Fairview Avenue N Bridge Replacement Project

Appendix B

Contents

City of Seattle (SDOT)

Cultural Resources Discipline Report (Redacted Version)

Fairview Avenue North Bridge

July 2014

Submitted to

Washington State Department of Transportation

Prepared for

Seattle Department of Transportation

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ABSTRACT

Environmental Science Associates (ESA) was retained by Perteet, on behalf of the Seattle Department of Transportation (SDOT), to conduct a cultural resources assessment and literature review for the Fairview Avenue North Bridge Project. SDOT is proposing to completely remove and replace the existing East and West Bridge structures with a new structure. The project also includes reconstructing the roadway at the approaches on the north and south side of the bridge to taper the new section to the existing road section.

This project is subject to several regulations. As the project will receive funding from Federal Highways Administration, it is subject to Section 106 of the National Historic Preservation Act. Because this project will also undergo review for State Environmental Policy Act, the project will require review by the Seattle Landmarks Preservation Board, due to the adjacency of the Lake Union Steam Plant building, a Seattle Landmark. Because the project is located within 200' of the US Government Meander line, the project is subject to the Seattle Department of Planning and Development (DPD) Director's Rule 2-98, which outlines when and how an assessment archaeological resources should be conducted.

A review of geotechnical borings and geological maps indicates that project construction will occur primarily within imported fill material originating from previous construction and demolition within the vicinity of the project's Area of Potential Effects. Native sediments that may be impacted by project construction have been mapped as Pleistocene-aged glacial recessional lacustrine deposits, which were deposited prior to arrival of people in Western Washington. Therefore, the project is unlikely to encounter intact prehistoric or historic archaeological resources.

A historic property survey identified eight historic-age buildings. xxxxxxxxxxxxxxxxxxxxxxxxxxxxx xxxxxxxxxxxxxxxxxxxxxxxxxx. Two of the historic buildings have been previously recommended eligible to the National Register of Historic Places by the State Historic Preservation Officer and two additional buildings are considered eligible following the survey.

Because of the proximity of construction activity to historic buildings, ESA reviewed the Noise and Vibration Discipline Report to evaluate the potential for impacts from vibration. Because ZymoGenetics, which is located in the historic Lake Union Steam Plant building, uses vibration sensitive equipment as part of their ongoing research, specific analysis was conducted regarding anticipated vibration impacts; the Noise and Vibration Discipline Report indicates that while vibration does have potential to impact scientific equipment inside the building, no impacts to the structure are anticipated. No pile driving will be conducted for the bridge construction. Vibration limits and a monitoring program will be developed during Final Design to monitor vibration compliance. Therefore, no impacts are anticipated to the Lake Union Steam Plant building.

As no impacts to any of the four buildings are expected, ESA recommends that this project will have No Effect on Historic Properties under Section 106.

Based on correspondence with Seattle Landmarks Preservation Board staff, no impacts to the Lake Union Steam Plant (ZymoGenetics) building are anticipated and a Certificate of Approval will not be required.

This report documents that project is unlikely to encounter intact prehistoric or historic archaeological resources as defined in DPD's Director's Rule 2-98. This report does not identify the probable presence of archaeologically significant sites or resources; the project location is not a "known archaeologically significant site". In compliance with Director's Rule 2-98, all contract documents for general, excavation, and other subcontractors will include reference to regulations regarding archaeological resources (Chapters 27.34, 26.53, 27.44, 79.01, 79.90 RCW, and Chapter 25.48 WAC as applicable) and that construction crews will be required to comply with those regulations.

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INTRODUCTION

Environmental Science Associates (ESA) was retained by Perteet, on behalf of the Seattle Department of Transportation (SDOT) to conduct a cultural resources assessment/literature review for the Fairview Avenue North Bridge Project in Seattle, King County, Washington.

PROJECT DESCRIPTION

The Fairview Avenue North Bridge Project area is located on the east side of Lake Union along Fairview Avenue North between Yale Avenue North and Fairview Avenue East, Seattle, King County, Washington (Figure 1). The project area is located in Sections 20 and 29, Township 25 North, Range 4 East, on the Seattle North 15' series topographic map. The Fairview Avenue North Bridge consists of two bridges built in parallel. The northbound lanes are known as the East Bridge, which is a concrete structure constructed in 1963 and the southbound lane known as the West Bridge, which is a wooden trestle with a concrete deck constructed in 1948. The bridge spans a narrow embayment of Lake Union at the southeastern end of Waterway 8.

This project will completely remove and replace the existing East (481 feet long) and West (405 feet long) Bridge structures with a new 540 foot long structure. The project also includes reconstructing the roadway at the approaches on the north and south side of the bridge to taper the new section to the existing road section.

From the east side to the west side the new bridge will be configured to support an 8-foot wide sidewalk, a 12-foot wide and an 11-foot wide northbound travel lanes, a single 12-foot wide southbound travel lane, a two-foot wide buffer to separate traffic and cyclists, a 12-foot wide two way cycle track, and another 8-foot wide sidewalk. The project will either replace or relocate the existing floating pedestrian walkway to the west of the bridge and will include work typical to bridge and roadway reconstruction including the relocation of underground and underwater utilities and the installation of stormwater treatment and conveyance. The project will also require temporarily relocating a 115kV transmission line; a total of two temporary power poles will be installed, one each northwest and southwest of the bridge.

The two existing parallel bridges are constructed following the alignment of an older wooden trestles and the area adjacent to the bridges contains a multitude of creosote treated wooden piles and timbers and rubble. An abandoned creosote treated wooden pier extends out perpendicular from the bridge into Waterway 8 (Figure 2). The removal of treated wood piles, coal piers, and timbers within the project area may be required by regulatory agencies to offset impacts from the slightly wider new bridge. Final permit requirements have not been determined at this time; however, this work is included in the project description in the event pier removal is a requirement.

The location for construction staging has not been finalized. Several paved areas adjacent to the bridge approaches have been identified as possible staging areas (Figure 2).

During construction, the project will maintain two-way traffic with a sidewalk during the daytime. Nighttime detour would be required during construction activities such as girder placement. The nighttime detour impacts will be evaluated as part of the Traffic Report and are assumed minimal. Ground disturbance along the detour route is not anticipated (Figure 1).

REGULATORY ENVIRONMENT

Federal funding of Fairview Avenue North Bridge Project requires that the Federal Highways Administration (FHWA) comply with Section 106 of the National Historic Preservation Act ("Section 106"). FHWA has delegated their Section 106 responsibilities to the Washington State Department of Transportation (WSDOT). Section 106 requires that FHWA and WSDOT consider the effects of this undertaking upon Historic Properties within the project's Area of Potential Effects (APE). Federal code implementing Section 106, found at 36 CFR 800, includes a requirement that an effort be made to identify Historic Properties. In coordination with the Washington State Department of Archaeology and Historic Preservation (DAHP) and other stakeholders, WSDOT defined the APE for the Fairview Avenue North Bridge Project (Attachment A). This report has been prepared to meet the standards of the Section 106 process. This report documents all of the steps taken to consider the effects of the Fairview Avenue North Bridge Project on Historic Properties, and the results of the investigation.

Additional laws that apply to archaeological projects conducted within the State of Washington include: Archaeological Sites and Resources Law (RCW 27.53), Indian Graves and Records Law (RCW 27.44), Human Remains Law (RCW 68.50), and Abandoned and Historic Cemeteries and Historic Graves Law (RCW 68.60).

As this project will also undergo review for State Environmental Policy Act, the project will require review by the Seattle Landmarks Preservation Board, due to the adjacency of the Lake Union Steam Plant building, a Seattle Landmark.

Because the project is located within 200' of the US Government Meander line, the project is subject to the Seattle Department of Planning and Development (DPD) Director's Rule 2-98, which outlines when and how an assessment archaeological resources should be conducted.

