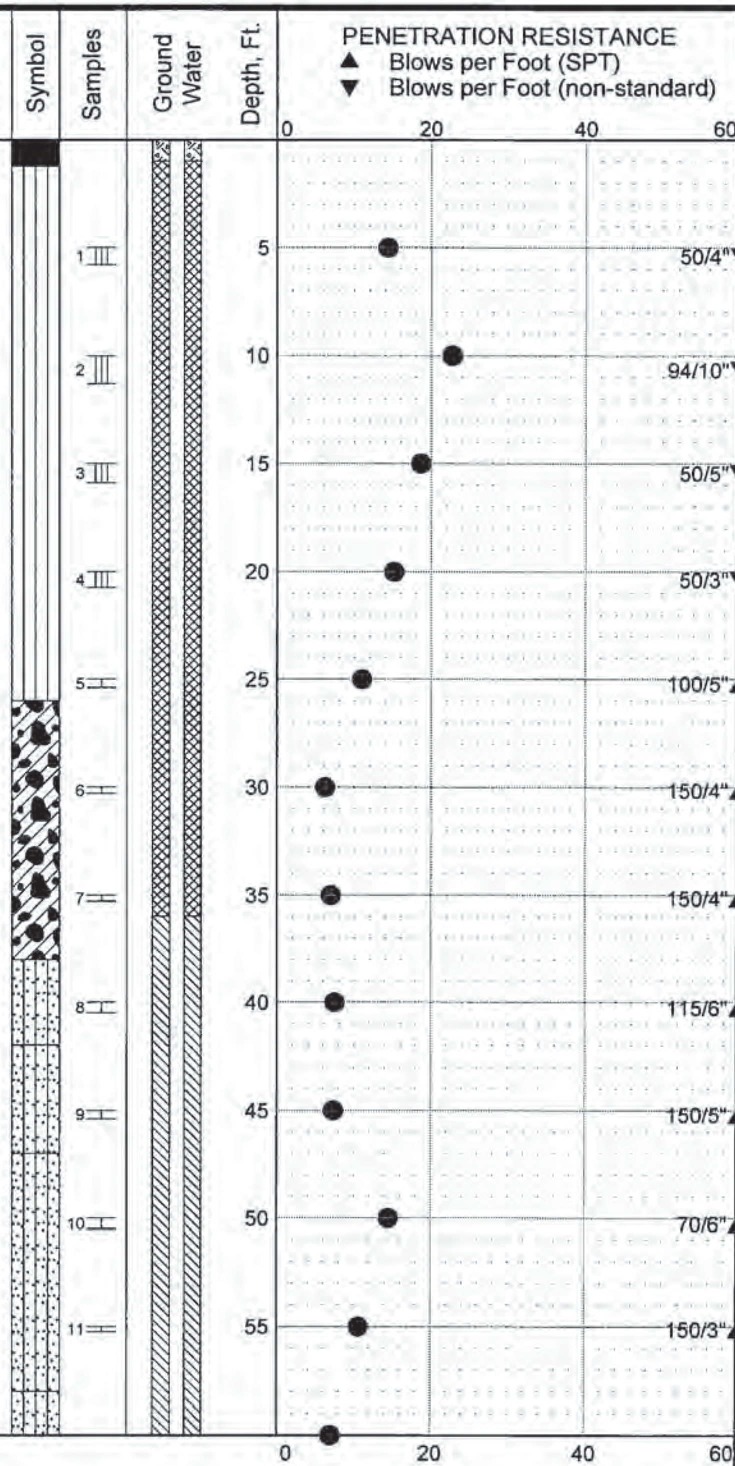

LEGEND

- * Sample Not Recovered
- 3" O.D. Split Spoon Sample
- Standard Penetration Test
- Piezometer Screen and Sand Filter
- Bentonite-Cement Grout
- Bentonite Chips/Pellets
- Bentonite Grout
- Ground Water Level in Well

● % Water Content

Plastic Limit ├─●─┤ Liquid Limit
Natural Water Content

NOTES

1. The boring was performed using Mud Rotary drilling methods.
2. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
3. The discussion in the text of this report is necessary for a proper understanding of the nature of the subsurface materials.
4. Groundwater level, if indicated above, is for the date specified and may vary.
5. Refer to KEY for explanation of symbols, codes and definitions.
6. USCS designation is based on visual-manual classification and selected lab testing.

Alaskan Way Viaduct and Seawall Project
Seattle, Washington

LOG OF BORING EB-3

June 2002 21-1-09490-816

SHANNON & WILSON, INC.
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FIG. A-7
Sheet 1 of 4

SOIL DESCRIPTION

Coordinates: N: 228,156 E: 1,267,918

Surface Elevation: 128.6 Ft. (NAVD-88)

Soil Description	Depth, Ft.
Very dense, green-gray to yellow-brown, silty, gravelly SAND, trace of clay; moist; massive, locally gravelly at bottom; (Qpnf, weathered) SM/GM.	
Very dense, yellow-brown, silty, gravelly SAND; moist; massive, weathered; (Qpnf, weathered) SM/GM. - Abundant gravel/cobbles below 82 feet (inferred from drill action).	75.0
Very dense, yellow-brown, slightly silty to silty, sandy GRAVEL, trace of clay; moist; massive, weathered; (Qpnf) GW-GM. - color change to green-gray between 110.0 and 116.0 feet	89.0

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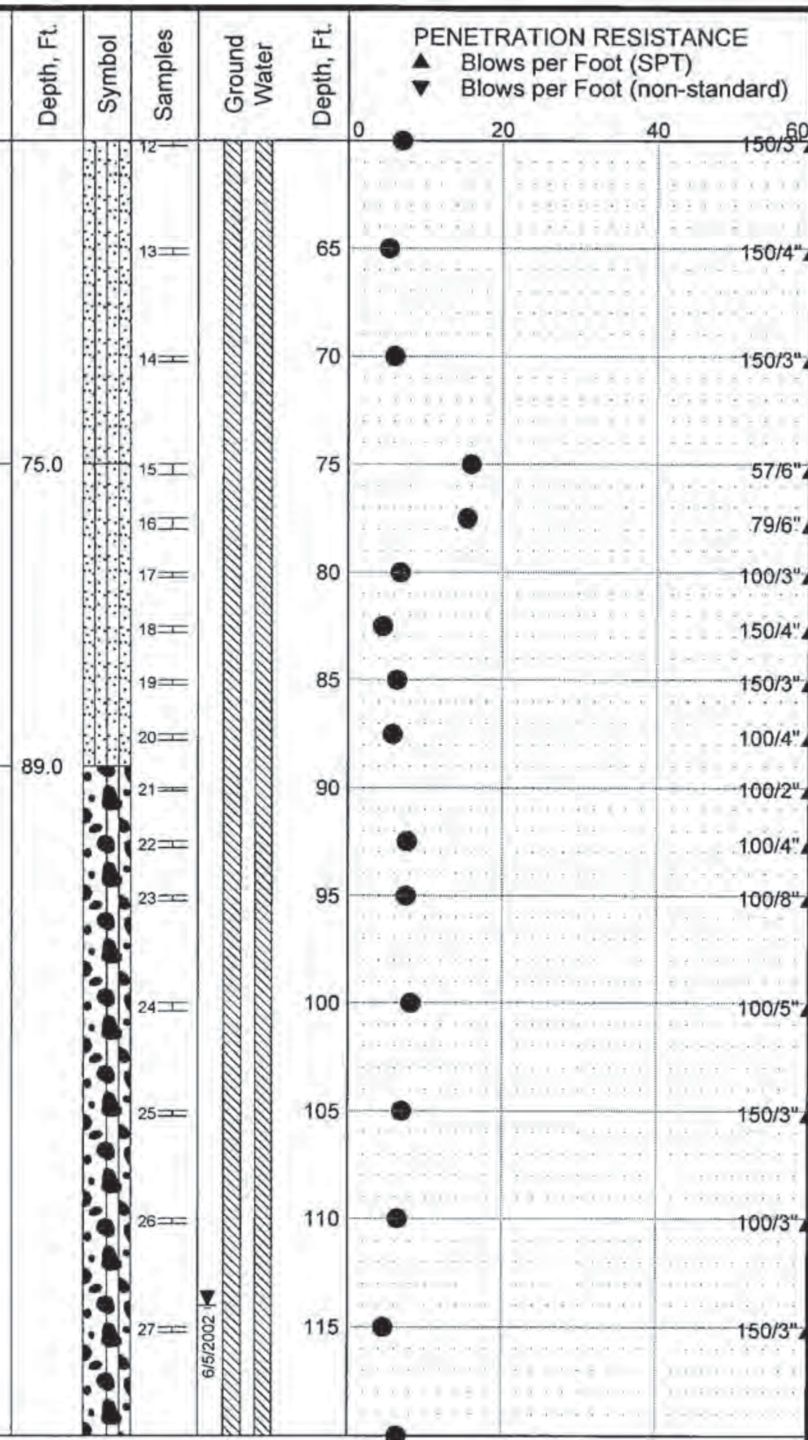

LEGEND

- * Sample Not Recovered
- 3" O.D. Split Spoon Sample
- Standard Penetration Test
- Piezometer Screen and Sand Filter
- Bentonite-Cement Grout
- Bentonite Chips/Pellets
- Bentonite Grout
- Ground Water Level in Well

● % Water Content

Plastic Limit ├──●──┤ Liquid Limit

Natural Water Content

NOTES

1. The boring was performed using Mud Rotary drilling methods.
2. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
3. The discussion in the text of this report is necessary for a proper understanding of the nature of the subsurface materials.
4. Groundwater level, if indicated above, is for the date specified and may vary.
5. Refer to KEY for explanation of symbols, codes and definitions.
6. USCS designation is based on visual-manual classification and selected lab testing.

Alaskan Way Viaduct and Seawall Project
Seattle, Washington

LOG OF BORING EB-3

June 2002 | 21-1-09490-816

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FIG. A-7
Sheet 2 of 4

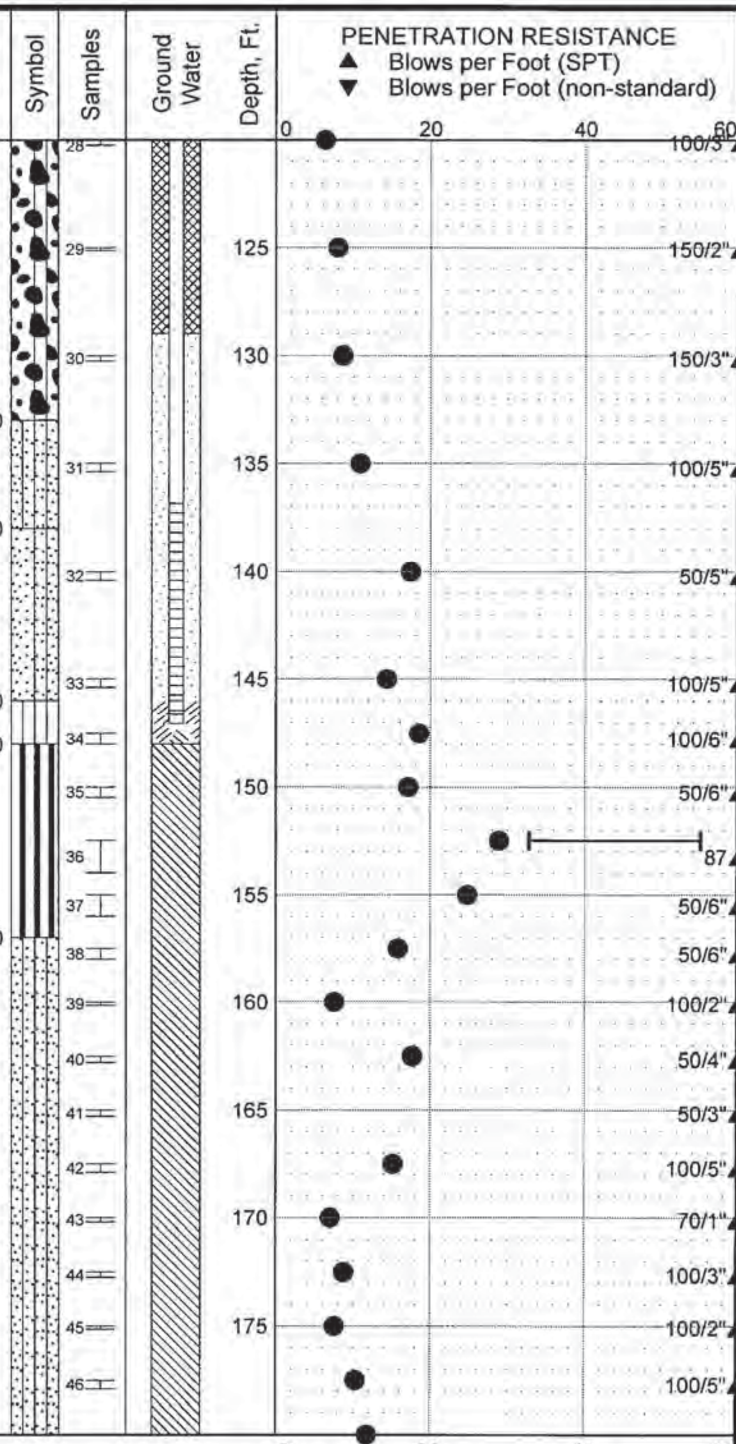
MASTER_LOG2 21-09490.GPJ SHAN_WIL.GDT 6/12/02 Log: AJC Rev: WDN Typ: EET

SOIL DESCRIPTION

Coordinates: N: 228,156 E: 1,267,918

Surface Elevation: 128.6 Ft. (NAVD-88)

Depth, Ft.	Soil Description
133.0	Very dense, gray, gravelly, silty SAND; moist; massive, scattered organics; (Qpnf) SM/ML.
138.0	Very dense, slightly silty, fine to medium SAND; moist; massive, scattered woody organics; (Qpnf) SP-SM/SP.
146.0	Interbedded, hard, brown, silty CLAY, SILT, and PEAT, and very dense, slightly silty, fine to medium SAND; moist; laminated, abundant ash; (Qpnl) ML/CL.
148.0	Very dense to hard, green-gray to yellow-brown, mottled, slightly silty, gravelly, clayey SAND to clayey SILT, trace of sand; moist; massive to bedded, abundant pumice, scattered charcoal, scattered root casts; (Qpns/Qpnm) MH/SC.
157.0	Very dense, yellow-brown and gray-brown, silty, gravelly SAND, trace of clay; moist; massive, scattered sandy gravel lenses, weathered; (Qpnf) SM/GM.



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LEGEND

- * Sample Not Recovered
- 3" O.D. Split Spoon Sample
- Standard Penetration Test
- Piezometer Screen and Sand Filter
- Bentonite-Cement Grout
- Bentonite Chips/Pellets
- Bentonite Grout
- Ground Water Level in Well

● % Water Content

Plastic Limit ├─●─┤ Liquid Limit
Natural Water Content

NOTES

1. The boring was performed using Mud Rotary drilling methods.
2. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
3. The discussion in the text of this report is necessary for a proper understanding of the nature of the subsurface materials.
4. Groundwater level, if indicated above, is for the date specified and may vary.
5. Refer to KEY for explanation of symbols, codes and definitions.
6. USCS designation is based on visual-manual classification and selected lab testing.

Alaskan Way Viaduct and Seawall Project
Seattle, Washington

LOG OF BORING EB-3

June 2002 21-1-09490-816

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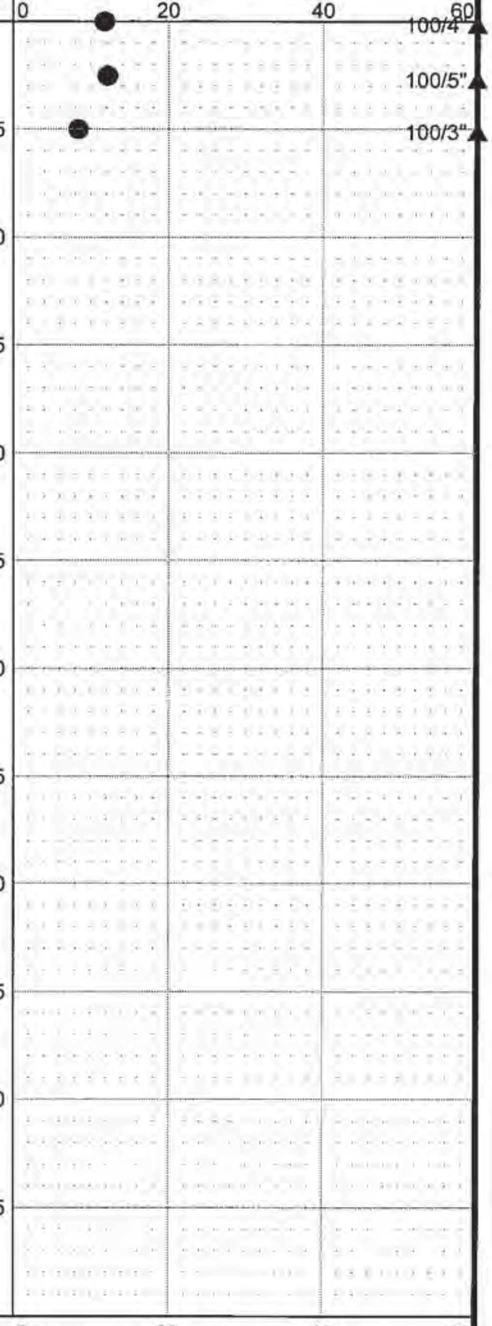
FIG. A-7
Sheet 3 of 4

SOIL DESCRIPTION Coordinates: N: 228,156 E: 1,267,918 Surface Elevation: 128.6 Ft. (NAVD-88)	Depth, Ft.	Symbol	Samples	Ground Water	Depth, Ft.
			47		
			48		
	185.3		49		185
BOTTOM OF BORING COMPLETED 4/4/2002					190
					195
					200
					205
					210
					215
					220
					225
					230
					235

PENETRATION RESISTANCE
▲ Blows per Foot (SPT)
▼ Blows per Foot (non-standard)



LEGEND

- * Sample Not Recovered
- 3" O.D. Split Spoon Sample
- Standard Penetration Test
- Piezometer Screen and Sand Filter
- Bentonite-Cement Grout
- Bentonite Chips/Pellets
- Bentonite Grout
- Ground Water Level in Well

● % Water Content

Plastic Limit ├─●─┤ Liquid Limit
Natural Water Content

NOTES

1. The boring was performed using Mud Rotary drilling methods.
2. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
3. The discussion in the text of this report is necessary for a proper understanding of the nature of the subsurface materials.
4. Groundwater level, if indicated above, is for the date specified and may vary.
5. Refer to KEY for explanation of symbols, codes and definitions.
6. USCS designation is based on visual-manual classification and selected lab testing.

Alaskan Way Viaduct and Seawall Project
Seattle, Washington

LOG OF BORING EB-3

June 2002 21-1-09490-816

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FIG. A-7
Sheet 4 of 4

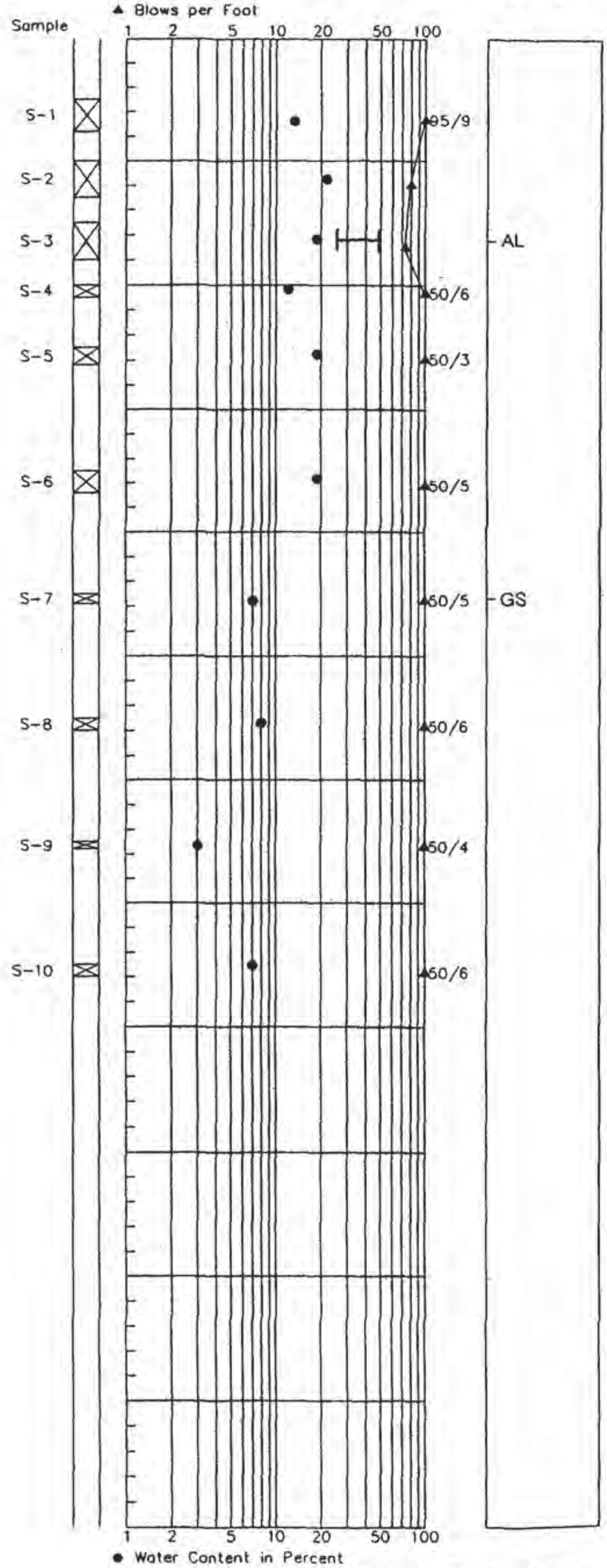
203, 1326

Boring Log B-2

Soil Descriptions

Ground Surface Elevation in Feet 117

Soil Description	Depth in Feet
Asphalt over Hard, damp, gray, sandy SILT.	0
Hard, moist, gray, silty CLAY with dry silt laminations.	5
Grades to SILT.	
Very dense, damp, gray, slightly gravelley, slightly silty SAND.	20
Bottom of Boring at 39.0 Feet. Completed 8/7/90	40



1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. Groundwater level, if indicated, is at time of drilling (ATD) or for date specified. Level may vary with time.

HARTCROWSER

J-3057 8/90

Figure A-3 1/1

BORING ONE

ELEVATION 120±

DEPTH IN FEET	MOISTURE CONTENT	DRY DENSITY (PCF)	BLOWS PER FOOT	GRAPHIC LOG	SOIL DESCRIPTION
0				ML	GRAY SLIGHTLY CLAYEY SILT STIFF, DAMP
	32.7		34 SPT		
5					ROUGH DRILLING - GRAVEL LAYER
	8.8	113.9	100/5" HD	ML	GRAY SLIGHTLY CLAYEY, SANDY SILT W/SOME GRAVEL, HARD, DRY
10					
	9.3		100/4" SPT		DIFFICULT DRILLING
15					
	15.1		110 SPT		
20					
	17.8	113.1	100/3" HD		
25				SM ML	GRAY SLIGHTLY CLAYEY SILT WITH THIN LAYERS OF FINE TO MEDIUM SAND VERY DENSE, DAMP
	13.3		106 SPT		
30					
	21.5		121 SPT		
35					

BOTTOM OF BORING 33.5'
COMPLETED 3-10-76

NOTE: SPT INDICATES 2 INCH O.D. SAMPLER.
HD INDICATES 3 INCH O.D. SAMPLER.

BORING TWU

ELEVATION 120±

DEPTH IN FEET	MOISTURE CONTENT	DRY DENSITY (PCF)	BLOWS PER FOOT	GRAPHIC LOG	SOIL DESCRIPTION
0				GP SP	BROWN SILTY SAND AND GRAVEL, MEDIUM DENSE, WET (FILL)
	16.7		52 SPT	SM	GRAY VERY SILTY FINE TO MEDIUM SAND W/SOME GRAVEL, VERY DENSE, DRY
5					
	9.7		56-40/1" SPT		
10					GRAVELLY ROUGH DRILLING
			NO PENETRATION* SPT		
15					
	5.8	114.8	200/5" HD		EXTREMELY DIFFICULT DRILLING
	6.0	108.4			
20					
	8.9		84-75/2" SPT		COLOR CHANGES TO GREENISH GRAY
25					
	18.7		122 SPT	SP	GREENISH-GRAY SLIGHTLY SILTY FINE TO MEDIUM SAND, VERY DENSE, MOIST
30					
	13.3	103.0	150 HD		
	13.3	105.8			
35					
	19.3		137 SPT		SAND BECOMES FINER
40					

BOTTOM OF BORING 38.5'
COMPLETED 3-10-76

APPENDIX D
Ground Anchor Load Tests and Shoring Monitoring Program

APPENDIX D
GROUND ANCHOR LOAD TESTS AND SHORING MONITORING PROGRAM

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
Alignment Load	1 minute
0.25 Design Load (DL)	1 minute
0.5DL	1 minute
0.75DL	1 minute
1.0DL	1 minute
1.25DL	1 minute
1.5DL	60 minutes
1.75DL	1 minute
2.0DL	10 minutes

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
Alignment Load	1 minute
0.25 DL	1 minute
0.5DL	1 minute
0.75DL	1 minute
1.0DL	1 minute
1.25DL (soil nails)	1 minute
1.33DL (tiebacks)	10 minutes
1.5DL (soil nails)	

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 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; and
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.

Shoring Monitoring

Preconstruction Survey

A shoring monitoring program should be established to monitor the performance of the temporary shoring walls and to provide early detection of deflections that could potentially damage nearby improvements. We recommend that a preconstruction survey of adjacent improvements, such as streets, utilities and buildings, be performed prior to commencing construction. The preconstruction survey should include a video or photographic survey of the condition of existing improvements to establish the preconstruction condition, with special attention to existing cracks in streets or buildings.

Optical Survey

The shoring monitoring program should include an optical survey monitoring program. The recommended frequency of monitoring should vary as a function of the stage of construction as presented in the following table.

Construction Stage	Monitoring Frequency
During excavation and until wall movements have stabilized	Twice weekly
During excavation if lateral wall movements exceed 1 inch and until wall movements have stabilized	Three times per week
After excavation is complete and wall movements have stabilized, and before the floors of the building reach the top of the excavation	Twice monthly

Monitoring should include vertical and horizontal survey measurements accurate to at least 0.01 feet. A baseline reading of the monitoring points should be completed prior to beginning excavation. The survey data should be provided to GeoEngineers for review within 24 hours.

For shoring walls, we recommend that optical survey points be established: (1) along the top of the shoring walls; (2) at the curb on the north side of Bell Street, and the west side of 4th Avenue; (3) along the west side of the alley; and (4) on existing buildings located within a horizontal distance of the shoring walls equal to the height of the wall. The survey points should be located on every other soldier pile along the wall face for soldier pile and tieback shoring, and the points along the curb line/back of alley/existing buildings should be located at an approximate spacing of 25 feet. If lateral wall movements are observed to be in excess of ½ inch between successive readings or if total wall movements exceed 1 inch, construction of the shoring walls should be stopped to determine the cause of the movement and to establish the type and extent of remedial measures required.

Inclinometers

We recommend that four inclinometers be installed on the temporary shoring system. The inclinometers should be located near the midpoints of each of the four shoring walls. The inclinometers will supplement the optical survey data and provide accurate measurement of shoring wall deformations as a function of excavation depth. The inclinometers should be mounted to the backs of soldier piles to protect the inclinometers from damage during tieback installation. A flush-mount steel monument should be placed at the top of the inclinometers to protect the inclinometer casing from damage. The inclinometer casing should be filled with water prior to placement of the vertical elements or controlled density fill (CDF) backfill.

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 [redacted] and other project team members for the 314 Bell Street 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 314 Bell Street project in Seattle, 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
- project ownership.

---

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

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.

Have we delivered World Class Client Service?

Please let us know by visiting **www.geoengineers.com/feedback**.

GeoEngineers

APPENDIX B

GHG Emissions Worksheet

Belltown 36 Development

Section I: Buildings

Type (Residential) or Principal Activity (Commercial)	# Units	Square Feet (in thousands of square feet)	Emissions Per Unit or Per Thousand Square Feet (MTCO2e) Embodied	Energy	Transportation	Lifespan Emissions (MTCO2e)
Single-Family Home............................	0		98	672	792	0
Multi-Family Unit in Large Building	203		33	357	766	234606
Multi-Family Unit in Small Building	0		54	681	766	0
Mobile Home.......................................	0		41	475	709	0
Education		0.0	39	646	361	0
Food Sales		0.0	39	1,541	282	0
Food Service		0.0	39	1,994	561	0
Health Care Inpatient		0.0	39	1,938	582	0
Health Care Outpatient		0.0	39	737	571	0
Lodging		0.0	39	777	117	0
Retail (Other Than Mall).......................		12.0	39	577	247	10353
Office		19.0	39	723	588	25638
Public Assembly		0.0	39	733	150	0
Public Order and Safety		0.0	39	899	374	0
Religious Worship		0.0	39	339	129	0
Service		0.0	39	599	266	0
Warehouse and Storage		0.0	39	352	181	0
Other		0.0	39	1,278	257	0
Vacant		0.0	39	162	47	0

Section II: Pavement..........................

Pavement..		0.00				0

Total Project Emissions: **270597**

Version 1.7 12/26/07

APPENDIX C

Viewshed Analysis Report

APPENDIX C

AESTHETICS – VIEWSHED ANALYSIS

Purpose

The purpose of this *Viewshed Analysis* is to evaluate view-related impacts—specifically to City-designated public viewpoints and parks, Space Needle viewpoints, views of historic landmarks, and scenic routes—resulting from the proposed ***Belltown 36 Development***. The proposed building has been designed to be consistent with surrounding downtown development and existing zoning.

City Designated Public Viewpoints and Parks

The City's public view protection policies are intended to "*protect public views of significant natural and human-made features: Mount Rainier, the Olympic and Cascade Mountains, the downtown skyline, and major bodies of water including Puget Sound, Lake Washington, Lake Union and the Ship Canal, from public places consisting of specified viewpoints, parks, scenic routes, and view corridors identified in Attachment 1" to the SEPA code*.[1] While the City has officially-designated 89 public viewpoints, none of these viewpoints would be affected by the proposed project.

Space Needle Viewpoints

The most visible Landmark from many parts of the City is the Space Needle, which is located approximately 0.6 miles northwest of the project site. The City has identified ten viewpoints from which views of the Space Needle are to be protected.[2] None of the protected Space Needle viewpoints would be affected by the proposed ***Belltown 36 Development***.

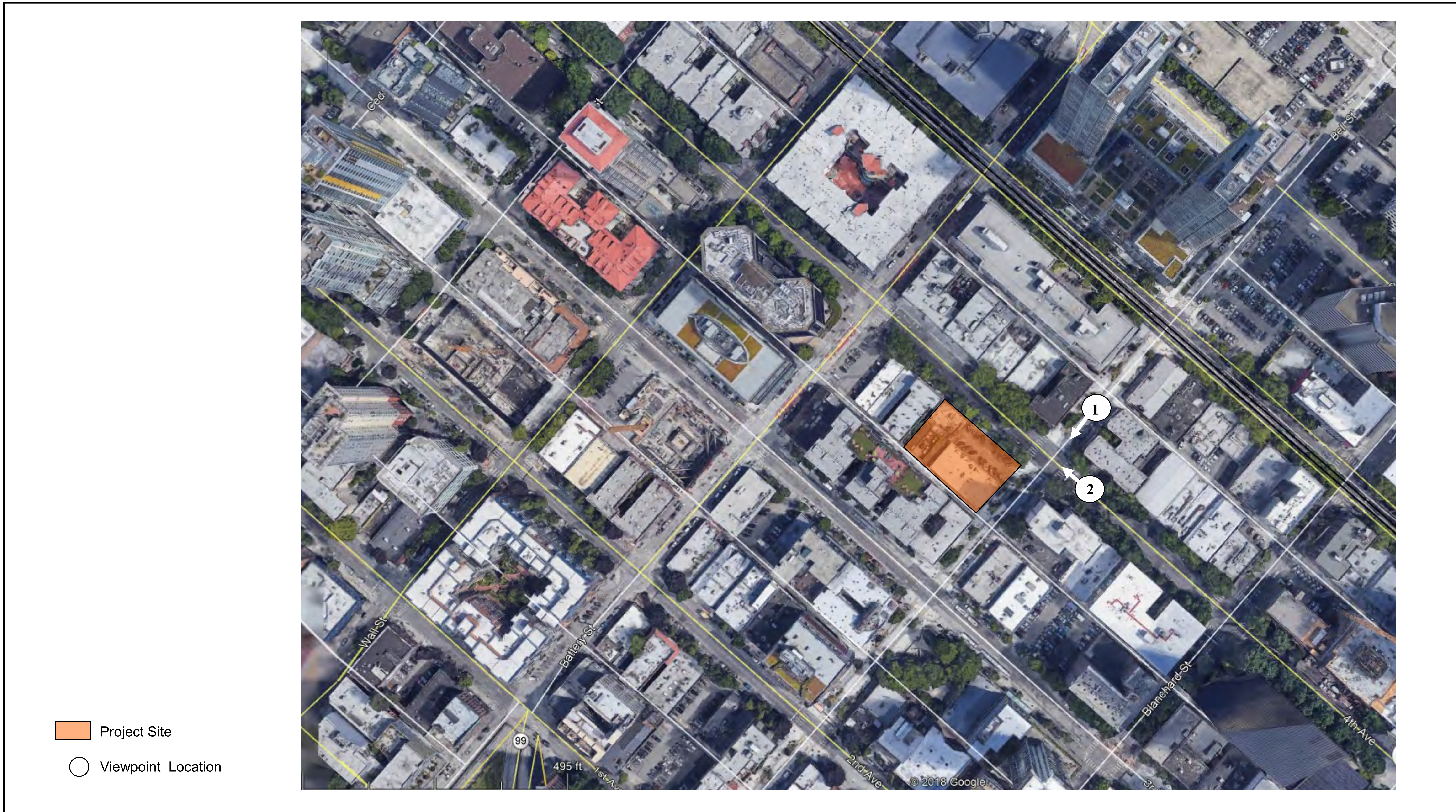
Views of Historic Landmarks

Designated City landmarks proximate to the site include the Franklin Apartment building, which is located directly to the east of the project site on the opposite side of Fourth Avenue. The Franklin Apartments is a three-level brick building that was constructed in 1918. The existing and proposed views from Bell Street and Fourth Avenue in relation to this Landmark are illustrated and described below under **Viewpoints 1** and **2**.

- **Viewpoint 1 – Figure 2** depicts the existing and proposed view looking west toward the project site from Bell Street. The Franklin Apartment building is partially visible in the foreground along the north side of Bell Street (right), and the project site is partially visible in the midfield view. Under the proposed view, the new ***Belltown 36*** building with upper level setbacks would be partially visible to the rear of the Franklin Apartment building, opposite the intersection of Bell Street and Fourth Avenue. The new building would further vertically define the Bell Street and Fourth Avenue street corridors and increase the visual

1 Seattle Municipal Code Chap. 25.05.675 P.2.a.i.
2 Seattle Municipal Code Chap. 25.05.675 P. and Seattle DCLU, 2001,

Belltown 36
Environmental Checklist



EA Engineering, Science, and Technology, Inc., PBC

Figure 1

Viewpoint Location Map

Existing View

Proposed View

Source: Bumgardner, 2018

Figure 2

Viewpoint 1—Bell Street, Looking West

density of buildings in proximity to the Franklin Apartment building. These changes would not be considered a significant impact given the approximately 70+ feet of physical separation between the ***Belltown 36 Development*** and Landmark building that would be provided by the Fourth Avenue right-of-way (including sidewalks and building setbacks). Views of the Franklin Apartment building would continue to be available from this location.

- **Viewpoint 2 – Figure 3** depicts the existing and proposed view looking north toward the project site from Fourth Avenue. The Franklin Apartment building is partially visible along the east side of Fourth Avenue (right), although the majority of the building is obscured by existing street trees. The project site is partially visible in the mid-field view on the opposite side of Fourth Avenue (left), although it too is largely obscured by vegetation. Under the proposed view, the new ***Belltown 36*** tower would be partially visible on the west (left) side of Fourth Avenue in the mid-field view. The new building would further vertically define the street corridor and increase the visual density of buildings in proximity to the Franklin Apartment building. Overall, these changes would not be considered a significant impact given the approximately 70+ feet of physical separation between the Landmark building and ***Belltown 36 Development*** that would be provided by the Fourth Avenue right-of-way (including sidewalks and building setbacks). Views of the Franklin Apartment building would continue to be available from this location.

Scenic Routes

City ordinances[3] identify specific scenic routes throughout the City in which view protection is to be encouraged of the significant natural and human-made features listed in the City's public view protection policies. There are no scenic routes adjacent to the project site. Fifth Avenue, located approximately one block to the west of the site, is the closest designed scenic route, and the ***Belltown 36 Development*** would not be expected to affect views from this scenic route.

Summary

No significant view impacts from protected public viewpoints are anticipated. The proposed building would be consistent with existing buildings in the Belltown area and as allowed by the City's Land Use Code, and would be separated from the nearest City-designated Landmark (Franklin Apartments) by the Fourth Avenue right-of-way. Therefore, no mitigation would be required.

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[3] Ord. #97025 (Scenic Routes Identified by the Seattle Engineering Department's Traffic Division) and Ord. #114057 (Seattle Mayor's Recommended Open Space Policies). The SEPA Scenic Routes Map incorrectly references Ord. # 97027, whereas the reference should be to Ord. # 97025.

Existing View

Proposed View

Source: Bumgardner, 2018

Figure 3

Viewpoint 2—Fourth Avenue, Looking North

EA Engineering, Science, and Technology, Inc., PBC

APPENDIX D

Shadow Analysis Report

APPENDIX D

SHADOWS

Seattle's SEPA policies aim to "minimize or prevent light blockage and the creation of shadows on open spaces most used by the public."[1] Policy background, however, indicates that due to the scale of development that is permitted Downtown, it is not practical to prevent shadow impacts at all public open spaces in Downtown. In general, within the Downtown, areas where shadow impacts may be mitigated are: Westlake Park and Plaza, Freeway Park, Steinbrueck Park, Convention Center Park, and Kobe Terrace Park. None of these parks are proximate to the project site. There are three parks in the general vicinity (i.e. within three to four blocks) of the project site – Bell Street Park, Regrade Park and Denny Park.

- **Bell Street Park** – is located adjacent to the site, to the south. This is a four block park with one lane of traffic that contains landscaping, seating, and open space.

- **Regrade Park** - is located approximately a half-block to the south. This is a fenced off-leash dog park.

- **Denny Park** - is located approximately four blocks to the north of the site. The 4.63-acre park contains paths, mature trees, landscaping, a dog off-leash area, play area and passive open space.

Factors that influence the extent of shading include: weather (e.g., cloud cover); building height, width and facade orientation; and the proximity of other intervening structures, topographic variations and significant landscaping.

This Appendix contains shadow diagrams that depict shading from the ***Belltown 36 Development*** project (**Figure 1)** for vernal equinox (approx. March 21st), summer solstice (approx. June 21st), autumnal equinox (approx. Sept. 21st), and winter solstice (approx. December 21st). The figures and accompanying text below describe possible shadow impacts to Bell Street Park, Regrade Park and Denny Park that could occur, within the context of shading from existing buildings that are located within several blocks of the project site. The City's SEPA policies address shadow impacts with consideration given to the effect "at times when the public most frequently uses that space."[2]

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1 Seattle Municipal Code Chapter 25.05.675 Q2.
2 Seattle Municipal Code Chapter 25.05.675 Q2.

Figure 1

Shadow Studies—Belltown 36 Development

The following analysis summarizes shadow impacts for various times of the day on each of the key days of the solar year. These key days of the solar year and times of the day depict worst-case impacts. Shadow-related impacts, however, can also occur at other times of the day throughout the year. Because of the earth's rotation, the duration of shadow-related impacts varies for a stationary observer[3] based on season, depending upon the width of the shadow. The shadow graphics have been adjusted to compensate for topography and, in the case of vernal equinox, summer solstice, and autumnal equinox, daylight savings time.[4]

Vernal (Spring) and Autumnal Equinox (refer to **Figure 1)**

Sunrise on the vernal and autumnal equinox (approx. March 21st and September 21st) occurs at about 6:11 AM and sunset at 6:21 PM.

The extent of possible shading from the proposed development must also be considered within the context of climatic data for the month (e.g., on average the number of clear, partly cloudy and cloudy days). Data[5] indicate that on average March has 4 clear days, 8 partly cloudy days and 19 cloudy days.[6] Climatic data[7] for the month of September indicate that on average September typically has 3 clear days, 6 partly cloudy days and 22 cloudy days.

As indicated in **Figure 1** for Vernal Equinox, potential impacts depicting shadows from the proposed project, together with shadows from other nearby buildings, were evaluated at 9 AM, 12 PM, and 5 PM. Pacific Daylight Savings Time is in-effect on this day.

- **At 8 AM**, shadows from the ***Belltown 36 Development*** would extend in a northwesterly direction and would not affect Bell Street Park, Regrade Park or Denny Park.

- **At 12 PM,** shadows from the ***Belltown 36 Development*** would extend in a northerly direction and would not affect Bell Street Park, Regrade Park or Denny Park.

- **At 5 PM**, shadows from the ***Belltown 36 Development*** would extend in an easterly direction and would shade a portion of the Bell Street Park, primarily between Fourth and Fifth Avenues. Overall, less than approximately 25 percent of the total four block park area would be shaded. Shadows from the proposed building would not affect Regrade Park or Denny Park at this time of day.

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3 The rate of change of the sun's angle relative to the earth varies widely by season – from about 5 degrees horizontally and 2 degrees vertically every 15 minutes in June to 3 degrees horizontally and 1 degree vertically every 15 minutes in December.

4 Pacific Daylight Savings Time (PDST) applies to shadow impacts associated with spring equinox, summer solstice and autumnal equinox.

5 NOAA, 2005.

6 NOAA defines a clear day as one with zero to 3/10 average sky cover, a partly cloudy is one with 4/10 to 7/10 tenths average sky cover and a cloudy day is one with 8/10 to 10/10 tenths average sky cover.

7 op cit.

Summer Solstice (refer to **Figure 1**)

Sunrise on summer solstice (approx. June 21st) occurs at about 5:11 AM and sunset at 9:10 PM. Pacific Daylight Savings Time remains in-effect on this day.

Climatic data[8] for the month of June indicates that on average June has 7 clear days, 8 partly cloudy days and 15 cloudy days.[9]

As indicated by **Figure 1** for summer solstice, potential impacts depicting shadows from the proposed project, together with shadows from other nearby buildings, were evaluated at 9 AM, 12 PM and 5 PM.

- **At 8 AM**, shadows from the ***Belltown 36 Development*** would extend in a westerly direction and would not affect Bell Street Park, Regrade Park or Denny Park.

- **At 12 PM,** shadows from the ***Belltown 36 Development*** would extend in a northerly direction and would not affect Bell Street Park, Regrade Park or Denny Park.

- **At 5 PM**, shadows from the ***Belltown 36 Development*** would extend in an easterly direction and would shade a portion of the Bell Street Park, primarily to the north and south of Fourth Avenue. Overall, approximately 10 percent of the total four block park area would be shaded.

Winter Solstice (refer to **Figure 1**)

Sunrise on winter solstice (approx. December 21st) occurs at about 7:54 AM and sunset at 5:19 PM.

Climatic data[10] for the month of December indicate that on average December has 3 clear days, 4 partly cloudy days and 23 cloudy days.[11]

As indicated in **Figure 1**, for winter solstice, potential impacts depicting shadows from the proposed project, together with shadows from other nearby high-rise buildings, were evaluated at 9 AM, 12 PM, and 4 PM.[12]

- **At 9 AM**, shadows from the ***Belltown 36 Development*** would extend in a northwesterly direction and would not affect Bell Street Park, Regrade Park or Denny Park.

- **At 12 PM,** shadows from the ***Belltown 36 Development*** would extend in a northerly direction and would not affect Bell Street Park, Regrade Park or Denny Park.

---

8 op cit.

9 NOAA defines a clear day as one with zero to 3/10 average sky cover, a partly cloudy is one with 4/10 to 7/10 tenths average sky cover and a cloudy day is one with 8/10 to 10/10 tenths average sky cover.

10 op cit.

11 NOAA defines a clear day as one with zero to 3/10 average sky cover, a partly cloudy is one with 4/10 to 7/10 tenths average sky cover and a cloudy day is one with 8/10 to 10/10 tenths average sky cover.

12 8 AM and 5 PM are not described because the sun is still below the horizon at these times and there are no discernable shadows.

- At **4 PM**, shadows from the ***Belltown 36 Development*** would extend in a northeasterly direction and would shade would shade a portion of the Bell Street Park, primarily to the block between Fourth and Fifth Avenues. Overall, approximately 25 percent of the total four block park area would be shaded. Shadows from other buildings in the vicinity would also contribute to shading this and other portions of the park at this time of day. Shadows from the proposed building would not affect Denny Park or Regrade Park at this time of day.

Summary

As described above, the proposed ***Belltown 36 Development*** would periodically contribute to shading portions of the Bell Street Park during the evening time hours. Shading would mainly occur to the area of the park between Fourth and Fifth Avenues, and to a lesser degree, south of Fourth Avenue. The Bell Street Park contains one lane of traffic, bike lanes, sidewalks, seating elements and landscaping and is used for both passive recreation and programmed activities. Overall, 25 percent or less of the four-block park area would be affected by shading from the proposed project, and existing buildings also contribute to shading other areas of the park in evening time hours. In general, anticipated shadow impacts are typical of Downtown development and no impacts would occur to Downtown areas where shadow impacts may be mitigated (i.e. Westlake Park and Plaza, Freeway Park, Steinbrueck Park, Convention Center Park and Kobe Terrace Park).

Regrade Park and Denny Park would not be affected by shading from the ***Belltown 36 Development***.

APPENDIX E

Solar Glare Analysis

Solar Glare Analysis

for the proposed

Belltown 36 Development

(Master Use Permit No. 3028930)

Prepared for

Security Properties
701 Fifth Avenue, Suite 5700
Seattle, WA 98104

October 2018

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Section I – Overview

Purpose of this Study

The purpose of this *Solar Glare Analysis* is to evaluate light and glare-related impacts -- specifically reflected to solar glare -- resulting from glazing associated with the ***Belltown 36 Development*** that is proposed for this site.[1] The focus of the analysis is the potential environmental impact to motorists on Third Avenue and Fourth Avenue during the AM and PM peak traffic hour periods, as well as residential buildings in the vicinity.

Proposed Action

The proponent is submitting a Master Use Permit (MUP) (#3028930) for development of the ***Belltown 36 Development*** project, which would involve construction of a new 30-story mixed-use building with approximately 203 apartment units, 19,000 sq. ft. of office space, and 12,000 sq. ft. of retail space in Downtown Seattle's Belltown Neighborhood. Below-grade parking would be provided for 237 vehicles. Access to the parking garage would be provided from the mid-block alley.

The proposed project would be located on a 19,440 square foot (0.45 acres) site near the intersection of Fourth Avenue and Bell Street (see **Figures 1** and **2**). Development of the ***Belltown 36 Development*** project would involve demolition and removal of the existing building and surface parking. Site preparation and construction could begin in fall 2019, with building occupancy by winter 2022.

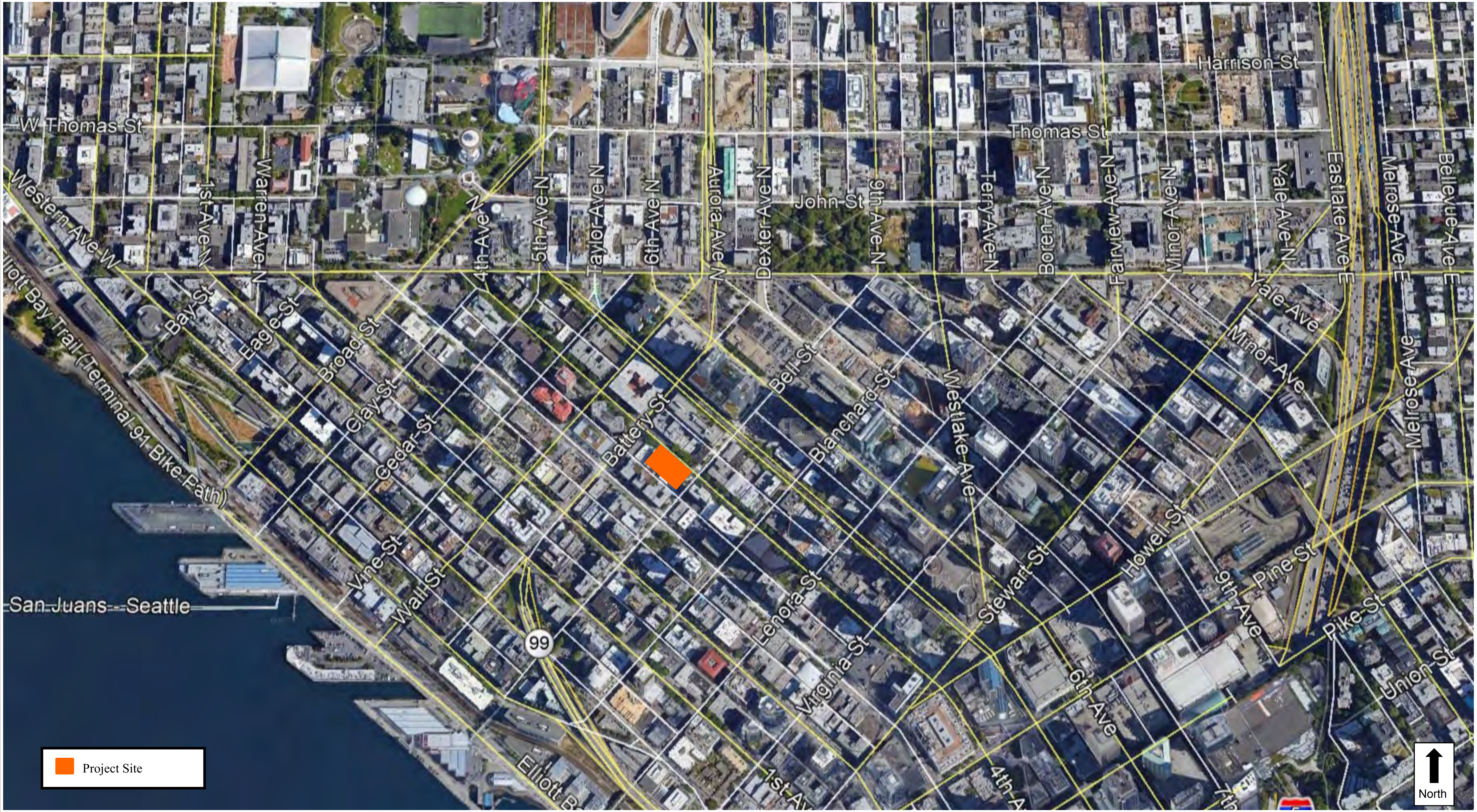
The proposed building lot coverage would occupy approximately 100 percent of the site (**Figure 2**). **Figure 3** depicts a perspective looking northwest. It is proposed that the façades of the building include brick, concrete, metal, and glass.

As shown in **Figure 3**, it is proposed that any glazing and/or glass panels on the façade would be consistent with the City's Energy Code requirements. Reflectivity would be dictated by the nature of glass that is employed and the requirements set forth by the City's Energy Code. However, it is our understanding that no excessively-reflective surfaces (i.e., mirrored glass, or polished metals) that go beyond what is required to meet energy-related code provisions are proposed anywhere on the exterior of the project.

The proposed project would also include landscaping and pedestrian improvements to upgrade the existing pedestrian features and landscaping on the site. For pedestrians, the proposed landscape plan includes a series of wider sidewalks and landscaped areas that would provide connections between Fourth Avenue, Bell Street, and the surrounding neighborhood.

[1] This analysis has been prepared by EA Engineering, Science, and Technology, Inc. PBC. Staff at EA have prepared reflected solar glare analyses for approximately 60+ buildings and structures -- predominantly in the downtown Seattle and Bellevue areas.

Belltown 36
Environmental Checklist



Source: EA Engineering and Google Maps, 2018

EA Engineering, Science, and Technology, Inc.

Figure 1
Vicinity Map

Belltown 36
Environmental Checklist

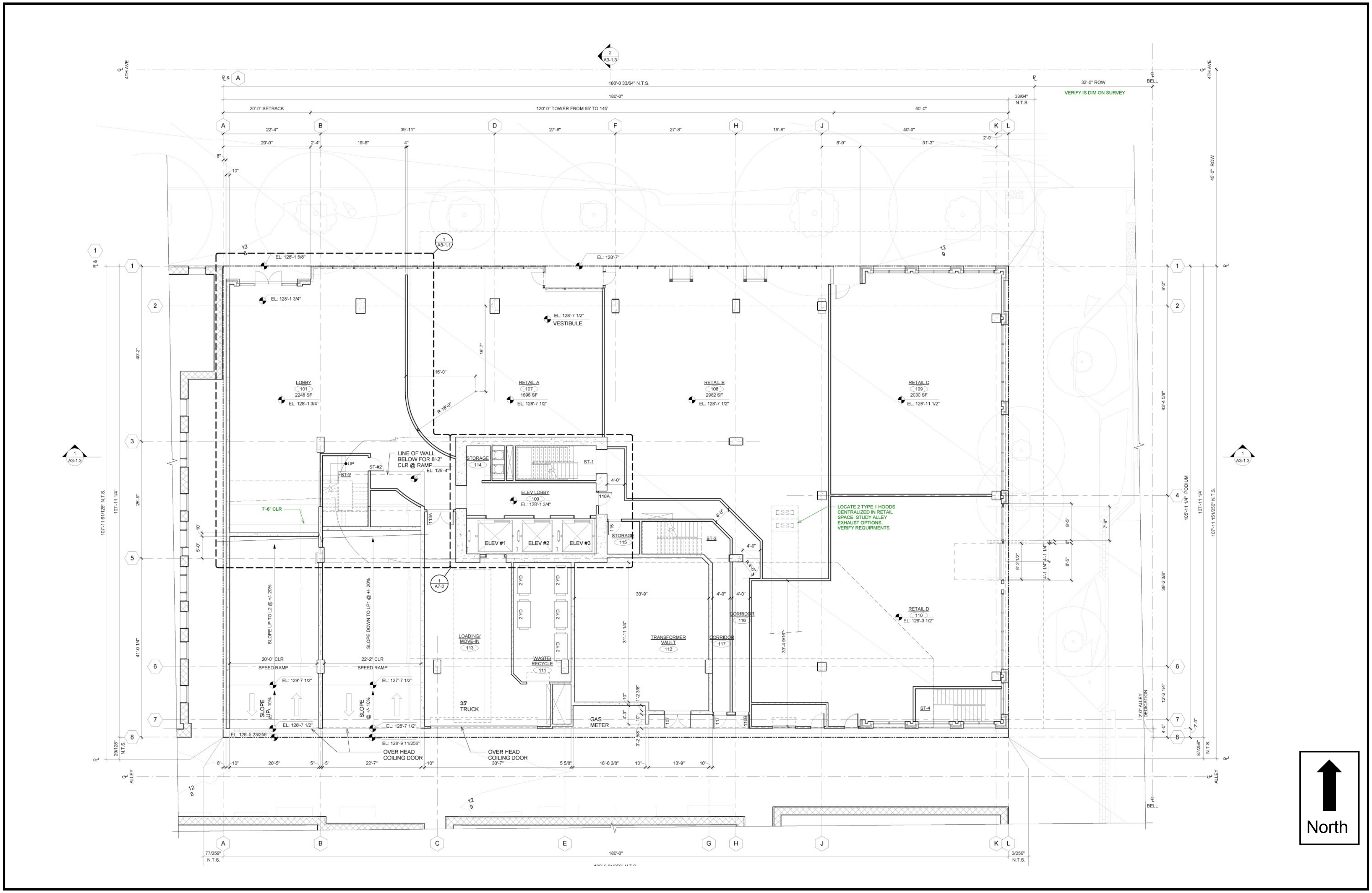


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Figure 2

Site Plan

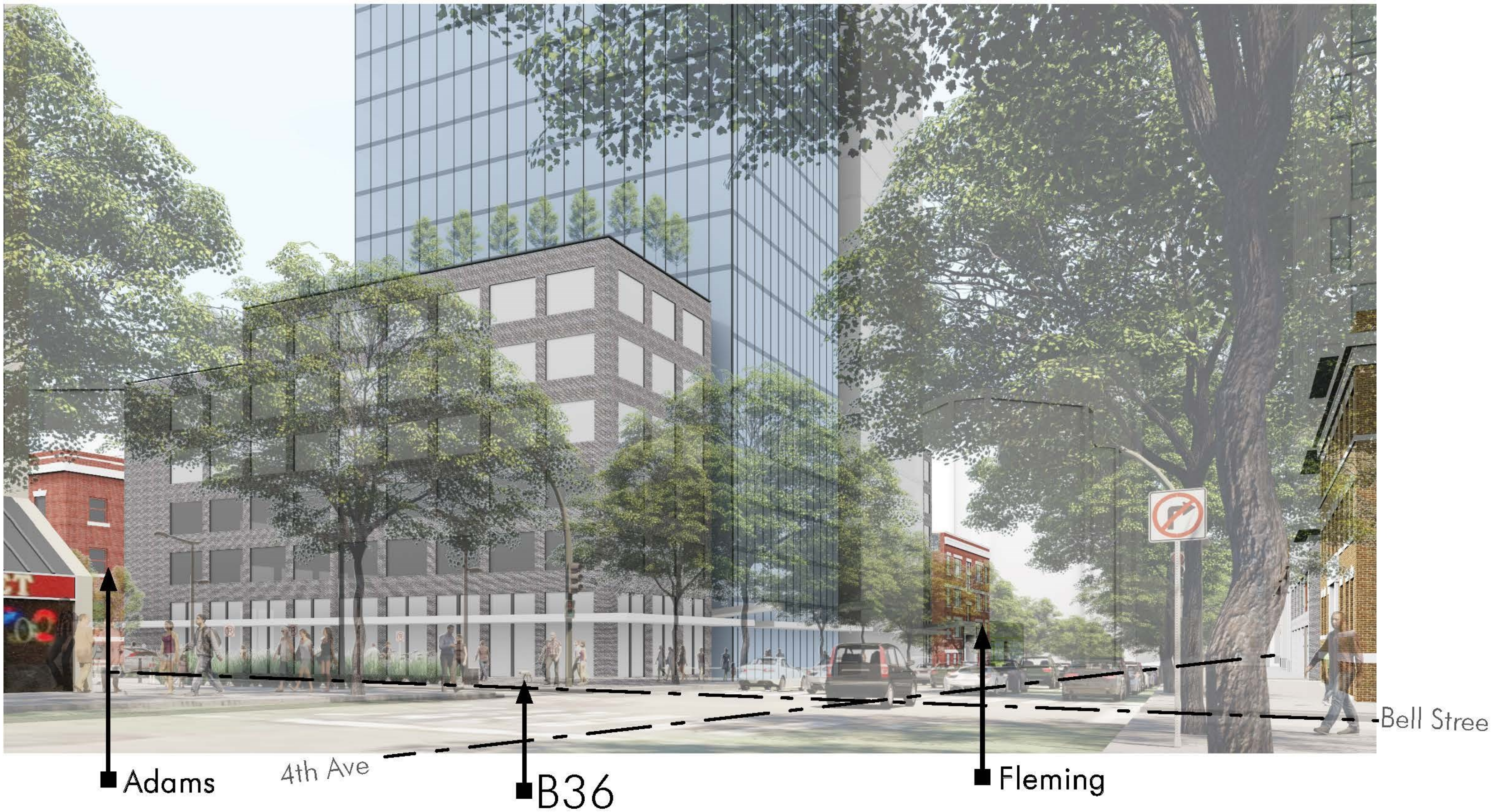

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Figure 3

Building Rendering

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Section II -- Analysis

Approach

This glare analysis has been prepared consistent with provisions of Seattle's Land Use Code and acceptable methodology[2] for projects within the City. The methodology that has been used involves a trigonometric/planimetric approach for determining reflected solar glare impacts. This analysis primarily evaluates reflected solar glare impacts resulting from glazing on the façade of the proposed building during four key periods of the year – vernal equinox (March 21st), summer solstice (June 21st), autumnal equinox (September 21st), and winter solstice (December 21st).

The glare diagrams that are contained in this analysis include adjustments for:

- the gradient of Third and Fourth Avenues based on street profile information;
- adjacent buildings; and,
- daylight savings time, which affects vernal equinox, summer solstice and autumnal equinox.

Background

Sources of Light and Glare

While the light from vehicle headlights and reflective solar glare from glazing and other specular surfaces on vehicles can cause temporary glare impacts associated with a development project, the principal source of glare associated with most development projects is sunlight reflected from specular surfaces on building facades. Factors influencing the amount of reflective solar glare that may occur include: weather (e.g., cloud cover); building height, width and orientation of the façade; percent of the façade that is glazed or composed of specular material; reflectivity of the glass or specular surfaces; design relationship between the glazed and non-glazed portions of the façade (e.g., glass inset from the sash, horizontal and vertical modulation); the color and texture of building materials that comprise the façade; and the proximity of other intervening structures or landscaping.

Principal sources of light that presently occur proximate to the project site include streetlights along adjacent roadways; light from headlights of vehicles operating on adjacent streets and maneuvering on parking lots; and building lighting (interior and in some instances low-level exterior) in the immediate area of the site. Existing streetlight fixtures are approximately 30 ft. tall and the lamps are cobra-style (cobra lamps function by lighting a broad area).

Factors that Affect Solar Glare

Structures and, to an extent, vegetation can mitigate the environmental impacts of reflected solar glare from glazing. Such can occur if these mitigating factors are located between the sun and the glass or specular surface or between the reflective surface of the façade and the area

2 City of Seattle; Department of Community Development. 1979 and 1980. *Light and Glare Study, Phase I* and *Light and Glare Study, Phase II.*

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potentially affected by reflected solar glare. While coniferous and/or evergreen vegetation typically afford the greatest amount of mitigation, at times deciduous vegetation can also restrict the amount of solar glare that is reflected from glazing -- from approximately late April to late October when leaves are present. Any on-site trees and street trees that are proposed for the project site would be deciduous. Between late October and late April, while the amount of glare restriction afforded by deciduous trees is substantially less (influenced by the density of the branches), even during this time of the year they can partially restrict the amount of reflected solar glare emanating from glazed surfaces below a height of 20-30 ft.

While **Figures 4-7** have been adjusted to compensate for existing buildings and the surrounding topography, they depict a worst-case scenario in that they cannot accurately depict the following factors that would further limit the extent of possible reflected solar glare:

- the mitigating effect of existing and/or proposed on-site trees and street trees; and
- the extent of façade modulation and building materials that are proposed.

Glare Conditions of the Proposed Project

The ***Belltown 36 Development*** is located in Seattle's Belltown neighborhood and would consist of a 30-story mixed-use building with approximately 203 apartment units, 19,000 sq. ft. of office space, and 12,000 sq. ft. of retail space. The proposed project would result in an increased number of vehicles entering and exiting the site from the mid-block alley.

Based on the height of the proposed ***Belltown 36 Development*** relative to the existing surrounding properties, the proposed project would be noticeable. As such, stationary sources of light (e.g., interior lighting, pedestrian-level lighting, illuminated signage) from the ***Belltown 36 Development*** would be visible from locations proximate to the project site. Specific information relative to stationary building light fixtures, signage, façade materials (in terms of specular or reflective characteristics) and glazing would be provided as part of the construction-level plans associated with the City's Building Permit process. Light fixtures would be shielded and directed away from adjacent properties. The building facade would not include highly reflective glazing or materials. At times during the construction period, however, required area lighting of the job site (safety requirements) would be provided, which would be noticeable within the immediate vicinity of the project site.

Findings

Summary of Findings

The analysis indicates while motorists on Third Avenue and Fourth Avenue could experience reflected solar glare from the façades of the proposed building, such glare would primarily be outside of the cone-of-influence and would not be expected to cause problems for motorists nor differ substantially from periodic glare from stationary and mobile sources that motorists typically experience. Motorists would generally be shaded from glare by adjacent buildings and trees. Additionally, motorists would be expected to be moving more slowly during AM and PM peak traffic hour periods due to high levels of congestion, thereby giving drivers sufficient time to react to any potential solar glare-related impacts.

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Results of the Analysis

Figures 4-7 depict reflected solar glare from the facades of the proposed ***Belltown 36 Development*** at two times each day during each of the four key days of the solar year -- vernal equinox (approx. March 21st), summer solstice (approx. June 21st), autumnal equinox (approx. September 21st), and winter solstice (approx. December 21st). The two times of the day (8 AM and 5 PM[3]) reflect the two peak hour traffic periods for Third Avenue and Fourth Avenue. It should be noted, however, that solar glare-related impacts may also occur at other times of the day and days of the year. Also, because of the earth's rotation, the duration of reflected solar glare impacts will vary – from several minutes[4] for a stationary observer to substantially less for a mobile observer.

The following analysis considers that Fourth Avenue is limited to one-way traffic. Vehicles on Fourth Avenue travel north, while vehicles on Third Avenue travel north and south.

The analysis also considers the tiered design of the ***Belltown 36 Development,*** in which the dimensions of the building differ from levels one through six, seven through fifteen, and sixteen through thirty.

Vernal Equinox – Approximately March 21st (refer to **Figure 4**). Climatic data indicate that March typically has 3 clear days, 6 partly cloudy days and 22 cloudy days.[5]

- At **8 AM**, reflected solar glare would extend from portions of the east façade of the proposed building to the north towards Fourth Avenue and could potentially affect motorists for approximately five to six seconds. Reflected solar glare would also extend from portions of the south façade to the south towards Third Avenue and could potentially affect motorists for roughly four to five seconds. While noticeable, this glare would be outside the cone-of-influence for drivers and would not be expected to cause problems for motorists nor differ substantially from periodic glare from stationary and mobile sources that motorists typically experience.

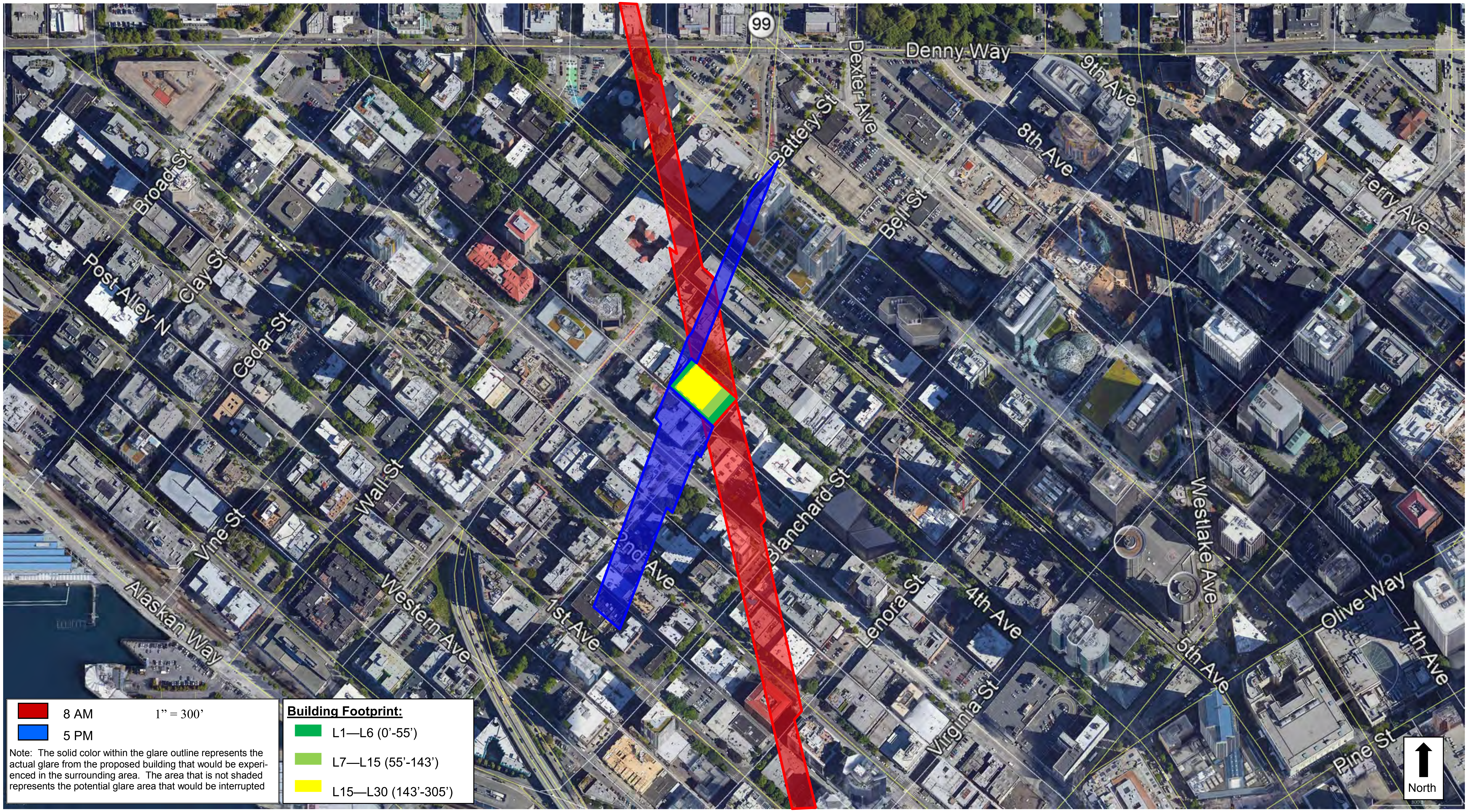
- At **5 PM**, reflected solar glare would extend from portions of the north façade of the proposed building to the northeast towards portions of Fourth Avenue and could potentially affect motorists for approximately two to three seconds. Reflected solar glare would also extend from portions of the west façade towards Third Avenue and could potentially affect motorists for roughly three to four seconds. While noticeable, this glare would be outside the cone-of-influence for drivers and would not be expected to cause problems for motorists nor differ substantially from periodic glare from stationary and mobile sources that motorists typically experience.

---

3 8:30 AM and 4 PM for winter solstice because sunrise occurs slight before 8:30 AM and sunset occurs slightly after 4 PM.

4 The rate of change of the sun's angle relative to the earth varies widely by season – from about 5 degrees horizontally and 2 degrees vertically every 15 minutes in June to 3 degrees horizontally and 1 degree vertically every 15 minutes in December.

5 U.S. Dept. of Commerce, NOAA, 1992.



Source: EA Engineering and Google Maps, 2018

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Figure 4

March 21 — Vernal Equinox — Pacific Daylight Savings Time

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Summer Solstice – Approximately June 21st (refer to **Figure 5**). Climatic data indicate that June typically has 5 clear days, 8 partly cloudy days and 17 cloudy days.[6]

- At **8 AM**, reflected solar glare would extend from portions of the east façade of the proposed building to the north towards Fourth Avenue and could potentially affect motorists for approximately five to six seconds. Reflected solar glare would also extend from portions of the south façade to the south towards Third Avenue and could potentially affect motorists for roughly one to two seconds. While noticeable, this glare would be outside the cone-of-influence for drivers and would not be expected to cause problems for motorists nor differ substantially from periodic glare from stationary and mobile sources that motorists typically experience.

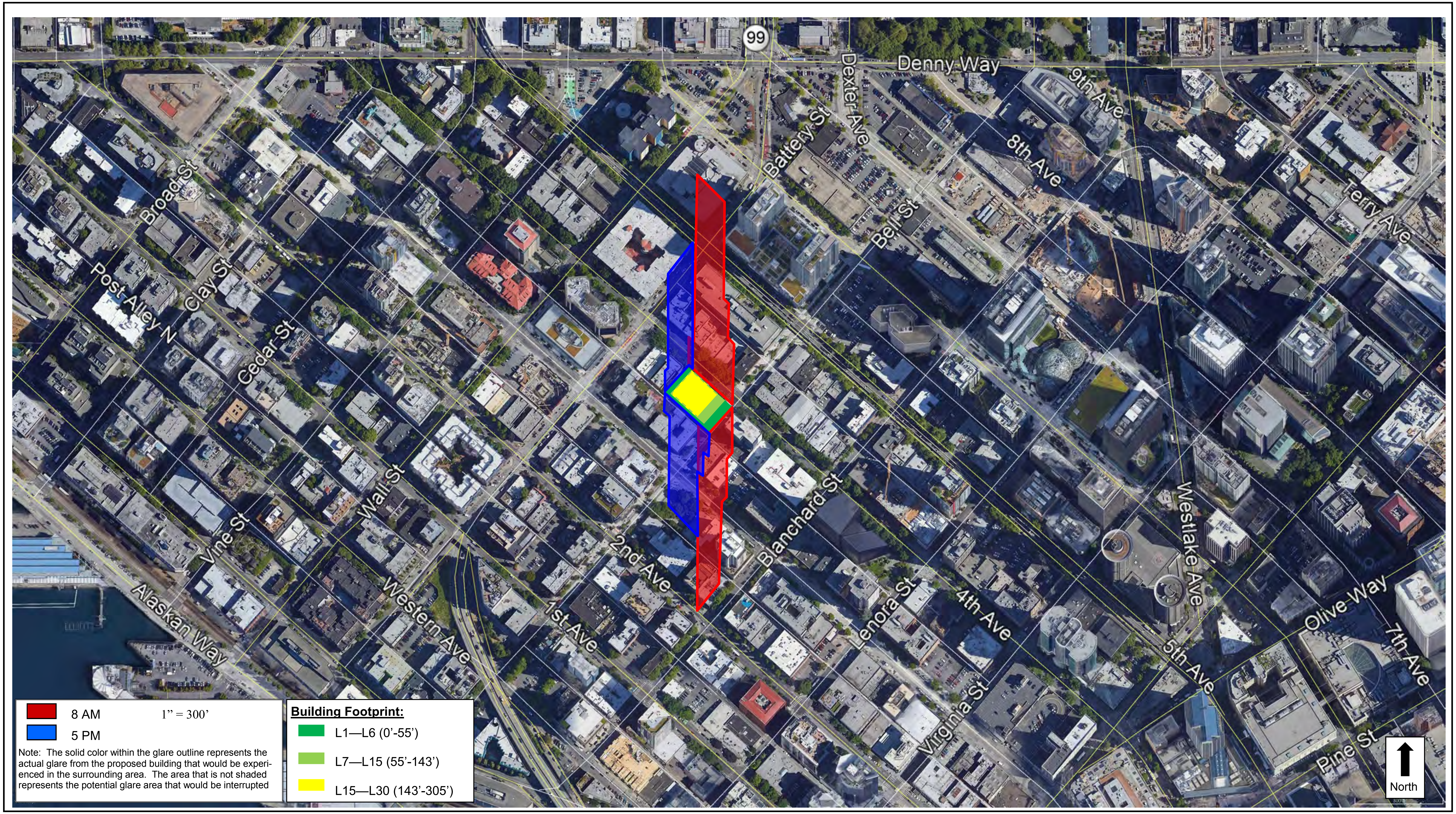
- At **5 PM**, reflected solar glare would extend from portions of the north façade of the proposed building to the northeast towards portions of Fourth Avenue and could potentially affect motorists for approximately two to three seconds. Reflected solar glare would also extend from portions of the west façade towards Third Avenue and could potentially affect motorists for roughly two to three seconds. While noticeable, this glare would be outside the cone-of-influence for drivers and would not be expected to cause problems for motorists nor differ substantially from periodic glare from stationary and mobile sources that motorists typically experience.

Autumnal Equinox – Approximately September 21st (refer to **Figure 6**). Climatic data indicate that September typically has 8 clear days, 9 partly cloudy days and 13 cloudy days.[7]

- At **8 AM**, reflected solar glare would extend from portions of the east façade of the proposed building to the north towards Fourth Avenue and could potentially affect motorists for approximately five to six seconds. Reflected solar glare would also extend from portions of the south façade to the south towards Third Avenue and could potentially affect motorists for roughly five to six seconds. While noticeable, this glare would be outside the cone-of-influence for drivers and would not be expected to cause problems for motorists nor differ substantially from periodic glare from stationary and mobile sources that motorists typically experience.

- At **5 PM**, reflected solar glare would extend from portions of the north façade of the proposed building to the northeast towards portions of Fourth Avenue and could potentially affect motorists for approximately one to two seconds. Reflected solar glare would also extend from portions of the west façade towards Third Avenue and could potentially affect motorists for roughly two to three seconds. While noticeable, this glare would be outside the cone-of-influence for drivers and would not be expected to cause problems for motorists nor differ substantially from periodic glare from stationary and mobile sources that motorists typically experience.