AREA OF POTENTIAL EFFECTS

The Area of Potential Effect (APE) includes direct effects related to construction and indirect effects to two historic buildings immediately adjacent to the bridge. The APE for direct effects is the footprint of the bridge replacement including the bridge approaches, the location of the abandoned pier, and construction staging areas (Figures 1 and 2). The depth of disturbance for bridge piling drill shafts is up to 120 feet; the depth of disturbance for the bridge approaches and utilities is up to 12 feet. The location for construction staging has not been finalized. Several paved areas adjacent to the bridge have been identified as possible staging areas. Four potential staging areas are currently included in the APE though not all are expected to be utilized. The APE for indirect effects includes the Lake Union Steam Plant Building (Zymogenetics) and the Washington Laundry Building. Indirect effects are expected to include noise and vibration during bridge construction.

The detour route is the Eastlake Avenue East right-of-way between East Galer Street and Harrison Street; detours are not anticipated to involve ground disturbance, therefore they are not included in the APE.

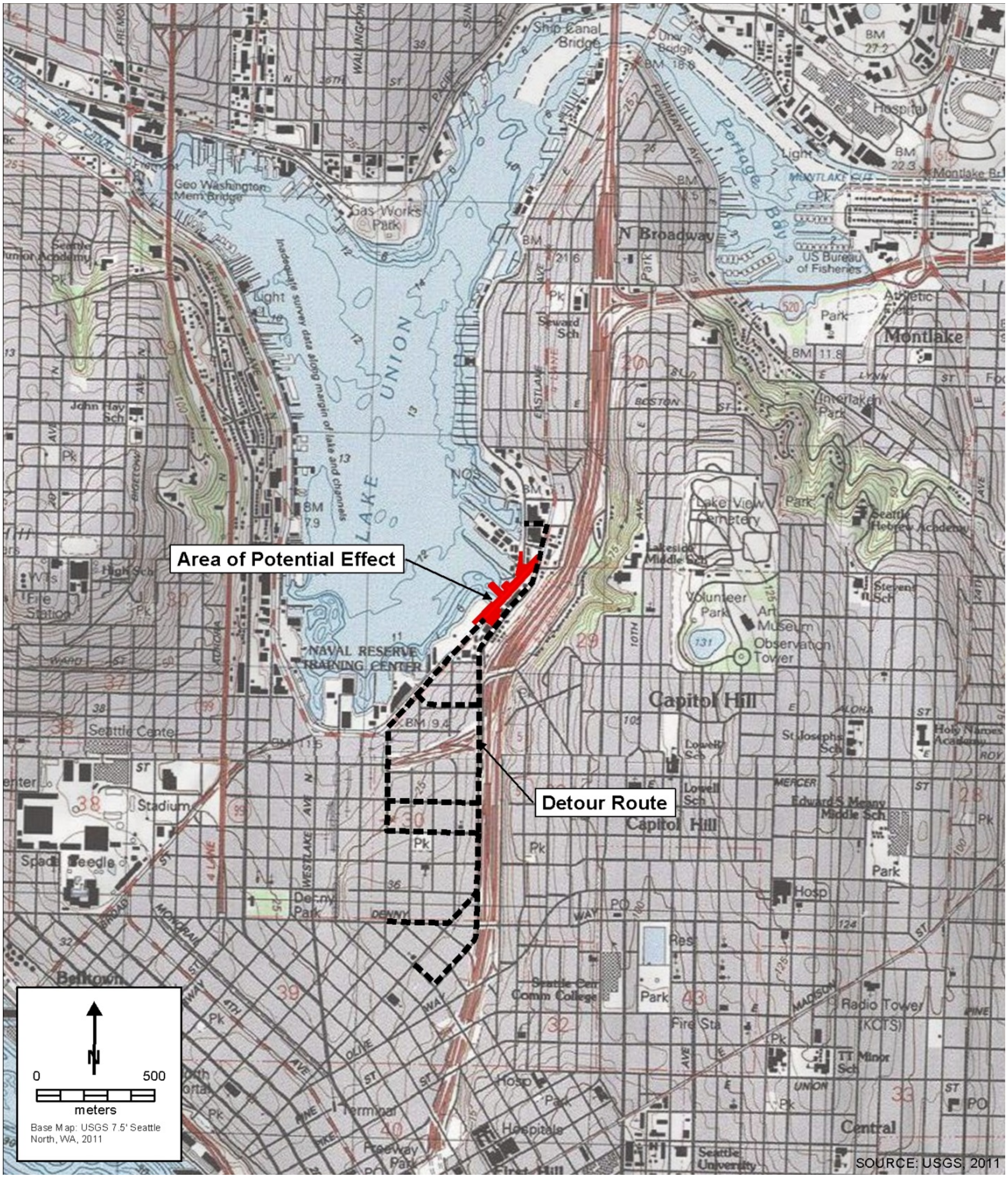

Figure 1. Location of the Fairview Avenue North Bridges Project.

Figure 2. Fairview Avenue Bridge APE, possible staging areas, and detour route.

BACKGROUND RESEARCH METHODS

ESA conducted a literature review of the Fairview Avenue North Bridge Project area (extending one half mile in every direction from the footprint of the APE). Information reviewed included previous archaeological survey reports, ethnographic studies, historic maps, government landowner records, aerial photographs, and regional histories. These records were reviewed in order to determine the presence of any potentially significant cultural resources or Traditional Cultural Properties (TCPs) within the project area. Relevant documents were examined via Washington State Department of Archaeology and Historic Preservation (DAHP)'s Washington Information System for Architectural and Archaeological Records Data (WISAARD) online database, other online resources, and ESA's research library.

ENVIRONMENTAL SETTING

Geological Background

The Fairview Avenue North bridges are located over a small inlet of water at the southeast end of Lake Union at approximately 30 feet above mean sea level (amsl) adjacent to the lake shore. The area of the approaches is a filled and graded lake front that slopes up to Capitol Hill to the east.

Lake Union was formed during the most recent glaciation of the Seattle area, the Vashon Stade of the Fraser Glaciation, when ice from the Puget Lobe of the Cordilleran Ice Sheet overrode Seattle approximately 17,400 years ago prior to rapidly retreating by 16,400 years ago (Troost and Booth 2008). In the post-glacial period, the lake basin represented a low-lying area situated between glacial hills (moraines) to the west (Queen Anne), east (Capitol Hill) and north (Lake Union). Prior the construction of the Lake Washington Ship Canal (c. 1911-1934) and connection to Lake Washington via the Montlake Cut, Lake Union was fed by springs, streams, and intermittent runoff from the nearby hills. The lake's only outlet was a small stream (Salmon Creek or Ross Creek) flowing towards Salmon Bay, which was later supplanted by the Fremont Cut (Chrzastowski 1983). Construction of the Ship Canal did not significantly affect the mean seasonal elevation of Lake Union, which stood naturally at 21.0 feet above Mean Lower Low Water, with approximately 0.5 feet of seasonal variation (Eastwick 1891 cited in Chrzastowski 1983). However, because Lake Union was fed by spring and stream flow, as well as intermittent seasonal runoff over most of the post-glacial Holocene, short and long-term variability in precipitation would have resulted in fluctuations in lake levels exceeding those seen today. As a result, the position of the shoreline fluctuated somewhat over time.

Near surface deposits beneath the Fairview Avenue North bridges have been mapped as Vashon recessional lacustrine deposits that have been historically modified by humans, including grading and filling (Troost et al. 2005). The pre-Fraser glacial western flank of Capitol Hill adjacent to the bridges contains landslide deposits, raising the possibility of some colluvial contribution to the stratigraphy of the project area. Geotechnical studies within the APE (Aspect 2008; HWA 2012) provided additional information about near surface stratigraphy which is discussed in Section 11.1.

Flora and Fauna

The project falls within the Puget Sound Area of the Tsuga heterophylla (western hemlock) vegetation zone, which encompasses most of western Washington (Franklin and Dyrness 1988:70, 88-89). Native species characteristic of the Tsuga heterophylla vegetation zone include a variety of ferns, vine maple, Oregon grape, trailing blackberry, huckleberry, Pacific trillium, western red cedar, Douglas fir, big leaf maple, red alder, and western hemlock. In addition, Prairie, oak woodland, and pine forests are encountered within the Puget Sound Area of the Tsuga heterophylla zone. Native fauna include deer, cougar, elk, bear, coyotes, beaver, skunk, quail, grouse, weasel, muskrat, and river otter. Fish species which are currently found within Lake Union include smallmouth and largemouth bass, yellow perch, black crappie, other sunfish, brown bullhead and small numbers of coastal cutthroat trout. Migratory salmon and steelhead trout use the lake as a pathway to Lakes Washington and Sammamish (Washington Department of Fish & Wildlife 2013).

ETHNOGRAPHIC BACKGROUND

Overview

Lake Union has landform characteristics commonly associated with seasonal and permanent Native American habitation areas including freshwater streams, marshes, canoe access points, and beaches. Lake Union itself was known as *XáXu7cHoo* or "small lake" as compared to the larger Lake Washington (Thrush 2007:223).

Ethnographic Resources within the Project Vicinity

A total of four Native American place names were recorded along the southeast shorelines of Lake Union in the vicinity of the APE (Table 1). None overlap or are within the APE.

Table 1. Recorded ethnographic place names in the vicinity of the APE.

Name	Description	Citation
XáXu7cHoo ("small lake")	Lake Union	Thrush 2007:223
Sxwuba'bats ("place where jumping occurred")	A waterfront place known for being obstructed by logs, opposite present site of Gas Works Park	Hilbert et al. 2001:102
StL3Ep ("deep")	South of above place name. Known for an abrupt beach due to the steep slope of Capitol Hill where it meets Lake Union.	Hilbert et al. 2001:102; Thrush 2007:225
Cta'qwc1d ("where a trail descends to the water")	End point of a trail from Elliott Bay to the southern tip of Lake Union near David Denny's saw mill.	Hilbert et al. 2001:102; Thrush 2007:225

HISTORIC BACKGROUND

Overview

The South Lake Union/Cascade Neighborhood vicinity was first settled by Euro-Americans in the 1850s (Thomas Street History Services 2005:4). The claim of David and Louisa Denny, perhaps the most notable of Seattle's early pioneers, encompassed the entire southern shore of Lake Union as far south as present-day Denny Way and extended up the eastern shore, effectively encompassing the majority of what would become known as South Lake Union and the Cascade Neighborhood (US Surveyor General 1991). Almost immediately, industrial usage defined the landscape. Early lumber mills at the water's edge were joined by brickyards and coal transportation operations, while a number of smaller businesses sprang up further away from the shore. Residential development in the form of small, wood-frame, single-family houses and some multi-family buildings followed as increasing numbers of workers, many immigrants from all over Europe, came into the once remote and sparsely populated area, also giving rise to the need for churches and school buildings (Thomas Street History Services 2005:4-12).

In 1909 the Northern Pacific Railroad built a rail line along the west side of Lake Union along with a freight distribution depot at Terry Avenue. In 1912 Seattle City Light built the Lake Union Power House, a hydro-electric facility, on the eastern side of the lake which was quickly converted to an oil-fired steam plant and subsequently substantially expanded. In 1914 a Ford Motor Company Model-T assembly plant was built just to the south of the steam plant, Ford's first production facility west of the Mississippi. Bill Boeing began producing aircraft on Lake Union in 1916. A number of commercial laundries also joined the mélange in the 1910s. The first phase of the Denny Regrade completed in 1911served to provide easier access to South Lake Union from downtown Seattle, and the completion and opening of the Ballard Locks and the Lake Washington Ship Canal in 1917 further facilitated industrial expansion and in addition encouraged the use of Lake Union for shipbuilding and other maritime industries (Thomas Street History Services 2005:9-14).

After World War I, the area saw an influx of automobile showrooms and auto maintenance related buildings. The Great Depression took a toll on industry, resulting in a slowing but not all out stop of development. In 1931 the Seattle Times Building was completed and in 1932 the Aurora Speedway (now WA 99) was built. By the late 1930s a large number of warehouses had filled in gaps in South Lake Union and residential structures were concentrated along the eastern side of the lake, up the Capitol Hill slope in the vicinity known as the Cascade Neighborhood. Post World War II, industrial and commercial development continued with new buildings reflecting the more streamlined aesthetic of the period. An earthquake in 1949 caused irreparable damage to the Cascade School building, which was demolished and not replaced, signaling the decline in residential population which had begun with the Depression and would continue throughout the latter half of the twentieth century (Thomas Street History Services 2005:14-20).

In 1959 the entirety of South Lake Union was rezoned for manufacturing. The construction of Interstate 5, completed in 1962, resulted in the destruction of some three hundred homes in the Cascade Neighborhood. Together these planning and infrastructure decisions forever changed the character of the area. A period of blight followed during the 1970s and 1980s, countered by activism on the part of remaining Cascade Neighborhood residents. The 1990s saw heated discussions about the future of the vicinity with visions ranging from a grand park to maintenance of the remaining stock of low-income housing. The development of the area as a biotechnical research zone interspersed with high rise housing won out and execution of this contemporary version of South Lake Union/Cascade Neighborhood is well underway (Thomas Street History Services 2005:21-24).

Fairview Avenue North

This portion of Fairview Avenue North was originally named Southlake Avenue (Baist Map Company 1912; Kroll Map Company 1920; Sanborn 1905, 1917). It was an elevated route (above Lake Union) which passed in front of wharves and commercial buildings such as the Washington Laundry Company (built 1909) at 1165 Eastlake Avenue North and the Seattle City Light and Power's Lake Union Hydroelectric House (built 1912) at 1241 Eastlake Avenue North. City of Seattle ordinances indicate efforts were underway to construct a bridge along this part of Fairview Avenue North beginning in 1913 and continuing through 1915 (Ordinance No. 31471, 32538, 33032, 33633, 34922). As early as 1917 a wooden piling trestle bridge existed along the eastern side of Fairview Avenue North directly in front of the Washington Laundry Company and the Hydroelectric House. By 1923 two wooden piling trestle bridges were located along Fairview Avenue North, built in parallel with a 3-foot wide gap between.

The existing West Bridge was built in 1948 to replace the western trestle bridge previously constructed at this location. It is unknown if the original trestle piling foundations were removed, or remain beneath the existing bridge. The existing East Bridge was built in 1963. Sawed pilings visible beneath the East Bridge are likely associated with the original trestle foundations.

Lake Union Power House and Steam Plant

In 1911 notable architect Daniel Huntington designed the Seattle City Light and Power's Lake Union Hydroelectric House, known then as the "Power House" (Berner and Dorpat 1991:90; Boyle 1987; Gordon 1988). Huntington was the Seattle City Architect from 1911-1925 and designed many municipal buildings for Seattle, but also is known for co-designing the First United Methodist Church on 5th and Marion. The Power House was constructed in 1912 and utilized overflow water from the Volunteer Park Reservoir on Capitol Hill, located 412 feet uphill. In 1914 it was modified by Huntington to accommodate an oil-fired steam engine which supplemented the facility's output.

The Power House was located on the shores of Lake Union to take advantage of the uphill reservoir and the ability to bring fuel in by barge on Lake Union. A 1911 Lighting Department annual report states: "It is intended that the steam plant be situated on the same site which will be accessible for its fuel supply from the Northern Pacific Railway, or by the new Lake Washington Canal" (Boyle 1987:1). The Landmarks Nomination form goes on to state: "The open waterway to the west of the Power House and Steam Plant allowed for easy access. When Fairview Avenue was constructed to the west of the power plant it was a raised street built on pilings so that water access was maintained" (Boyle 1987:1). The original 1911 plans for the Power House predate the construction of Fairview Avenue (Boyle 1987:2).