6 U.S. Dept. of Commerce, NOAA, 1992.
7 Ibid.



Source: EA Engineering and Google Maps, 2018

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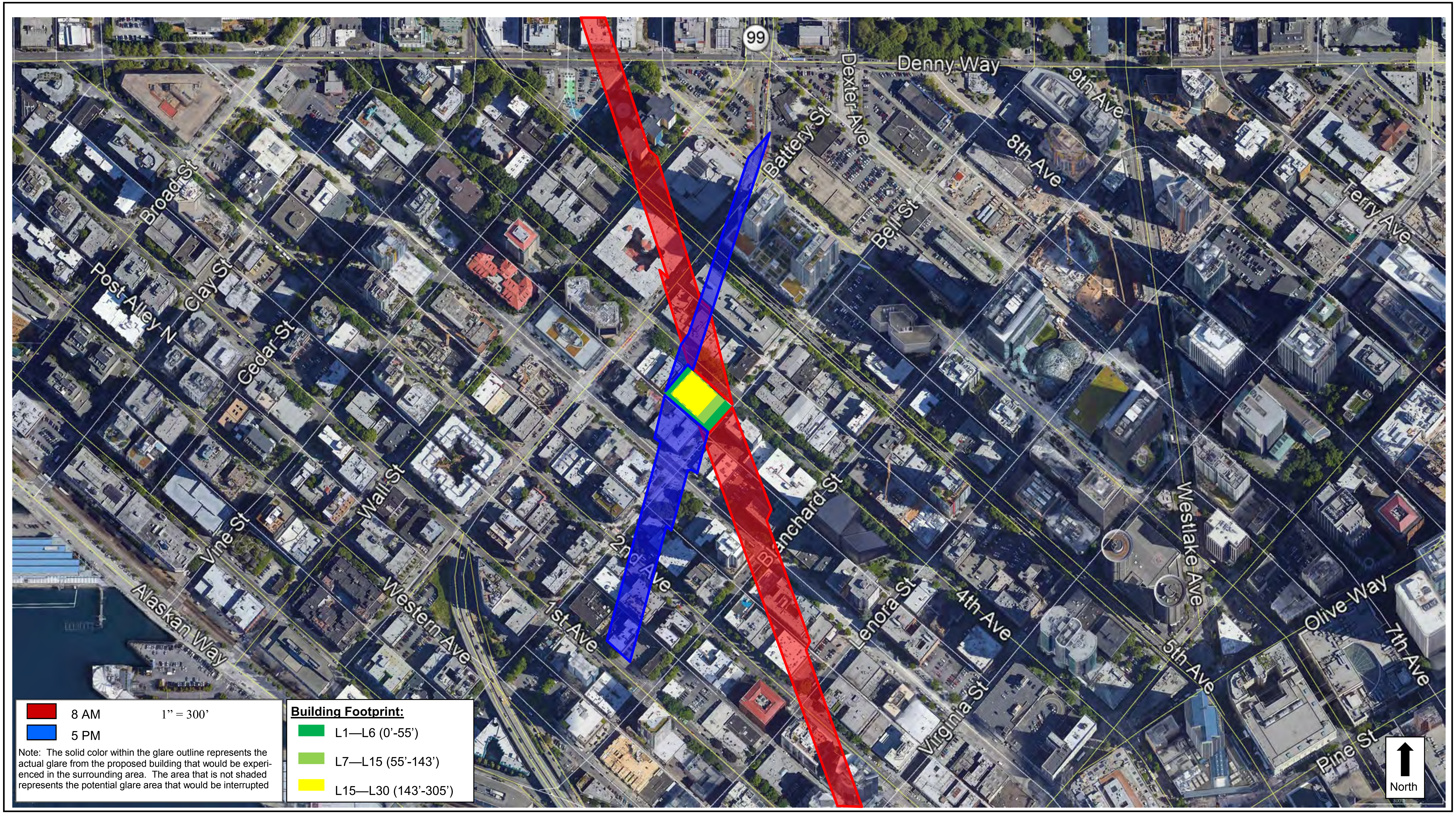
Figure 5

June 21 — Summer Solstice — Pacific Daylight Savings Time



Source: EA Engineering and Google Maps, 2018

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Figure 6

September 21 — Autumnal Equinox — Pacific Daylight Savings Time

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Winter Solstice – Approximately December 21st (refer to **Figure 7**). Climatic data indicate that December typically has 2 clear days, 4 partly cloudy days and 25 cloudy days.[8] On this day of the year at 4 PM the altitude of the sun above the horizon is approximately 2 degrees; therefore, reflected solar glare distances are great.

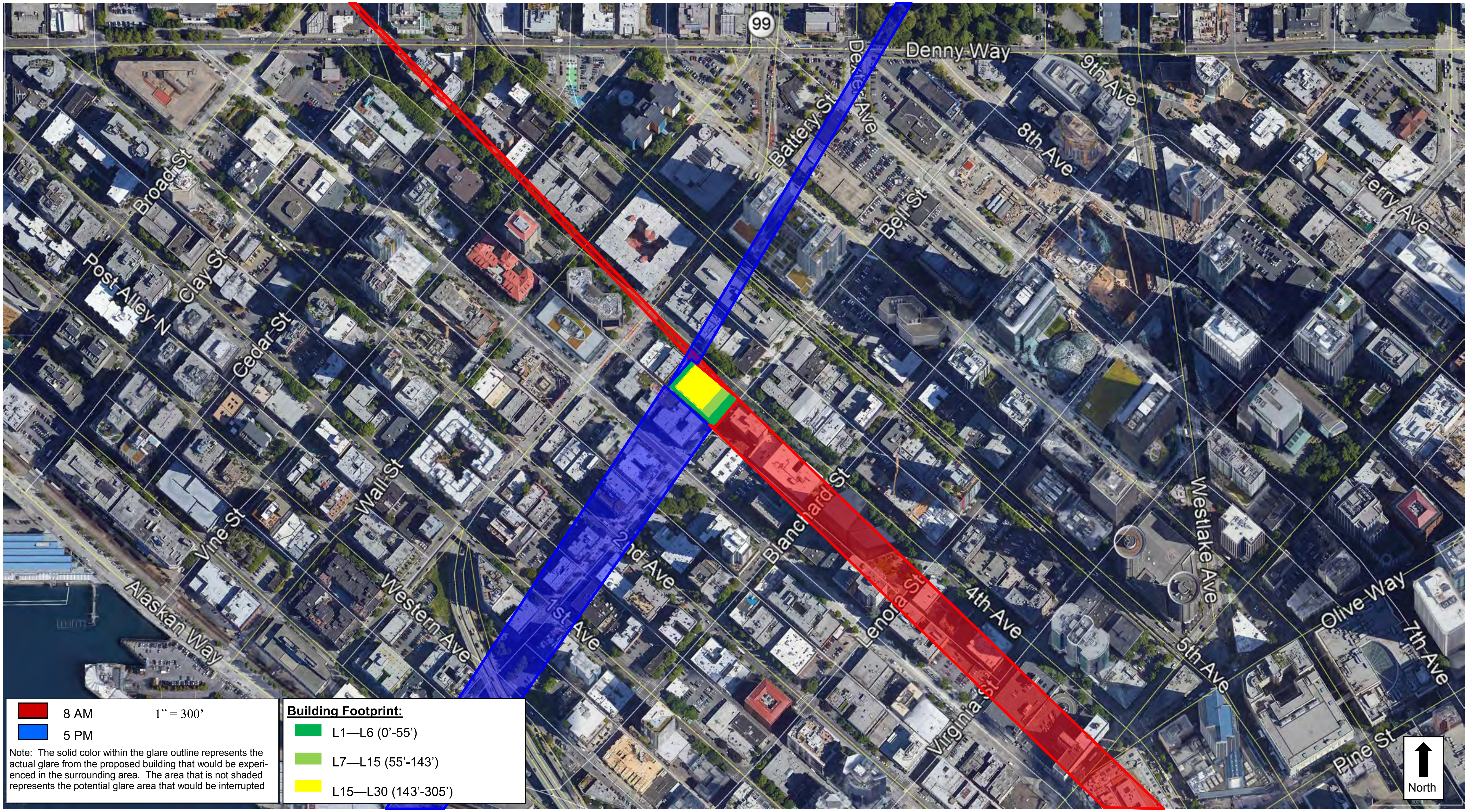
- At **8:30 AM**, reflected solar glare would extend from portions of the east façade of the proposed building to the north towards Fourth Avenue and could potentially affect motorists for approximately five to six seconds. Reflected solar glare would also extend from portions of the south façade to the south towards Third Avenue and could potentially affect northbound motorists for roughly 35 to 45 seconds. However, there are a limited number of days at this time of year with sun, and it is anticipated that most areas at street level would be shaded by adjacent buildings and trees, which would significantly reduce or eliminate impacts on motorists. Additionally, during this time of day, traffic is usually moving more slowly due to high levels of congestion, thereby giving drivers sufficient time to react to any potential solar glare-related impacts.

- At **4 PM**, reflected solar glare would extend from portions of the north façade of the proposed building to the northeast towards portions of Fourth Avenue and could potentially affect motorists for less than one second. Reflected solar glare would also extend from portions of the west façade towards Third Avenue and could potentially affect motorists for roughly four to five seconds. While noticeable, this glare would be outside the cone-of-influence for drivers and would not be expected to cause problems for motorists nor differ substantially from periodic glare from stationary and mobile sources that motorists typically experience.

In summary, while motorists on Third Avenue and Fourth Avenue could experience reflected solar glare from the façades of the proposed building, such glare would primarily be outside the cone-of-influence and would not be expected to cause problems for motorists nor differ substantially from periodic glare from stationary and mobile sources that motorists typically experience. Motorists would generally be shaded from glare by adjacent buildings and trees. Additionally, motorists would be expected to be moving more slowly during mornings and evenings due to high levels of congestion, thereby giving drivers sufficient time to react to any potential solar glare-related impacts.

Analysis also indicates that at certain times of the year and times of day – assuming that weather conditions are suitable (e.g., not raining or overcast) -- reflected solar glare from the façades of the proposed ***Belltown 36 Development*** could be noticeable to residents in buildings within a few blocks of the project site. While noticeable, no significant long-term impact is anticipated, partly due to mitigating effects such as less-reflective building materials being used, building modulation, as well as the fact that reflected glare, if it occurs, would be limited in duration.

8 U.S. Dept. of Commerce, NOAA, 1992.



Source: EA Engineering and Google Maps, 2018

EA Engineering, Science, and Technology, Inc.

Figure 7

December 21 — Winter Solstice — Pacific Standard Time

Potential Mitigation Measures

In summary, no significant long term, reflected solar glare-related environmental impacts are anticipated for motorists on Third Avenue or Fourth Avenue as a result of the proposed ***Belltown 36 Development*** and no mitigation measures are necessary. The following measures, however, would help to reduce overall light and glare from the project as it relates to the neighborhood surrounding the site.

- Building façade materials are still in the process of being finalized, and the facades of the proposed building could include metal and glass window wall structure with glass spandrel panels or the like. The City's Downtown Design Review Board is currently reviewing project-related design elements. Reflectivity of the glazing will be dictated by the nature of glass that is employed and the requirements set forth by the City's Energy Code and the LEED energy requirements. It is anticipated, however, that no excessively-reflective surfaces (i.e. mirrored glass, or polished metals) that go beyond what is required to meet energy-related code provisions are proposed anywhere on the exterior of the project buildings.

- Building façade modulation would reduce the effect of any potential reflected solar glare.

- The proposed street trees, as well as the use of building materials with relatively low-reflectivity at street level would minimize reflective glare-related impacts to pedestrians, motorists and nearby residents.

- Pedestrian-scale lighting would be provided consistent with code, function and safety requirements. Exterior lighting would include fixtures to direct the light downward and/or upward and away from off-site land uses.

Significant Unavoidable Adverse Impacts

No significant unavoidable adverse impacts are anticipated.

APPENDIX F

MUP Appendix A Report

Hewitt's Café / Two Bells Tavern
2315 4th Avenue, Seattle
Appendix A

BOLA Architecture + Planning
September 25, 2018

INTRODUCTION

Background

This Appendix A Report was prepared to help determine the eligibility of a small commercial building in Seattle's Belltown neighborhood as a local landmark. The building at 2315 4th Avenue was included in the City of Seattle's historic survey of downtown properties in 2007 and was the subject of a landmark nomination report by the Department of Neighborhoods (DON). The nomination was considered by the Seattle Landmarks Preservation Board in 2008, but the property was not designated.

The report utilizes information cited in the 2007 nomination, augmented by additional research undertaken in October 2017 – March 2018. This included several site visits to document the building's exterior and interior elements, site features, and urban context. Additional historic information came from the following sources:

- Drawings and permit records from the Seattle Department of Construction and Inspections (SDCI).

- DON Historical Site Inventories and "Historic Context Report on Belltown."

- Property information from the current King County i-Map online records, and archival tax records from Puget Sound Regional Archives.

- Digital historic photographs from the Seattle Public Library (SPL), University of Washington Libraries Special Collections (UWLSC), and the Museum of History and Industry (MOHAI). Digital maps and photos from Seattle Municipal Archives (SMA).

- Historic Polk Directories and biographical information about the building's owners and occupants.

- Archival *Seattle Times* newspaper articles from the Seattle Times Historical Archives database (Seattle Public Library).

- Information about the building and tavern's history from the owner and operator Tina Morelli-Lee.

PROPERTY DATA

Historic / Current Name: Hewitt's Café / Two Bells Tavern
Address: 2313 4th Avenue (also cited as 2315 4th Avenue), Seattle, WA 98121

Site Location: The property is situated on the west side of 4th Avenue between Bell and Battery Streets.
Tax Parcel Number: 065600-0605
Legal Description: Lot 10, Block 36, Second Addition to that part of City of Seattle, as laid off by A.A. Denny and W. N. Bell (Commonly known as Bell & Denny's 2nd Addition to the city of Seattle), according to the Plat thereof recorded in Volume 1 of Plats, Page 77, record of King County, Washington; except the Easterly 12 feet thereof condemned in King County Superior Court cause No. 52280 for 4th Avenue, as provided by Ordinance No. 137756 of the City of Seattle.

Original Construction Date: 1923 (remodeled 1954 and 1992-1993)
Original Use: Retail Grocery & Meat Market & Stores
Later Use: Café/Tavern & Storage
Current Use: Vacant

Original Designer: George W. Stoddard, Architect, Seattle (1923)
Original Builder: Unknown

Later Designer: Larry Rouch, Designer, Seattle (1992-1993)
Later Builder: Ron Christiansen, Contractor (ca 1993)

Site Area: 6,480 square feet (0.15 acres) (King County Assessor)
Building Sizes: 5,030 square feet (King County Assessor)

Original Property Owner: John Scott
Later Owners & Operators: Prudential Insurance (10.5.32)
Harold G. Stern ($13,000 purchase, 3.29.1944)
Hugo W. Johansson ($40,000 purchase, on 6.28.50)
Guv Stevens, Owner, Two Bells Tavern (1953)
E. G Harvey ($60,000 purchase in 1958)
Patricia Ryan and Rolon Bert Garner (ca 1982 –1998)
Quattro E. Campana (1998- present)

Present Owner: Tina Morelli-Lee
Quattro E. Campana, LLC
909 36th Avenue
Seattle, WA 98122

HISTORIC CONTEXT AND SIGNIFICANCE

Development of the Belltown Neighborhood

The Two Bells Tavern is located within the Belltown area, north of the city's retail and financial center. Historically, this area was envisioned as an apartment district, and was part of the multi-phase regrading of Denny Hill, a major infrastructure effort that began in 1898 as a vision to make Seattle's steep hills and streets more level and encourage development. The block on which the Two Bells Tavern is located was included in the second regrade project (1903 - 1911). The building is associated with retail businesses that served the early residents in the emerging neighborhood.

Belltown, like the rest of the city, evolved significantly during the 1920s. Its location close to downtown made it an ideal location for apartment buildings to house downtown and waterfront workers, with an accompanying array of cafés, taverns, and small grocery stores. Belltown also became the center of the film industry in the Pacific Northwest, and the neighborhood's close-in, low-density location encouraged auto-oriented businesses such as service garages, printers and small-scale suppliers, and assemblers servicing downtown businesses. Although the city expected development following the final phase of the regrade, the work was completed just as the country entered the Great Depression. Population growth virtually came to a standstill.

Seattle was transformed, however, by World War II. The North Pacific location made it a strategic military location for the war against Japan, and its airplane factories, shipyards, and steel mills made it a crucial part of the war effort. Boeing alone increased employment from 4,000 to 50,000 between 1939 and 1945. Belltown's proximity to downtown and waterfront industries also made it a center for union activity, with this trend continuing through the 1950s, and numerous other union halls were constructed. Additionally, the 1962 World's Fair just north of Belltown, led to the construction of modern motels in the eastern part of the neighborhood.

Despite these developments, much of the area remained undeveloped. In his 1973 book, *Seattle Cityscape #2*, Victor Steinbrueck commented: "the Denny Regrade area is a mixed-up no man's land of used car sales and parking lots, motels, and punch card-facade sterile office buildings … [that] add noting to the quality of the city … [A] park and residential development would be ideal here in helping to breathe life into downtown" (Steinbrueck, pp. 38-39). Older urban residents, artists, musicians, and small retail business took advantage of this atmosphere and the low-cost rents that accompanied it, beginning in the 1960s and 1970s. These decades also saw some high-rise mixed-use apartment/condominium buildings, many in the southwestern area closer to Pike Place Market.

In the succeeding decades, while property values increased in other nearby areas, those in the Regrade/Belltown area remained restrained. Belltown served as a creative center in the 1970s and 1980s, supporting a public culture of galleries, art bars, bookstores and small shops. It became increasingly attractive for denser development at the end of the 20th century. The site at 2315 4th Avenue is zoned DMR/C 280/125 (Downtown Mixed Residential/Commercial) by the City to increase residential density in the neighborhood.

The Building's Ownership and Occupancy History

Historic maps indicate that, prior to 1923, the site was vacant. That year, the subject building was designed and built for John Scott, Esquire. Scott may have been a partner in Scott-Poor Inc., a real estate investment firm with offices at 900 2nd Avenue. The first tenants of the building are not known, but the original building plan labels the center store as a "grocery and meat market." Fourteen years later, the tax assessor's property record photo from 1937 shows a café in the center space and a grocery in the northern store.

The property owner in the 1930s may have faced bankruptcy, as the Prudential Insurance Company is listed as the owner in 1937. Later property owners were Harold G. Stern (1944), president of Refrigeration Supply Inc., who purchased it for $13,000; and Hugo W. Johanson (1950), who purchased it for $40,000. By 1953, it was owned by the Guy B. Stevens & Company, and E. G. Harvey (or B. E. Harvey), who purchased it in 1958 for $60,000. Other owners and operators of the tenant business have varied for periods through history, according to the Seattle *Polk Directory*. J. Leonard Crawford owned the J. L. Crawford Beer Parlor in 1938, a few years after the end of Prohibition. Signage visible in tax assessor's photos from the mid-1930s notes a grocery with soda fountain, and ads for cigars, magazines, candies and Sunfreeze ice cream. Soon afterward, the tavern was renamed Two Bells. The tavern has remained the building's long-time tenant, operated by various owners since that time. In 1948, it was operated by P. M. Iseminger and W. A. Stewart. It appears that the tavern occupied only one of the three storefront spaces, while 2315 and 2317 4th Avenue were occupied by separate tenants, which changed often during the post-war decades. It housed the Signal Equipment Company in 1950, and another long-term tenant was Bernard Wagner.

In 1951, Bill Hewitt established Hewitt's Café in the center space and in 1953 converted the northern retail space (at 2317) into a banquet room. He also expanded the banquet room into the northern garage space to the rear in 1955. Hewitt was born in Bremerton and had a long career in hospitality, as indicated by his early interest in the field and studies in the food and hotel program at Washington State College, from which he graduated in 1941. During the war he served primarily at Fort Lewis, in food services. Shortly after opening his own café in 1951, he established Hewitt's Catering Service in the subject building to arrange larger events for clients. He closed the café to focus on these larger events and moved the banquet facility to 3229 Fairview Avenue N, the location of the Tyee Yacht Club on Lake Union.

After Hewitt closed the café in the early 1960s, the building experienced a series of short-term tenants and vacancies during the 1960s – 1970s. These included Steel Industries in 1970, Harmon-Jordal Photography in 1971-1973, and the Sweda International Cash Register Sales and Service and its storage space in 1975. In the late 1970s and at times in the 1980s, a portion of the building housed the Fleetfoot Delivery Service. In 1982, both the building and Two Bells Tavern business were acquired by Patricia Ryan. Ryan, along with bartender Rolon Bert Garner, who later became her husband, operated it as a café and art bar with personally curated art exhibits while retaining the exterior. The recent owners of the Belltown Tavern, Tina Morelli and Jeff Lee, who purchased it in 1998, continued the tradition of exhibiting work by local artists until they closed the business at the end of 2017.

The Original Architect, George Wellington Stoddard

The original builder of 2315 4th Avenue has not been identified. George Wellington Stoddard was the original designer. Stoddard (1896-1967), a native of Detroit, attended the University of Illinois, where he earned a degree in architectural engineering in 1917. Following graduation, he served with the U. S. Army in France until 1920. He then moved to Seattle, where his father, Lewis M. Stoddard, had established a practice as a naval architect. He joined the practice and the firm was renamed Stoddard and Son (*Seattle Times*, March 27, 1960).

Between the 1920s and 1970s, Stoddard and his firms designed over 220 projects (Johnson). During this early part of his career (1920-29), he designed a plant for Metropolitan Press/Brasa/Orfeo building at 2107 3rd Avenue, and, in 1929, the nearby Seville Building at 2226 3rd Avenue. Stoddard's two largest early works are Tacoma's Winthrop Hotel (S 9th Street at S Broadway), built in 1925, and an ornate parking garage at 6th Avenue and Olive Way. He also designed a number of large residences in Broadmoor, Queen Anne, and Capitol Hill.

Following his father's death in 1929, he established his own firm, George Wellington Stoddard & Associates. The firm undertook a wide variety of work, including apartment buildings, clinics, banks, and other commercial structures as well as hospitals, markets, college facilities, and multi-family housing, along with many remodels and additions. As the Depression continued, Stoddard, like his colleagues, undertook government contracts. In 1940 – 1943, he joined several of the city's best-known architects – William J. Bain, J. Lister Holmes, William Aitken and John T. Jacobson – on the Yesler Terrace Public Housing. He also developed the Aloha Terrace apartment complex on Capitol Hill in 1943-1944. In his later career, Stoddard completed numerous institutional projects, including Memorial Stadium (1947, now part of the Seattle Center), and an addition to the University of Washington Stadium South Stands (1950). Perhaps his best-known work of the period is the 1950 Green Lake Aqua Theater.

In 1955, Stoddard formed a partnership with Francis Huggard; the firm was known as George W. Stoddard-Huggard Associates, Architects and Engineers. After Stoddard's 1960 retirement the firm became Stoddard and Huggard (*Seattle Times,* March 27, 1960). Stoddard was an extremely active citizen and served on numerous boards and committees, such as the State Hospital Advisory Council Executive Committee (1948 - 1949), the Seattle Civic Arts Committee, the King County Educational Advisory Committee (1950 - 1951) and the King County Juvenile Advisory Committee (1952). He served on the board of the Seattle Symphony for many years and as president of the Washington State Chapter of the American Institute of Architects in 1946-1947. He died in 1967, at the age of 71.

The Building Type and Architectural Style

The original building is an eclectic mix of architectural styles, including Mission and Gothic Revival. The design follows some of the traditions of an early 20th century retail building type, with its primary facade made up largely by storefronts with display windows set above bulkheads and capped by transom windows, which were useful to illuminate the interior space. The building was oriented to pedestrian traffic rather than vehicles, and its primary east facade features three equivalent entries, each set back into a recess within the property line and building footprint to provide protection from weather. It was modestly scaled with tenant spaces of one or two bays and original floor heights set at 10'.

The original design provided a tall primary facade with raised parapets along the front edge of the slightly sloping flat roof, which emphasized the entries by steeply pitched gable-end forms and decorative medallions.

ARCHITECTURAL DESCRIPTION

Setting and Urban Context

The property is situated in an area north of the city's retail and financial core, and south of Denny Way and the Uptown/Seattle Center area. Buildings present in Belltown today represent a considerable mix of ages, uses and scales – offices, apartments, and condominium buildings of various scales – with stores, restaurants, and bars at street level, and some parking lots. Forty years ago, an urban inventory of the Denny Regrade neighborhood, sponsored by Historic Seattle, identified seven potential landmarks within three blocks of the Two Bells Tavern site: the Austin A Bell Building (1889, 2362 1st Avenue), Herman Building (1904, 2021 1st Avenue), Fire Station No. 2 (4th Avenue and Battery Street), Otis Elevator Building (1923, 2200 4th Avenue), Farwest Lithocraft Building (1937, 3rd Avenue and Wall Street), the P.I. Building (1948, 521 Wall Street), and United Airlines Building (1965, 2023 6th Avenue), along with others cited as "significant to the city." The Two Bells Tavern building was not identified as either of these. Currently there are 25 properties in the Belltown neighborhood, to the north of Lenora Street, that have been designated as Seattle landmarks.

The Site and Building

The site is approximately 108' by 60' and the open back courtyard to the west is 53.4' by 24.5'. The Two Bells Tavern is in the middle of the block on the west side on 4th Avenue between Bell and Battery Streets. The immediate surroundings include old and new buildings. Across 4th Avenue to the northeast are both the city's oldest operating fire station and a new five-story condominium. Directly across 4th Avenue are small 1950s buildings, a 1970s high-rise, and two older apartment buildings, the 1918 Franklin at 2302 4th Avenue, and the 1922 Charlesgate at 2230 4th Avenue. Directly behind the tavern and across the alley to the west, at 2312 3rd Avenue, is a large, recently constructed 251-unit condominium building, the Moda. A 16'-wide alley separates the buildings. Abutting the building to the north is the adjacent Fleming Apartment Building at 2321 4th Avenue, which dates from 1918

The property is a 6,480 square foot, mid-block parcel containing a single story, commercial building dating from 1923. The U-shaped, approximate 5,180 square foot structure houses a small office/retail space and a tavern/café in the front or eastern 60' by 54.6' section, along with two approximately 18' by 53' back wings to the west. The back wings were cited on an original drawing as garage spaces, while the front commercial spaces were designed as two separate stores – a grocery and meat market. For many decades the building was a neighborhood café, and a popular tavern. The tavern closed at the end of 2017 and the building is currently vacant.

The King County Assessor's archival property record card from 1937 indicates the one-story subject building contained a store and garage in a structure with four rooms. The one-story building is of brick construction with wood and timber framing supporting the generally flat roof. It is U-shaped in plan, measuring 60' along 4th Avenue and 107' deep. The primary facade faces onto 4th Avenue. It is clad with stucco and has three storefronts, each with a segmental arched entry leading to an approximate 3' deep recess, which are surrounded by irregularly sized and laid bricks set in horizontal and radiating patterns. The central entry recess, with a width of 6', is more prominent than the 4' wide north and south entries. Each entry was originally announced by a raised parapet and stepped gable shape, which characterized the building, were removed in 2010. The current flat parapets step up slightly above each entry.

The building was noted in the assessor's property record card from the mid-1930s as having good construction grade, with solid masonry construction with a concrete foundation and concrete floor joists, and a tar and gravel roof. According to the notes in the property record, the brick was a common type unit, finished with stucco on "front only," with stucco trim and metal coping. Outer dimensions were cited as 40' by 60', plus a 9' by 22' lean-to extension in the middle of the back. Two wings, each noted as 18' by 59', were shown at the back to make up the present building. (Current verified dimensions are slightly different. The building area is approximately 5,180 square feet.)

The two large display windows on the primary facade are each divided into three sections with outermost windows of 5' by 6'-9" and the center ones 5' by 3'. Originally, the two outer sections contained three nine-light operable transoms, while the narrower center section had a single divided-light transom of the same size. At some point, the original transom sash were replaced with single, undivided glazing units. All of the other windows appear to be original wood sash, painted, with single glazing. Originally, there was a decorative cast band that framed the top and upper sides of each of the storefronts. These bands have been changed to simpler horizontal trim forms.

Below the storefront windows, the bulkheads feature a masonry base of brick soldier courses and panels of herringbone pattern brick, the angles of which reflect the pattern of the brick entryway surrounds, and a rowlock brick sill course below the window frames. The masonry walls extending into the entry recesses are exposed rather than stucco clad. The painted wood panel entry doors with glazing in each of the recesses may be original. The center doorway has an arched four-light transom, while those to the north and south have no transoms. The northernmost door, leading to a separate retail space, is fitted with a security grill.

The composition featured cast bands above the storefront windows, cast parapet caps, and decorative brickwork surrounds at each of the entry openings and at the bulkheads below the display windows. Historic photos indicate the stucco cladding and brickwork on the building's front facade were contrasting light and dark colors. Photos from ca. 2007 and earlier indicate the filed color of the light buff yellow stucco and dark red brickwork, which emphasized the different materials. The building's character has been minimized by the removal of the gable-shaped parapet and other decorative devices and the current dark gray color scheme.

The building's south facade, facing the adjacent parking lot, consists of painted masonry with a sign for the restaurant, but few other features. The roofline steps down slightly toward the west following the slight slope of the flat roof. A range of rooftop ventilation equipment associated with the kitchen functions is visible. These, and other roof-top mechanical units, were added in the early 1990s. Fitted against the building's south wall, near the northwest corner of the neighboring parking lot, there is a separate small storage structure.

The back 17'-wide north and south wings, which are set along the outer property lines, extend beyond this section of the building to the alley. These wings were designed originally to hold garage spaces, separated from the main wing of the building by an 8"-wide hollow tile with wall deep wood storage spaces. As shown on the original drawings, each of the garages was fitted with a pair of wood panel type doors set within 8'-wide and 9'-6" tall openings; steel lintels supported the hollow tile above the openings. The original drawings show fourteen separate garages in four bays in each of the two wings. These were entered through a center court paved with 5" of concrete sloped to a central drain.

The narrow west facade of the original apartment space, which was situated between the north and south wings, is shown in a section drawing. It contained two wood panel type doors, paired single-hung windows, and an assembly of three double-hung wood windows within the hollow tile wall. Currently, the paved courtyard area is fenced off to provide a small patio for the former tavern. The west end of the courtyard is enclosed with a chain link fence.

More recent permit drawings and a current ALTA survey indicate the courtyard is 24' wide and 53'-5' deep. The southern wing currently features 15-light metal windows that replaced original wood panel doors in at least two bays when the space within it was remodeled. The original openings in the north wing were infilled with plain-faced concrete block when it was converted to accommodate dining functions and storage spaces in the 1950s; only the original brick pillars remain visible.

Interior Layout and Finishes

The interior was originally divided to correspond with three storefronts. The center bay was wider, at 26', while the north and south bays were 17' wide. The northern one has housed a tavern for much of its history; the south wall behind the bar back still defines much of this space. A row of booths sits along the south wall. The center bay space has been combined into a dining area for the tavern with a portion of the bar extended. The older (southernmost) section appears to have been unchanged for many years, with a bar along the north wall. The stained wood back bar was located along the north-south demising wall until the tavern was expanded in 1992-1993. At that time the northern wall of the front section of its north wall was removed, opening the dining area to the center space, and the original bar extended into a U-shape.

According to the original plans, the rear of the center space contained a small, two-room apartment with a living room and kitchen, along with a bathroom. These spaces were converted to café/tavern use repeatedly, and they currently contain restrooms, storage and office areas, and access to the rear patio. According to the 1937 record the interior finishes included plastered partition frame walls, fir trim, and cement floors. Remodeling since then has resulted in some more contemporary interior finishes with painted gypsum wallboard, painted and stained wood trim, linoleum flooring, and acoustic tile and panel ceiling finishes. Similarly, the kitchen and prep areas of the former tavern and café, which were located in the back of the southern and middle storefront sections, contain a mix of finishes and an ad hoc arrangement of plumbing and power systems, scullery fixtures and restaurant equipment.

In the 1950s, the northern retail space was converted into a banquet dining facility, along with a portion of the garage behind it. The northern storefront space was used subsequently for other commercial tenants, and until recently, it served as a commercial space. The back garages have been turned into storage spaces for the café and occupants, with the southern one provided with a bank of windows, which are presently covered by vines. The north garage wing contains a series of small, marginal store rooms. Conditions within these spaces appeared poor in late 2017, with temporary posts supporting the roof framing and ceiling and wall finishes partially delaminating or missing.

Changes over Time

In addition to the visible changes described previously, there are documented revisions to it indicated in the following permit records:

Date	Changes
1953	(Permit 424164) Alter building and establish occupancy in connection with existing restaurant 60x108
1960	(Permit 12467) Two gas heaters
1968	(Permit 525936) Erect 3-faced electric sign
1973	Erect and maintain sign
1973	Install automatic sprinklers
1973	Wire sign
1973	Install breaker panel to replace fuses and wire for sprinkler flow value
8.2.1974	Install hot water tank
2.16.1978	Fire alarm bells on existing circuit
12.21.1982	Alter existing tavern and change use and occupy as tavern/restaurant per plans
1.26.1983	Install range hood and duct system
2.15.1983	Install service
1.11.1993	Interior alteration to expand tavern, change use of a portion of building from restaurant and accessory storage to tavern and occupy per plans
March-June 1994	DCLU and Seattle Dept. of Licensing correspondence with owner Patricia Ryan regarding use of the outdoor deck, and withdrawal of proposal to build a deck
1.11.1994	Install rooftop gas/package unit with concentric ceiling diffuser
4.27.1998	Interior alterations to expand tavern, change use of a portion of building from restaurant and accessory storage to tavern and occupy per plans

BIBLIOGRAPHY AND SOURCES

City of Seattle.
Department of Construction and Inspections, Permit Records and Drawings for 2313-2315 4th Ave.
Department of Neighborhoods, Historic Preservation Program
Mimi Sheridan, "Belltown Historic Context Statement," ca. 2007.
Landmarks Preservation Program, Landmark Map, www.seattle.gov/neighborhoods/programs-and-services/historic-preservation/landmarks/landmarks-map (accessed November 10, 2017).
Seattle Municipal Archives, Digital Photograph and Map Collections. www.seattle.gov/cityarchives/ (accessed October 23 and 30, 2017).

Crowley, Walt. "Ryan, Patricia McGuiness (1944-2001), HistoryLink.org Essay No. 3487, 8.7.2001 (accessed October 18, 2017).

Dorpat, Paul and DorpatSherrardLomont, Seattle Now & Then Blog, www.pauldorpat.com/ (accessed September 25, 2018). "St Vinnie's in Belltown," April 4, 2015.

Fiset, Louis. "Aqua Theatre – Seattle," HistoryLink.org, April 25, 1999.

Flood, Chuck. *Lost Restaurants of Seattle,"* Charlestown, South Carolina: The History Press, 2017, p. 123.

Friends of Historic Belltown, "What We Are Doing," January 2017, friendsofhistoricbelltown.org/wp/index.php/what-we-are-doing/ (accessed November 29, 2017).

Houser, Michael. "Stoddard, George W." in Architect Biographies, Docomomo-WeWa website www.docomomo-wewa.org/architects_detail.php?id=62 (accessed October 30, 2017).

Humphrey, Clark.
Seattle's Belltown, Charleston, South Carolina: Arcadia Publishing, 2007, pp. 93-95.
"A City of a Hill / Remembering Rolon Bert Garner," *Queen Anne & Magnolia News*, September 22, 2015

Johnson Partnership, "Metropolitan Press Printing Company/Brasa Building, Historic and Cultural Resources Report Supplement," July 2008.

King County Assessor Records for Parcel No. 065600-0605 (available from Puget Sound Regional Archives, Bellevue College).

King County i-Map Interactive Mapping Tool. www.kingcounty.gov/operations/GIS/Maps/iMAP.aspx (accessed November 13, 2017).

Kroll Map Company. *Kroll Maps to Seattle,* ca. 1912-1920, 1940-1960 and ca. 2000.

Nyberg, Folke and Victor Steinbrueck. *Denny Regrade: An Inventory of Buildings and Urban Design Resources.* Seattle: Historic Seattle, 1975.

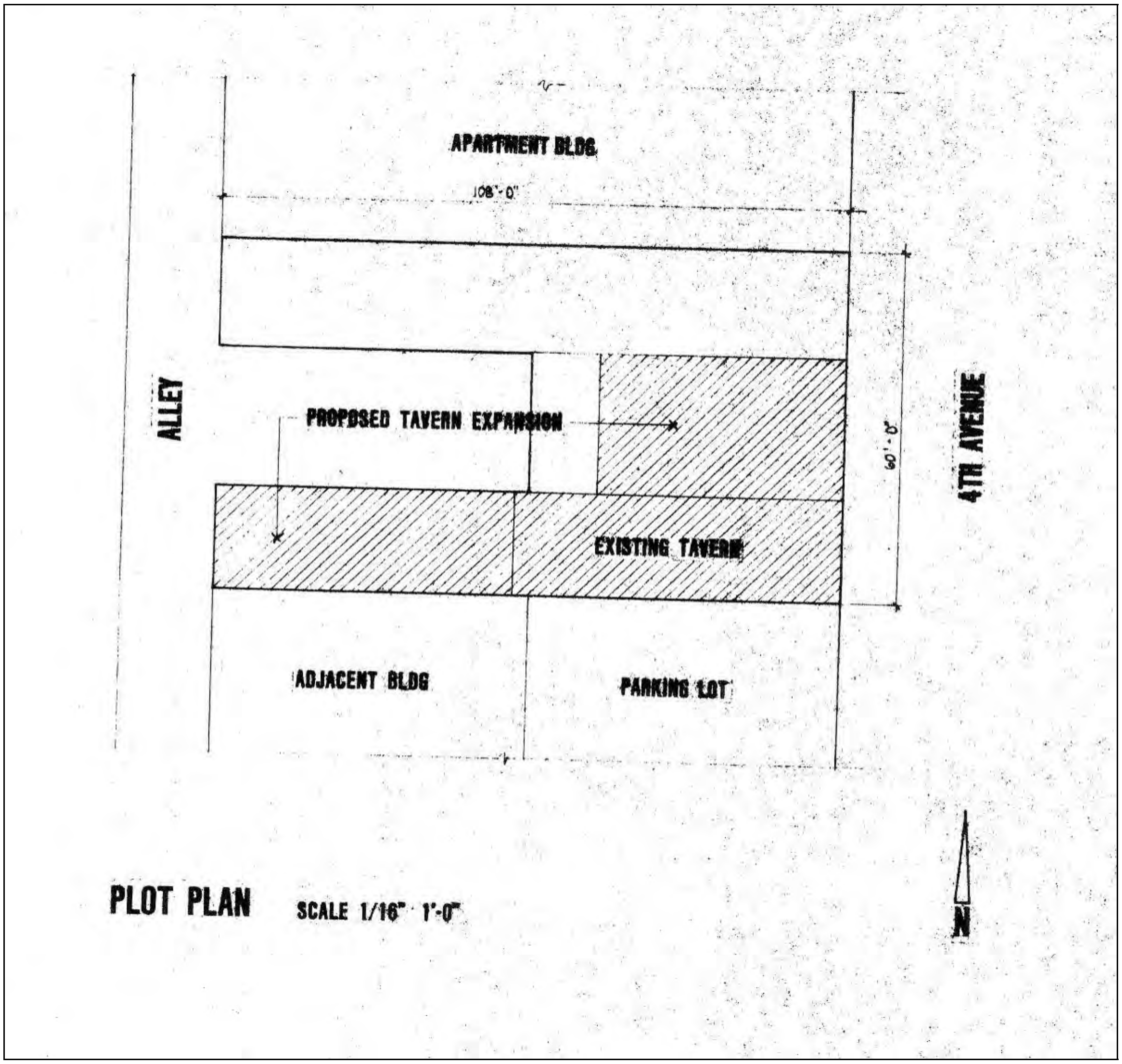
R. W. Polk & Co., Inc. *Polk Directory to Seattle* (Residential and Business Listings): 1923 - 1990.

Seattle Post-Intelligencer, "G. W. Stoddard," (obituary), September 30, 1967, p. 14.

Seattle Times . "G. W. Stoddard, Architect Since 1920, to Retire," March 27, 1960.

SITE PLAN

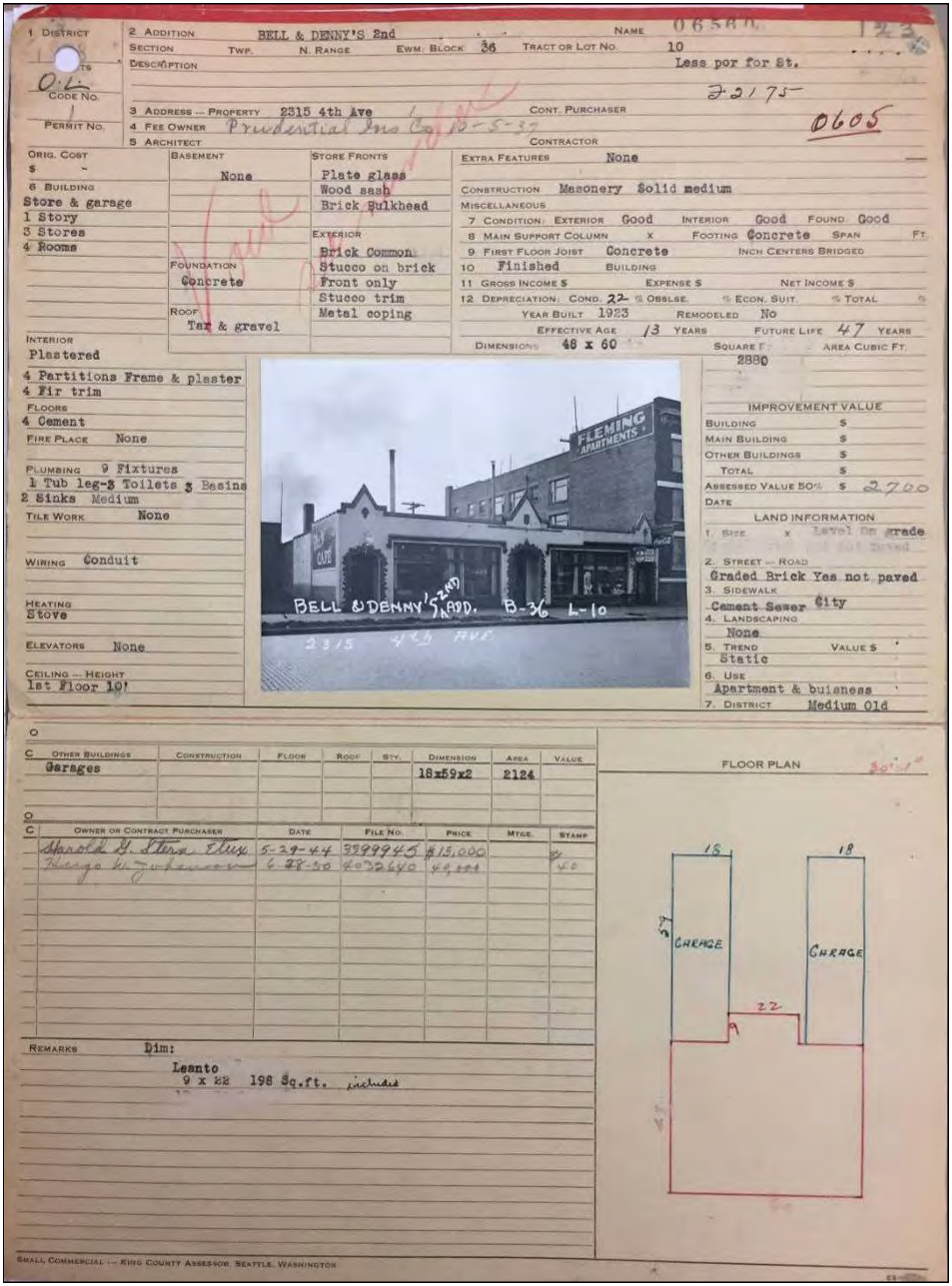
The site plan below, from an October 13, 1992 permit drawing set, shows in the L-shaped patterned sections the area renovated at that time (SDCI). The building is made up by the U-shaped footprint. Actual north is oriented to the upper left, while reference north is oriented up in this plan and in this nomination report.



Above, 4th Avenue in 1944, looking northwest from Bell Street during a municipal street paving project. The subject building is visible on the far left (SMA image 40419). Below, looking northwest along 4th Avenue from Bell Street in 1958 (SMA image 56688). Bottom, a detail view of the sidewalk and building in 1958 when street trees were planted. At this time it was known as Hewitt's Catering, according to one of the signs (SMA image 56687).

Above, a view looking south from the Space Needle in 1962 (SPL image spl_gg_76620010).

KING COUNTY ASSESSOR HISTORIC PROPRETY RECORDS



1 District 1
O.L. Code No.
Permit No.
2 Addition BELL & DENNY'S 2nd
Section Twp. N. Range Ewm. Block 36 Tract or Lot No. 10
Description Less por for St.
Name 06560
72175
0605
3 Address — Property 2315 4th Ave
4 Fee Owner Prudential Ins Co 10-5-37
5 Architect
Cont. Purchaser
Contractor

Orig. Cost $ -
6 Building Store & garage
1 Story
3 Stores
4 Rooms
Basement None
Foundation Concrete
Roof Tar & gravel
Store Fronts Plate glass, Wood sash, Brick Bulkhead
Exterior Brick Common, Stucco on brick, Front only, Stucco trim, Metal coping
Extra Features None
Construction Masonery Solid medium
Miscellaneous
7 Condition: Exterior Good Interior Good Found. Good
8 Main Support Column x Footing Concrete Span Ft.
9 First Floor Joist Concrete Inch Centers Bridged
10 Finished Building
11 Gross Income $ Expense $ Net Income $
12 Depreciation: Cond. 22 % Obslse. % Econ. Suit. % Total %
Year Built 1923 Remodeled No
Effective Age 13 Years Future Life 47 Years
Dimensions 48 x 60 Square Ft. 2880 Area Cubic Ft.

Interior Plastered
4 Partitions Frame & plaster
4 Fir trim
Floors 4 Cement
Fire Place None
Plumbing 9 Fixtures
1 Tub leg-3 Toilets 3 Basins
2 Sinks Medium
Tile Work None
Wiring Conduit
Heating Stove
Elevators None
Ceiling — Height 1st Floor 10'

Improvement Value
Building $
Main Building $
Other Buildings $
Total $
Assessed Value 50% $ 2700
Date

Land Information
1. Size x Level on grade
2. Street — Road Graded Brick Yes not paved
3. Sidewalk Cement Sewer City
4. Landscaping None
5. Trend Static Value $
6. Use Apartment & business
7. District Medium Old

Other Buildings	Construction	Floor	Roof	Sty.	Dimension	Area	Value
Garages					18x59x2	2124	

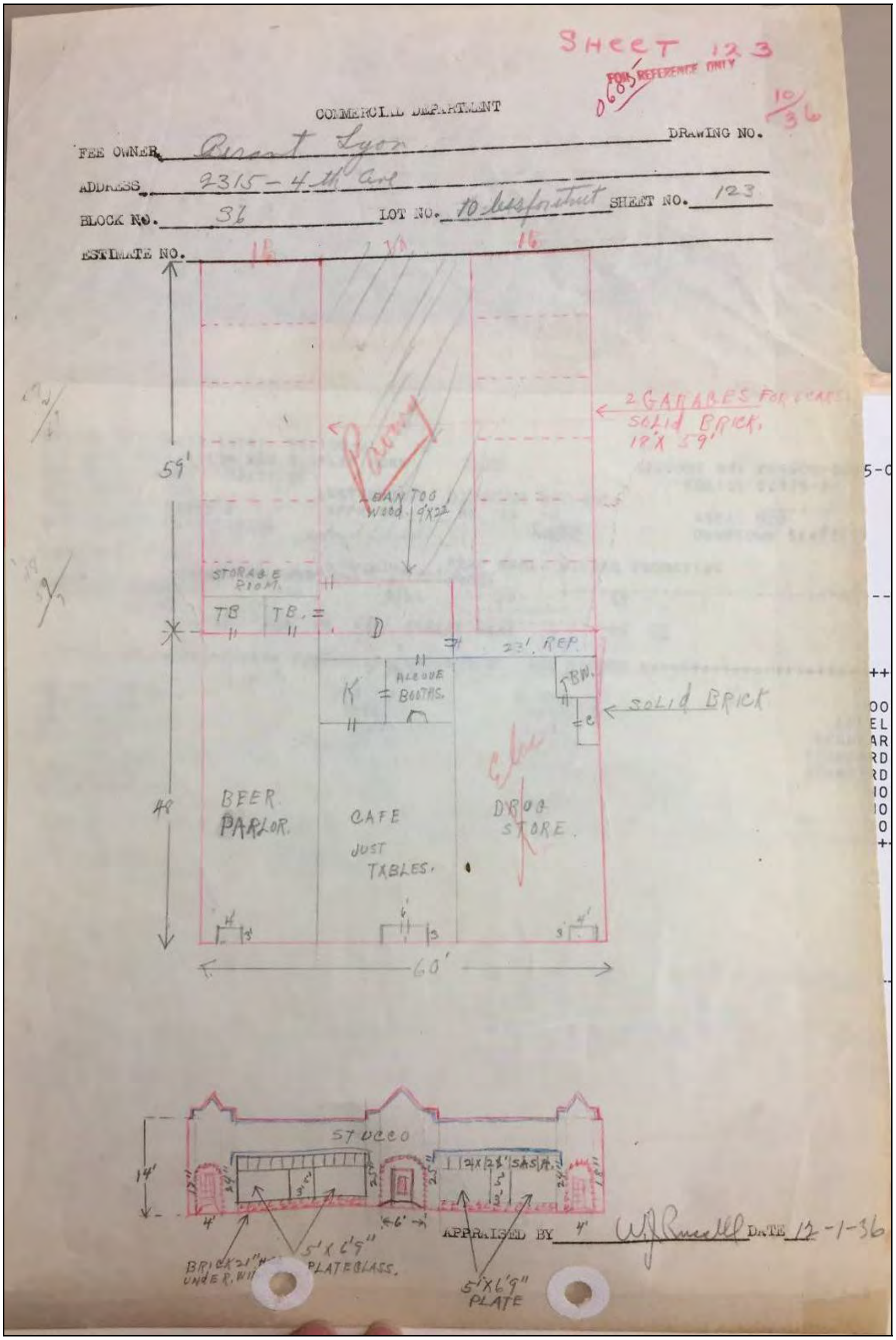
Owner or Contract Purchaser	Date	File No.	Price	Mtge.	Stamp
Harold G. Stern Etux	5-29-44	3399945	$15,000		
Hugo W. Johnson	6-28-56	4032640	40,000		40

Remarks Dim:
Leanto
9 x 22 198 Sq.ft. included

Floor Plan 30'
18 18 57 22 9
GARAGE GARAGE

Small Commercial — King County Assessor, Seattle, Washington

Above, the King County Tax Assessor's property record card of 1937.



Above, King County Tax Assessor's record, December 1, 1936. The assessor's plan sketch cites three tenant spaces on the plan as "Beer Parlor," "Café, just tables," and "Drug Store," and notes "D" for the small dwelling to the back of the café. Behind it there was a "Lean-To" and two wings containing garages. Notes on the sketched elevation cite the exterior east facade materials.

Above, King County Assessor's property record card photo from 1937, and below, the property record card photo from 1986.

Above, the Assessor's online photo of the Two Bells subject building prior to exterior alterations and repainting (King County Parcel Viewer).

OTHER BUILDINGS BY ARCHITECT GEORGE STODDARD

Above left, the 1923 Metropolitan Press Building, at 2107-2111 3rd Avenue (DON Historic Property Inventory photo, March 18, 2007). Above right, the 1929 Dakota Advertising Agency Building at 2226 3rd Avenue. Below, the Green Lake Aqua Theater (1950, altered), shown ca. 1951. (UW Libraries Special Collections [UWLSC], Art Hupy, photographer, image Hupy 5185a-6).

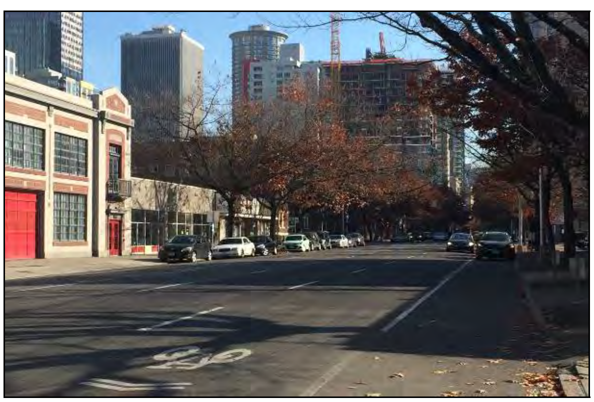
Below left, Renton Hospital (1945, demolished), shown here in a 1946 photo. (UWLSC, Dearborn Massar, photographer, image DM4293). Below right, a 1945 King County Tax Assessor's property record photo of one of the buildings in the Aloha Terrace Apartments on Capitol Hill (1943-44). Stoddard was involved with its development, in addition to design.

CURRENT CONTEXT VIEWS

Unless noted otherwise, the current photos are by Susan Boyle and date from October and November 2017.

Left, Bell Street Park, a 1.33 acre pedestrian redevelopment between 1st and 5th Avenue, shown west of 3rd Avenue, 2015 (SMA image 177635). Below, Regrade Park at 2251 3rd Avenue, two blocks southwest of the subject property, in 2015 (SMA image 178319).

Below left, looking south on 4th Avenue from Battery Street. Right, looking west at the Fleming Apartment building, which abuts the Two Bells, at 2321 4th Avenue. Bottom right, looking east at the south facade of the nearby building at 314 Bell Street.



CURRENT BUILDING VIEWS

Above, looking northwest on 4th Avenue at the Two Bells Tavern property.

Below, looking west at the primary east façade in November 2017.

Above, view of the storefronts on the primary east facade in November 2017.

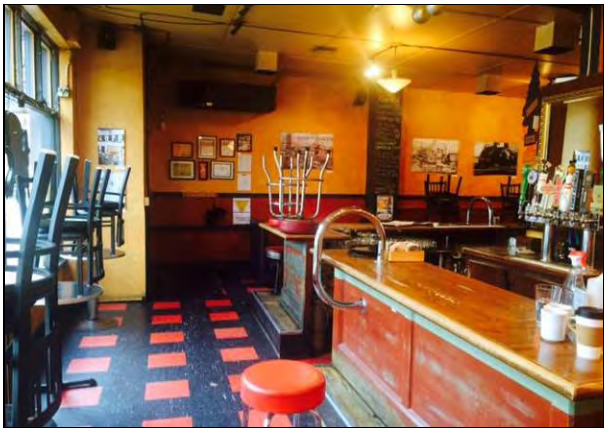
Below, oblique view of the building' current primary facade in March 2018.

Above, looking north at the south facade of the building and portions of the adjacent parking lot in March 2018. This lot is a separate parcel. Below, detail view of the southeast corner.

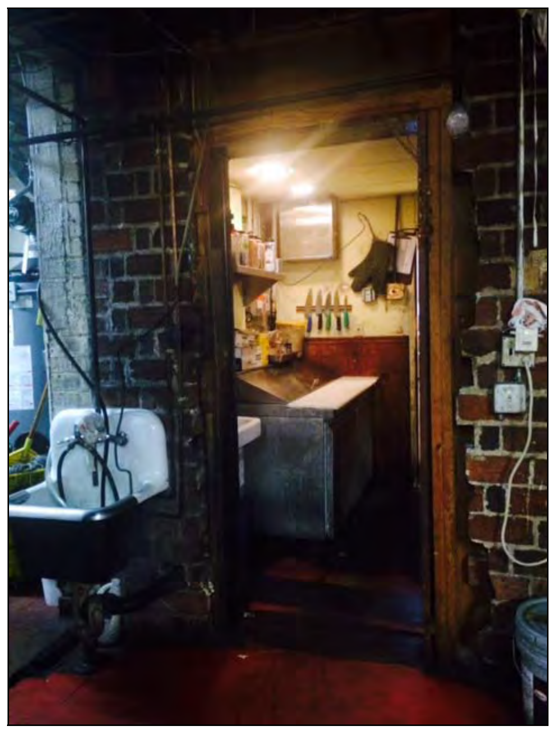
Above, looking northeast from the alley on the west at the open courtyard and the northern of the two masonry garage wings.

Above left, looking northeast at the fence that subdivides the courtyard and back patio with portions of the primary building section (right) and the north wing (left). The Fleming Apartment building is visible in the background.

Above right, a view of the former patio area behind the building's primary section. These photos date from November 2017.



Above left, looking south at the bar interior and of the east façade in November 2017. Above right, another store room in a south garage space. Below left, the kitchen scullery space. Below right, looking east into the prep kitchen viewed from the scullery. The hollow tile wall appears to be part of the original building.



APPENDIX G

Transportation Impact Analysis Report

Transportation Impact Analysis

BELLTOWN 36 MIXED USE – 4TH AND BELL

SDCI Project: 3028930

Prepared for:
Security Properties

September 2018

Prepared by:

transpogroup
WHAT TRANSPORTATION CAN BE.

12131 113th Avenue NE, Suite 203
Kirkland, WA 98034
Phone: 425-821-3665
Fax: 425-825-8434
www.transpogroup.com

1.18117.00

Table of Contents

Appendix

Figures

Tables

Introduction

The purpose of this transportation impact analysis (TIA) is to identify potential transportation-related impacts to the surrounding street network associated with the development of the proposed Belltown 36 mixed-use project located at 314 Bell Street in the Belltown neighborhood of Seattle (see Figure 1).

Project Description

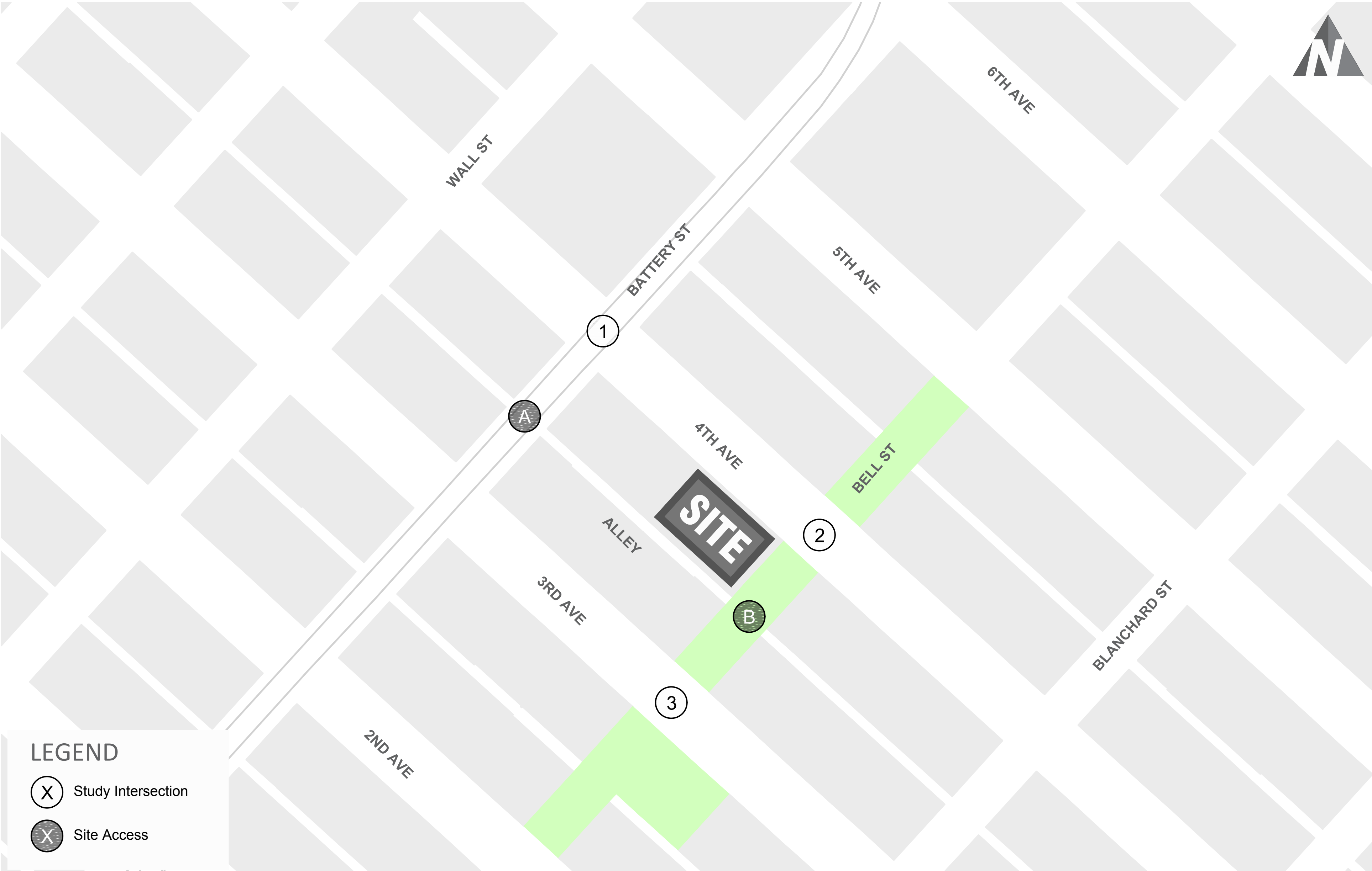
The proposed project includes the development of up to 225 apartment units, approximately 19,000 square feet of office, and approximately 12,000 square feet of retail. Secured on-site parking will be provided for the residential and office uses with 234 vehicle parking stalls as well as approximately 125 bicycle stalls with access provided via the alley that extends between Bell Street and Battery Street. Figure 2 illustrates the preliminary site plan. It is anticipated that the development would be constructed and occupied by 2022. The existing on-site uses include approximately 7,200 square feet of office that would be removed with the development of the project.

Study Scope

The scope of this analysis is based on coordination with City of Seattle Department of Construction and Inspections (SDCI) staff. Based on anticipated travel patterns for project-generated vehicle traffic, the following intersections were selected for study:

1. 4th Avenue/Battery Street
2. 4th Avenue/Bell Street
3. 3rd Avenue/Bell Street

In addition to the study intersections, the alley intersections with Bell Street and Battery Street were also analyzed under future (2022) with-project conditions. The scope of the analysis included a review of both the weekday AM and PM peak hour conditions. The analysis includes a review of existing conditions in the vicinity of the project site, including the street network, existing and future without-project peak hour traffic volumes, traffic operations, traffic safety, non-motorized facilities, and transit service. Future (2022) with-project conditions are evaluated by adding site-generated traffic to future (2022) without-project volumes and were then compared to future (2022) without-project conditions to identify the relative impacts the proposed project has on the surrounding transportation system.



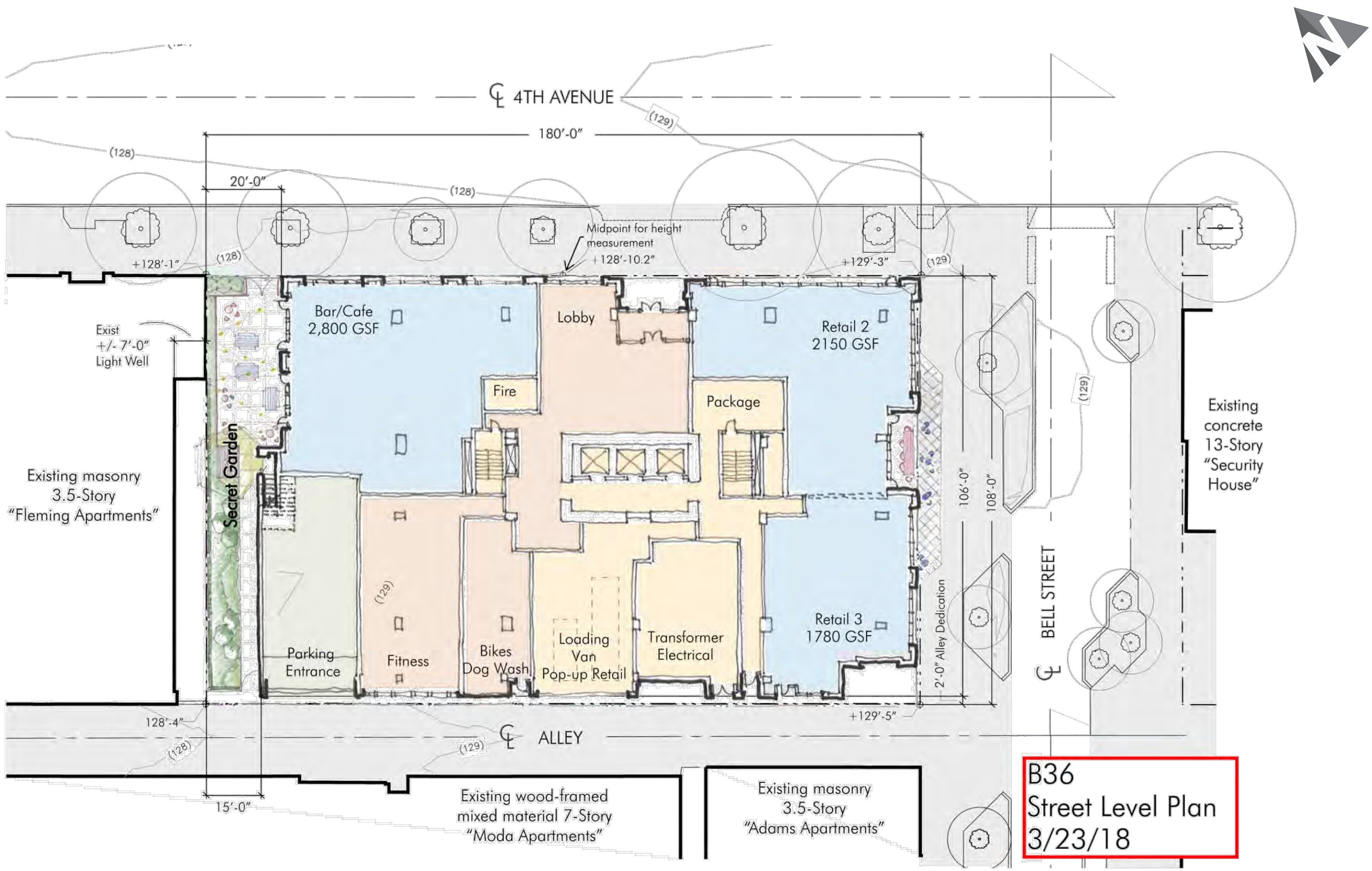
Site Vicinity & Study Intersections

Belltown 36 Mixed Use

FIGURE
1

transpogroup
WHAT TRANSPORTATION CAN BE.

Sep 12, 2018 - 11:06am kassil M:\18\1.18117.00 - Belltown 36 Mixed Use - 4th and Bell\Graphics\DWG\Graphics_18117.dwg Layout: Study Intersections



Preliminary Site Plan

Belltown 36 Mixed Use

FIGURE 2

transpogroup WHAT TRANSPORTATION CAN BE.

Sep 12, 2018 - 11:06am kassil M:\18\1.18117.00 - Belltown 36 Mixed Use - 4th and Bell\Graphics\DWG\Graphics_18117.dwg Layout: Site Plan

Existing & Future Without-Project Conditions

This section describes both existing and future (2022) without-project conditions within the identified study area. Study area characteristics are provided for the street network, planned improvements, non-motorized facilities, transit service, existing and future forecasted without-project traffic volumes, traffic operations, and traffic safety.

Street System

The following describes the existing street network within the vicinity of the proposed project and anticipated changes resulting from planned improvements.

Existing Inventory

Bell Street is a one lane roadway classified as an access street by the City of Seattle. The roadway accommodates one-way travel in the southwest direction. Bell street, adjacent to the project site, is a part of the Bell Street Park that is a park corridor with an open space for pedestrians, bicyclists and automobiles. Sidewalks are provided along both sides of the street. Parking is provided along southeast side of the street. A bicycle sharrow is provided along the street. The alley providing access to the project site can be accessed via Bell Street.

Battery Street is a two-lane roadway classified as a principal arterial by the City of Seattle with one lane dedicated to buses only. The roadway accommodates one-way travel in the northeast direction. Parking and sidewalks are provided along both sides of the street. The alley providing access to the project site can be accessed via Battery Street.

3rd Avenue is defined as a minor arterial by the City of Seattle and is a primary transit corridor. It is a four-lane roadway with a speed limit of 30 miles per hour. Sidewalks are provided along both sides of 3rd Avenue within the vicinity of the project.

4th Avenue is defined as a principal arterial by the City of Seattle. It is a four-lane roadway providing one-way northwest travel. In the vicinity of the project site, 4th Avenue allows for parking as well as provides sidewalks along both sides of the roadway. A bicycle sharrow is provided along the southwest side of the roadway.

Planned Improvements

Based on a review of the City of Seattle *2018-2023 Proposed Capital Improvement Program* (CIP) three street system transportation projects were identified within the vicinity of the project. The Overlook Walk and East-West Connections project will affect Bell Street due to removal of the Alaskan Way Viaduct. The City has targeted the specific east/west streets for improving connections. Additionally, the Alaskan Way Main Corridor Project is anticipated to affect Battery Street with the decommissioning the Battery Street tunnel. The 3rd Avenue Corridor Improvements Program makes multimodal improvements in the Third Avenue Downtown Corridor. These improvements include constructing streetscape improvements, remarking cross walks, and installing pedestrian signals.

No specific changes were identified as part of these projects that would impact the operational analysis within the study area by the project’s 2022 horizon year and such no changes were assumed in the analysis.

Non-Motorized Facilities

Sidewalks are provided throughout the study area. All crossings at 4th Avenue, Bell Street, 3rd Avenue, and Battery Street are signalized. Bell street, adjacent to the project site, is a part of the Bell Street Park that is a park corridor with an open space for pedestrians, bicyclists and automobiles. In addition, Bell Street and 4th Avenue provide bicycle sharrows.

Transit Service

The study area is well served by transit with service provided by King County Metro Transit, Community Transit, and Sound Transit.

There are many bus stops within less than a quarter mile (or 5-minute) walking distance from the site. Service is provided along 4th Avenue and 3rd Avenue within a block of the site. The primary transit corridor in the vicinity of the site is along 3rd Avenue with the nearest bus stop on the north side of 3rd Avenue between Battery Street and Bell Street. This corridor is served by approximately 30 different bus routes including service by RapidRide C, D, and E lines as well as multiple frequent transit lines to North, Central, and South Seattle neighborhoods.

In addition, Seattle Department of Transportation (SDOT) and King County Metro are working together on the 3rd Avenue Transit Corridor Improvements. The project is part of a larger plan to create a vibrant, safe and thriving 3rd Avenue. It will improve transit function and create a more welcoming urban environment along the corridor between Denny Way and Jackson Street. The project includes upgrades to transit amenities, improved lighting, enhancements to landscaping, and provision of artistic elements such as murals and intersection features.

Traffic Volumes

The following sections document the development of the traffic volumes used in the existing and future without-project operations analyses.

Existing Traffic Volumes

Existing turning movement counts at the study intersections were collected in April 2018. Detailed existing AM and PM peak period traffic counts are included in Appendix A. The existing weekday AM and PM peak hour traffic volumes were rounded to the nearest five vehicles to account for daily fluctuations and are shown in Figure 3.

Future Without-Project Volumes

Future (2022) without-project traffic volumes are comprised of the existing traffic volumes, background traffic growth, and traffic generated from the planned “pipeline” developments. Based on direction from SDCI, an annual growth rate of 1.0 percent was applied to existing study intersection traffic volumes to estimate 2022 horizon year background traffic growth. In addition to the growth rate, which accounts for the background growth from pipeline projects in the area, traffic from specific pipeline projects in the vicinity were added to the future (2022) without-project traffic volumes as a conservative estimate and to account for cumulative impacts. The pipeline projects included in the background growth are discussed below. Forecast future without-project traffic volumes for the future horizon year are shown in Figure 4.

Existing Peak Hour Traffic Volumes

Belltown 36 Mixed Use

FIGURE 3

transpogroup
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Future (2022) Without-Project Peak Hour Traffic Volumes

FIGURE 4

Belltown 36 Mixed Use

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Pipeline projects are based on a review of planned developments on the SDCI website and through coordination with City staff, 16 planned development projects were identified in the study area and include the following projects:

- **2025 5th Avenue (#3026266):** Mixed-use development including 458 apartment units and ground floor retail.
- **210 Wall Street (#6516677):** Mixed-use development including 275 apartment units, approximately 911,289 square feet of ground floor retail.
- **2101 7th Avenue (#3013154)** Mixed-use development including approximately 1,123,052 square feet of administrative office use in two buildings with ground floor retail.
- **2116 4th Avenue (#3019344)** Mixed-use development including 332 residential units, 142 hotel rooms, and approximately 1,985 square feet of ground floor retail.
- **2121 5th Avenue (#3022614):** Mixed-use development including 119 residential units, 207 hotel rooms, and ground floor restaurant and retail uses.
- **2200 7th Avenue (#3018578)** Mixed-use development including approximately 853,049 square feet of office and 23,128 square feet of retail.
- **2205 7th Avenue (#3026858)** Mixed-use development including office and ground floor retail.
- **2326 6th Avenue (#6566754):** Mixed-use development including 891 residential units, 72 lodging units, 2,071 square feet of retail, 4,885 square feet of restaurant, 10,247 square feet of drinking establishment, and 13,297 square feet of office uses.
- **2301 7th Avenue (#3019371):** Mixed-use development including 638 residential units, 10,509 square feet of retail, and 175,116 square feet of office uses.
- **2104 3rd Avenue (#6537719):** Mixed-use development including 132 residential units and approximately 4,824 square feet of ground-floor retail.
- **2302 4th Avenue (#3018968):** Mixed-use development including 285 residential units and ground-floor retail.
- **2234 2nd Ave (#3020027):** 63 residential units and 3,200 SF of commercial space.
- **2218 1st Ave (#3026541):** 59 residential units (7 SEDUs, 28 studios, 24 apartments), and a ground-level restaurant.
- **2033 4th Ave (#3025502):** 170 hotel rooms and 10 residential units.
- **2031 3rd Ave (#3018686):** 176,565 SF office, 13 hotel rooms, 352 apartments and 5,477 SF of retail.
- **2229 6th Ave (#30181831):** 85,000 SF of office.

These “pipeline projects” account for the cumulative impacts without the project and have been approved or are in the approval process but have yet to be constructed. The anticipated distribution and assignment of the pipeline project’s generated trips were obtained from each projects’ traffic consultant for the TIA or assumed to be similar to the Belltown 36 distribution and were used to develop the horizon year, without-project traffic volumes.

Traffic Operations

The following sections summarize traffic operations for existing and future conditions for individual study intersections.

The operational characteristics of an intersection are determined by calculating the intersection level of service (LOS). At signalized intersections, LOS is measured in average control delay per vehicle and is typically reported using the intersection delay. Traffic operations and average vehicle delay for an intersection can be described qualitatively with a range of levels of service (LOS A through LOS F), with LOS A indicating free-flowing traffic and LOS F indicating extreme congestion and long vehicle delays. Appendix B contains a detailed explanation of LOS criteria and definitions.

For the operations analysis of existing conditions at the signalized study intersections, signal timing and phasing information was obtained from the Seattle Department of Transportation (SDOT). Analysis parameters such as lane channelization and traffic signal settings were maintained for future (2022) without-project conditions from existing conditions.

Weekday AM and PM peak hour traffic operations for existing and future without-project conditions were evaluated at the study intersections based on the procedures identified in the *Highway Capacity Manual* (2010), and were evaluated using *Synchro 9.1*. *Synchro 9.1* is a software program that uses *HCM* methodology to evaluate intersection LOS and average vehicle delays. Results for the existing and future without-project operations analyses are summarized in Table 1. Detailed LOS worksheets for each intersection analysis are included in Appendix C.

Table 1. Existing and Future Weekday Peak Hour Intersection LOS Summary

	Existing		2022 Without-Project	
Intersection	**LOS[1]**	**Delay[2]**	**LOS**	**Delay**
AM Peak Hour				
1. 4th Avenue/Battery Street	B	18.3	B	18.8
2. 4th Avenue/Bell Street	B	10.1	B	10.5
3. 3rd Avenue and Bell Street	A	9.8	B	10.2
PM Peak Hour				
1. 4th Avenue/Battery Street	B	18.8	B	19.3
2. 4th Avenue/Bell Street	B	14.6	B	15.0
3. 3rd Avenue and Bell Street	A	9.6	A	9.9

1. Level of Service (A – F) as defined by the *Highway Capacity Manual* (TRB, 2010)
2. Average delay per vehicle in seconds.

The City of Seattle's Comprehensive Plan does not define a LOS standard for individual intersections, but instead focuses on the incremental delay at LOS E and F intersection for determining whether an impact is potentially significant or not. However, the City generally recognizes LOS E and F as poor operations for signalized locations.

As shown in Table 1, all intersections currently operate at LOS B or better during the weekday AM and PM peak hour. Under future (2022) without-project conditions with the anticipated growth in traffic, the off-site study intersections are forecast to continue to operate at LOS B or better with increases in delay estimated to be less than 1 second relative to existing conditions during both the weekday AM and PM peak hours.

Traffic Safety

Recent collision records were reviewed within the study area to identify existing traffic safety issues at the study intersections and along key corridors. The most recent three-year summary of accident data from the Seattle Department of Transportation (SDOT) is for the period between January 1, 2015 and December 31, 2017. Table 2 provide a summary of the collision review.

Table 2. Intersection Three-Year Collision Summary – 2015 to 2017

Location	Number of Collisions 2015	2016	2017	Total	Annual Average
Intersections					
1. 4th Avenue/Battery Street	8	3	2	13	4.3
2. 4th Avenue/Bell Street	1	0	1	2	0.7
3. 3rd Avenue/Bell Street	1	0	1	2	0.7
Roadway Segments					
4th Avenue between Bell St and Battery St	4	1	0	5	1.7
Battery Street between 3rd Ave and 4th Ave	2	2	0	4	1.3
Bell Street between 3rd Ave and 4th Ave	4	1	0	5	1.7

Source: City of Seattle 2018

SDOT defines high collision locations (HCL) at signalized intersections with 10 or more collisions in the previous year, unsignalized intersections with 5 or more collisions in the previous year, mid-block locations with 10 or more collisions in the previous year, and locations with 5 or more pedestrian or bike collisions in the previous three years. No intersection or corridor in the study area meets the HCL criteria.

As shown in Table 2, all study intersections averaged 5 or less collisions per year. The two intersections along Bell Street averaged fewer than 1 collision per year. The 4th Avenue/Battery Street intersection averaged approximately 4 collisions per year during the study period, all of which were angle collisions primarily resulting in property damage only. There were no reported fatalities with the study area; however, there was one reported pedestrian collision which occurred at the 4th Avenue/Bell Street intersection.