In 1914, 1918, and 1921 expansion facilities were built north of the original Power House following designs created by Huntington; these were known as the "Auxiliary Steam Plant" (1914), "Second Unit" (1918), and "Third Unit" (1921) (Gordon 1988). The expansions increased the electrical output with oil-fired steam engines (Sanborn 1917, 1950; Wilson 2009:162). The construction efforts are well-documented in photographs housed at the Seattle Municipal Archives. The original Power House, Auxiliary Steam Plant, Second Unit, and Third Unit are known collectively as the Lake Union Steam Plant. In 1987 the Lake Union Steam Plant was nominated as a Seattle Landmark (Boyle 1987). The nomination was approved by the City of Seattle Landmarks Preservation Board in 1988 (Gordon 1988). The buildings are now occupied by ZymoGenetics, a private medical research company.

Proposed modifications to a listed City of Seattle Landmark require a Certificate of Approval from the Landmark Preservation Board; this approval process seeks to preserve the features that make a landmark significant. The Landmarks Determination for the Lake Union Steam Plant requires the preservation of the following significant features (emphasis added): "the entire exterior of the buildings, including the roofs and the stacks; the site excluding the fuel storage tank located north of the power plant and excluding the submerged parcels extending into Lake Union; and those portions of the interior (excluding equipment) which, if altered, would alter the appearance of the exterior" (Gordon 1988:15). The excluded "submerged parcels extending into Lake Union" are located west of the Fairview Avenue North Bridges on either side of Waterway No. 8; at least two piers for barges were located at Waterway No. 8. It should be noted that the preservation of water access from Lake Union to the Steam Plant is not specifically excluded, so any proposed plans to close off water access (i.e., filling this portion of the Lake) may require review by the Landmarks Preservation Board.

The Steam Plant was evaluated for National Register of Historic Places (NRHP) eligibility in 2008 and was determined not eligible. However, in review for the current project the building is considered eligible for listing in the NRHP under Criteria A and C (see below for the current evaluation of eligibility). Any potential impacts to the Steam Plant would require compliance with potential Seattle Landmark regulations.

Historic Resources within the Project Vicinity

There are six properties listed on a historic register adjacent to the APE (Table 2).

Three of the listed properties are historic vessels moored nearby. There is no impact expected to the historic vessels by the project and they will not be included in the historic property survey for the project.

Table 2. Register-listed or designated historic properties within immediate vicinity of project area.

Name	Description	National Register of Historic Places Status	Seattle Landmarks Status
Lake Union Drydock Co.	Complex of buildings on piers built 1919/1920	Determined Eligible 1998	
Lake Union Power House and Steam Plant	Complex of four buildings, c. 1920	Determined Not Eligible 2008/Recommended Eligible 2014	Designated 1988
Steinhart, Theriault and Anderson Building	Built 1956	Determined Eligible 2003	
Adventuress	Historic Schooner, 1914	Listed 1989	
Chickamauga	Historic Tugboat, 1915	Listed 2001	
Zodiac	Historic Schooner, 1924	Listed 1982	

PREVIOUS ARCHAEOLOGICAL RESEARCH

ESA conducted a records search of DAHP's online Washington Information System for Architectural and Archaeological Records Data (WISAARD) on December 2, 2013.

The records search resulted in the identification of two cultural resource studies (Table 3) and two recorded sites (Table 4) within a half mile radius of the proposed project. Neither of the previous studies included field work. No cultural resource assessments have previously been conducted within the APE, and there are no recorded archaeological sites within the APE.

Table 3. Previous cultural resources studies within 0.50 mile of the project.

Citation	Project	Approximate Distance from Project	Cultural Resources Identified	National Register of Historic Places Eligibility[1]
Forsman et al. 1997	Denny Way/Lake Union Combined Sewer Overflow Control Project	0.50 mile south	(no field component)	N/A
Courtois et al. 1999	Central Link Light Rail EIS	0.25 mile east	(no field component)	N/A

[1] opinion of recorder

Table 4. xxxxxxxxx

Redacted

[1] opinion of recorder

Expectations

Historic

Geotechnical probes have encountered historic construction and utility related debris and wood within imported fill that covers the project area to depths of 7 to 40 feet. Such materials are expected to be encountered during much of the ground disturbing work associated with the project. These materials are related to industrial and commercial development of the project area since the early 1900s, as well as creation of the transportation corridor. Such materials would not be considered significant since they lack their original context.

Ethnohistoric

There is ample general historic evidence for Native American occupation along the Lake Union shoreline up to and after contact with Euroamericans. However, there is no specific information for Native American occupation within the project area itself, and no evidence for such occupation has been noted within any geotechnical probes. There are no specific expectations for ethnohistoric archaeological remains within the project area. Such resources, if they were to exist, could include bone and shell food refuse; stone, bone, shell, and wood tools and decorative objects; waste products from the shaping of tools and decorative objects; postmolds, stains, and elements from wooden structures, such as houses, drying racks, and other structures; rock pavements and alignments; hearths with charcoal, food refuse, and/or fire modified rocks; pits; midden with varying amounts of organic refuse, shell, and other debris. These deposits might include artifacts originating from Euroamerican manufacture, such as ceramics, glass, and metal, indicating the incorporation of such items into Native American life ways.

Precontact

Although Lake Union has existed since the Late Pleistocene, there is no specific archaeological evidence for Native American occupation along the Lake Union shoreline prior to contact with Euroamericans. Nevertheless, the lake was an important resource for freshwater fishing of trout and gathering of plants. The configuration of the shoreline has varied over time and seasonally with fluctuations in precipitation

– the ultimate source of lake inflow, especially prior to creation of the Lake Washington Ship Canal. The absence of recorded precontact archaeological sites along the Lake Union shoreline may result from a lack of cultural resource surveys, rather than reflecting a lack of precontact human occupation.

If precontact archaeological resources exist within the APE, they could include food refuse in the form of bone and shell; stone, bone, shell, and wood tools and decorative objects; waste products from the shaping of tools and decorative objects; postmolds, stains, and elements from wooden structures, such as houses, drying racks, and other structures; rock pavements and alignments; hearths with charcoal, food refuse, and/or fire modified rocks; pits; midden with varying amounts of organic refuse, shell, and other debris. Unlike ethnohistoric deposits, in situ precontact deposits would not include Euroamerican artifacts. Project design alternatives calling for partial or complete filling beneath the bridge deck will provide permanent protection for any buried or submerged ethnohistoric cultural resources within the project area.

FIELD ASSESSMENT METHODS

Due to the disturbed/filled nature of the vicinity of the Fairview Avenue North Bridges as well as the pavement covering much of the APE, subsurface archaeological testing was not carried out as part of the cultural resources assessment. Geotechnical probes of the area were evaluated for cultural materials and to assess the likelihood for buried archaeological resources. A reconnaissance survey to document historic above-ground resources was conducted. xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx.

Geotechnical Probes

A total of seven geoprobes were placed between 2008 and 2011 along the long axis of the project area (Aspect 2008; HWA 2012). Results of the geoprobes are discussed below.

Historic Property Survey

ESA staff archaeologist Erin Claussen conducted a site visit on December 9, 2013 to photodocument historic period properties in the project vicinity and gather information to prepare Historic Property Inventories (HPI). During the survey Claussen determined which of the properties on the east side of Eastlake Avenue East had a view of the APE; these were recorded as were those properties immediately adjacent to the APE. A total of eight historic structures were identified and HPIs were prepared or updated.

The West Bridge is a pre-stressed concrete girder bridge built ca. 1963 and the East Bridge is a concrete slab bridge built in 1948. Both bridges are subject to FHWA's Program Comment on Common Post-1945 Concrete and Steel Bridges and the bridges are exempt from Section 106 review. No further documentation was conducted for either bridge.

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RESULTS

Geotechnical Probes

Borelog information for geotechnical probes indicated that the approaches to the Fairview Avenue North bridges consist of 30 to 40 feet of imported fill (deeper on the south approach) containing historic construction and utility refuse, including brick and metal fragments, glass shards, and masonry pipe fragments. The most likely origin for this material is related to the construction of nearby historic buildings (see below). The inlet below the bridge deck contains between 7 and 28 feet of imported gravelly silty sand with brick fragments and wood debris. From mid-span to the south, lake deposits underlie the fill. From mid-span to the north, however, deposits directly beneath the fill have been identified as Vashon recessional outwash (HWA 2012: Figure 4).

Geoprobes did not identify any substantial post-Pleistocene surfaces where people might have lived and conducted subsistence activities during the Holocene. If such deposits once existed, it is possible that construction grading and site preparation associated with 20th century industrialization and commercialization of the project area long since destroyed and removed them.

Historic Property Survey

Eight structures built 1909-1963 were inventoried at the reconnaissance level as part of the historic property survey (Table 5, Figure 3). Photographs of the buildings were taken from the public right-of-way and HPIs were prepared (Appendix B).

Table 5. Recorded above-ground historic-aged resources within immediate vicinity of project area.

Map #	Description	Address	Year Built	National Register of Historic Places Eligibility1
1	Lake Union Drydock Co.	1515 Fairview Ave. E.	1919/ 1920	Determined Eligible 1998
2	Commercial Business	1514 Fairview Ave. E.	1943	Not Eligible
3	Lake Union Power House and Steam Plant	1241 Eastlake Ave. E.	c.1920	Eligible/Seattle Landmark Listed 1998
4	Washington Laundry Co.	1165 Eastlake Ave. E.	1909	Potentially Eligible
5	Steinhart, Theriault and Anderson Building	1264 Eastlake Ave. E.	1956	Determined Eligible 2003
6	Multi-Family Dwelling	1262 Eastlake Ave. E.	1909	Not Eligible
7	Glenwood/Villa Carmela Apartments	1258 Eastlake Ave. E.	1908	Not Eligible
8	Industrial	1150 Eastlake Ave. E.	1948	Not Eligible

[1] opinion of author

Figure 3. Recorded Historic Properties in Immediate Vicinity of APE. Numbers refer to properties listed in Table 5.

Lake Union Drydock Company (ID #1)

Physical Description

Built largely between 1920 and 1940, the Lake Union Drydock Company located at 1515 Fairview Avenue East consists of a complex of wood frame buildings, drydocks, piers and other structures, most of which stand on pilings extending out over Lake Union, with functions related to the building, maintenance, repair and storage of boats, ships and seaplanes. The structures vary accordingly in plan and form. The main office building would appear to be the only structure that has seen alterations to original exterior materials. It appears to have been partially reclad in vinyl siding and some windows and doors replaced. The rest of structures visible during reconnaissance appeared to retain original horizontal or vertical flush shiplap or tongue-and-groove cladding or vertical board and batten cladding and original wooden sash windows, as was noted on the earlier HPI.

Figure 4. Lake Union Drydock Company, Main Office Building; view to west.

Statement of Significance

The Lake Union Drydock Company was determined NRHP eligible in 1998 under Criterion A. It continues operations today and is one of the oldest continuous commercial ventures in Seattle. This, coupled with its prominence in early maritime industry on Lake Union and its role in shipbuilding as it related to important twentieth century political, social and economic events including Prohibition and WWII, support the property's continued NRHP eligibility.

<u>1514 Fairview Avenue East (ID #2)</u>

Built in 1943, the building at 1514 Fairview Ave. East is a two-story wood frame commercial building with a rectangular plan, shed (half-gabled) roof with moderate eaves at the front (west) and side (north and south) elevations. Cladding is board on board vertical wood siding with whitewashed rectangular wood paneling present at the southern elevation, possibly to cover damage to the vertical board or to facilitate signage at this end of the building. Siding on front (western) elevation is unpainted. Siding on side (north) elevation is whitewashed. One metal replacement window (only window visible during survey) is located at the second-floor, center of the western elevation. With the exception of one modern entry door at the southern end of the western elevation, all doors appear to be original wood doors including four large sliding garage doors, though it appears at least one of these garage doors no longer functions, as an entry door has been cut into it.

Figure 5. 1514 Fairview Avenue East; view to northeast.

Statement of Significance

The building was constructed in 1943 according to the King County Assessor. The original architect, builder and occupant are unknown, although the King County Assessor lists the owner as the Lake Union Drydock Co., suggesting that the building was originally associated with this still extant company/ complex of structures located directly across Fairview Ave. East. It would appear that most elements of the building's exterior are original. Exceptions include a second-floor window at the center of the western elevation of the structure and an entry door at the southern end of the western elevation. In light of these minor alterations, the building's integrity is considered good. With its shed roof and large sliding garage doors/sliding garage door bays (it is clear at least one door no longer functions), the building exhibits elements of the Industrial Vernacular style. However, it does not appear to embody stylistic characteristics or a method of construction that would warrant special recognition. Therefore the property does not appear eligible for listing in the NRHP based upon its architectural qualities.

Lake Union Power House and Steam Plant (ZymoGenetics Building) (ID #3)

Physical Description

Built in 1912, the Power House at 1241 Eastlake Ave. East is a single-story wood and concrete frame structure with a basement level below the grade of Eastlake Ave. It has a rectangular plan and side-gabled roof with gabled parapets projecting up from the gable end walls. The roof is clay tile. Two small concrete towers are set at the sides of shed dormers in the center of the east and west roofs. A hipped cupola sits in the center of the ridge of the roof. The building is clad in stucco. Windows appear to be original.

Built between 1914 and 1921, the Lake Union Steam Plant at 1241 Eastlake Ave. East is a two-story concrete frame structure. It has a rectangular plan and flat roof with a decorative parapet. Cladding is brick and stucco. Decorative glazed terracotta panels adorn the southern half of the western elevation. Windows have been replaced in a sympathetic manner.

Figure 6. View of Lake Union Power House and Steam Plant (ZymoGenetics Building) view to northeast.

Statement of Significance

Although the Lake Union Power House and Steam Plant was determined not eligible for listing in the NRHP in 2008, the current survey considers that the building is eligible under Criteria A and C. The Power House and Steam Plant are directly associated with the coming of electricity to greater Seattle and are demonstrative of the evolution of the technology used to generate it. The Power House was designed by notable architect Daniel Huntington. The exterior of the Power House is almost completely intact with only minor changes occurring shortly after its construction in 1912. The Lake Union Steam Plant has undergone slightly more significant changes. Though each phase of expansion enlarged the structure, the construction of the Third Unit of the Steam Plant resulted in the most significant alterations to the appearance of the exterior in the form of a 126 foot by 38 foot second story penthouse at the Eastlake Ave. elevation to house distribution equipment. Glazed decorative terracotta panels were also added to the east elevation at this time (Boyle 1987). Since the building was acquired by ZymoGenetics in 2002, all original windows have been replaced, though in a sympathetic manner. Much care has been taken to preserve all other exterior elements including the terracotta panels. Six reproduction smokestacks sit atop the building today. There were seven original functional smoke stacks. The Lake Union Steam Plant exhibits elements of early industrial style accompanied by some Beaux Arts decorative elements.

Washington Laundry Company (ID #4)

Physical Description

Built in 1909, the building at 1165 Eastlake Avenue E. is a four-story (two below grade at the Eastlake Avenue elevation, all above at the Fairview Avenue elevation) commercial building with an L-shaped plan, flat roof, and flat parapet. Cladding is stucco. The building underwent an extensive remodel in 1946, designed by Seattle firm George W. Stoddard and Associates. The Eastlake Avenue elevation of the building retains many features of this modernistic remodel while the Fairview Avenue elevation retains the feel of the original early 1900s structure with bays of three pane high and four pane wide, early (though not original), horizontal pivoting (middle row of panes), metal-frame windows. The three bays at the top floor of the portion of the building that abuts Fairview Avenue have modern replacement windows in place. Some other windows throughout the building are also modern replacements. The Eastlake Avenue elevation features newer entrances.

Figure 7. Washington Laundry Company Building, northwest elevation; Fairview Bridge railing in foreground. View to southeast.