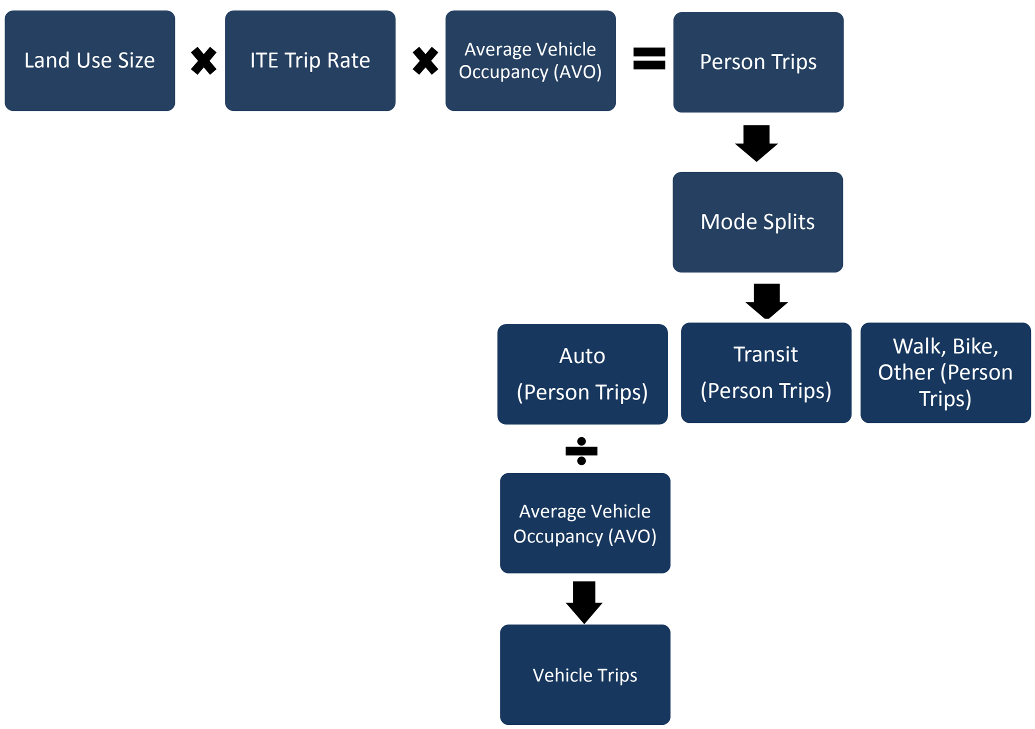
Along the roadway segments adjacent to the project, including the alley access intersections for the project, there was an average of 2 collisions reported per year. Only 1 of the reported collisions within the 3-year study period resulted in an injury and there were no reported pedestrian or bicyclist collisions.

Project Impacts

This section of the analysis documents the proposed project's impacts on the surrounding street network and study intersections. First, estimated traffic volumes generated by the proposed site are distributed and assigned to adjacent streets and intersections within the study area for the weekday AM and PM peak hour study period. Next, project trips are added to future without-project traffic volumes and any potential impact to traffic operations. Site specific items are also discussed such as the operation of the site's access driveway and estimated parking demand of the proposed project's land uses.

Vehicle Trip Generation

The proposed project includes up to 225 apartment units with approximately 19,000 square feet (sf) of office space, 12,000 sf of retail space and removal of the existing 7,200 sf of office space. Trip generation estimates have been prepared for the proposed mixed-use development based on trip rates identified using the Institute of Transportation Engineers (ITE) Trip Generation Manual, 10th Edition (2017). Trip rates consistent with ITE Family Housing (High Rise) (LU #222), General Office Building (LU # 710), and Shopping Center (LU #820) were utilized for the proposed uses. Trip rates consistent with ITE General Office Building (LU # 710) was utilized for the existing uses being removed. Consistent with City approved methodology, the core ITE trip rates were adjusted for localized average vehicle occupancies and mode splits. The methodology used in this analysis has been approved by City staff and is consistent with previous studies conducted in the area. The flow chart below illustrates the process utilized to estimate the projects trip generation.



Person trips were developed based on trip rates and average vehicle occupancy information from ITE's *Trip Generation* (10th Edition) for the proposed and existing uses. Person trips were separated by mode based on the assumptions described below for the proposed residential and retail uses as well as the existing office use being removed with the project.

Residential Use. Local mode split information, from American Community Survey (ACS) data[1] is applied to arrive at transit, non-motorized, carpool and single occupant vehicles (SOV) trips. Person trips by mode were determined by multiplying the person trips by the estimated mode splits. The resulting mode split based on the ACS data resulted in 25 percent of trips by vehicle, 20 percent by transit, and 55 percent walking, biking, or other modes. After applying the auto mode split, residential and daycare person trips were then converted back to vehicle trips by using average vehicle occupancies of 1.13.

Retail Use. Given the nature and size of the proposed retail, it is anticipated this would mainly serve local residents and workers. This would result in a high proportion of walking trips to and from the surrounding neighborhood. The analysis assumes that 10 percent of the retail customers would drive to the site and that the average vehicle occupancy would be 1.20.[2]

Office Use. The 2016 Center City Commuter Mode Split Survey for the Belltown area was utilized for the proposed and existing office use. The data shows 50 percent of employee trips were made by vehicle, 35 percent by transit, and 15 percent walking, biking, or other modes. After applying the vehicle mode split, office person trips were then converted back to vehicle trips by using average vehicle occupancies of 1.28.[3]

Table 3 provides a summary of the trip generation for the proposed land uses. A detailed summary of the trip generation calculations for these uses has been provided in Appendix D.

Table 3. Estimated Weekday Vehicle Trip Generation

			AM Peak-Hour Trips			PM Peak-Hour Trips		
Land Use	**Size**	**Daily Trips[1]**	**In**	**Out**	**Total**	**In**	**Out**	**Total**
Proposed								
Residential	225 du	256	4	25	29	14	6	20
General Office	19,000 sf	95	10	2	12	2	10	12
Retail	12,000 sf	52	2	1	3	3	3	6
Subtotal		*403*	*16*	*28*	*44*	*19*	*19*	*38*
Existing								
General Office	7,200 sf	36	3	1	4	1	3	4
Total Net New Trips		***367***	***13***	***27***	***40***	***18***	***16***	***34***

Notes: du = dwelling units, sf = square-feet
1. Vehicle trips were estimated based on person trip calculations and localized mode split information.

As shown in Table 3, the proposed project is anticipated to generate approximately 367 net new daily vehicle trips with 40 net new vehicle trips during the AM peak hour and 34 net new vehicle trips during the PM peak hour.

Trip Distribution & Assignment

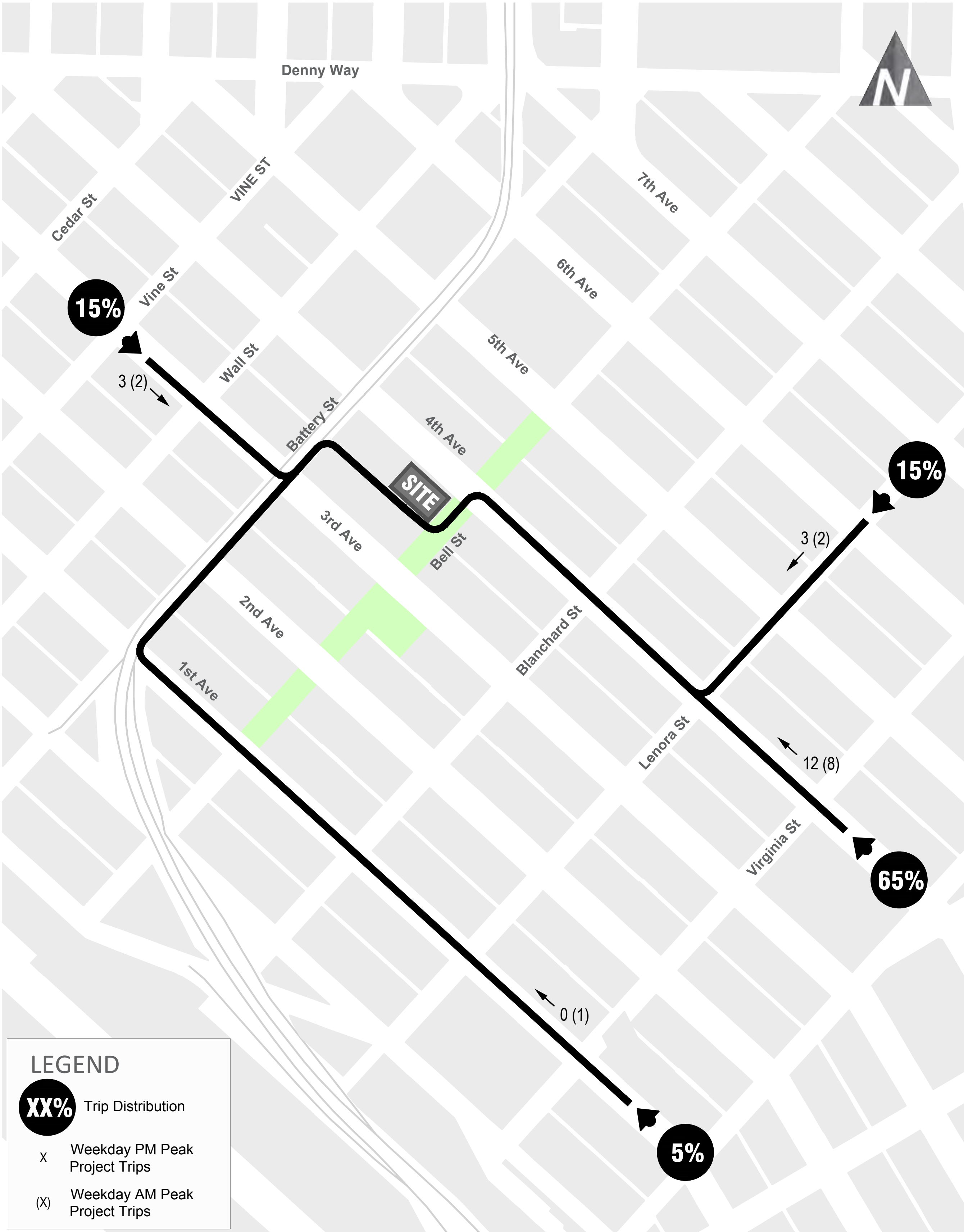
Travel patterns for vehicular traffic to and from the proposed site were based on a similar project in the Belltown neighborhood and were based on coordination with SDCI staff.

Figure 5 and Figure 6 illustrate the inbound and outbound vehicle trip distribution of the proposed project, respectively. The weekday AM and PM peak hour trips were assigned to the study area based on the trip distribution and the location of the site accesses.

[1] Census Tract 72.

[2] AVO consistent with other projects submitted in the Belltown neighborhood.

[3] Based on 2016 Center City Commuter Mode Split Survey for the Belltown area.



Inbound Project Trip Distribution and Assignment

FIGURE 5

Belltown 36 Mixed Use

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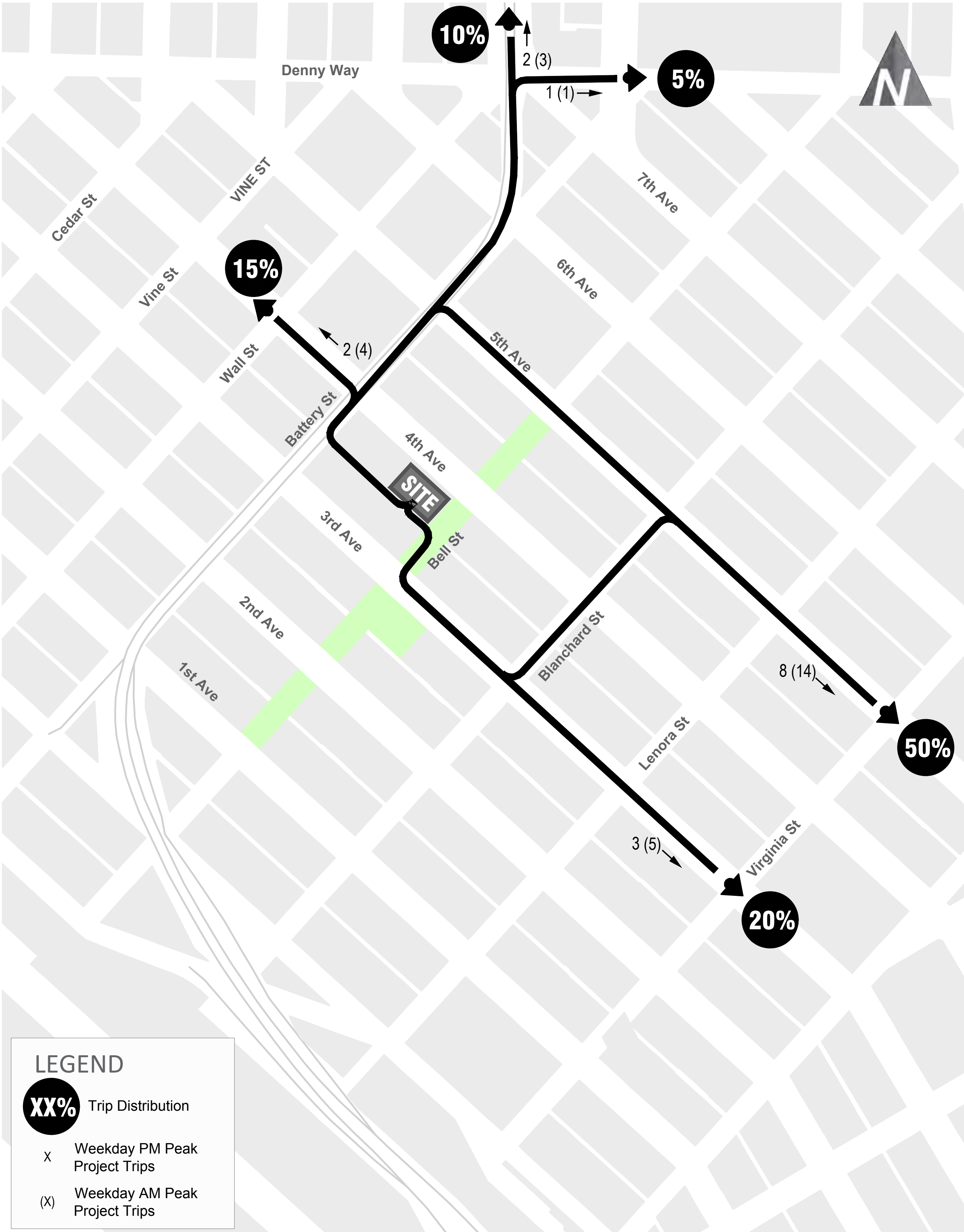

Outbound Project Trip Distribution and Assignment

FIGURE 6

Belltown 36 Mixed Use

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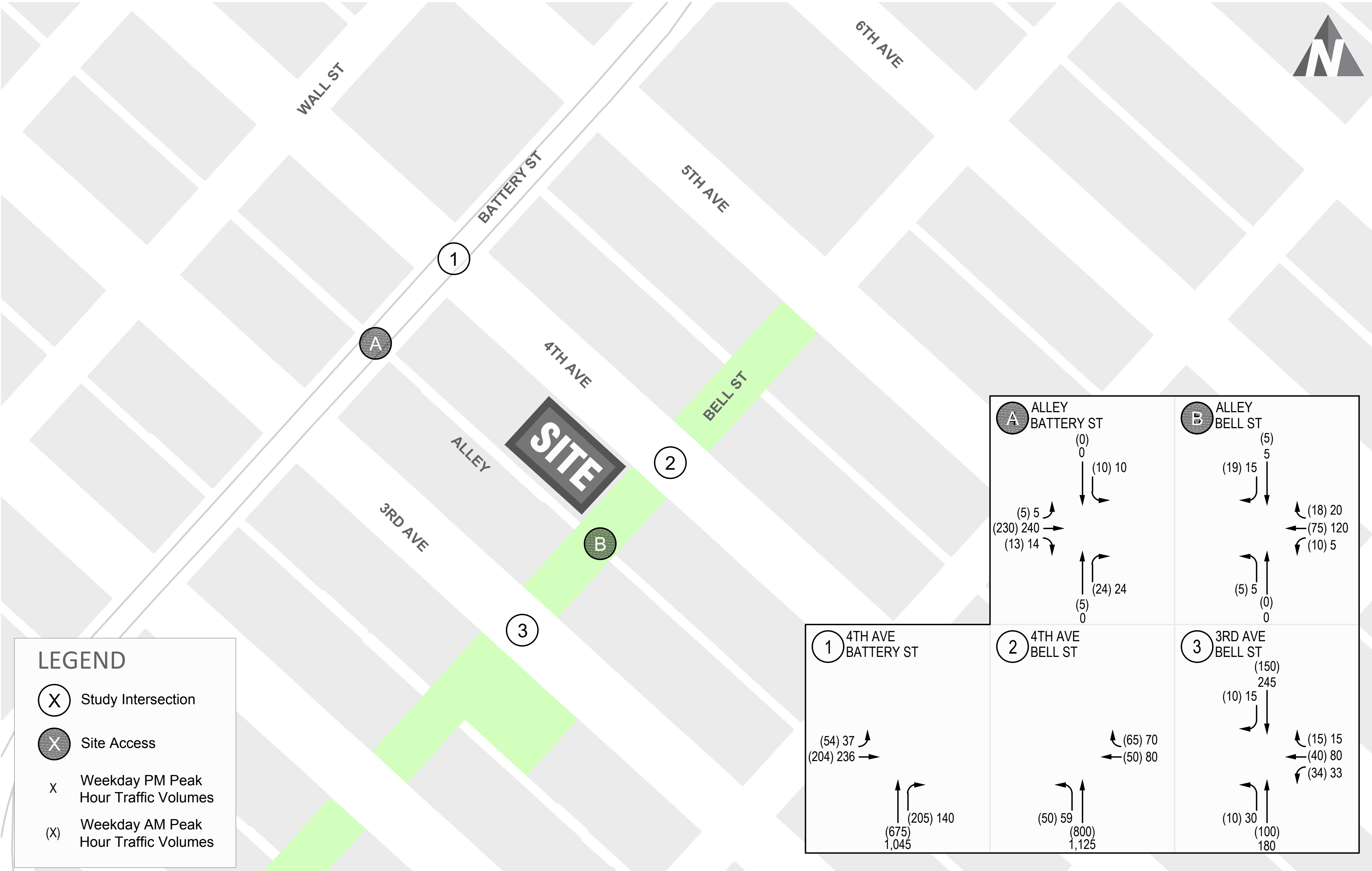
Traffic Volume Impact

The assigned project generated traffic was added to the future without-project weekday AM and PM peak hour traffic volumes at the study intersections. The resulting 2022 with-project peak hour traffic volumes are shown in Figure 7. Table 4 summarizes the project traffic volume impact at the study intersections during the weekday AM and PM peak hours.

Table 4. Study Intersection Traffic Volume Impacts

	Weekday Peak Hour Total Entering Vehicles			
Intersection	2022 Without- Project	Net New Project Trips	2022 With-Project	Project Share
AM Peak Hour				
1. 4th Avenue/Battery Street	1,125	13	1,138	1.1%
2. 4th Avenue/Bell Street	955	10	965	1.0%
3. 3rd Avenue/Bell Street	345	14	359	3.9%
PM Peak Hour				
1. 4th Avenue/Battery Street	1,450	8	1,458	0.5%
2. 4th Avenue/Bell Street	1,320	14	1,334	1.0%
3. 3rd Avenue/Bell Street	590	8	598	1.3%

As shown in Table 4, the percent traffic volume impacts at the off-site study intersections are approximately 1 percent or less during the weekday PM peak hour and approximately 4 percent or less during the weekday AM peak hour. Traffic volumes typically fluctuate day-to-day by five to ten percent depending on factors such as the day of the week, weather conditions, and traffic conditions elsewhere in the surrounding street network. This increase in traffic volumes related to project traffic falls within these normal fluctuations and will likely go unnoticed by the majority of roadway users in the study area.



Future (2022) With-Project Peak Hour Traffic Volumes

Belltown 36 Mixed Use

FIGURE 7

transpogroup WHAT TRANSPORTATION CAN BE.

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Traffic Operations Impact

The following section summarizes the future with-project LOS at the study intersections relative to the without-project conditions to identify project-related impacts.

A future with-project level-of-service analysis was conducted for the weekday AM and PM peak hour to analyze traffic impacts of the proposed project. The same methodologies were applied and all intersection parameters such as channelization and intersection control were consistent with those used in the evaluation of future without-project conditions. A comparison of horizon year 2022 future without-project and future with-project weekday AM and PM peak hour traffic operations are summarized in Table 5. Detailed LOS worksheets are provided in Appendix C.

Table 5. Future Weekday Peak Hour Intersection LOS Summary

	2022 Without-Project		2022 With-Project	
Intersection	**LOS[1]**	**Delay[2]**	**LOS**	**Delay**
AM Peak Hour				
1. 4th Avenue/Battery Street	B	18.8	B	18.8
2. 4th Avenue/Bell Street	B	10.5	B	10.5
3. 3rd Avenue and Bell Street	B	10.2	B	10.6
PM Peak Hour				
1. 4th Avenue/Battery Street	B	19.3	B	19.3
2. 4th Avenue/Bell Street	B	15.0	B	15.1
3. 3rd Avenue and Bell Street	A	9.9	B	10.1

1. Level of Service (A – F) as defined by the *Highway Capacity Manual* (TRB, 2010)
2. Average delay per vehicle in seconds.

As shown in Table 5, with the addition of the project, the off-site study intersections continue to operate at LOS B or better during the weekday AM and PM peak hours with little to no change in calculated delays relative to without-project conditions.

Site Access

The proposed project includes an on-site 234-stall parking garage. Access to the garage would be provided via the alley between Bell Street and Battery Street. The two alley intersections along Bell Street and Battery Street were evaluated consistent with the methodology described above for the off-site study intersections. At unsignalized side-street, stop-controlled intersections, LOS is measured by the average delay on the worst-movement of the intersection. The detailed LOS worksheets are provided in Appendix C.

Both alley intersections along Bell Street and Battery Street are forecast to operate at LOS C or better under future with-project conditions during both the weekday AM and PM peak hours.

Transportation Concurrency

The City of Seattle has implemented a Transportation Concurrency system to comply with one of the requirements of the Washington State Growth Management Act (GMA). The system, described in the DPD *Director's Rule 5-2009* and the City's Land Use and Zoning Code, is designed to provide a mechanism that determines whether adequate transportation facilities would be available "concurrent" with proposed development projects.

Screenlines are imaginary lines drawn across primary roadways to monitor traffic going from one side to the other. The screenlines closest to the project site were chosen for review. The screenline that was analyzed for concurrency review is East of CBD (12.12) as shown in Table 6. As a conservative estimate, it was assumed that all project-generated traffic traveling in the direction of the screenlines would extend across the screenlines.

Table 6. Transportation Concurrency Analysis

SL#[1]	Location	Dir[2]	Capacity	2008 Volume	Project Traffic	V/C Ratio w/ Project	LOS Standard
12.12	East of CBD	EB	13,300	8,266	16	0.63	1.00
		WB	11,736	6,491	5	0.55	1.00

1. SL# = Screenline Number
2. Direction: NB = Northbound, SB = Southbound, EB = Eastbound, WB = Westbound

The transportation concurrency analysis indicates that with traffic generated by the proposed project the screenlines would have v/c ratios less than the City v/c threshold; thus, the project would meet the City's concurrency requirements.

Transit Impacts

As noted above, the site is well served by transit and it is anticipated that the existing transit and planned 3rd Avenue corridor improvements will be able to accommodate the additional demand as a result of this project.

Non-Motorized Impacts

Pedestrians and bicyclists are anticipated to account for a share of the trips generated by the proposed project as the project is well served by both pedestrian and bicycle facilities. As noted above, sidewalks are provided throughout the study area. All crossings at 4th Avenue, 3rd Avenue, Bell Street, and Battery Street are signalized. Bell street, adjacent to the project site, is a part of the Bell Street Park that is a park corridor with an open space for pedestrians, bicyclists and automobiles. The existing sharrows along Bell Street and 4th Avenue provide a north-south and westbound connections for bicyclists and eastbound connections are provided along Blanchard Street.

In addition to the pedestrian and bicyclist facilities near the site, floating bike shares are now prevalent in Seattle, allowing for use of bicycles for individuals that may not own a bicycle and allows for use a bicycle without needing a bicycle storage rack.

The SDOT *Seattle Bicycle Master Plan 2017-2021 Implementation Plan* (April 2017) was also reviewed and three projects were identified near the project site. The first project is proposed and includes a bike lane along 4th Avenue between Pike Street and Vine Street. The second and third projects are still pending route location. These two projects would construct protected bicycle lanes within the vicinity of the project along either 4th Avenue or 5th Avenue as well as along either Bell Street or Blanchard Street. These projects would replace the existing sharrows along these roadways, where applicable.

Parking Analysis

A parking analysis for the proposed development was completed including a description of the proposed parking supply and the estimated peak parking demand of the project.

Parking Supply

The proposed project will provide an on-site parking garage for the proposed uses which will be accessed from the alley between Bell Street and Battery Street. The project is proposing to provide 234 total vehicle parking stalls including 205 stalls secured for the residential use and 29 stalls for the office use. Additionally, the project will provide approximately 125 bicycle parking stalls on site. Per Seattle Municipal Code (SMC) 23.54.015, there are no vehicle parking requirements for the development as it is located within the Belltown Urban Center Village.

The existing parking supply and associated demand of the existing uses will be removed with the development of the project.

Parking Demand

The parking demand associated with the residential use of the proposed project was calculated using the King County Right Size Parking calculator. The King County Right Size Parking calculator is an online tool developed by King County that estimates parking/unit ratios for multi-family developments throughout urban areas of King County. The Right Size Parking calculator relies on the unit mix[4] of the proposed development and the development location to estimate a parking demand ratio. Based on the project's proposed unit mix for the proposed site, a peak parking demand of 0.64 stalls per apartment unit was identified,[5] resulting in a peak parking demand of approximately 144 vehicles for up to 225 apartment units. Given the proposed secured supply of 205 parking stalls for the residential use, the full residential demand could be accommodated on-site. Residential visitors would likely utilize on-street parking or public, paid off-street parking lots.

The parking rate used to estimate the peak parking demand for the office use was based on the ITE *Parking Generation* rates. The ITE *Parking Generation* land use assumed for the analysis included was General Office (LU #701). The mode splits were assumed to be the same as used to estimate the trip generation, with 50 percent of office trips being made by vehicle. Based on the assumed mode splits the estimated parking demand rates and resulting demand for the office use is 1.24 vehicles per 1,000 square feet with a peak demand of 24 vehicles. The detailed parking demand estimate for the retail use is included in Appendix E. Given the proposed supply of 29 parking stalls for the office use, the full office demand could be accommodated on-site.

The parking rate used to estimate the peak parking demand for the retail use was also based on the ITE *Parking Generation* rates assuming the Shopping Center (LU #820) land use. The mode splits were assumed to be the same as used to estimate the trip generation, with only 10 percent of retail trips being made by vehicle. Based on the assumed mode splits the estimated parking demand rates and resulting demand for the retail use is 0.26 vehicles per 1,000 square feet with a peak demand of 4 vehicles. The detailed parking demand estimate for the retail use is included in Appendix E. The limited retail parking demand will likely utilize on-street parking or public, paid off-street parking lots.

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[4] The proposed apartment units include approximately 30 studios, 93 1-bedrooms, 91 two-bedroom, and 11 three-bedroom units.

[5] The detailed King County Right Sized Parking input and results are provided in Appendix E.

Findings and Conclusions

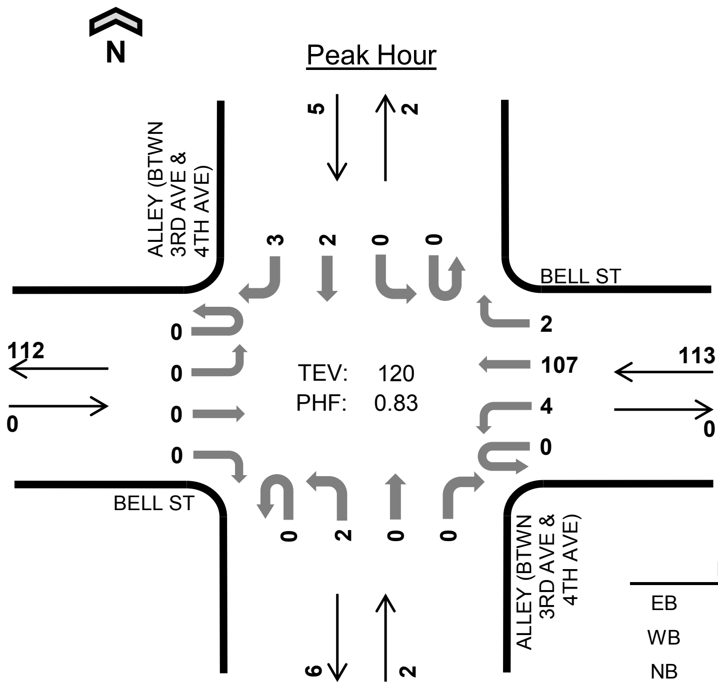
This transportation impact analysis summarizes the project traffic impacts of the proposed Belltown 36 mixed-use development project located in the Belltown neighborhood of Seattle. General findings and recommendations include:

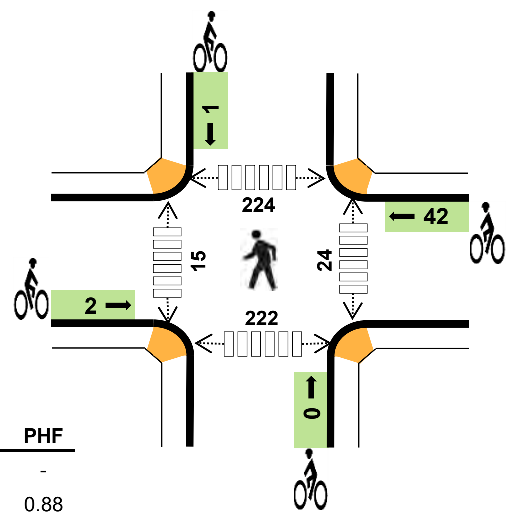
- The proposed project would construct up to 225 residential apartment units, 19,000 sf of office, and approximately 12,000 sf of retail space and remove the existing 7,200 sf of office on the site.
- After accounting for the existing site uses, the development is anticipated to generate 367 net new daily vehicle trips with 40 net new vehicle trips during the AM peak hour and 34 net new vehicle trips during the PM peak hour.
- All of the off-site study intersections are anticipated to operate at LOS B or better under both existing and future condition during both the weekday AM and PM peak hours.
- Access to the site is proposed via the alley adjacent to the site between Battery and Bell Streets. With the project, the two alley intersections are forecast to operate at LOS C or better during both the weekday AM and PM peak hours.
- The transportation concurrency analysis indicates that with traffic generated by the project, the screenlines would have v/c ratios that are less than the City level of service thresholds; thus, the conditions would meet concurrency requirements.
- The project would provide 234 on-site parking spaces for the residential and office uses; however, no on-site parking is required by code as the project is located with the Belltown Urban Center Village. The analysis estimates a residential peak parking demand of 144 vehicles, which would be accommodated within the secured residential parking. Similarly, the estimated peak office parking demand of 24 vehicles would be accommodated within the proposed office parking supply of 29 stalls. The peak retail parking demand was estimated to be up to 4 vehicles which would likely utilize on-street parking or public, paid off-street parking lots.

Appendix A: Traffic Counts

ALLEY (BTWN 3RD AVE & 4TH AVE)
BELL ST

Date: Wed, Apr 04, 2018
Count Period: 4:00 PM to 6:00 PM
Peak Hour: 4:30 PM to 5:30 PM





	HV %:	PHF
EB	-	-
WB	16.8%	0.88
NB	0.0%	0.25
SB	0.0%	0.42
TOTAL	15.8%	0.83

Two-Hour Count Summaries

Interval Start	BELL ST Eastbound UT	LT	TH	RT	BELL ST Westbound UT	LT	TH	RT	ALLEY (BTWN 3RD AVE & 4TH AVE) Northbound UT	LT	TH	RT	ALLEY (BTWN 3RD AVE & 4TH AVE) Southbound UT	LT	TH	RT	15-min Total	Rolling One Hour
4:00 PM	0	0	0	0	0	1	23	0	0	0	0	0	0	0	0	1	25	0
4:15 PM	0	0	0	0	0	1	23	0	0	0	2	0	0	0	0	0	26	0
4:30 PM	**0**	**0**	**0**	**0**	**0**	**1**	**23**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**2**	**27**	0
4:45 PM	**0**	**0**	**0**	**0**	**0**	**1**	**27**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**28**	106
5:00 PM	**0**	**0**	**0**	**0**	**0**	**1**	**30**	**1**	**0**	**2**	**0**	**0**	**0**	**0**	**1**	**1**	**36**	117
5:15 PM	**0**	**0**	**0**	**0**	**0**	**1**	**27**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**29**	**120**
5:30 PM	0	0	0	0	0	1	17	1	0	0	0	0	0	0	0	2	21	114
5:45 PM	0	0	0	0	0	2	22	0	0	0	0	0	0	0	0	1	25	111
Count Total	0	0	0	0	0	9	192	3	0	2	2	0	0	0	2	7	217	0
Peak Hour	**0**	**0**	**0**	**0**	**0**	**4**	**107**	**2**	**0**	**2**	**0**	**0**	**0**	**0**	**2**	**3**	**120**	**0**

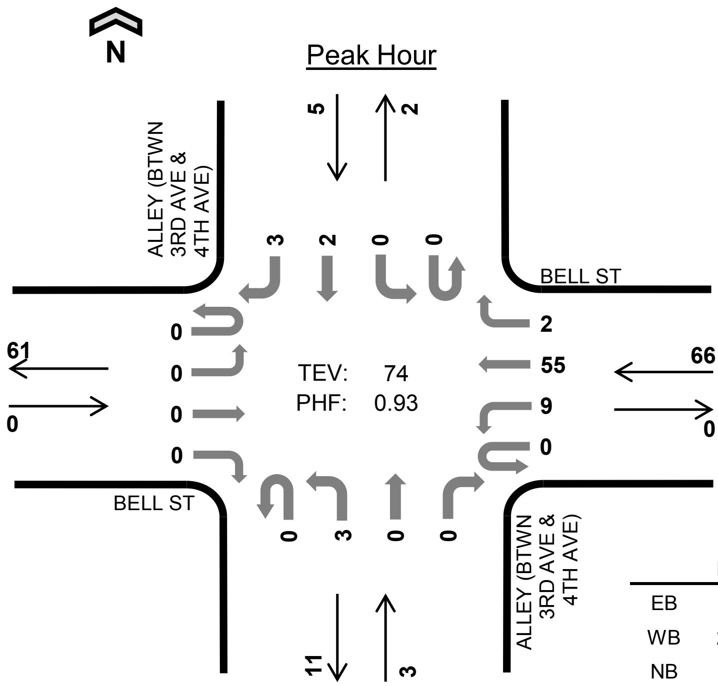
Note: Two-hour count summary volumes include heavy vehicles but exclude bicycles in overall count.

Interval Start	Heavy Vehicle Totals EB	WB	NB	SB	Total	Bicycles EB	WB	NB	SB	Total	Pedestrians (Crossing Leg) East	West	North	South	Total
4:00 PM	0	4	0	0	*4*	0	9	0	0	*9*	5	0	31	33	*69*
4:15 PM	0	6	0	0	*6*	0	13	0	1	*14*	9	4	39	53	*105*
4:30 PM	**0**	**5**	**0**	**0**	***5***	**0**	**6**	**0**	**0**	***6***	**5**	**6**	**35**	**45**	*91*
4:45 PM	**0**	**4**	**0**	**0**	***4***	**0**	**10**	**0**	**1**	***11***	**2**	**2**	**50**	**40**	*94*
5:00 PM	**0**	**5**	**0**	**0**	***5***	**1**	**8**	**0**	**0**	***9***	**6**	**6**	**79**	**54**	*145*
5:15 PM	**0**	**5**	**0**	**0**	***5***	**1**	**18**	**0**	**0**	***19***	**11**	**1**	**60**	**83**	***155***
5:30 PM	0	2	0	0	*2*	0	6	0	0	*6*	6	7	88	58	*159*
5:45 PM	0	2	0	0	*2*	1	12	0	0	*13*	13	2	85	72	*172*
Count Total	0	33	0	0	*33*	3	82	0	2	*87*	57	28	467	438	*990*
Peak Hour	**0**	**19**	**0**	**0**	***19***	**2**	**42**	**0**	**1**	***45***	**24**	**15**	**224**	**222**	***485***

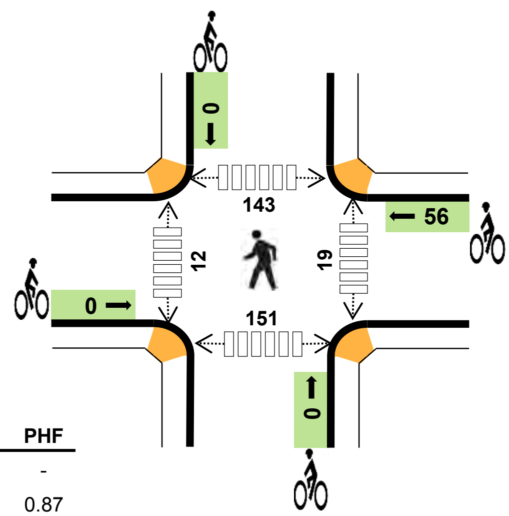
ALLEY (BTWN 3RD AVE & 4TH AVE)
BELL ST

Date: Wed, Apr 04, 2018
Count Period: 7:00 AM to 9:00 AM
Peak Hour: 8:00 AM to 9:00 AM

Peak Hour



	HV %:	PHF
EB	-	-
WB	21.2%	0.87
NB	0.0%	0.38
SB	0.0%	0.63
TOTAL	18.9%	0.93



Two-Hour Count Summaries

Interval Start	BELL ST Eastbound UT	LT	TH	RT	BELL ST Westbound UT	LT	TH	RT	ALLEY (BTWN 3RD AVE & 4TH AVE) Northbound UT	LT	TH	RT	ALLEY (BTWN 3RD AVE & 4TH AVE) Southbound UT	LT	TH	RT	15-min Total	Rolling One Hour
7:00 AM	0	0	0	0	0	2	11	0	0	0	0	0	0	0	2	0	15	0
7:15 AM	0	0	0	0	0	3	12	1	0	0	0	0	0	0	0	0	16	0
7:30 AM	0	0	0	0	0	2	11	0	0	0	0	0	0	0	0	0	13	0
7:45 AM	0	0	0	0	0	1	8	0	0	0	0	0	0	0	0	1	10	54
8:00 AM	**0**	**0**	**0**	**0**	**0**	**3**	**14**	**2**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**19**	58
8:15 AM	**0**	**0**	**0**	**0**	**0**	**1**	**15**	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**1**	**1**	**20**	62
8:30 AM	**0**	**0**	**0**	**0**	**0**	**3**	**12**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**16**	65
8:45 AM	**0**	**0**	**0**	**0**	**0**	**2**	**14**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**1**	**1**	**19**	**74**
Count Total	0	0	0	0	0	17	97	3	0	3	0	0	0	0	4	4	128	0
Peak Hour	**0**	**0**	**0**	**0**	**0**	**9**	**55**	**2**	**0**	**3**	**0**	**0**	**0**	**0**	**2**	**3**	**74**	**0**

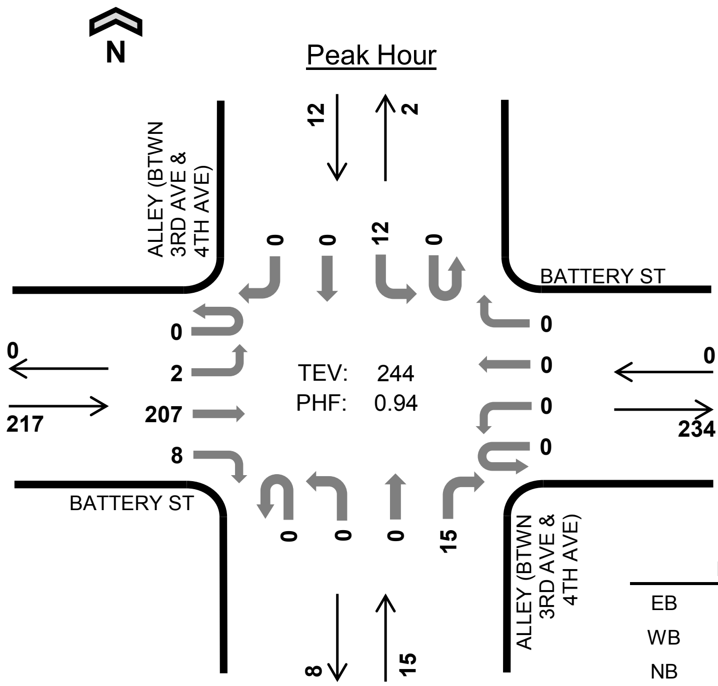
Note: Two-hour count summary volumes include heavy vehicles but exclude bicycles in overall count.