Statement of Significance

The original occupant of the building was the Washington Laundry Company, but the original architect and builder are unknown. The earlier HPI states that the building was altered extensively in a 1946 remodel, particularly the Eastlake elevation. Changes included the removal of several bays of windows and their replacement with a panel of glass blocks which is still present today. Six sloping piers which frame the windows and doors at the Eastlake elevation were also added at this time and are also still present. A smokestack once sat atop the building, similar to those on the adjacent Lake Union Steam Plant, and may have been removed at this time. The architect for this remodel was George W. Stoddard and Associates. George W. Stoddard was a prolific Seattle architect from the 1920s through the 1950s. The remodel of the Washington Laundry Company building coincides with and reflects Stoddard's post-WWII embrace of modernism (DAHP n.d.). The building has seen some less extensive alterations since, namely newer entrances at the Eastlake elevation, and the replacement of some windows throughout. The Fairview Avenue elevation retains more of the feeling of the original 1909 building with bays of three pane high and four pane wide, early (though not original), horizontal pivoting (middle row of panes), metal-frame windows still present. Three of the bays at the top floor of the portion of the building that abuts Fairview Avenue have modern replacement windows in place. In light of the alterations, the building's integrity is considered fair in reference to both its original design and its 1946 Stoddard and Associates remodel. The building exhibits some elements of the commercial/industrial modern style. Given the building's direct link to the early 1900s industrial development of the South Lake Union area and its status as one of the few surviving structures from this era coupled with its association with renown Seattle architect George W. Stoddard and its exemplification of his shift to a purely modern design aesthetic, the building appears to be eligible for listing in the NRHP under Criteria A and C.

<u>Steinhart, Theriault and Anderson Building (ID #5)</u>

Physical Description

Built in 1956, the Steinhart Theriault and Anderson (STA) Building at 1264 Eastlake Avenue East is a single-story, cantilevered glass box/steel frame building with a rectangular plan, flat roof, and flat parapet. The southern elevation is clad in vertical redwood siding. A screen of redwood strips screens a covered balcony and floor-to-ceiling windows at the western elevation. The northern elevation features uncovered floor-to-ceiling windows with the screen resuming at the eastern end. The eastern elevation features the same screen and covered balcony configuration as the western. The foundation is faced in natural stone. The STA Building exhibits nearly perfect integrity, having seen virtually no changes to its exterior elements since construction.

Figure 8. Steinhart, Theriault and Anderson building.

Statement of Significance

The Steinhart, Theriault and Anderson Building was determined eligible for listing in the NRHP in 2003.

1262 Eastlake Avenue East (ID #6)

Physical Description

Built in 1909, the building at 1262 Eastlake Avenue East is a two-story wood frame multi-family dwelling with a rectangular plan and low-pitched gable-on-hip roof with a moderate eave on the north and west elevations (east elevation not visible during reconnaissance). A full-width, two-story porch spans the south elevation, the roof of which consists of an extended eave overhang. Cladding is vinyl siding and windows are metal replacement. The full-width, two-story wood porch, which spans the south elevation of the structure, is likely an original element (though probably rebuilt).

Figure 9. 1262 Eastlake Avenue East

Statement of Significance

The original architect and builder are unknown. The building's exterior has seen extensive replacement of materials including the cladding, which is currently vinyl siding, and windows, which are metal frame. The full-width, two-story wood porch, which spans the south elevation of the structure, is likely an original element (though probably rebuilt). Its roof consists of the eave overhang of the main structure's roof, and it appears that it also facilitates entry to second floor apartments. Because of these alterations, the building's integrity is considered fair. With its full-width porch and hipped roof, the building exhibits some elements of the Greek Revival style. However, it does not appear to embody stylistic characteristics or a method of construction that would warrant special recognition and it is not located in a cohesive grouping of similar building types. Therefore the property does not appear eligible for listing in the NRHP based upon its architectural qualities or associations.

<u>Glenwood Apartments/Villa Carmela (ID #7)</u>

Physical Description

Built in 1908, the building at 1258 Eastlake Avenue East is a three-story wood frame multi-family dwelling atop a street-level garage. It has a rectangular plan and flat roof with decorative parapet. The façade is symmetrical and appears to be two units wide. It features oriel-type bay windows toward the outer edges spanning the second and third floors. They are capped with red architectural shingled hipped roofs. A bracketed roof with the same red architectural shingles overhangs the front entry. A bracketed top window echoing the roof over the front entry and also with red architectural shingles is at the center of the façade at the third floor. Cladding is stucco. It would appear that all windows are new vinyl replacements and doors modern decorative steel. Gates at garage level and wrought metal fencing atop the garage as well as decorative tilework around an entry door to the garage appear to be modern.

Figure10. Gatewood Apartments/Villa Carmela.

Statement of Significance

The apartment building was known historically as the Glenwood Apartments and today as Villa Carmela. The original architect and builder are unknown. The exterior of the building appears to have been maintained in keeping with the building's Spanish style. It would appear that all windows and doors have been replaced, albeit in a sympathetic manner. Built into the hillside, the structure sits atop a garage that is at street level at the western (front) elevation. Gates at garage level and wrought metal fencing atop the garage as well as decorative tilework around an entry door to the garage appear to be modern. Despite these alterations, the building's integrity is considered good. However, it does not appear to embody stylistic characteristics or a method of construction that would warrant special recognition and it is not located in a cohesive grouping of similar building types. Therefore the property does not appear eligible for listing in the NRHP based upon its architectural qualities or associations.

<u>1150 Eastlake Avenue East (ID #8)</u>

Physical Description

Built in 1948, the building at 1150 Eastlake Avenue East is a two-story wood and concrete block frame industrial building with an irregular plan and flat roof with a parapet at the north elevation. Cladding is coursed painted or stained wood shingles at the front (western) and part of the southern elevation; painted concrete block on the side (north and south) elevations. There is also fiberglass or some other kind of composite paneling present on the south elevation. The windows on the building's second story front (western) elevation appear to have been replaced at some point. Windows on the first story front (western) elevation are wood frame; the sashes are possibly original though aluminum screens present in two upper sashes are likely a later addition. Double metal doors on the eastern elevation are also most likely not original. An attached garage at the southern end of the building is also concrete block and though it appears to be original to the structure, is fitted with a newer overhead door and entry door.

Figure11. 1150 Eastlake Avenue East; view to northeast.

Statement of Significance

The original architect, builder and occupant are unknown. It would appear that most elements of the building's exterior are original. An exception is the windows on the building's second story front (western) elevation which appear to have been replaced at some point. Double metal doors on the western elevation are also most likely not original. An attached garage at the southern end of the building appears to be an original part of the structure, but is fitted with a newer overhead door and entry door. The building's integrity is considered good, however its current condition is only fair. The building exhibits some elements of the commercial/industrial vernacular style, however it does not appear to embody stylistic characteristics or a method of construction that would warrant special recognition and it is not located in a cohesive grouping of similar building types. Therefore the property does not appear eligible for listing in the NRHP based upon its architectural qualities or associations.

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ASSESSMENT OF EFFECTS ON HISTORIC PROPERTIES

If a property is considered eligible to the NRHP, the lead federal agency must determine if the project will affect the property and whether it would be an Adverse Effect. Two of the properties adjacent to the APE are have been formally determined eligible to the NRHP and two properties within the APE for Indirect Effects are considered eligible (Table 6). When the qualities that make a property eligible for listing on the NRHP are diminished, such diminishment is an "Adverse Effect".

One of the four structures, the Lake Union Drydock Company is located at the north end of the APE and is adjacent to potential staging areas. As there is no ground disturbance expected within the staging areas, ESA recommends that there is No Effect to this structure.

The Steinhart, Theriault, and Anderson Building is located east of the APE; the building overlooks the north end of the APE. Because there is no significant change to the streetscape on Fairview Avenue North and the new bridge will essentially encompass the same footprint, ESA recommends that the project will have No Effect to the Steinhart, Theriault, and Anderson Building.