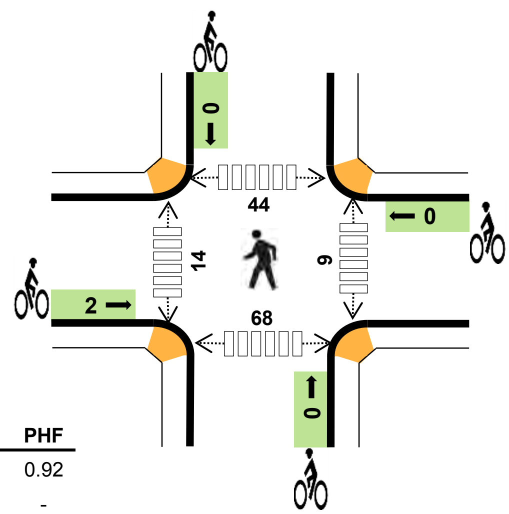
Interval Start	Heavy Vehicle Totals EB	WB	NB	SB	Total	Bicycles EB	WB	NB	SB	Total	Pedestrians (Crossing Leg) East	West	North	South	Total
7:00 AM	0	2	0	1	*3*	0	6	0	0	*6*	5	1	22	14	*42*
7:15 AM	0	4	0	0	*4*	0	8	0	0	*8*	3	3	13	13	*32*
7:30 AM	0	4	0	0	*4*	0	12	0	0	*12*	3	1	30	17	*51*
7:45 AM	0	2	0	0	*2*	0	13	0	0	*13*	7	0	33	39	*79*
8:00 AM	**0**	**3**	**0**	**0**	***3***	**0**	**10**	**0**	**0**	***10***	**3**	**2**	**19**	**27**	*51*
8:15 AM	**0**	**4**	**0**	**0**	***4***	**0**	**16**	**0**	**0**	***16***	**5**	**1**	**29**	**34**	*69*
8:30 AM	**0**	**5**	**0**	**0**	***5***	**0**	**16**	**0**	**0**	***16***	**6**	**3**	**53**	**49**	*111*
8:45 AM	**0**	**2**	**0**	**0**	***2***	**0**	**14**	**0**	**0**	***14***	**5**	**6**	**42**	**41**	*94*
Count Total	0	26	0	1	*27*	0	95	0	0	*95*	37	17	241	234	*529*
Peak Hour	**0**	**14**	**0**	**0**	***14***	**0**	**56**	**0**	**0**	***56***	**19**	**12**	**143**	**151**	*325*

ALLEY (BTWN 3RD AVE & 4TH AVE)
BATTERY ST

Date: Wed, Apr 04, 2018
Count Period: 4:00 PM to 6:00 PM
Peak Hour: 4:00 PM to 5:00 PM

Peak Hour





	HV %:	PHF
EB	15.7%	0.92
WB	-	-
NB	0.0%	0.63
SB	16.7%	0.60
TOTAL	14.8%	0.94

Two-Hour Count Summaries

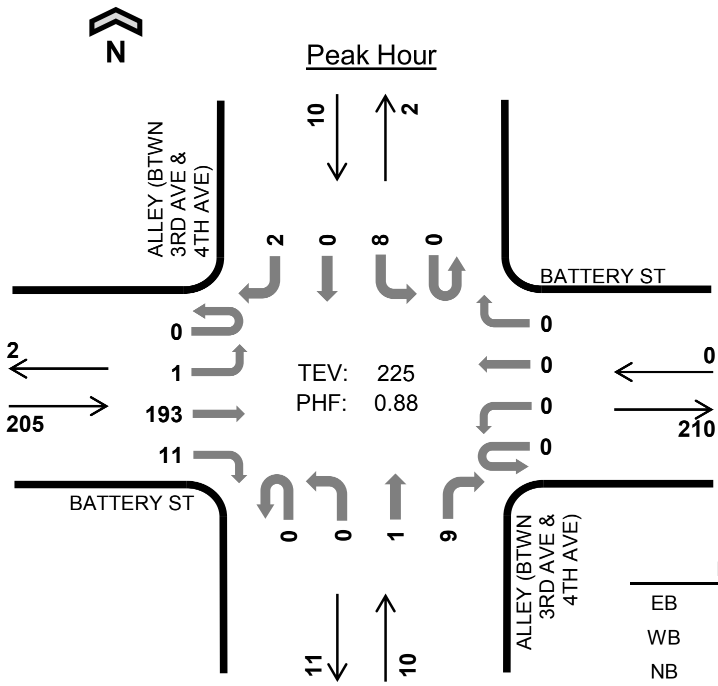
Interval Start	BATTERY ST				BATTERY ST				ALLEY (BTWN 3RD AVE & 4TH AVE)				ALLEY (BTWN 3RD AVE & 4TH AVE)				15-min Total	Rolling One Hour
	Eastbound				Westbound				Northbound				Southbound					
	UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT		
4:00 PM	0	0	51	2	0	0	0	0	0	0	0	1	0	5	0	0	59	0
4:15 PM	0	0	52	2	0	0	0	0	0	0	0	6	0	3	0	0	63	0
4:30 PM	0	1	55	3	0	0	0	0	0	0	0	4	0	2	0	0	65	0
4:45 PM	0	1	49	1	0	0	0	0	0	0	0	4	0	2	0	0	57	244
5:00 PM	0	0	25	0	0	0	0	0	0	0	0	3	0	0	1	0	29	214
5:15 PM	0	0	13	0	0	0	0	0	0	0	0	4	0	0	0	0	17	168
5:30 PM	0	0	41	2	0	0	0	0	0	0	0	2	0	0	0	0	45	148
5:45 PM	0	0	55	0	0	0	0	0	0	0	0	1	0	0	0	0	56	147
Count Total	0	2	341	10	0	0	0	0	0	0	0	25	0	12	1	0	391	0
Peak Hour	0	2	207	8	0	0	0	0	0	0	0	15	0	12	0	0	244	0

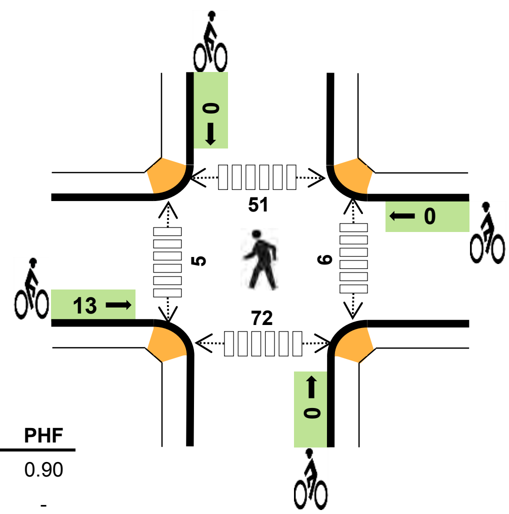
Note: Two-hour count summary volumes include heavy vehicles but exclude bicycles in overall count.

Interval Start	Heavy Vehicle Totals					Bicycles					Pedestrians (Crossing Leg)				
	EB	WB	NB	SB	Total	EB	WB	NB	SB	Total	East	West	North	South	Total
4:00 PM	9	0	0	0	9	0	0	0	0	0	2	3	14	14	33
4:15 PM	7	0	0	1	8	0	0	0	0	0	5	3	12	11	31
4:30 PM	8	0	0	1	9	1	0	0	0	1	1	5	5	16	27
4:45 PM	10	0	0	0	10	1	0	0	0	1	1	3	13	27	44
5:00 PM	10	0	0	0	10	1	0	1	0	2	0	2	2	34	38
5:15 PM	11	0	0	0	11	1	0	0	0	1	0	2	0	35	37
5:30 PM	11	0	0	0	11	1	0	0	0	1	1	6	0	33	40
5:45 PM	6	0	0	0	6	0	0	0	0	0	0	2	0	27	29
Count Total	72	0	0	2	74	5	0	1	0	6	10	26	46	197	279
Peak Hour	34	0	0	2	36	2	0	0	0	2	9	14	44	68	135

ALLEY (BTWN 3RD AVE & 4TH AVE)
BATTERY ST

Date: Wed, Apr 04, 2018
Count Period: 7:00 AM to 9:00 AM
Peak Hour: 8:00 AM to 9:00 AM





	HV %:	PHF
EB	14.1%	0.90
WB	-	-
NB	0.0%	0.63
SB	0.0%	0.63
TOTAL	12.9%	0.88

Two-Hour Count Summaries

Interval Start	BATTERY ST Eastbound UT	LT	TH	RT	BATTERY ST Westbound UT	LT	TH	RT	ALLEY (BTWN 3RD AVE & 4TH AVE) Northbound UT	LT	TH	RT	ALLEY (BTWN 3RD AVE & 4TH AVE) Southbound UT	LT	TH	RT	15-min Total	Rolling One Hour
7:00 AM	0	0	29	2	0	0	0	0	0	0	1	3	0	2	2	0	39	0
7:15 AM	0	0	39	2	0	0	0	0	0	0	0	2	0	2	0	0	45	0
7:30 AM	0	0	43	3	0	0	0	0	0	0	0	2	0	1	0	1	50	0
7:45 AM	0	0	41	3	0	0	0	0	0	0	0	3	0	5	0	0	52	186
8:00 AM	**0**	**0**	**36**	**4**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**2**	**0**	**0**	**43**	190
8:15 AM	**0**	**0**	**54**	**3**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**3**	**0**	**3**	**0**	**1**	**64**	209
8:30 AM	**0**	**1**	**52**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**3**	**0**	**0**	**0**	**0**	**57**	216
8:45 AM	**0**	**0**	**51**	**4**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**2**	**0**	**3**	**0**	**1**	**61**	**225**
Count Total	0	1	345	21	0	0	0	0	0	0	2	19	0	18	2	3	411	0
Peak Hour	**0**	**1**	**193**	**11**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**9**	**0**	**8**	**0**	**2**	**225**	**0**

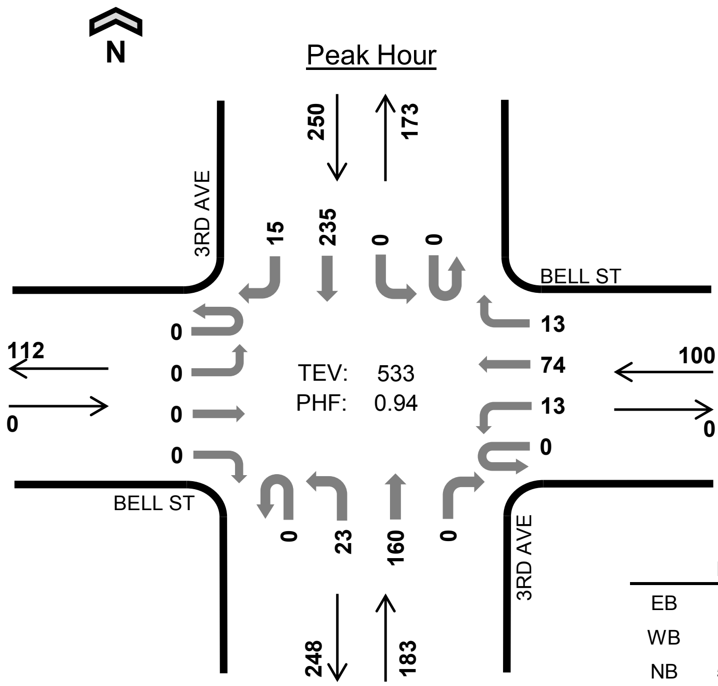
Note: Two-hour count summary volumes include heavy vehicles but exclude bicycles in overall count.

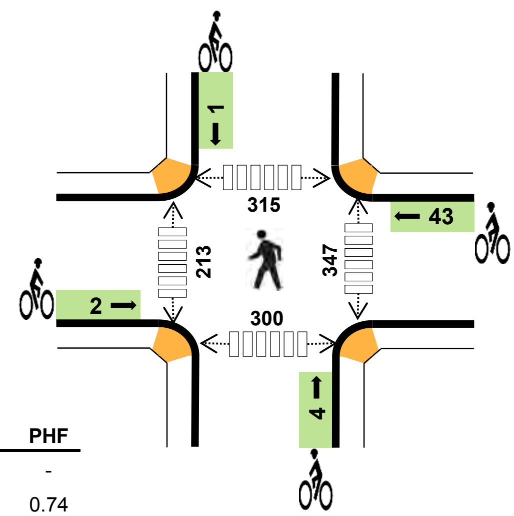
Interval Start	Heavy Vehicle Totals EB	WB	NB	SB	Total	Bicycles EB	WB	NB	SB	Total	Pedestrians (Crossing Leg) East	West	North	South	Total
7:00 AM	7	0	0	0	*7*	2	0	0	0	*2*	1	1	1	5	*8*
7:15 AM	5	0	0	0	*5*	1	0	0	0	*1*	0	0	9	14	*23*
7:30 AM	6	0	0	0	*6*	0	0	0	0	*0*	2	2	2	13	*19*
7:45 AM	5	0	0	0	*5*	1	0	0	0	*1*	1	4	17	22	*44*
8:00 AM	**10**	**0**	**0**	**0**	***10***	**1**	**0**	**0**	**0**	***1***	**3**	**1**	**14**	**14**	***32***
8:15 AM	**6**	**0**	**0**	**0**	***6***	**2**	**0**	**0**	**0**	***2***	**1**	**1**	**9**	**19**	***30***
8:30 AM	**9**	**0**	**0**	**0**	***9***	**2**	**0**	**0**	**0**	***2***	**1**	**1**	**14**	**15**	***31***
8:45 AM	**4**	**0**	**0**	**0**	***4***	**8**	**0**	**0**	**0**	***8***	**1**	**2**	**14**	**24**	***41***
Count Total	52	0	0	0	*52*	17	0	0	0	*17*	10	12	80	126	*228*
Peak Hour	**29**	**0**	**0**	**0**	***29***	**13**	**0**	**0**	**0**	***13***	**6**	**5**	**51**	**72**	***134***

Mark Skaggs: (425) 250-0777 mark.skaggs@idaxdata.com

3RD AVE
BELL ST

Date: Wed, Apr 04, 2018
Count Period: 4:00 PM to 6:00 PM
Peak Hour: 5:00 PM to 6:00 PM





	HV %:	PHF
EB	-	-
WB	14.0%	0.74
NB	54.6%	0.86
SB	23.6%	0.96
TOTAL	32.5%	0.94

Two-Hour Count Summaries

Interval Start	BELL ST Eastbound				BELL ST Westbound				3RD AVE Northbound				3RD AVE Southbound				15-min Total	Rolling One Hour
	UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT		
4:00 PM	0	0	0	0	0	5	10	8	1	3	35	0	0	0	46	5	113	0
4:15 PM	0	0	0	0	0	2	16	6	0	4	28	0	0	0	41	3	100	0
4:30 PM	0	0	0	0	0	4	18	4	0	6	31	0	0	0	44	4	111	0
4:45 PM	0	0	0	0	0	2	18	6	0	2	44	0	0	0	55	2	129	453
5:00 PM	**0**	**0**	**0**	**0**	**0**	**3**	**25**	**6**	**0**	**7**	**36**	**0**	**0**	**0**	**56**	**2**	**135**	475
5:15 PM	**0**	**0**	**0**	**0**	**0**	**5**	**18**	**1**	**0**	**8**	**45**	**0**	**0**	**0**	**59**	**6**	**142**	517
5:30 PM	**0**	**0**	**0**	**0**	**0**	**3**	**14**	**3**	**0**	**5**	**39**	**0**	**0**	**0**	**56**	**6**	**126**	532
5:45 PM	**0**	**0**	**0**	**0**	**0**	**2**	**17**	**3**	**0**	**3**	**40**	**0**	**0**	**0**	**64**	**1**	**130**	533
Count Total	0	0	0	0	0	26	136	37	1	38	298	0	0	0	421	29	986	0
Peak Hour	**0**	**0**	**0**	**0**	**0**	**13**	**74**	**13**	**0**	**23**	**160**	**0**	**0**	**0**	**235**	**15**	**533**	**0**

Note: Two-hour count summary volumes include heavy vehicles but exclude bicycles in overall count.

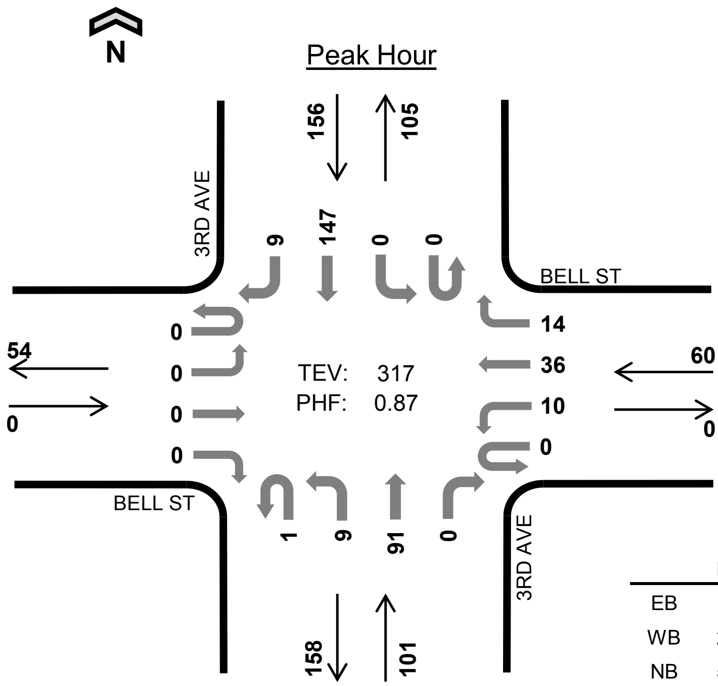
Interval Start	Heavy Vehicle Totals					Bicycles					Pedestrians (Crossing Leg)				
	EB	WB	NB	SB	Total	EB	WB	NB	SB	Total	East	West	North	South	Total
4:00 PM	0	4	21	16	*41*	0	6	0	0	*6*	40	33	40	44	*157*
4:15 PM	0	6	19	16	*41*	0	15	0	0	*15*	61	54	51	70	*236*
4:30 PM	0	5	17	15	*37*	0	6	0	1	*7*	51	50	50	63	*214*
4:45 PM	0	4	23	14	*41*	0	9	0	1	*10*	52	40	42	58	*192*
5:00 PM	**0**	**5**	**25**	**17**	***47***	**1**	**7**	**1**	**1**	***10***	**91**	**46**	**75**	**68**	*280*
5:15 PM	**0**	**4**	**30**	**17**	***51***	**0**	**18**	**1**	**0**	***19***	**86**	**43**	**76**	**79**	*284*
5:30 PM	**0**	**3**	**27**	**12**	***42***	**0**	**6**	**1**	**0**	***7***	**74**	**71**	**78**	**59**	*282*
5:45 PM	**0**	**2**	**18**	**13**	***33***	**1**	**12**	**1**	**0**	***14***	**96**	**53**	**86**	**94**	*329*
Count Total	0	33	180	120	*333*	2	79	4	3	*88*	551	390	498	535	*1,974*
Peak Hour	**0**	**14**	**100**	**59**	***173***	**2**	**43**	**4**	**1**	***50***	**347**	**213**	**315**	**300**	***1,175***

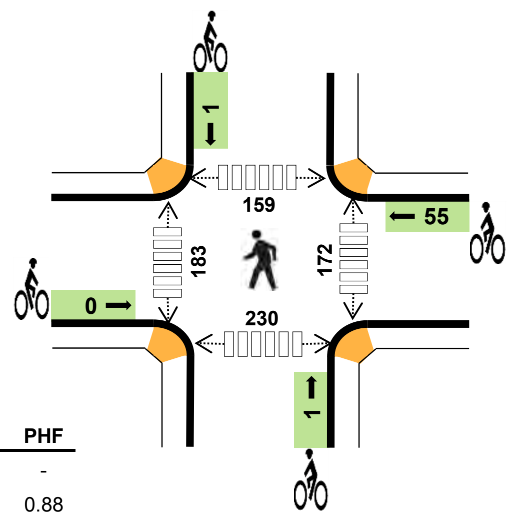
Mark Skaggs: (425) 250-0777 mark.skaggs@idaxdata.com

3RD AVE
BELL ST

idax

Date: Wed, Apr 04, 2018
Count Period: 7:00 AM to 9:00 AM
Peak Hour: 8:00 AM to 9:00 AM





	HV %:	PHF
EB	-	-
WB	23.3%	0.88
NB	50.5%	0.87
SB	55.8%	0.76
TOTAL	47.9%	0.87

Two-Hour Count Summaries

Interval Start	BELL ST				BELL ST				3RD AVE				3RD AVE				15-min Total	Rolling One Hour
	Eastbound				Westbound				Northbound				Southbound					
	UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT		
7:00 AM	0	0	0	0	0	1	8	1	0	0	17	0	0	0	23	1	51	0
7:15 AM	0	0	0	0	0	2	5	4	0	0	19	0	0	0	23	3	56	0
7:30 AM	0	0	0	0	0	4	8	1	0	2	25	0	0	0	29	1	70	0
7:45 AM	0	0	0	0	0	2	4	2	0	0	16	0	0	0	36	3	63	240
8:00 AM	**0**	**0**	**0**	**0**	**0**	**2**	**9**	**4**	**0**	**1**	**20**	**0**	**0**	**0**	**27**	**2**	**65**	254
8:15 AM	**0**	**0**	**0**	**0**	**0**	**2**	**12**	**3**	**0**	**2**	**22**	**0**	**0**	**0**	**33**	**1**	**75**	273
8:30 AM	**0**	**0**	**0**	**0**	**0**	**4**	**6**	**3**	**1**	**2**	**24**	**0**	**0**	**0**	**48**	**3**	**91**	294
8:45 AM	**0**	**0**	**0**	**0**	**0**	**2**	**9**	**4**	**0**	**4**	**25**	**0**	**0**	**0**	**39**	**3**	**86**	**317**
Count Total	0	0	0	0	0	19	61	22	1	11	168	0	0	0	258	17	557	0
Peak Hour	**0**	**0**	**0**	**0**	**0**	**10**	**36**	**14**	**1**	**9**	**91**	**0**	**0**	**0**	**147**	**9**	**317**	**0**

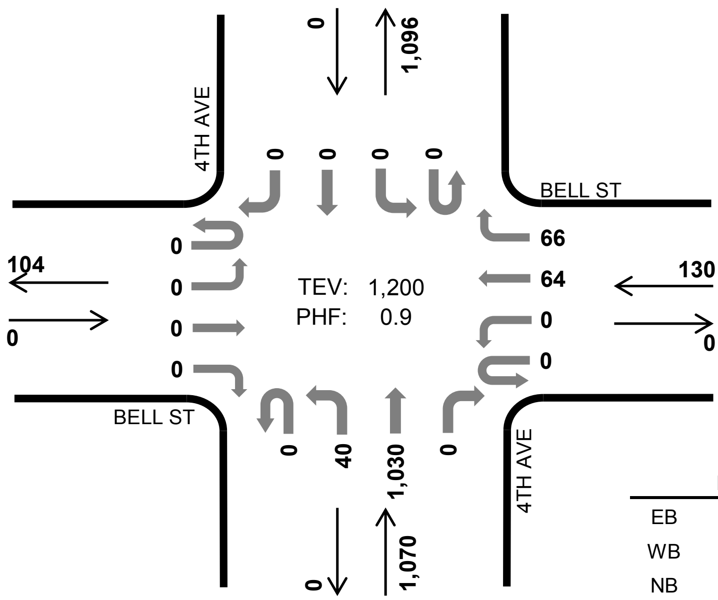
Note: Two-hour count summary volumes include heavy vehicles but exclude bicycles in overall count.

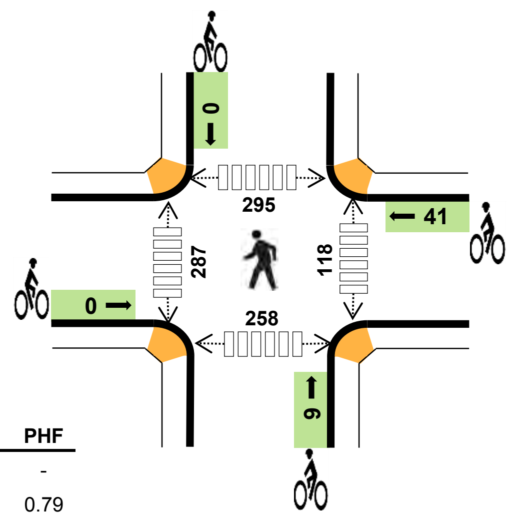
Interval Start	Heavy Vehicle Totals					Bicycles					Pedestrians (Crossing Leg)				
	EB	WB	NB	SB	Total	EB	WB	NB	SB	Total	East	West	North	South	Total
7:00 AM	0	2	11	14	*27*	0	5	0	0	*5*	25	18	17	20	*80*
7:15 AM	0	4	15	18	*37*	0	8	0	0	*8*	27	28	21	32	*108*
7:30 AM	0	4	14	18	*36*	0	12	0	1	*13*	29	35	42	32	*138*
7:45 AM	0	2	12	24	*38*	0	13	0	0	*13*	37	34	35	40	*146*
8:00 AM	**0**	**3**	**14**	**20**	***37***	**0**	**10**	**0**	**0**	***10***	**42**	**43**	**37**	**46**	*168*
8:15 AM	**0**	**4**	**11**	**21**	***36***	**0**	**16**	**0**	**1**	***17***	**43**	**46**	**38**	**51**	*178*
8:30 AM	**0**	**5**	**14**	**26**	***45***	**0**	**16**	**1**	**0**	***17***	**48**	**58**	**52**	**58**	*216*
8:45 AM	**0**	**2**	**12**	**20**	***34***	**0**	**13**	**0**	**0**	***13***	**39**	**36**	**32**	**75**	*182*
Count Total	0	26	103	161	*290*	0	93	1	2	*96*	290	298	274	354	*1,216*
Peak Hour	**0**	**14**	**51**	**87**	***152***	**0**	**55**	**1**	**1**	***57***	**172**	**183**	**159**	**230**	***744***

4TH AVE
BELL ST

Date: Wed, Apr 04, 2018
Count Period: 4:00 PM to 6:00 PM
Peak Hour: 5:00 PM to 6:00 PM

Peak Hour





	HV %:	PHF
EB	-	-
WB	11.5%	0.79
NB	1.8%	0.86
SB	-	-
TOTAL	2.8%	0.90

Two-Hour Count Summaries

Interval Start	BELL ST Eastbound UT	LT	TH	RT	BELL ST Westbound UT	LT	TH	RT	4TH AVE Northbound UT	LT	TH	RT	4TH AVE Southbound UT	LT	TH	RT	15-min Total	Rolling One Hour
4:00 PM	0	0	0	0	0	0	16	11	0	9	196	0	0	0	0	0	232	0
4:15 PM	0	0	0	0	0	0	15	8	0	10	200	0	0	0	0	0	233	0
4:30 PM	0	0	0	0	0	0	19	11	0	5	195	0	0	0	0	0	230	0
4:45 PM	0	0	0	0	0	0	19	7	0	8	222	0	0	0	0	0	256	951
5:00 PM	**0**	**0**	**0**	**0**	**0**	**0**	**19**	**8**	**0**	**13**	**222**	**0**	**0**	**0**	**0**	**0**	**262**	981
5:15 PM	**0**	**0**	**0**	**0**	**0**	**0**	**20**	**21**	**0**	**9**	**261**	**0**	**0**	**0**	**0**	**0**	**311**	1,059
5:30 PM	**0**	**0**	**0**	**0**	**0**	**0**	**14**	**27**	**0**	**5**	**248**	**0**	**0**	**0**	**0**	**0**	**294**	1,123
5:45 PM	**0**	**0**	**0**	**0**	**0**	**0**	**11**	**10**	**0**	**13**	**299**	**0**	**0**	**0**	**0**	**0**	**333**	**1,200**
Count Total	0	0	0	0	0	0	133	103	0	72	1,843	0	0	0	0	0	2,151	0
Peak Hour	**0**	**0**	**0**	**0**	**0**	**0**	**64**	**66**	**0**	**40**	**1,030**	**0**	**0**	**0**	**0**	**0**	**1,200**	**0**

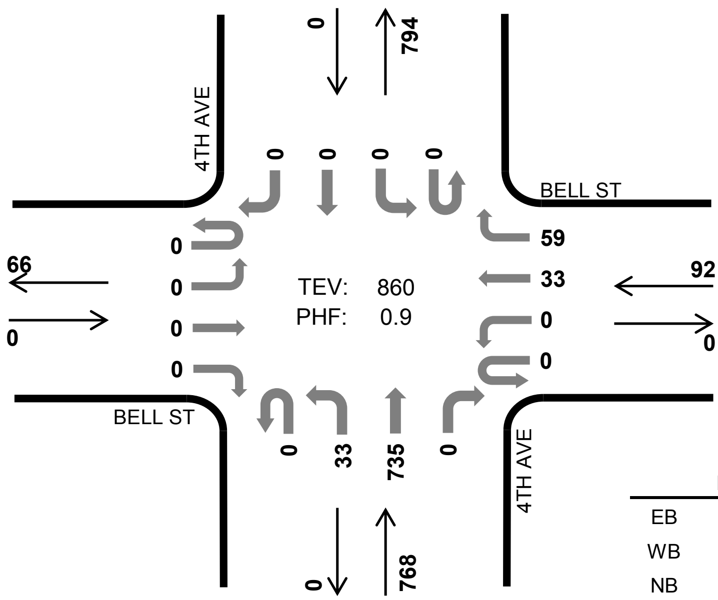
Note: Two-hour count summary volumes include heavy vehicles but exclude bicycles in overall count.

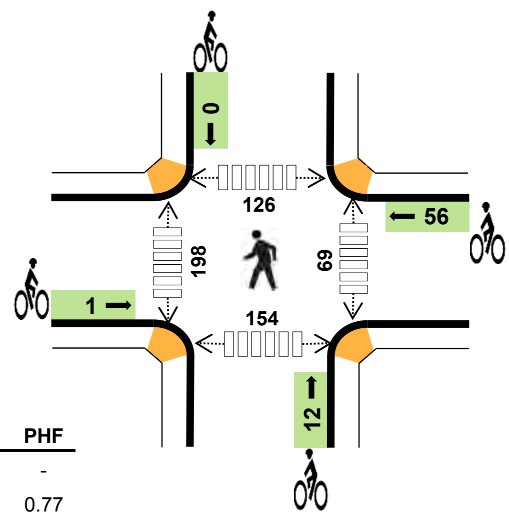
Interval Start	Heavy Vehicle Totals EB	WB	NB	SB	Total	Bicycles EB	WB	NB	SB	Total	Pedestrians (Crossing Leg) East	West	North	South	Total
4:00 PM	0	5	11	0	*16*	0	7	2	0	*9*	22	45	30	25	*122*
4:15 PM	0	6	11	0	*17*	0	12	2	0	*14*	30	47	26	44	*147*
4:30 PM	0	7	10	0	*17*	0	5	5	0	*10*	21	46	38	30	*135*
4:45 PM	0	4	11	0	*15*	1	9	5	0	*15*	22	51	49	35	*157*
5:00 PM	**0**	**5**	**5**	**0**	***10***	**0**	**6**	**5**	**0**	***11***	**20**	**63**	**78**	**53**	*214*
5:15 PM	**0**	**5**	**6**	**0**	***11***	**0**	**17**	**0**	**0**	***17***	**29**	**62**	**61**	**70**	*222*
5:30 PM	**0**	**3**	**5**	**0**	***8***	**0**	**6**	**1**	**0**	***7***	**39**	**85**	**78**	**57**	*259*
5:45 PM	**0**	**2**	**3**	**0**	***5***	**0**	**12**	**3**	**0**	***15***	**30**	**77**	**78**	**78**	*263*
Count Total	0	37	62	0	*99*	1	74	23	0	*98*	213	476	438	392	*1,519*
Peak Hour	**0**	**15**	**19**	**0**	***34***	**0**	**41**	**9**	**0**	***50***	**118**	**287**	**295**	**258**	***958***

4TH AVE
BELL ST

Date: Wed, Apr 04, 2018
Count Period: 7:00 AM to 9:00 AM
Peak Hour: 8:00 AM to 9:00 AM

Peak Hour





	HV %:	PHF
EB	-	-
WB	18.5%	0.77
NB	4.2%	0.92
SB	-	-
TOTAL	5.7%	0.90

Two-Hour Count Summaries

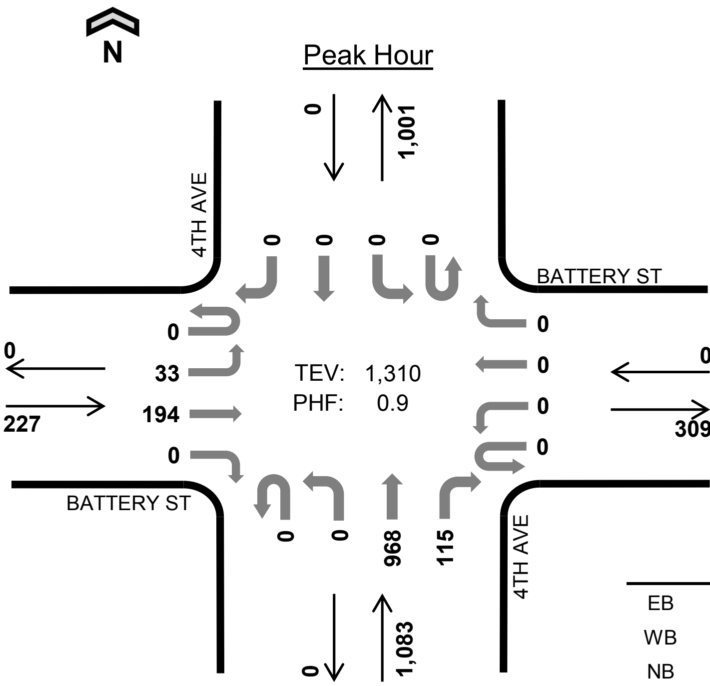
Interval Start	BELL ST Eastbound UT	LT	TH	RT	BELL ST Westbound UT	LT	TH	RT	4TH AVE Northbound UT	LT	TH	RT	4TH AVE Southbound UT	LT	TH	RT	15-min Total	Rolling One Hour
7:00 AM	0	0	0	0	0	0	6	7	0	6	140	0	0	0	0	0	159	0
7:15 AM	0	0	0	0	0	0	6	6	0	9	163	0	0	0	0	0	184	0
7:30 AM	0	0	0	0	0	0	8	6	0	5	186	0	0	0	0	0	205	0
7:45 AM	0	0	0	0	0	0	5	14	0	5	164	0	0	0	2	0	190	738
8:00 AM	**0**	**0**	**0**	**0**	**0**	**0**	**5**	**13**	**0**	**14**	**186**	**0**	**0**	**0**	**0**	**0**	**218**	797
8:15 AM	**0**	**0**	**0**	**0**	**0**	**0**	**10**	**14**	**0**	**6**	**174**	**0**	**0**	**0**	**0**	**0**	**204**	817
8:30 AM	**0**	**0**	**0**	**0**	**0**	**0**	**9**	**11**	**0**	**6**	**174**	**0**	**0**	**0**	**0**	**0**	**200**	812
8:45 AM	**0**	**0**	**0**	**0**	**0**	**0**	**9**	**21**	**0**	**7**	**201**	**0**	**0**	**0**	**0**	**0**	**238**	**860**
Count Total	0	0	0	0	0	0	58	92	0	58	1,388	0	0	0	2	0	1,598	0
Peak Hour	**0**	**0**	**0**	**0**	**0**	**0**	**33**	**59**	**0**	**33**	**735**	**0**	**0**	**0**	**0**	**0**	**860**	**0**

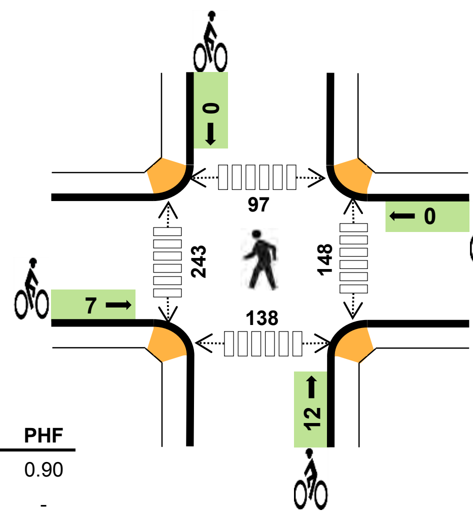
Note: Two-hour count summary volumes include heavy vehicles but exclude bicycles in overall count.

Interval Start	Heavy Vehicle Totals EB	WB	NB	SB	Total	Bicycles EB	WB	NB	SB	Total	Pedestrians (Crossing Leg) East	West	North	South	Total
7:00 AM	0	2	9	0	*11*	0	5	2	0	*7*	7	26	16	8	*57*
7:15 AM	0	4	8	0	*12*	0	8	2	0	*10*	16	31	10	15	*72*
7:30 AM	0	4	10	0	*14*	0	13	3	0	*16*	13	48	22	16	*99*
7:45 AM	0	2	10	2	*14*	0	14	2	0	*16*	26	43	36	31	*136*
8:00 AM	**0**	**5**	**14**	**0**	***19***	**0**	**9**	**4**	**0**	***13***	**25**	**40**	**22**	**24**	*111*
8:15 AM	**0**	**3**	**5**	**0**	***8***	**1**	**15**	**4**	**0**	***20***	**12**	**46**	**29**	**28**	*115*
8:30 AM	**0**	**5**	**6**	**0**	***11***	**0**	**16**	**1**	**0**	***17***	**14**	**55**	**44**	**60**	*173*
8:45 AM	**0**	**4**	**7**	**0**	***11***	**0**	**16**	**3**	**0**	***19***	**18**	**57**	**31**	**42**	***148***
Count Total	0	29	69	2	*100*	1	96	21	0	*118*	131	346	210	224	*911*
Peak Hour	**0**	**17**	**32**	**0**	***49***	**1**	**56**	**12**	**0**	***69***	**69**	**198**	**126**	**154**	***547***

4TH AVE
BATTERY ST

Date: Wed, Apr 04, 2018
Count Period: 4:00 PM to 6:00 PM
Peak Hour: 5:00 PM to 6:00 PM





	HV %:	PHF
EB	17.6%	0.90
WB	-	-
NB	1.8%	0.88
SB	-	-
TOTAL	4.6%	0.90

Two-Hour Count Summaries

Interval Start	BATTERY ST Eastbound UT	LT	TH	RT	BATTERY ST Westbound UT	LT	TH	RT	4TH AVE Northbound UT	LT	TH	RT	4TH AVE Southbound UT	LT	TH	RT	15-min Total	Rolling One Hour
4:00 PM	0	5	58	0	0	0	0	0	0	0	165	41	0	0	0	0	269	0
4:15 PM	0	9	47	0	0	0	0	0	0	0	177	33	0	0	0	0	266	0
4:30 PM	0	8	47	0	0	0	0	0	0	0	175	30	0	0	0	0	260	0
4:45 PM	0	8	61	0	0	0	0	0	0	0	201	24	0	0	0	0	294	1,089
5:00 PM	**0**	**9**	**54**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**197**	**28**	**0**	**0**	**0**	**0**	**288**	1,108
5:15 PM	**0**	**4**	**46**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**258**	**18**	**0**	**0**	**0**	**0**	**326**	1,168
5:30 PM	**0**	**14**	**42**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**242**	**34**	**0**	**0**	**0**	**0**	**332**	1,240
5:45 PM	**0**	**6**	**52**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**271**	**35**	**0**	**0**	**0**	**0**	**364**	**1,310**
Count Total	0	63	407	0	0	0	0	0	0	0	1,686	243	0	0	0	0	2,399	0
Peak Hour	**0**	**33**	**194**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**968**	**115**	**0**	**0**	**0**	**0**	**1,310**	**0**

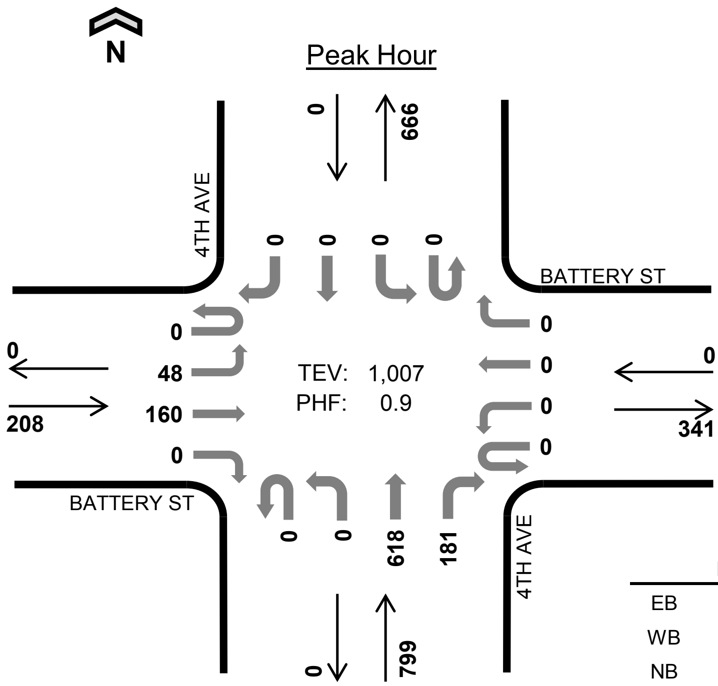
Note: Two-hour count summary volumes include heavy vehicles but exclude bicycles in overall count.

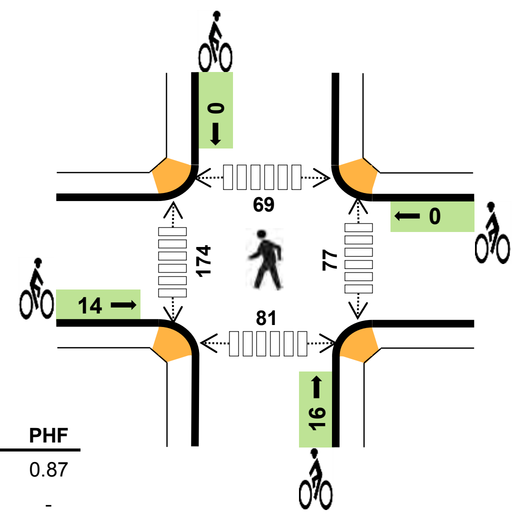
Interval Start	Heavy Vehicle Totals EB	WB	NB	SB	Total	Bicycles EB	WB	NB	SB	Total	Pedestrians (Crossing Leg) East	West	North	South	Total
4:00 PM	9	0	12	0	*21*	0	0	1	0	*1*	23	49	15	9	*96*
4:15 PM	9	0	10	0	*19*	1	0	3	0	*4*	15	44	11	10	*80*
4:30 PM	8	0	13	0	*21*	1	0	5	0	*6*	30	44	7	18	*99*
4:45 PM	10	0	11	0	*21*	2	0	6	0	*8*	29	54	22	26	*131*
5:00 PM	**11**	**0**	**5**	**0**	***16***	**1**	**0**	**7**	**0**	***8***	**26**	**57**	**23**	**26**	*132*
5:15 PM	**11**	**0**	**6**	**0**	***17***	**4**	**0**	**0**	**0**	***4***	**35**	**64**	**28**	**44**	*171*
5:30 PM	**12**	**0**	**6**	**0**	***18***	**2**	**0**	**1**	**0**	***3***	**52**	**52**	**25**	**36**	*165*
5:45 PM	**6**	**0**	**3**	**0**	***9***	**0**	**0**	**4**	**0**	***4***	**35**	**70**	**21**	**32**	*158*
Count Total	76	0	66	0	*142*	11	0	27	0	*38*	245	434	152	201	*1,032*
Peak Hour	**40**	**0**	**20**	**0**	***60***	**7**	**0**	**12**	**0**	***19***	**148**	**243**	**97**	**138**	***626***

Mark Skaggs: (425) 250-0777 mark.skaggs@idaxdata.com

4TH AVE
BATTERY ST

Date: Wed, Apr 04, 2018
Count Period: 7:00 AM to 9:00 AM
Peak Hour: 8:00 AM to 9:00 AM





	HV %:	PHF
EB	13.5%	0.87
WB	-	-
NB	4.3%	0.89
SB	-	-
TOTAL	6.2%	0.90

Two-Hour Count Summaries

Interval Start	BATTERY ST Eastbound				BATTERY ST Westbound				4TH AVE Northbound				4TH AVE Southbound				15-min Total	Rolling One Hour
	UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT		
7:00 AM	0	5	30	0	0	0	0	0	0	0	120	25	0	0	0	0	180	0
7:15 AM	0	7	32	0	0	0	0	0	0	0	138	32	0	0	0	0	209	0
7:30 AM	0	4	37	0	0	0	0	0	0	0	160	34	0	0	0	0	235	0
7:45 AM	0	14	35	0	0	0	0	0	0	0	142	42	0	0	0	0	233	857
8:00 AM	**0**	**12**	**25**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**163**	**36**	**0**	**0**	**0**	**0**	**236**	913
8:15 AM	**0**	**15**	**45**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**142**	**48**	**0**	**0**	**0**	**0**	**250**	954
8:30 AM	**0**	**11**	**44**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**141**	**44**	**0**	**0**	**0**	**0**	**240**	959
8:45 AM	**0**	**10**	**46**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**172**	**53**	**0**	**0**	**0**	**0**	**281**	**1,007**
Count Total	0	78	294	0	0	0	0	0	0	0	1,178	314	0	0	0	0	1,864	0
Peak Hour	**0**	**48**	**160**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**618**	**181**	**0**	**0**	**0**	**0**	**1,007**	**0**

Note: Two-hour count summary volumes include heavy vehicles but exclude bicycles in overall count.

Interval Start	Heavy Vehicle Totals					Bicycles					Pedestrians (Crossing Leg)				
	EB	WB	NB	SB	Total	EB	WB	NB	SB	Total	East	West	North	South	Total
7:00 AM	7	0	9	0	*16*	2	0	2	0	*4*	11	20	7	9	*47*
7:15 AM	5	0	8	0	*13*	0	0	2	0	*2*	15	25	10	8	*58*
7:30 AM	6	0	10	0	*16*	0	0	4	0	*4*	12	34	11	11	*68*
7:45 AM	5	0	11	0	*16*	1	0	3	0	*4*	22	36	20	22	*100*
8:00 AM	**8**	**0**	**13**	**0**	***21***	**2**	**0**	**5**	**0**	***7***	**19**	**36**	**13**	**16**	*84*
8:15 AM	**7**	**0**	**5**	**0**	***12***	**1**	**0**	**4**	**0**	***5***	**20**	**37**	**22**	**18**	*97*
8:30 AM	**9**	**0**	**7**	**0**	***16***	**3**	**0**	**2**	**0**	***5***	**19**	**47**	**20**	**17**	*103*
8:45 AM	**4**	**0**	**9**	**0**	***13***	**8**	**0**	**5**	**0**	***13***	**19**	**54**	**14**	**30**	***117***
Count Total	51	0	72	0	*123*	17	0	27	0	*44*	137	289	117	131	*674*
Peak Hour	**28**	**0**	**34**	**0**	***62***	**14**	**0**	**16**	**0**	***30***	**77**	**174**	**69**	**81**	***401***

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Appendix B: LOS Definitions

Highway Capacity Manual 2010

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* (Transportation Research Board, 2010).

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*, Transportation Research Board, 2010.
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*, Transportation Research Board, 2010.
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)	50	160	0	0	0	0	0	620	180	0	0	0
Future Volume (veh/h)	50	160	0	0	0	0	0	620	180	0	0	0
Number	7	4	14				5	2	12			
Initial Q (Qb), veh	0	0	0				0	0	0			
Ped-Bike Adj(A_pbT)	1.00		1.00				1.00		0.89			
Parking Bus, Adj	1.00	1.00	1.00				1.00	1.00	1.00			
Adj Sat Flow, veh/h/ln	1900	1667	0				0	1827	1827			
Adj Flow Rate, veh/h	56	178	0				0	689	200			
Adj No. of Lanes	0	1	0				0	4	1			
Peak Hour Factor	0.90	0.90	0.90				0.90	0.90	0.90			
Percent Heavy Veh, %	14	14	0				0	4	4			
Cap, veh/h	176	506	0				0	3008	661			
Arrive On Green	0.39	0.39	0.00				0.00	0.16	0.16			
Sat Flow, veh/h	287	1288	0				0	6540	1382			
Grp Volume(v), veh/h	234	0	0				0	689	200			
Grp Sat Flow(s),veh/h/ln	1575	0	0				0	1571	1382			
Q Serve(g_s), s	0.8	0.0	0.0				0.0	6.7	9.0			
Cycle Q Clear(g_c), s	7.0	0.0	0.0				0.0	6.7	9.0			
Prop In Lane	0.24		0.00				0.00		1.00			
Lane Grp Cap(c), veh/h	682	0	0				0	3008	661			
V/C Ratio(X)	0.34	0.00	0.00				0.00	0.23	0.30			
Avail Cap(c_a), veh/h	682	0	0				0	3008	661			
HCM Platoon Ratio	1.00	1.00	1.00				1.00	0.33	0.33			
Upstream Filter(I)	1.00	0.00	0.00				0.00	0.98	0.98			
Uniform Delay (d), s/veh	15.0	0.0	0.0				0.0	18.2	19.1			
Incr Delay (d2), s/veh	1.4	0.0	0.0				0.0	0.2	1.1			
Initial Q Delay(d3),s/veh	0.0	0.0	0.0				0.0	0.0	0.0			
%ile BackOfQ(50%),veh/ln	3.4	0.0	0.0				0.0	3.0	3.6			
LnGrp Delay(d),s/veh	16.4	0.0	0.0				0.0	18.4	20.3			
LnGrp LOS	B							B	C			
Approach Vol, veh/h		234						889				
Approach Delay, s/veh		16.4						18.8				
Approach LOS		B						B				

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4				
Phs Duration (G+Y+Rc), s		38.0		32.0				
Change Period (Y+Rc), s		4.5		4.5				
Max Green Setting (Gmax), s		33.5		27.5				
Max Q Clear Time (g_c+I1), s		11.0		9.0				
Green Ext Time (p_c), s		1.1		0.2				

Intersection Summary			
HCM 2010 Ctrl Delay			18.3
HCM 2010 LOS			B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	0	35	60	35	735	0	0	0	0
Future Volume (veh/h)	0	0	0	0	35	60	35	735	0	0	0	0
Number				3	8	18	5	2	12			
Initial Q (Qb), veh				0	0	0	0	0	0			
Ped-Bike Adj(A_pbT)				1.00		0.85	1.00		1.00			
Parking Bus, Adj				1.00	1.00	1.00	1.00	1.00	1.00			
Adj Sat Flow, veh/h/ln				0	1597	1900	1900	1827	0			
Adj Flow Rate, veh/h				0	39	67	39	817	0			
Adj No. of Lanes				0	1	0	0	4	0			
Peak Hour Factor				0.90	0.90	0.90	0.90	0.90	0.90			
Percent Heavy Veh, %				0	19	19	4	4	0			
Cap, veh/h				0	158	272	163	3140	0			
Arrive On Green				0.00	0.34	0.34	0.54	0.54	0.00			
Sat Flow, veh/h				0	472	810	193	6094	0			
Grp Volume(v), veh/h				0	0	106	253	603	0			
Grp Sat Flow(s),veh/h/ln				0	0	1282	1765	1430	0			
Q Serve(g_s), s				0.0	0.0	4.2	0.0	5.3	0.0			
Cycle Q Clear(g_c), s				0.0	0.0	4.2	5.2	5.3	0.0			
Prop In Lane				0.00		0.63	0.15		0.00			
Lane Grp Cap(c), veh/h				0	0	430	1005	2298	0			
V/C Ratio(X)				0.00	0.00	0.25	0.25	0.26	0.00			
Avail Cap(c_a), veh/h				0	0	430	1005	2298	0			
HCM Platoon Ratio				1.00	1.00	1.00	1.00	1.00	1.00			
Upstream Filter(I)				0.00	0.00	1.00	1.00	1.00	0.00			
Uniform Delay (d), s/veh				0.0	0.0	16.8	8.8	8.8	0.0			
Incr Delay (d2), s/veh				0.0	0.0	1.4	0.6	0.3	0.0			
Initial Q Delay(d3),s/veh				0.0	0.0	0.0	0.0	0.0	0.0			
%ile BackOfQ(50%),veh/ln				0.0	0.0	1.6	2.8	2.1	0.0			
LnGrp Delay(d),s/veh				0.0	0.0	18.2	9.4	9.1	0.0			
LnGrp LOS						B	A	A				
Approach Vol, veh/h					106			856				
Approach Delay, s/veh					18.2			9.1				
Approach LOS					B			A				

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2						8
Phs Duration (G+Y+Rc), s		42.0						28.0
Change Period (Y+Rc), s		4.5						4.5
Max Green Setting (Gmax), s		37.5						23.5
Max Q Clear Time (g_c+I1), s		7.3						6.2
Green Ext Time (p_c), s		1.2						0.1

Intersection Summary	
HCM 2010 Ctrl Delay	10.1
HCM 2010 LOS	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	10	35	15	10	90	0	0	145	10
Future Volume (veh/h)	0	0	0	10	35	15	10	90	0	0	145	10
Number				3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh				0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)				1.00		0.76	0.91		1.00	1.00		0.82
Parking Bus, Adj				1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln				1900	1545	1900	1900	1258	0	0	1218	1900
Adj Flow Rate, veh/h				11	40	17	11	103	0	0	167	11
Adj No. of Lanes				0	1	0	0	2	0	0	2	0
Peak Hour Factor				0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87
Percent Heavy Veh, %				0	23	0	51	51	0	0	56	56
Cap, veh/h				70	256	109	146	1145	0	0	1196	77
Arrive On Green				0.32	0.32	0.32	0.55	0.55	0.00	0.00	0.55	0.55
Sat Flow, veh/h				219	795	338	155	2139	0	0	2235	141
Grp Volume(v), veh/h				68	0	0	61	53	0	0	87	91
Grp Sat Flow(s),veh/h/ln				1351	0	0	1149	1088	0	0	1157	1158
Q Serve(g_s), s				2.5	0.0	0.0	0.0	1.6	0.0	0.0	2.6	2.7
Cycle Q Clear(g_c), s				2.5	0.0	0.0	1.6	1.6	0.0	0.0	2.6	2.7
Prop In Lane				0.16		0.25	0.18		0.00	0.00		0.12
Lane Grp Cap(c), veh/h				434	0	0	693	598	0	0	636	637
V/C Ratio(X)				0.16	0.00	0.00	0.09	0.09	0.00	0.00	0.14	0.14
Avail Cap(c_a), veh/h				434	0	0	693	598	0	0	636	637
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	1.00	1.00	0.00	0.00	1.00	1.00
Uniform Delay (d), s/veh				17.0	0.0	0.0	7.4	7.5	0.0	0.0	7.7	7.7
Incr Delay (d2), s/veh				0.8	0.0	0.0	0.3	0.3	0.0	0.0	0.5	0.5
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				1.0	0.0	0.0	0.6	0.5	0.0	0.0	0.9	0.9
LnGrp Delay(d),s/veh				17.7	0.0	0.0	7.7	7.7	0.0	0.0	8.1	8.2
LnGrp LOS				B			A	A			A	A
Approach Vol, veh/h					68			114			178	
Approach Delay, s/veh					17.7			7.7			8.1	
Approach LOS					B			A			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2				6		8
Phs Duration (G+Y+Rc), s		43.0				43.0		27.0
Change Period (Y+Rc), s		4.5				4.5		4.5
Max Green Setting (Gmax), s		38.5				38.5		22.5
Max Q Clear Time (g_c+I1), s		3.6				4.7		4.5
Green Ext Time (p_c), s		0.4				0.4		0.1

Intersection Summary	
HCM 2010 Ctrl Delay	9.8
HCM 2010 LOS	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	35	195	0	0	0	0	0	970	115	0	0	0
Future Volume (veh/h)	35	195	0	0	0	0	0	970	115	0	0	0
Number	7	4	14				5	2	12			
Initial Q (Qb), veh	0	0	0				0	0	0			
Ped-Bike Adj(A_pbT)	1.00		1.00				1.00		0.83			
Parking Bus, Adj	1.00	1.00	1.00				1.00	1.00	1.00			
Adj Sat Flow, veh/h/ln	1900	1610	0				0	1863	1863			
Adj Flow Rate, veh/h	39	217	0				0	1078	128			
Adj No. of Lanes	0	1	0				0	4	1			
Peak Hour Factor	0.90	0.90	0.90				0.90	0.90	0.90			
Percent Heavy Veh, %	18	18	0				0	2	2			
Cap, veh/h	112	517	0				0	3250	666			
Arrive On Green	0.36	0.36	0.00				0.00	0.17	0.17			
Sat Flow, veh/h	144	1420	0				0	6669	1313			
Grp Volume(v), veh/h	256	0	0				0	1078	128			
Grp Sat Flow(s),veh/h/ln	1564	0	0				0	1602	1313			
Q Serve(g_s), s	0.0	0.0	0.0				0.0	10.4	5.9			
Cycle Q Clear(g_c), s	8.4	0.0	0.0				0.0	10.4	5.9			
Prop In Lane	0.15		0.00				0.00		1.00			
Lane Grp Cap(c), veh/h	629	0	0				0	3250	666			
V/C Ratio(X)	0.41	0.00	0.00				0.00	0.33	0.19			
Avail Cap(c_a), veh/h	629	0	0				0	3250	666			
HCM Platoon Ratio	1.00	1.00	1.00				1.00	0.33	0.33			
Upstream Filter(I)	1.00	0.00	0.00				0.00	0.90	0.90			
Uniform Delay (d), s/veh	16.8	0.0	0.0				0.0	18.7	16.8			
Incr Delay (d2), s/veh	1.9	0.0	0.0				0.0	0.2	0.6			
Initial Q Delay(d3),s/veh	0.0	0.0	0.0				0.0	0.0	0.0			
%ile BackOfQ(50%),veh/ln	4.0	0.0	0.0				0.0	4.7	2.2			
LnGrp Delay(d),s/veh	18.8	0.0	0.0				0.0	18.9	17.4			
LnGrp LOS	B							B	B			
Approach Vol, veh/h		256						1206				
Approach Delay, s/veh		18.8						18.8				
Approach LOS		B						B				

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4				
Phs Duration (G+Y+Rc), s		40.0		30.0				
Change Period (Y+Rc), s		4.5		4.5				
Max Green Setting (Gmax), s		35.5		25.5				
Max Q Clear Time (g_c+I1), s		12.4		10.4				
Green Ext Time (p_c), s		1.8		0.2				

Intersection Summary			
HCM 2010 Ctrl Delay			18.8
HCM 2010 LOS			B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	0	65	65	40	1030	0	0	0	0
Future Volume (veh/h)	0	0	0	0	65	65	40	1030	0	0	0	0
Number				3	8	18	5	2	12			
Initial Q (Qb), veh				0	0	0	0	0	0			
Ped-Bike Adj(A_pbT)				1.00		0.79	1.00		1.00			
Parking Bus, Adj				1.00	1.00	1.00	1.00	1.00	1.00			
Adj Sat Flow, veh/h/ln				0	1696	1900	1900	1863	0			
Adj Flow Rate, veh/h				0	72	72	44	1144	0			
Adj No. of Lanes				0	1	0	0	4	0			
Peak Hour Factor				0.90	0.90	0.90	0.90	0.90	0.90			
Percent Heavy Veh, %				0	12	12	2	2	0			
Cap, veh/h				0	298	298	117	2639	0			
Arrive On Green				0.00	0.44	0.44	0.44	0.44	0.00			
Sat Flow, veh/h				0	684	684	137	6293	0			
Grp Volume(v), veh/h				0	0	144	352	836	0			
Grp Sat Flow(s),veh/h/ln				0	0	1368	1819	1458	0			
Q Serve(g_s), s				0.0	0.0	4.6	0.0	9.3	0.0			
Cycle Q Clear(g_c), s				0.0	0.0	4.6	9.2	9.3	0.0			
Prop In Lane				0.00		0.50	0.12		0.00			
Lane Grp Cap(c), veh/h				0	0	596	850	1906	0			
V/C Ratio(X)				0.00	0.00	0.24	0.41	0.44	0.00			
Avail Cap(c_a), veh/h				0	0	596	850	1906	0			
HCM Platoon Ratio				1.00	1.00	1.00	1.00	1.00	1.00			
Upstream Filter(I)				0.00	0.00	1.00	1.00	1.00	0.00			
Uniform Delay (d), s/veh				0.0	0.0	12.5	13.7	13.8	0.0			
Incr Delay (d2), s/veh				0.0	0.0	1.0	1.5	0.7	0.0			
Initial Q Delay(d3),s/veh				0.0	0.0	0.0	0.0	0.0	0.0			
%ile BackOfQ(50%),veh/ln				0.0	0.0	1.9	5.0	3.8	0.0			
LnGrp Delay(d),s/veh				0.0	0.0	13.4	15.2	14.5	0.0			
LnGrp LOS						B	B	B				
Approach Vol, veh/h					144			1188				
Approach Delay, s/veh					13.4			14.7				
Approach LOS					B			B				

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2						8
Phs Duration (G+Y+Rc), s		35.0						35.0
Change Period (Y+Rc), s		4.5						4.5
Max Green Setting (Gmax), s		30.5						30.5
Max Q Clear Time (g_c+I1), s		11.3						6.6
Green Ext Time (p_c), s		1.7						0.2

Intersection Summary			
HCM 2010 Ctrl Delay			14.6
HCM 2010 LOS			B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	15	75	15	25	160	0	0	235	15
Future Volume (veh/h)	0	0	0	15	75	15	25	160	0	0	235	15
Number				3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh				0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)				1.00		0.72	0.92		1.00	1.00		0.83
Parking Bus, Adj				1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln				1900	1667	1900	1900	1226	0	0	1532	1900
Adj Flow Rate, veh/h				16	80	16	27	170	0	0	250	16
Adj No. of Lanes				0	1	0	0	2	0	0	2	0
Peak Hour Factor				0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Percent Heavy Veh, %				0	14	0	55	55	0	0	24	24
Cap, veh/h				60	302	60	200	1110	0	0	1626	103
Arrive On Green				0.28	0.28	0.28	0.59	0.59	0.00	0.00	0.59	0.59
Sat Flow, veh/h				217	1085	217	227	1929	0	0	2819	173
Grp Volume(v), veh/h				112	0	0	104	93	0	0	131	135
Grp Sat Flow(s),veh/h/ln				1519	0	0	1040	1060	0	0	1456	1460
Q Serve(g_s), s				4.0	0.0	0.0	0.0	2.8	0.0	0.0	2.8	2.9
Cycle Q Clear(g_c), s				4.0	0.0	0.0	2.6	2.8	0.0	0.0	2.8	2.9
Prop In Lane				0.14		0.14	0.26		0.00	0.00		0.12
Lane Grp Cap(c), veh/h				423	0	0	682	628	0	0	863	866
V/C Ratio(X)				0.26	0.00	0.00	0.15	0.15	0.00	0.00	0.15	0.16
Avail Cap(c_a), veh/h				423	0	0	682	628	0	0	863	866
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	1.00	1.00	0.00	0.00	1.00	1.00
Uniform Delay (d), s/veh				19.7	0.0	0.0	6.3	6.4	0.0	0.0	6.4	6.4
Incr Delay (d2), s/veh				1.5	0.0	0.0	0.5	0.5	0.0	0.0	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
%ile BackOfQ(50%),veh/ln				1.9	0.0	0.0	1.0	0.9	0.0	0.0	1.2	1.3
LnGrp Delay(d),s/veh				21.2	0.0	0.0	6.8	6.9	0.0	0.0	6.7	6.8
LnGrp LOS				C			A	A			A	A
Approach Vol, veh/h					112			197			266	
Approach Delay, s/veh					21.2			6.8			6.8	
Approach LOS					C			A			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2				6		8
Phs Duration (G+Y+Rc), s		46.0				46.0		24.0
Change Period (Y+Rc), s		4.5				4.5		4.5
Max Green Setting (Gmax), s		41.5				41.5		19.5
Max Q Clear Time (g_c+I1), s		4.8				4.9		6.0
Green Ext Time (p_c), s		0.6				0.6		0.1

Intersection Summary	
HCM 2010 Ctrl Delay	9.6
HCM 2010 LOS	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	50	195	0	0	0	0	0	675	205	0	0	0
Future Volume (veh/h)	50	195	0	0	0	0	0	675	205	0	0	0
Number	7	4	14				5	2	12			
Initial Q (Qb), veh	0	0	0				0	0	0			
Ped-Bike Adj(A_pbT)	1.00		1.00				1.00		0.89			
Parking Bus, Adj	1.00	1.00	1.00				1.00	1.00	1.00			
Adj Sat Flow, veh/h/ln	1900	1667	0				0	1827	1827			
Adj Flow Rate, veh/h	56	217	0				0	750	228			
Adj No. of Lanes	0	1	0				0	4	1			
Peak Hour Factor	0.90	0.90	0.90				0.90	0.90	0.90			
Percent Heavy Veh, %	14	14	0				0	4	4			
Cap, veh/h	154	533	0				0	3008	661			
Arrive On Green	0.39	0.39	0.00				0.00	0.16	0.16			
Sat Flow, veh/h	234	1358	0				0	6540	1382			
Grp Volume(v), veh/h	273	0	0				0	750	228			
Grp Sat Flow(s),veh/h/ln	1592	0	0				0	1571	1382			
Q Serve(g_s), s	1.0	0.0	0.0				0.0	7.3	10.3			
Cycle Q Clear(g_c), s	8.4	0.0	0.0				0.0	7.3	10.3			
Prop In Lane	0.21		0.00				0.00		1.00			
Lane Grp Cap(c), veh/h	687	0	0				0	3008	661			
V/C Ratio(X)	0.40	0.00	0.00				0.00	0.25	0.34			
Avail Cap(c_a), veh/h	687	0	0				0	3008	661			
HCM Platoon Ratio	1.00	1.00	1.00				1.00	0.33	0.33			
Upstream Filter(I)	1.00	0.00	0.00				0.00	0.97	0.97			
Uniform Delay (d), s/veh	15.4	0.0	0.0				0.0	18.5	19.7			
Incr Delay (d2), s/veh	1.7	0.0	0.0				0.0	0.2	1.4			
Initial Q Delay(d3),s/veh	0.0	0.0	0.0				0.0	0.0	0.0			
%ile BackOfQ(50%),veh/ln	4.1	0.0	0.0				0.0	3.2	4.2			
LnGrp Delay(d),s/veh	17.1	0.0	0.0				0.0	18.6	21.1			
LnGrp LOS	B							B	C			
Approach Vol, veh/h		273						978				
Approach Delay, s/veh		17.1						19.2				
Approach LOS		B						B				

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4				
Phs Duration (G+Y+Rc), s		38.0		32.0				
Change Period (Y+Rc), s		4.5		4.5				
Max Green Setting (Gmax), s		33.5		27.5				
Max Q Clear Time (g_c+I1), s		12.3		10.4				
Green Ext Time (p_c), s		1.2		0.3				

Intersection Summary			
HCM 2010 Ctrl Delay			18.8
HCM 2010 LOS			B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	0	50	65	40	800	0	0	0	0
Future Volume (veh/h)	0	0	0	0	50	65	40	800	0	0	0	0
Number				3	8	18	5	2	12			
Initial Q (Qb), veh				0	0	0	0	0	0			
Ped-Bike Adj(A_pbT)				1.00		0.85	1.00		1.00			
Parking Bus, Adj				1.00	1.00	1.00	1.00	1.00	1.00			
Adj Sat Flow, veh/h/ln				0	1597	1900	1900	1827	0			
Adj Flow Rate, veh/h				0	56	72	44	889	0			
Adj No. of Lanes				0	1	0	0	4	0			
Peak Hour Factor				0.90	0.90	0.90	0.90	0.90	0.90			
Percent Heavy Veh, %				0	19	19	4	4	0			
Cap, veh/h				0	192	247	168	3133	0			
Arrive On Green				0.00	0.34	0.34	0.54	0.54	0.00			
Sat Flow, veh/h				0	573	737	203	6081	0			
Grp Volume(v), veh/h				0	0	128	275	658	0			
Grp Sat Flow(s),veh/h/ln				0	0	1311	1762	1430	0			
Q Serve(g_s), s				0.0	0.0	5.0	0.0	5.9	0.0			
Cycle Q Clear(g_c), s				0.0	0.0	5.0	5.8	5.9	0.0			
Prop In Lane				0.00		0.56	0.16		0.00			
Lane Grp Cap(c), veh/h				0	0	440	1004	2298	0			
V/C Ratio(X)				0.00	0.00	0.29	0.27	0.29	0.00			
Avail Cap(c_a), veh/h				0	0	440	1004	2298	0			
HCM Platoon Ratio				1.00	1.00	1.00	1.00	1.00	1.00			
Upstream Filter(I)				0.00	0.00	1.00	1.00	1.00	0.00			
Uniform Delay (d), s/veh				0.0	0.0	17.1	8.9	8.9	0.0			
Incr Delay (d2), s/veh				0.0	0.0	1.7	0.7	0.3	0.0			
Initial Q Delay(d3),s/veh				0.0	0.0	0.0	0.0	0.0	0.0			
%ile BackOfQ(50%),veh/ln				0.0	0.0	2.0	3.1	2.4	0.0			
LnGrp Delay(d),s/veh				0.0	0.0	18.8	9.6	9.2	0.0			
LnGrp LOS						B	A	A				
Approach Vol, veh/h					128			933				
Approach Delay, s/veh					18.8			9.3				
Approach LOS					B			A				

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2						8
Phs Duration (G+Y+Rc), s		42.0						28.0
Change Period (Y+Rc), s		4.5						4.5
Max Green Setting (Gmax), s		37.5						23.5
Max Q Clear Time (g_c+I1), s		7.9						7.0
Green Ext Time (p_c), s		1.3						0.2

Intersection Summary	
HCM 2010 Ctrl Delay	10.5
HCM 2010 LOS	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	20	40	15	10	100	0	0	150	10
Future Volume (veh/h)	0	0	0	20	40	15	10	100	0	0	150	10
Number				3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh				0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)				1.00		0.76	0.91		1.00	1.00		0.82
Parking Bus, Adj				1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln				1900	1545	1900	1900	1258	0	0	1218	1900
Adj Flow Rate, veh/h				23	46	17	11	115	0	0	172	11
Adj No. of Lanes				0	1	0	0	2	0	0	2	0
Peak Hour Factor				0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87
Percent Heavy Veh, %				0	23	0	51	51	0	0	56	56
Cap, veh/h				119	237	88	135	1162	0	0	1199	75
Arrive On Green				0.32	0.32	0.32	0.55	0.55	0.00	0.00	0.55	0.55
Sat Flow, veh/h				369	738	273	137	2169	0	0	2240	137
Grp Volume(v), veh/h				86	0	0	67	59	0	0	90	93
Grp Sat Flow(s),veh/h/ln				1379	0	0	1161	1088	0	0	1157	1159
Q Serve(g_s), s				3.2	0.0	0.0	0.0	1.8	0.0	0.0	2.7	2.7
Cycle Q Clear(g_c), s				3.2	0.0	0.0	1.8	1.8	0.0	0.0	2.7	2.7
Prop In Lane				0.27		0.20	0.16		0.00	0.00		0.12
Lane Grp Cap(c), veh/h				443	0	0	698	598	0	0	636	638
V/C Ratio(X)				0.19	0.00	0.00	0.10	0.10	0.00	0.00	0.14	0.15
Avail Cap(c_a), veh/h				443	0	0	698	598	0	0	636	638
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	1.00	1.00	0.00	0.00	1.00	1.00
Uniform Delay (d), s/veh				17.2	0.0	0.0	7.5	7.5	0.0	0.0	7.7	7.7
Incr Delay (d2), s/veh				1.0	0.0	0.0	0.3	0.3	0.0	0.0	0.5	0.5
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				1.3	0.0	0.0	0.7	0.6	0.0	0.0	0.9	1.0
LnGrp Delay(d),s/veh				18.2	0.0	0.0	7.8	7.8	0.0	0.0	8.1	8.2
LnGrp LOS				B			A	A			A	A
Approach Vol, veh/h					86			126			183	
Approach Delay, s/veh					18.2			7.8			8.2	
Approach LOS					B			A			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2				6		8
Phs Duration (G+Y+Rc), s		43.0				43.0		27.0
Change Period (Y+Rc), s		4.5				4.5		4.5
Max Green Setting (Gmax), s		38.5				38.5		22.5
Max Q Clear Time (g_c+I1), s		3.8				4.7		5.2
Green Ext Time (p_c), s		0.4				0.4		0.1

Intersection Summary	
HCM 2010 Ctrl Delay	10.2
HCM 2010 LOS	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	35	230	0	0	0	0	0	1045	140	0	0	0
Future Volume (veh/h)	35	230	0	0	0	0	0	1045	140	0	0	0
Number	7	4	14				5	2	12			
Initial Q (Qb), veh	0	0	0				0	0	0			
Ped-Bike Adj(A_pbT)	1.00		1.00				1.00		0.83			
Parking Bus, Adj	1.00	1.00	1.00				1.00	1.00	1.00			
Adj Sat Flow, veh/h/ln	1900	1610	0				0	1863	1863			
Adj Flow Rate, veh/h	39	256	0				0	1161	156			
Adj No. of Lanes	0	1	0				0	4	1			
Peak Hour Factor	0.90	0.90	0.90				0.90	0.90	0.90			
Percent Heavy Veh, %	18	18	0				0	2	2			
Cap, veh/h	102	528	0				0	3250	666			
Arrive On Green	0.36	0.36	0.00				0.00	0.17	0.17			
Sat Flow, veh/h	121	1450	0				0	6669	1313			
Grp Volume(v), veh/h	295	0	0				0	1161	156			
Grp Sat Flow(s),veh/h/ln	1571	0	0				0	1602	1313			
Q Serve(g_s), s	0.0	0.0	0.0				0.0	11.2	7.2			
Cycle Q Clear(g_c), s	10.0	0.0	0.0				0.0	11.2	7.2			
Prop In Lane	0.13		0.00				0.00		1.00			
Lane Grp Cap(c), veh/h	631	0	0				0	3250	666			
V/C Ratio(X)	0.47	0.00	0.00				0.00	0.36	0.23			
Avail Cap(c_a), veh/h	631	0	0				0	3250	666			
HCM Platoon Ratio	1.00	1.00	1.00				1.00	0.33	0.33			
Upstream Filter(I)	1.00	0.00	0.00				0.00	0.88	0.88			
Uniform Delay (d), s/veh	17.3	0.0	0.0				0.0	19.0	17.4			
Incr Delay (d2), s/veh	2.5	0.0	0.0				0.0	0.3	0.7			
Initial Q Delay(d3),s/veh	0.0	0.0	0.0				0.0	0.0	0.0			
%ile BackOfQ(50%),veh/ln	4.9	0.0	0.0				0.0	5.0	2.8			
LnGrp Delay(d),s/veh	19.8	0.0	0.0				0.0	19.3	18.1			
LnGrp LOS	B							B	B			
Approach Vol, veh/h		295						1317				
Approach Delay, s/veh		19.8						19.2				
Approach LOS		B						B				

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4				
Phs Duration (G+Y+Rc), s		40.0		30.0				
Change Period (Y+Rc), s		4.5		4.5				
Max Green Setting (Gmax), s		35.5		25.5				
Max Q Clear Time (g_c+I1), s		13.2		12.0				
Green Ext Time (p_c), s		2.0		0.3				

Intersection Summary		
HCM 2010 Ctrl Delay		19.3
HCM 2010 LOS		B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	0	80	70	45	1125	0	0	0	0
Future Volume (veh/h)	0	0	0	0	80	70	45	1125	0	0	0	0
Number				3	8	18	5	2	12			
Initial Q (Qb), veh				0	0	0	0	0	0			
Ped-Bike Adj(A_pbT)				1.00		0.79	1.00		1.00			
Parking Bus, Adj				1.00	1.00	1.00	1.00	1.00	1.00			
Adj Sat Flow, veh/h/ln				0	1696	1900	1900	1863	0			
Adj Flow Rate, veh/h				0	89	78	50	1250	0			
Adj No. of Lanes				0	1	0	0	4	0			
Peak Hour Factor				0.90	0.90	0.90	0.90	0.90	0.90			
Percent Heavy Veh, %				0	12	12	2	2	0			
Cap, veh/h				0	322	282	123	2631	0			
Arrive On Green				0.00	0.44	0.44	0.44	0.44	0.00			
Sat Flow, veh/h				0	738	647	150	6276	0			
Grp Volume(v), veh/h				0	0	167	385	915	0			
Grp Sat Flow(s),veh/h/ln				0	0	1386	1815	1458	0			
Q Serve(g_s), s				0.0	0.0	5.4	0.0	10.5	0.0			
Cycle Q Clear(g_c), s				0.0	0.0	5.4	10.3	10.5	0.0			
Prop In Lane				0.00		0.47	0.13		0.00			
Lane Grp Cap(c), veh/h				0	0	604	849	1906	0			
V/C Ratio(X)				0.00	0.00	0.28	0.45	0.48	0.00			
Avail Cap(c_a), veh/h				0	0	604	849	1906	0			
HCM Platoon Ratio				1.00	1.00	1.00	1.00	1.00	1.00			
Upstream Filter(I)				0.00	0.00	1.00	1.00	1.00	0.00			
Uniform Delay (d), s/veh				0.0	0.0	12.7	14.0	14.1	0.0			
Incr Delay (d2), s/veh				0.0	0.0	1.1	1.7	0.9	0.0			
Initial Q Delay(d3),s/veh				0.0	0.0	0.0	0.0	0.0	0.0			
%ile BackOfQ(50%),veh/ln				0.0	0.0	2.2	5.6	4.3	0.0			
LnGrp Delay(d),s/veh				0.0	0.0	13.8	15.8	15.0	0.0			
LnGrp LOS						B	B	B				
Approach Vol, veh/h					167			1300				
Approach Delay, s/veh					13.8			15.2				
Approach LOS					B			B				