The Lake Union Power House and Steam Plant is located within the APE for Indirect Effects. The construction of the new bridge is not expected to change access to the building or to substantially alter the general streetscape. Additionally, based on review of the Noise and Vibration Discipline Report, although vibration does have potential to impact scientific equipment inside the building, no impacts to the structure are anticipated. No pile driving will be conducted for the bridge construction. Vibration limits and a monitoring program will be developed during Final Design to monitor vibration compliance. Therefore ESA recommends that the project will have No Effect to the Lake Union Power House and Steam Plant.

The Washington Laundry Company Building is located within the APE for Indirect Effects and is adjacent to a potential staging area. Based on review of the Noise and Vibration Discipline Report, no impacts to the structure are anticipated. No pile driving will be conducted for the bridge construction. Vibration limits and a monitoring program will be developed during Final Design to monitor vibration compliance. As there is no ground disturbance expected within the staging area, there are no effects anticipated related to construction staging. The construction of the new bridge is not expected to change access to the building or to substantially alter the general streetscape. Therefore, ESA recommends that the project will have No Effect to the Washington Laundry Company building.

Table 6. Summary of Effects on Historic Properties

Map #	Description	National Register of Historic Places Eligibility	Effect or Adverse Effect Anticipated
1	Lake Union Drydock Co.	Determined Eligible 1998	None
3	Lake Union Power House and Steam Plant	Potentially Eligible	None
4	Washington Laundry Co.	Potentially Eligible	None
7	Steinhart, Theriault and Anderson Building	Determined Eligible 2003	None

RECOMMENDATIONS

Section 106

Based upon the results of the historic property survey and geotechnical review in combination with the proposed construction methods, ESA extends no recommendations for further cultural resources work within the APE. As with any construction project, it may be appropriate to have an Inadvertent Discovery Plan in place in order to outline the procedures to be followed if cultural materials are identified during construction.

Seattle Landmarks Review

As this project is anticipated to go through State Environmental Policy Act (SEPA) review, the location of a Seattle Landmark (the Lake Union Steam Plant) adjacent to the project area will trigger an adjacency referral to the Landmarks Preservation Board. The referral would include a review of design drawings which is expected to be conducted at the staff level.

Seattle Department of Planning and Development Director's Rule 2-98

Based upon research on the project area and environs in this report, this project is unlikely to encounter intact prehistoric or historic archaeological resources. This report does not identify the probable presence of archaeological significant sites or resources. A review of records managed by DAHP indicates the project location is not a "known archaeologically significant site".

In compliance with Director's Rule 2-98, all contract documents for general, excavation, and other subcontractors will include reference to regulations regarding archaeological resources (Chapters 27.34, 26.53, 27.44, 79.01, 79.90 RCW, and Chapter 25.48 WAC as applicable) and that construction crews will be required to comply with those regulations.

Compliance with State Cultural Resources Laws

The findings and professional opinions included in this report are based on review of documents and standard cultural resources techniques including historic property survey and examination of the results of geotechnical probes; however each has its limitations. It is possible that unanticipated cultural resource materials may be encountered during construction. In the event that cultural resources are observed during implementation of the project then work should be temporarily suspended at that location and a professional archaeologist should be consulted.

Pursuant to RCWs 68.50.645, 27.44.055, and 68.60.055, if ground disturbing activities encounter human skeletal remains during the course of construction, then all activity will cease that may cause further disturbance to those remains. The area of the find will be secured and protected from further disturbance. The finding of human skeletal remains will be reported to the county medical examiner/coroner and local law enforcement in the most expeditious manner possible. The remains will not be touched, moved, or further disturbed. The county medical examiner/coroner will assume jurisdiction over the human skeletal remains and make a determination of whether those remains are forensic or non-forensic. If the county medical examiner/coroner determines the remains are non-forensic, then they will report that finding to the Department of Archaeology and Historic Preservation (DAHP) who will then take jurisdiction over the remains. The DAHP will notify any appropriate cemeteries and all affected tribes of the find. The State Physical Anthropologist will make a determination of whether the remains are Indian or Non-Indian and report that finding to any appropriate cemeteries and the affected tribes. The DAHP will then handle all consultation with the affected parties as to the future preservation, excavation, and disposition of the remains.

BIBLIOGRAPHY

Aspect Consulting

2008 Geotech Boring Logs Fairview Bridge. In *Geotechnical Data Report Fairview Bridge Replacement Project Seattle, Washington (Appendix D),* prepared by HWA Geosciences, Inc., for Perteet Engineering. On file, ESA Paragon, Seattle.

Baist Map Company

1912 *Surveys of Seattle*. On file, Seattle Public Library.

Berner, Richard C. and Paul Dorpat

1991 *Seattle 1900-1920: From Boomtown, Urban Turbulence, to Restoration.* Seattle in the Twentieth Century Series, Vol. 1. Charles Press, Seattle.

Boyle, Susan

1987 *City of Seattle Landmarks Preservation Board Nomination Form for the Lake Union Steam Plant.* On file, Seattle Landmarks Preservation Board.

Chrzastowski, Michael

1983 *Historical Changes to Lake Washington and Route of the Lake Washington Ship Canal, King County Washington*. Water Resources Investigations Open File Report 81-1182. United States Geological Survey.

Courtois, Shirley L., Katheryn H. Krafft, Catherine Wickwire, James C. Bard, and Robin McClintock

1999 *Central Link Light Rail Transit Project, Final Environmental Impact Statement: Technical Report Historic and Archaeological Resources*. Prepared by Courtois & Associates and CH2M Hill for Central Puget Sound Regional Transit Authority, Seattle. On file, DAHP, Olympia.

Dorpat, Paul and Genevieve McCoy

1998 *Building Washington: A History of Washington State Public Works*. Tartu Publications, Seattle.

Eastwick, P.G.

1891 Report on Survey with Estimates for Proposed Lake Washington Ship Canal. U.S. Engineers Office, Portland. Unpublished report.

Forsman, Leonard A., Dennis E. Lewarch, and Lynn L. Larson

1997 *Denny Way / Lake Union Combined Sewer Overflow Control Project, Seattle, King County Cultural Resources Assessment.* Prepared by Larson Anthropological/Archaeological Services for King County Department of Natural Resources, Water Pollution Control, Seattle. On file, DAHP, Olympia.

Franklin, Jerry F. and C.T. Dyrness

1988 *Natural Vegetation of Oregon and Washington*. Oregon State University Press, Corvallis.

Gordon, Karen

1988 *City of Seattle Landmarks Preservation Board Designation Report for the Lake Union Steam Plant.* On file, Seattle Landmarks Preservation Board.

HDR

2009 *Concept Design Report and Cost Estimate, Fairview Avenue N Bridge*. Prepared by HDR for Seattle Department of Transportation Bridge Rehabilitation and Replacement Program. On file, ESA Paragon, Seattle.

HWA Geosciences, Inc.

2012 *Geotechnical Data Report Fairview Bridge Replacement Project Seattle, Washington*. Prepared by HWA Geosciences, Inc., for Perteet Engineering. On file, ESA Paragon, Seattle.

Hilbert, Vi, Jay Miller, and Zalmai Zahir

2001 *Puget Sound Geography: Original Manuscript from T. T. Waterman*. Lushootseed Press, Seattle. Available from Zahir Consulting Services, Federal Way, WA.

Kroll Map Company

1920 *Atlas of King County*. Kroll Map Company, Seattle. On file, Seattle Public Library.

Pacific Aerial Surveys

1937a Section 20, Township 25 North, Range 4 East. Electronic document, http://info.kingcounty.gov/transportation/kcdot/roads/mapandrecordscenter/mapvault/Default.aspx?DocId=PQ2HSZI9KrU1, accessed November 14, 2011.

1937b Section 29, Township 25 North, Range 4 East. Electronic document, http://info.kingcounty.gov/transportation/kcdot/roads/mapandrecordscenter/mapvault/Default.aspx?DocId=k4WbvUKsXVA1, accessed November 14, 2011.

Sanborn Map Company

1905 *Seattle, Vol. III, Sheets 329 and 334*. On file, Seattle Public Library.

1917 *1905 Seattle corrected to 1917, Vol. IV, Sheets 443, 450, 492*. On file, Seattle Public Library.