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2						8
Phs Duration (G+Y+Rc), s		35.0						35.0
Change Period (Y+Rc), s		4.5						4.5
Max Green Setting (Gmax), s		30.5						30.5
Max Q Clear Time (g_c+I1), s		12.5						7.4
Green Ext Time (p_c), s		1.9						0.2

Intersection Summary			
HCM 2010 Ctrl Delay			15.0
HCM 2010 LOS			B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	25	80	15	30	180	0	0	245	15
Future Volume (veh/h)	0	0	0	25	80	15	30	180	0	0	245	15
Number				3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh				0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)				1.00		0.72	0.93		1.00	1.00		0.83
Parking Bus, Adj				1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln				1900	1667	1900	1900	1226	0	0	1532	1900
Adj Flow Rate, veh/h				27	85	16	32	191	0	0	261	16
Adj No. of Lanes				0	1	0	0	2	0	0	2	0
Peak Hour Factor				0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Percent Heavy Veh, %				0	14	0	55	55	0	0	24	24
Cap, veh/h				90	283	53	207	1096	0	0	1632	99
Arrive On Green				0.28	0.28	0.28	0.59	0.59	0.00	0.00	0.59	0.59
Sat Flow, veh/h				323	1016	191	239	1904	0	0	2829	167
Grp Volume(v), veh/h				128	0	0	117	106	0	0	137	140
Grp Sat Flow(s),veh/h/ln				1530	0	0	1028	1060	0	0	1456	1463
Q Serve(g_s), s				4.6	0.0	0.0	0.0	3.2	0.0	0.0	2.9	3.0
Cycle Q Clear(g_c), s				4.6	0.0	0.0	3.0	3.2	0.0	0.0	2.9	3.0
Prop In Lane				0.21		0.12	0.27		0.00	0.00		0.11
Lane Grp Cap(c), veh/h				426	0	0	675	628	0	0	863	867
V/C Ratio(X)				0.30	0.00	0.00	0.17	0.17	0.00	0.00	0.16	0.16
Avail Cap(c_a), veh/h				426	0	0	675	628	0	0	863	867
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	1.00	1.00	0.00	0.00	1.00	1.00
Uniform Delay (d), s/veh				19.9	0.0	0.0	6.4	6.4	0.0	0.0	6.4	6.4
Incr Delay (d2), s/veh				1.8	0.0	0.0	0.6	0.6	0.0	0.0	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
%ile BackOfQ(50%),veh/ln				2.2	0.0	0.0	1.1	1.0	0.0	0.0	1.3	1.3
LnGrp Delay(d),s/veh				21.7	0.0	0.0	7.0	7.0	0.0	0.0	6.8	6.8
LnGrp LOS				C			A	A			A	A
Approach Vol, veh/h					128			223			277	
Approach Delay, s/veh					21.7			7.0			6.8	
Approach LOS					C			A			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2				6		8
Phs Duration (G+Y+Rc), s		46.0				46.0		24.0
Change Period (Y+Rc), s		4.5				4.5		4.5
Max Green Setting (Gmax), s		41.5				41.5		19.5
Max Q Clear Time (g_c+I1), s		5.2				5.0		6.6
Green Ext Time (p_c), s		0.6				0.6		0.1

Intersection Summary	
HCM 2010 Ctrl Delay	9.9
HCM 2010 LOS	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↰						↑↑↑↑	↱			
Traffic Volume (veh/h)	54	204	0	0	0	0	0	675	205	0	0	0
Future Volume (veh/h)	54	204	0	0	0	0	0	675	205	0	0	0
Number	7	4	14				5	2	12			
Initial Q (Qb), veh	0	0	0				0	0	0			
Ped-Bike Adj(A_pbT)	1.00		1.00				1.00		0.89			
Parking Bus, Adj	1.00	1.00	1.00				1.00	1.00	1.00			
Adj Sat Flow, veh/h/ln	1900	1667	0				0	1827	1827			
Adj Flow Rate, veh/h	60	227	0				0	750	228			
Adj No. of Lanes	0	1	0				0	4	1			
Peak Hour Factor	0.90	0.90	0.90				0.90	0.90	0.90			
Percent Heavy Veh, %	14	14	0				0	4	4			
Cap, veh/h	157	530	0				0	3008	661			
Arrive On Green	0.39	0.39	0.00				0.00	0.16	0.16			
Sat Flow, veh/h	240	1350	0				0	6540	1382			
Grp Volume(v), veh/h	287	0	0				0	750	228			
Grp Sat Flow(s),veh/h/ln	1590	0	0				0	1571	1382			
Q Serve(g_s), s	1.7	0.0	0.0				0.0	7.3	10.3			
Cycle Q Clear(g_c), s	9.0	0.0	0.0				0.0	7.3	10.3			
Prop In Lane	0.21		0.00				0.00		1.00			
Lane Grp Cap(c), veh/h	687	0	0				0	3008	661			
V/C Ratio(X)	0.42	0.00	0.00				0.00	0.25	0.34			
Avail Cap(c_a), veh/h	687	0	0				0	3008	661			
HCM Platoon Ratio	1.00	1.00	1.00				1.00	0.33	0.33			
Upstream Filter(I)	1.00	0.00	0.00				0.00	0.97	0.97			
Uniform Delay (d), s/veh	15.6	0.0	0.0				0.0	18.5	19.7			
Incr Delay (d2), s/veh	1.9	0.0	0.0				0.0	0.2	1.4			
Initial Q Delay(d3),s/veh	0.0	0.0	0.0				0.0	0.0	0.0			
%ile BackOfQ(50%),veh/ln	4.4	0.0	0.0				0.0	3.2	4.2			
LnGrp Delay(d),s/veh	17.5	0.0	0.0				0.0	18.6	21.1			
LnGrp LOS	B							B	C			
Approach Vol, veh/h		287						978				
Approach Delay, s/veh		17.5						19.2				
Approach LOS		B						B				

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4				
Phs Duration (G+Y+Rc), s		38.0		32.0				
Change Period (Y+Rc), s		4.5		4.5				
Max Green Setting (Gmax), s		33.5		27.5				
Max Q Clear Time (g_c+I1), s		12.3		11.0				
Green Ext Time (p_c), s		1.2		0.3				

Intersection Summary	
HCM 2010 Ctrl Delay	18.8
HCM 2010 LOS	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	0	50	65	50	800	0	0	0	0
Future Volume (veh/h)	0	0	0	0	50	65	50	800	0	0	0	0
Number				3	8	18	5	2	12			
Initial Q (Qb), veh				0	0	0	0	0	0			
Ped-Bike Adj(A_pbT)				1.00		0.85	1.00		1.00			
Parking Bus, Adj				1.00	1.00	1.00	1.00	1.00	1.00			
Adj Sat Flow, veh/h/ln				0	1597	1900	1900	1827	0			
Adj Flow Rate, veh/h				0	56	72	56	889	0			
Adj No. of Lanes				0	1	0	0	4	0			
Peak Hour Factor				0.90	0.90	0.90	0.90	0.90	0.90			
Percent Heavy Veh, %				0	19	19	4	4	0			
Cap, veh/h				0	192	247	209	3083	0			
Arrive On Green				0.00	0.34	0.34	0.54	0.54	0.00			
Sat Flow, veh/h				0	573	737	274	5987	0			
Grp Volume(v), veh/h				0	0	128	278	667	0			
Grp Sat Flow(s),veh/h/ln				0	0	1311	1739	1430	0			
Q Serve(g_s), s				0.0	0.0	5.0	0.0	6.0	0.0			
Cycle Q Clear(g_c), s				0.0	0.0	5.0	5.8	6.0	0.0			
Prop In Lane				0.00		0.56	0.20		0.00			
Lane Grp Cap(c), veh/h				0	0	440	994	2298	0			
V/C Ratio(X)				0.00	0.00	0.29	0.28	0.29	0.00			
Avail Cap(c_a), veh/h				0	0	440	994	2298	0			
HCM Platoon Ratio				1.00	1.00	1.00	1.00	1.00	1.00			
Upstream Filter(I)				0.00	0.00	1.00	1.00	1.00	0.00			
Uniform Delay (d), s/veh				0.0	0.0	17.1	8.9	8.9	0.0			
Incr Delay (d2), s/veh				0.0	0.0	1.7	0.7	0.3	0.0			
Initial Q Delay(d3),s/veh				0.0	0.0	0.0	0.0	0.0	0.0			
%ile BackOfQ(50%),veh/ln				0.0	0.0	2.0	3.1	2.4	0.0			
LnGrp Delay(d),s/veh				0.0	0.0	18.8	9.6	9.3	0.0			
LnGrp LOS						B	A	A				
Approach Vol, veh/h					128			945				
Approach Delay, s/veh					18.8			9.4				
Approach LOS					B			A				

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2						8
Phs Duration (G+Y+Rc), s		42.0						28.0
Change Period (Y+Rc), s		4.5						4.5
Max Green Setting (Gmax), s		37.5						23.5
Max Q Clear Time (g_c+I1), s		8.0						7.0
Green Ext Time (p_c), s		1.4						0.2

Intersection Summary	
HCM 2010 Ctrl Delay	10.5
HCM 2010 LOS	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	34	40	15	10	100	0	0	150	10
Future Volume (veh/h)	0	0	0	34	40	15	10	100	0	0	150	10
Number				3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh				0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)				1.00		0.76	0.91		1.00	1.00		0.82
Parking Bus, Adj				1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln				1900	1545	1900	1900	1258	0	0	1218	1900
Adj Flow Rate, veh/h				39	46	17	11	115	0	0	172	11
Adj No. of Lanes				0	1	0	0	2	0	0	2	0
Peak Hour Factor				0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87
Percent Heavy Veh, %				0	23	0	51	51	0	0	56	56
Cap, veh/h				171	202	75	135	1162	0	0	1199	75
Arrive On Green				0.32	0.32	0.32	0.55	0.55	0.00	0.00	0.55	0.55
Sat Flow, veh/h				533	628	232	137	2169	0	0	2240	137
Grp Volume(v), veh/h				102	0	0	67	59	0	0	90	93
Grp Sat Flow(s),veh/h/ln				1393	0	0	1161	1088	0	0	1157	1159
Q Serve(g_s), s				3.8	0.0	0.0	0.0	1.8	0.0	0.0	2.7	2.7
Cycle Q Clear(g_c), s				3.8	0.0	0.0	1.8	1.8	0.0	0.0	2.7	2.7
Prop In Lane				0.38		0.17	0.16		0.00	0.00		0.12
Lane Grp Cap(c), veh/h				448	0	0	698	598	0	0	636	638
V/C Ratio(X)				0.23	0.00	0.00	0.10	0.10	0.00	0.00	0.14	0.15
Avail Cap(c_a), veh/h				448	0	0	698	598	0	0	636	638
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	1.00	1.00	0.00	0.00	1.00	1.00
Uniform Delay (d), s/veh				17.4	0.0	0.0	7.5	7.5	0.0	0.0	7.7	7.7
Incr Delay (d2), s/veh				1.2	0.0	0.0	0.3	0.3	0.0	0.0	0.5	0.5
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				1.6	0.0	0.0	0.7	0.6	0.0	0.0	0.9	1.0
LnGrp Delay(d),s/veh				18.6	0.0	0.0	7.8	7.8	0.0	0.0	8.1	8.2
LnGrp LOS				B			A	A			A	A
Approach Vol, veh/h					102			126			183	
Approach Delay, s/veh					18.6			7.8			8.2	
Approach LOS					B			A			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2				6		8
Phs Duration (G+Y+Rc), s		43.0				43.0		27.0
Change Period (Y+Rc), s		4.5				4.5		4.5
Max Green Setting (Gmax), s		38.5				38.5		22.5
Max Q Clear Time (g_c+I1), s		3.8				4.7		5.8
Green Ext Time (p_c), s		0.4				0.4		0.1

Intersection Summary	
HCM 2010 Ctrl Delay	10.6
HCM 2010 LOS	B

Intersection	
Int Delay, s/veh	1.8

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✣						↱			↰	
Traffic Vol, veh/h	5	230	13	0	0	0	0	5	24	10	0	0
Future Vol, veh/h	5	230	13	0	0	0	0	5	24	10	0	0
Conflicting Peds, #/hr	56	0	77	78	0	57	77	0	78	57	0	56
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	-	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	88	88	88	88	88	88	88	88	88	88	88	88
Heavy Vehicles, %	14	14	14	0	0	0	0	0	0	0	0	0
Mvmt Flow	6	261	15	0	0	0	0	6	27	11	0	0

Major/Minor	Major1			Minor1			Minor2		
Conflicting Flow All	56	0	0	-	413	424	431	421	-
Stage 1	-	-	-	-	357	-	56	56	-
Stage 2	-	-	-	-	56	-	375	365	-
Critical Hdwy	4.24	-	-	-	6.5	6.2	7.1	6.5	-
Critical Hdwy Stg 1	-	-	-	-	5.5	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.1	5.5	-
Follow-up Hdwy	2.326	-	-	-	4	3.3	3.5	4	-
Pot Cap-1 Maneuver	1475	-	-	0	532	634	538	527	0
Stage 1	-	-	-	0	632	-	-	-	0
Stage 2	-	-	-	0	-	-	650	627	0
Platoon blocked, %		-	-						
Mov Cap-1 Maneuver	1475	-	-	-	464	588	479	460	-
Mov Cap-2 Maneuver	-	-	-	-	464	-	479	460	-
Stage 1	-	-	-	-	583	-	-	-	-
Stage 2	-	-	-	-	-	-	611	578	-

Approach	EB	NB	SB
HCM Control Delay, s	0.2	11.8	12.7
HCM LOS		B	B

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	SBLn1
Capacity (veh/h)	562	1475	-	-	479
HCM Lane V/C Ratio	0.059	0.004	-	-	0.024
HCM Control Delay (s)	11.8	7.5	0	-	12.7
HCM Lane LOS	B	A	A	-	B
HCM 95th %tile Q(veh)	0.2	0	-	-	0.1

Intersection												
Int Delay, s/veh	3.5											

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	0	0	0	10	75	18	5	0	0	0	5	19
Future Vol, veh/h	0	0	0	10	75	18	5	0	0	0	5	19
Conflicting Peds, #/hr	155	0	163	170	0	162	163	0	170	162	0	155
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	-	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	93	93	93	93	93	93	93	93	93	93	93	93
Heavy Vehicles, %	0	0	0	21	21	21	0	0	0	0	0	0
Mvmt Flow	0	0	0	11	81	19	5	0	0	0	5	20

Major/Minor				Major2			Minor1			Minor2		
Conflicting Flow All				170	0	0	458	454	-	-	444	415
Stage 1				-	-	-	170	170	-	-	274	-
Stage 2				-	-	-	288	284	-	-	170	-
Critical Hdwy				4.31	-	-	7.1	6.5	-	-	6.5	6.2
Critical Hdwy Stg 1				-	-	-	-	-	-	-	5.5	-
Critical Hdwy Stg 2				-	-	-	6.1	5.5	-	-	-	-
Follow-up Hdwy				2.389	-	-	3.5	4	-	-	4	3.3
Pot Cap-1 Maneuver				1300	-	-	516	505	0	0	511	642
Stage 1				-	-	-	-	-	0	0	687	-
Stage 2				-	-	-	724	680	0	0	-	-
Platoon blocked, %					-	-						
Mov Cap-1 Maneuver				1300	-	-	409	355	-	-	359	543
Mov Cap-2 Maneuver				-	-	-	409	355	-	-	359	-
Stage 1				-	-	-	-	-	-	-	576	-
Stage 2				-	-	-	684	570	-	-	-	-

Approach				WB			NB			SB		
HCM Control Delay, s				0.8			13.9			12.7		
HCM LOS							B			B		

Minor Lane/Major Mvmt	NBLn1	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	409	1300	-	-	491
HCM Lane V/C Ratio	0.013	0.008	-	-	0.053
HCM Control Delay (s)	13.9	7.8	0	-	12.7
HCM Lane LOS	B	A	A	-	B
HCM 95th %tile Q(veh)	0	0	-	-	0.2

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	37	236	0	0	0	0	0	1045	140	0	0	0
Future Volume (veh/h)	37	236	0	0	0	0	0	1045	140	0	0	0
Number	7	4	14				5	2	12			
Initial Q (Qb), veh	0	0	0				0	0	0			
Ped-Bike Adj(A_pbT)	1.00		1.00				1.00		0.83			
Parking Bus, Adj	1.00	1.00	1.00				1.00	1.00	1.00			
Adj Sat Flow, veh/h/ln	1900	1610	0				0	1863	1863			
Adj Flow Rate, veh/h	41	262	0				0	1161	156			
Adj No. of Lanes	0	1	0				0	4	1			
Peak Hour Factor	0.90	0.90	0.90				0.90	0.90	0.90			
Percent Heavy Veh, %	18	18	0				0	2	2			
Cap, veh/h	104	526	0				0	3250	666			
Arrive On Green	0.36	0.36	0.00				0.00	0.17	0.17			
Sat Flow, veh/h	126	1444	0				0	6669	1313			
Grp Volume(v), veh/h	303	0	0				0	1161	156			
Grp Sat Flow(s),veh/h/ln	1570	0	0				0	1602	1313			
Q Serve(g_s), s	0.2	0.0	0.0				0.0	11.2	7.2			
Cycle Q Clear(g_c), s	10.3	0.0	0.0				0.0	11.2	7.2			
Prop In Lane	0.14		0.00				0.00		1.00			
Lane Grp Cap(c), veh/h	630	0	0				0	3250	666			
V/C Ratio(X)	0.48	0.00	0.00				0.00	0.36	0.23			
Avail Cap(c_a), veh/h	630	0	0				0	3250	666			
HCM Platoon Ratio	1.00	1.00	1.00				1.00	0.33	0.33			
Upstream Filter(I)	1.00	0.00	0.00				0.00	0.87	0.87			
Uniform Delay (d), s/veh	17.4	0.0	0.0				0.0	19.0	17.4			
Incr Delay (d2), s/veh	2.6	0.0	0.0				0.0	0.3	0.7			
Initial Q Delay(d3),s/veh	0.0	0.0	0.0				0.0	0.0	0.0			
%ile BackOfQ(50%),veh/ln	5.0	0.0	0.0				0.0	5.0	2.8			
LnGrp Delay(d),s/veh	20.0	0.0	0.0				0.0	19.3	18.1			
LnGrp LOS	C							B	B			
Approach Vol, veh/h		303						1317				
Approach Delay, s/veh		20.0						19.2				
Approach LOS		C						B				

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4				
Phs Duration (G+Y+Rc), s		40.0		30.0				
Change Period (Y+Rc), s		4.5		4.5				
Max Green Setting (Gmax), s		35.5		25.5				
Max Q Clear Time (g_c+I1), s		13.2		12.3				
Green Ext Time (p_c), s		2.0		0.3				

Intersection Summary		
HCM 2010 Ctrl Delay		19.3
HCM 2010 LOS		B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	0	80	70	59	1125	0	0	0	0
Future Volume (veh/h)	0	0	0	0	80	70	59	1125	0	0	0	0
Number				3	8	18	5	2	12			
Initial Q (Qb), veh				0	0	0	0	0	0			
Ped-Bike Adj(A_pbT)				1.00		0.79	1.00		1.00			
Parking Bus, Adj				1.00	1.00	1.00	1.00	1.00	1.00			
Adj Sat Flow, veh/h/ln				0	1696	1900	1900	1863	0			
Adj Flow Rate, veh/h				0	89	78	66	1250	0			
Adj No. of Lanes				0	1	0	0	4	0			
Peak Hour Factor				0.90	0.90	0.90	0.90	0.90	0.90			
Percent Heavy Veh, %				0	12	12	2	2	0			
Cap, veh/h				0	322	282	154	2593	0			
Arrive On Green				0.00	0.44	0.44	0.44	0.44	0.00			
Sat Flow, veh/h				0	738	647	216	6189	0			
Grp Volume(v), veh/h				0	0	167	387	929	0			
Grp Sat Flow(s),veh/h/ln				0	0	1386	1794	1458	0			
Q Serve(g_s), s				0.0	0.0	5.4	1.9	10.6	0.0			
Cycle Q Clear(g_c), s				0.0	0.0	5.4	10.5	10.6	0.0			
Prop In Lane				0.00		0.47	0.17		0.00			
Lane Grp Cap(c), veh/h				0	0	604	842	1906	0			
V/C Ratio(X)				0.00	0.00	0.28	0.46	0.49	0.00			
Avail Cap(c_a), veh/h				0	0	604	842	1906	0			
HCM Platoon Ratio				1.00	1.00	1.00	1.00	1.00	1.00			
Upstream Filter(I)				0.00	0.00	1.00	1.00	1.00	0.00			
Uniform Delay (d), s/veh				0.0	0.0	12.7	14.1	14.1	0.0			
Incr Delay (d2), s/veh				0.0	0.0	1.1	1.8	0.9	0.0			
Initial Q Delay(d3),s/veh				0.0	0.0	0.0	0.0	0.0	0.0			
%ile BackOfQ(50%),veh/ln				0.0	0.0	2.2	5.7	4.4	0.0			
LnGrp Delay(d),s/veh				0.0	0.0	13.8	15.9	15.0	0.0			
LnGrp LOS						B	B	B				
Approach Vol, veh/h					167			1316				
Approach Delay, s/veh					13.8			15.3				
Approach LOS					B			B				

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2						8
Phs Duration (G+Y+Rc), s		35.0						35.0
Change Period (Y+Rc), s		4.5						4.5
Max Green Setting (Gmax), s		30.5						30.5
Max Q Clear Time (g_c+I1), s		12.6						7.4
Green Ext Time (p_c), s		1.9						0.2

Intersection Summary	
HCM 2010 Ctrl Delay	15.1
HCM 2010 LOS	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	33	80	15	30	180	0	0	245	15
Future Volume (veh/h)	0	0	0	33	80	15	30	180	0	0	245	15
Number				3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh				0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)				1.00		0.72	0.93		1.00	1.00		0.83
Parking Bus, Adj				1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln				1900	1667	1900	1900	1226	0	0	1532	1900
Adj Flow Rate, veh/h				35	85	16	32	191	0	0	261	16
Adj No. of Lanes				0	1	0	0	2	0	0	2	0
Peak Hour Factor				0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Percent Heavy Veh, %				0	14	0	55	55	0	0	24	24
Cap, veh/h				110	267	50	207	1096	0	0	1632	99
Arrive On Green				0.28	0.28	0.28	0.59	0.59	0.00	0.00	0.59	0.59
Sat Flow, veh/h				394	958	180	239	1904	0	0	2829	167
Grp Volume(v), veh/h				136	0	0	117	106	0	0	137	140
Grp Sat Flow(s),veh/h/ln				1533	0	0	1028	1060	0	0	1456	1463
Q Serve(g_s), s				4.9	0.0	0.0	0.0	3.2	0.0	0.0	2.9	3.0
Cycle Q Clear(g_c), s				4.9	0.0	0.0	3.0	3.2	0.0	0.0	2.9	3.0
Prop In Lane				0.26		0.12	0.27		0.00	0.00		0.11
Lane Grp Cap(c), veh/h				427	0	0	675	628	0	0	863	867
V/C Ratio(X)				0.32	0.00	0.00	0.17	0.17	0.00	0.00	0.16	0.16
Avail Cap(c_a), veh/h				427	0	0	675	628	0	0	863	867
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	1.00	1.00	0.00	0.00	1.00	1.00
Uniform Delay (d), s/veh				20.0	0.0	0.0	6.4	6.4	0.0	0.0	6.4	6.4
Incr Delay (d2), s/veh				2.0	0.0	0.0	0.6	0.6	0.0	0.0	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
%ile BackOfQ(50%),veh/ln				2.3	0.0	0.0	1.1	1.0	0.0	0.0	1.3	1.3
LnGrp Delay(d),s/veh				21.9	0.0	0.0	7.0	7.0	0.0	0.0	6.8	6.8
LnGrp LOS				C			A	A			A	A
Approach Vol, veh/h					136			223			277	
Approach Delay, s/veh					21.9			7.0			6.8	
Approach LOS					C			A			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2				6		8
Phs Duration (G+Y+Rc), s		46.0				46.0		24.0
Change Period (Y+Rc), s		4.5				4.5		4.5
Max Green Setting (Gmax), s		41.5				41.5		19.5
Max Q Clear Time (g_c+I1), s		5.2				5.0		6.9
Green Ext Time (p_c), s		0.6				0.6		0.1

Intersection Summary	
HCM 2010 Ctrl Delay	10.1
HCM 2010 LOS	B

Intersection	
Int Delay, s/veh	1.5

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	5	240	14	0	0	0	0	0	24	10	0	0
Future Vol, veh/h	5	240	14	0	0	0	0	0	24	10	0	0
Conflicting Peds, #/hr	58	0	82	77	0	53	82	0	77	53	0	58
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	-	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	94	94	94	94	94	94	94	94	94	94	94	94
Heavy Vehicles, %	16	16	16	0	0	0	0	0	0	17	17	17
Mvmt Flow	5	255	15	0	0	0	0	0	26	11	0	0

Major/Minor	Major1						Minor1			Minor2		
Conflicting Flow All	58	0	0				-	413	422	421	421	-
Stage 1	-	-	-				-	355	-	58	58	-
Stage 2	-	-	-				-	58	-	363	363	-
Critical Hdwy	4.26	-	-				-	6.5	6.2	7.27	6.67	-
Critical Hdwy Stg 1	-	-	-				-	5.5	-	-	-	-
Critical Hdwy Stg 2	-	-	-				-	-	-	6.27	5.67	-
Follow-up Hdwy	2.344	-	-				-	4	3.3	3.653	4.153	-
Pot Cap-1 Maneuver	1461	-	-				0	532	636	517	502	0
Stage 1	-	-	-				0	633	-	-	-	0
Stage 2	-	-	-				0	-	-	626	599	0
Platoon blocked, %		-	-									
Mov Cap-1 Maneuver	1461	-	-				-	462	586	466	435	-
Mov Cap-2 Maneuver	-	-	-				-	462	-	466	435	-
Stage 1	-	-	-				-	581	-	-	-	-
Stage 2	-	-	-				-	-	-	596	550	-

Approach	EB	NB	SB
HCM Control Delay, s	0.1	11.4	12.9
HCM LOS		B	B

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	SBLn1
Capacity (veh/h)	586	1461	-	-	466
HCM Lane V/C Ratio	0.044	0.004	-	-	0.023
HCM Control Delay (s)	11.4	7.5	0	-	12.9
HCM Lane LOS	B	A	A	-	B
HCM 95th %tile Q(veh)	0.1	0	-	-	0.1

Intersection	
Int Delay, s/veh	2.9

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations					✣			↰			↳	
Traffic Vol, veh/h	0	0	0	5	120	20	5	0	0	0	5	15
Future Vol, veh/h	0	0	0	5	120	20	5	0	0	0	5	15
Conflicting Peds, #/hr	239	0	237	246	0	248	237	0	246	248	0	239
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	-	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	83	83	83	83	83	83	83	83	83	83	83	83
Heavy Vehicles, %	0	0	0	17	17	17	0	0	0	0	0	0
Mvmt Flow	0	0	0	6	145	24	6	0	0	0	6	18

Major/Minor	Major2			Minor1				Minor2	
Conflicting Flow All	246	0	0	666	675	-	-	663	644
Stage 1	-	-	-	246	246	-	-	417	-
Stage 2	-	-	-	420	429	-	-	246	-
Critical Hdwy	4.27	-	-	7.1	6.5	-	-	6.5	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-	-	5.5	-
Critical Hdwy Stg 2	-	-	-	6.1	5.5	-	-	-	-
Follow-up Hdwy	2.353	-	-	3.5	4	-	-	4	3.3
Pot Cap-1 Maneuver	1237	-	-	376	378	0	0	384	476
Stage 1	-	-	-	-	-	0	0	595	-
Stage 2	-	-	-	615	587	0	0	-	-
Platoon blocked, %		-	-						
Mov Cap-1 Maneuver	1237	-	-	267	220	-	-	223	364
Mov Cap-2 Maneuver	-	-	-	267	220	-	-	223	-
Stage 1	-	-	-	-	-	-	-	452	-
Stage 2	-	-	-	574	446	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	0.3	18.8	17.4
HCM LOS		C	C

Minor Lane/Major Mvmt	NBLn1	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	267	1237	-	-	314
HCM Lane V/C Ratio	0.023	0.005	-	-	0.077
HCM Control Delay (s)	18.8	7.9	0	-	17.4
HCM Lane LOS	C	A	A	-	C
HCM 95th %tile Q(veh)	0.1	0	-	-	0.2

Appendix D: Trip Generation Worksheets

Appendix D: Trip Generation

Belltown 36 - 4th and Bell

Person Trip Calculation

Land Use	Size	Trip Rate[1]	Vehicle Trips	Inbound %	AVO Rate[2]	Person Trips
Proposed Use						
Multifamily Housing- High Rise (LU 222)	225 units					
Daily (dense multi-use urban)		2.07 vehicle trips/DU	466	50%	2.49	1,160
AM Peak Hour (dense multi-use urban)		0.21 vehicle trips/DU	47	12%	2.81	133
PM Peak Hour (dense multi-use urban)		0.19 vehicle trips/DU	43	70%	2.17	93
General Office (LU 710)	19,000 sf					
Daily (general urban/suburban)		9.74 vehicle trips/1000 sf	185	50%	1.31	242
AM Peak Hour (general urban/suburban)		1.16 vehicle trips/1000 sf	22	86%	1.30	29
PM Peak Hour (general urban/suburban)		1.15 vehicle trips/1000 sf	22	16%	1.32	29
Retail (LU 820)[3]	12,000 sf					
Daily		37.75 trips/1,000 sq. ft.	453	50%	1.37	621
AM Peak Hour		0.94 trips/1,000 sq. ft.	11	62%	1.31	15
PM Peak Hour		3.81 trips/1,000 sq. ft.	46	48%	1.43	65
Existing Use						
General Office (LU 710)	7,200 sf					
Daily (general urban/suburban)		9.74 vehicle trips/1000 sf	70	50%	1.31	92
AM Peak Hour (general urban/suburban)		1.16 vehicle trips/1000 sf	8	86%	1.30	11
PM Peak Hour (general urban/suburban)		1.15 vehicle trips/1000 sf	8	16%	1.32	11

Notes:

1. Trip rates based on Institute of Transportation Engineers' (ITE) *Trip Generation* 10th Edition equation and average trip rate as shown above.

2. AVO = average vehicle occupancy based on ITE *Trip Generation Manaul* (10th Edition)

Appendix D: Trip Generation

Belltown 36 - 4th and Bell

Person Trips by Mode of Travel

Trip Generation Summary	Percent By Mode[1]	Daily Person Trips	AM Peak Hour In	AM Peak Hour Out	AM Peak Hour Total	PM Peak Hour In	PM Peak Hour Out	PM Peak Hour Total
Proposed Use								
Apartment								
Walk, Bike, Other Trips	55%	640	9	64	73	36	15	51
Transit Trips	20%	230	3	24	27	13	6	19
Person Trips by Vehicle	25%	290	4	29	33	16	7	23
Total	100%	1,160	16	117	133	65	28	93
Office								
Walk, Bike, Other Trips	15%	36	3	1	4	1	3	4
Transit Trips	35%	85	9	1	10	2	8	10
Person Trips by Vehicle	50%	121	13	2	15	2	13	15
Total	100%	242	25	4	29	5	24	29
Retail								
Walk, Bike, Other Trips	80%	496	7	5	12	25	27	52
Transit Trips	10%	62	0	0	0	3	3	6
Person Trips by Vehicle	10%	63	2	1	3	3	4	7
Total	100%	621	9	6	15	31	34	65
Existing Use								
Office								
Walk, Bike, Other Trips	15%	14	2	0	2	0	2	2
Transit Trips	35%	32	3	1	4	1	3	4
Person Trips by Vehicle	50%	46	4	1	5	1	4	5
Total	100%	92	9	2	11	2	9	11

1. Person trip mode splits for the residential uses are based on 2012 - 2016 American Community Survey 5-Year Estimates for the census tract (#72) of the proposed project. Mode split for residential uses is based means of transportation to work by tenure Census Tract (#72) report B08137. Mode Split for the office use based on City of Seattle Cummute Reduction Survey (2016) for Belltown. The retail modesplit is consistent with other projects submitted in Seattle in the vicnity of the proposed project.

Vehicle Trip Generation

Land Use	AVO[1]	Daily Vehicle Trips	AM Peak Hour Vehicle Trips In	AM Peak Hour Vehicle Trips Out	AM Peak Hour Vehicle Trips Total	PM Peak Hour Vehicle Trips In	PM Peak Hour Vehicle Trips Out	PM Peak Hour Vehicle Trips Total
Proposed Use								
Apartment	1.13	256	4	25	29	14	6	20
Office	1.28	95	10	2	12	2	10	12
Retail	1.20	52	2	1	3	3	3	6
Subtotal		*403*	*16*	*28*	*44*	*19*	*19*	*38*
Existing Use								
Office	1.28	36	3	1	4	1	3	4
Net New Trips		**367**	**13**	**27**	**40**	**18**	**16**	**34**

1. Average Vehicle Occupancy (AVO) for residential based on 2012 - 2016 American Community Survey 5-Year Estimates for census tract (#72), report B08301. The retail AVO is consistent with other projects submitted in Seattle. Office AVO is based on City of Seattle Cummute Reduction Survey (2016) for Belltown.

Appendix E: Parking Demand Worksheets

Right Size Parking

King County Multi-Family Residential Parking Calculator V2.0

TOOLS TO BALANCE SUPPLY

CALCULATOR ABOUT THIS SITE

Enter a location...

Parking/Unit Ratio (Number of Stalls)

< .5 Stalls >= 1.5 Stalls

3 Parcels Selected

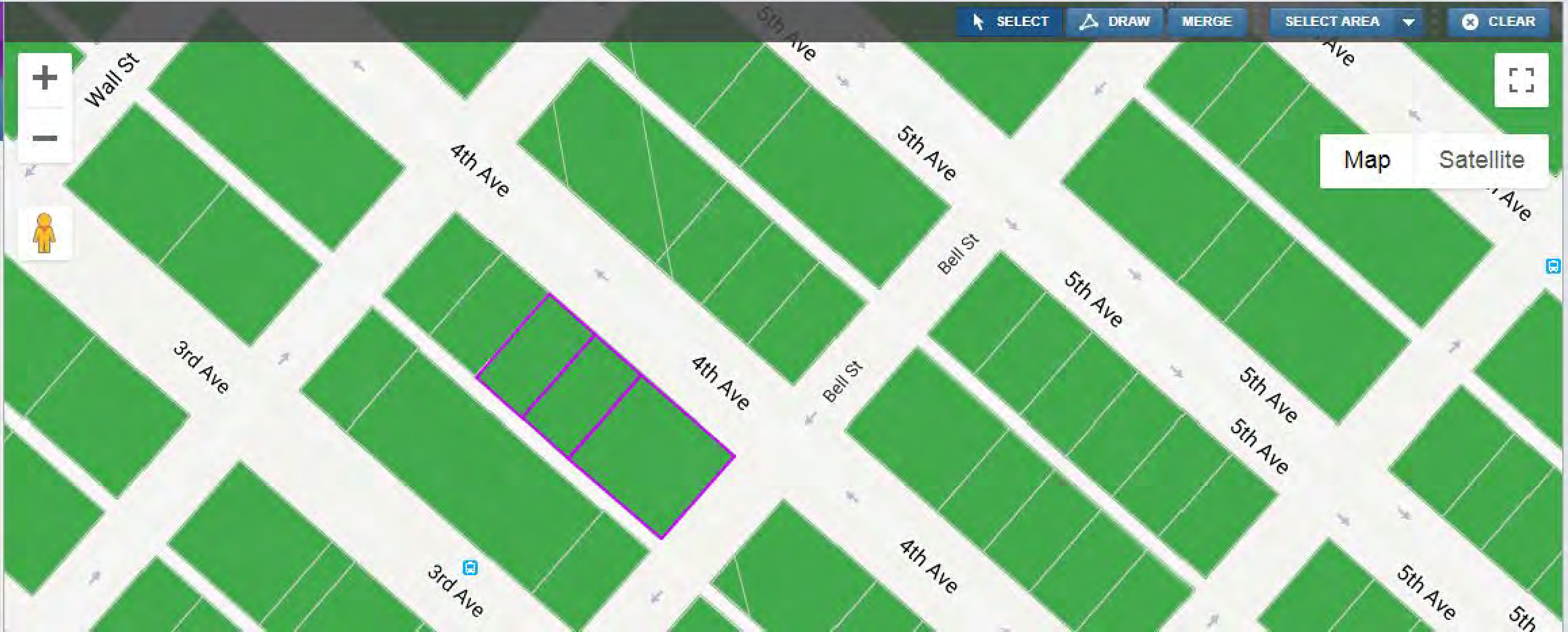
Parking/Unit Ratio

0.64

Building & Parking Specifications | Location Characteristics | Parking Impacts

The preset values below represent subregional (CBD, Urban and Suburban) average/median values (from field work) for building (with no affordable units) and parking specifications. These represent the default values, as a starting point, for which parking use ratios are estimated. Scroll down to view parking optimization estimates and guidance on unbundled and affordable housing options.

	NUMBER OF UNITS	AVERAGE RENT ($)	RESIDENTIAL AREA (SQ FT)
STUDIOS:	30	$1,315	532
1 BEDROOMS:	93	$1,756	732
2 BEDROOMS:	91	$2,389	839
3+ BEDROOMS:	11	$3,127	1933
TOTAL:	225	$2,020	181,648
AFFORDABLE UNITS:	0		



Appendix E - Parking Demand

Seattle Retail Parking Demand Rate Calculation

<u>Project Information</u>

Project:	Belltown 36 Mixed Use
Project No:	1.18117.00

<u>Retail Size:</u>

<u>Commercial Space</u>

12,000	sf	Retail

<u>Local Mode Split Data[1]:</u>

Vehicle	10%
Walk / Bicycle	80%
Transit	10%
	100%

<u>Parking Demand Rate[2]:</u>

2.55

<u>Localized Parking Demand Rate:</u>

Parking Demand Rate x Vehicle Mode Split

0.26	vehicles / 1,000 sf	Retail

<u>Parking Demand:</u>

Retail Size x Localized Parking Demand Rate

4	vehicles

Notes:

1. Based on the assumption that retail serves the local residents and employees and the majority of trips would be walking. Mode split considers that the smaller retail space is anticipated to serve the immediate vicinity via walk/bike trips.

2 Based on ITE *Parking Generation* (4th Edition, 2010) shopping center land use 820 for non-Friday weekday, non-December.

Appendix E - Parking Demand

Seattle Office Parking Demand Rate Calculation

Project Information

Project: Belltown 36 Mixed Use

Project No: 1.18117.00

Retail Size:

Commercial Space

19,000 sf General Office

Local Mode Split Data[1]:

Vehicle	50%
Walk / Bicycle	15%
Transit	35%
	100%

Parking Demand Rate[2]:

2.47 stalls / 1,000 sf (ITE Office Building #701)

Localized Parking Demand Rate:

Parking Demand Rate x Vehicle Mode Split

1.24 vehicles / 1,000 sf (General Office)

Parking Demand:

Office Size x Localized Parking Demand Rate

24 vehicles

Notes:

1. Mode Split for the office use based on City of Seattle Cummute Reduction Survey (2016) for B

2 Based on ITE Parking Generation (4th Edition, 2010) office building land use 701 for weekday u