1950 *1905 Seattle corrected to 1950, Vol. IV, Sheets 443, 447, 450, 492*. On file, Seattle Public Library.

Thomas Street History Services

2005 *Context Statement: South Lake Union Historic Survey and Inventory*. Prepared for the Historic Preservation Program Department of Neighborhoods, City of Seattle. Electronic document, http://www.seattle.gov/neighborhoods/preservation/ContextSLU.pdf, accessed December 4, 2013.

Thrush, Coll

2007 *Native Seattle: Histories from the Crossing-Over Place*. University of Washington Press, Seattle.

Troost, Kathy G., and Derek B. Booth

2008 Geology of Seattle and the Seattle area, Washington. In *Landslides and Engineering Geology of the Seattle, Washington, Area*, edited by Rex L. Baum, Jonathan W. Godt, and Lynn M. Highland, pp. 1-35. Reviews in Engineering Geology XX. The Geological Society of America, Boulder.

Troost, Kathy.G., Derek.B. Booth, Aaron P. Wisher, and Scott A. Shimel

2005 *The geologic map of Seattle – a progress report.* U.S. Geological Survey Open-File Report, 2005-1252, scale 1:24,000.

US Surveyor General

1991 *Township 25, Range 4 East Survey Map*. Electronic documents, http://www.blm.gov/or/landrecords/survey/yPlatView1_2.php?path=PWA&name=250n040em01.jpg
http://www.glorecords.blm.gov/results/default.aspx?searchCriteria=type=patent|st=WA|cty=033|ln=denny|twp_nr=25|rng_nr=4|sp=true|sw=true|sadv=false

Washington Department of Fish and Wildlife

2013 *Lake Union*. Electronic document, http://wdfw.wa.gov/fishing/washington/50/, accessed December 9, 2013.

Wilson, William H.

2009 *Shaper of Seattle: Reginald Heber Thomson's Pacific Northwest.* Washington State University Press, Pullman.

APPENDIX A

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REDACTED

APPENDIX B

Historic Property Inventory Forms

Historic Inventory Report

Location

Field Site No. DAHP No.

Historic Name: Lake Union Steam Plant

Common Name: Lake Union Steam Plant

Property Address: 1241 Eastlake Ave E, Seattle, WA 98102

Comments:

Tax No./Parcel No. 408880-2925

Plat/Block/Lot

Acreage

Supplemental Map(s)

Township/Range/EW	Section	1/4 Sec	1/4 1/4 Sec	County	Quadrangle
T25R04E	29			King	SEATTLE NORTH

Coordinate Reference

Easting: 1189788

Northing: 843165

Projection: Washington State Plane South

Datum: HARN (feet)

Identification

Survey Name: Fairview Ave. Bridge Project

Date Recorded: 12/09/2013

Field Recorder: Erin Claussen

Owner's Name: ARE 1201 Eastlake Ave.

Owner Address: 1241 Eastlake Ave. East

City: Seattle State: WA Zip: 98102

Classification: Building

Resource Status: Local Register

Comments: Seattle Landmark

Within a District? No

Contributing? No

National Register:

Local District:

National Register District/Thematic Nomination Name:

Eligibility Status: Not Determined - SHPO

Determination Date: 1/1/0001

Determination Comments:

Historic Inventory Report

Description

Historic Use: Government - Hydroelectric Power Generation

Current Use: Health Care - Medical Business/Office

Plan: Rectangle

Stories: 2

Structural System: Concrete - Reinforced Concrete

Changes to Plan: Intact

Changes to Interior: Extensive

Changes to Original Cladding: Intact

Changes to Windows: Extensive

Changes to Other: Moderate

Other (specify):

Style:	Cladding:	Roof Type:	Roof Material:
Other - Industrial	Veneer - Stucco	Flat with Parapet	Unknown
Beaux Arts - Classical Revival			

Foundation:	Form/Type:
Concrete - Poured	Industrial

Narrative

Study Unit	Other

Date of Construction: 1917 Built Date

Builder:

Engineer:

Architect: Daniel Huntington

Property appears to meet criteria for the National Register of Historic Places: Yes

Property is located in a potential historic district (National and/or local): No

Property potentially contributes to a historic district (National and/or local): No

Statement of Significance: This property was evaluated at the reconnaissance level in a cultural resources assessment completed for Seattle Department of Transportation (SDOT)'s proposed Fairview Ave. N. Bridge Project in the City of Seattle, King County, Washington. The property was previously recorded on a Historic Property Inventory Form in 1995, though no descriptions of the structure were provided. The building was assessed for National Register of Historic Places (NRHP) eligibility in 2008 and determined to be not eligible. It was however designated a Seattle Landmark by the City of Seattle Landmarks Preservation Board in 1998. It is the conclusion of this survey that the building is National Register Eligible under Critera A and C. This form is being prepared to record the building at a reconnaissance level with DAHP and to extend a recommendation of NRHP eligibility.

The following information is summarized from the Seattle Landmarks nomination (Gordon 1988). In 1911 notable architect Daniel Huntington designed the Seattle City Light and Power's Lake Union Hydroelectric House, known then as the "Power House" (Berner and Dorpat 1991:90; Boyle 1987; Gordon 1988). The Power House was constructed in 1912 and utilized overflow water from the Volunteer Park Reservoir on Capitol Hill, located to the east 412' uphill. In 1914 it was modified by Huntington to accommodate an oil-fired steam engine which supplemented the facility's output. In 1914, 1918, and 1921 expansion facilities were built north of the original Power House following designs created by Huntington; these were known as the "Auxiliary Steam Plant" (1914), "Second Unit" (1918), and "Third Unit" (1921) (Gordon 1988). The expansions increased the electrical output with oil-fired steam engines (Sanborn 1917, 1950; Wilson 2009:162). The construction efforts are well-documented in photographs housed at the Seattle Municipal Archives. The original Power House, Auxiliary Steam Plant, Second Unit, and Third Unit are known collectively as the Lake Union Steam Plant and constitute one structure. In 1987 the Lake Union Steam Plant was nominated as a Seattle Landmark (Boyle 1987). The nomination was approved by the City of Seattle Landmarks Preservation Board in 1988 (Gordon 1988). The buildings are now occupied by Zymogenetics, a private medical research company.
The exterior of the Power House is almost completely intact. Changes noted included moving forward in 1914 a pair of panel doors with glass transom which were originally recessed thereby providing a covered entry, to the face of the building. Another change taking place at this time was the removal of grillwork and installation of windows at the two dormer and gable ends. Finally, when the building ceased to operate as a generating plant, the cross arms contained within the still extant small concrete towers at the Eastlake elevation and exterior wires were removed. All other elements are as constructed in 1912 (Boyle 1987). The Power House exhibits some elements of the Spanish Eclectic style.
The Lake Union Steam Plant has undergone slightly more significant changes. Though each phase of expansion enlarged the structure, the construction of the Third Unit of the Steam Plant resulted in the most significant alterations to the appearance of the exterior in the form of a 126 foot by 38 foot second story penthouse at the Eastlake Ave. elevation to house distribution equipment. Glazed decorative terracotta panels were also added to the east elevation at this time (Boyle 1987). Since the building was acquired by Zymogenetics in 2002, all original windows have been replaced, though in a sympathetic manner. Much care has been taken to preserve all other exterior elements including the terracotta panels. Six reproduction smokestacks sit atop the building today. There were seven original functional smoke stacks. The Lake Union Steam Plant exhibits elements of early industrial style accompanied by some Beaux Arts decorative elements.

Description of Physical Appearance:

Built in 1912, the Power House at 1241 Eastlake Ave. East is a single-story wood and concrete frame structure with a basement level below the grade of Eastlake Ave. It has a rectangular plan and side-gabled roof with gabled parapets projecting up from the gable end walls. The roof is clay tile. Two small concrete towers are set at the sides of shed dormers in the center of the east and west roofs. A hipped cupola sits in the center of the ridge of the roof. The building is clad in stucco. Windows appear to be original.

Built between 1914 and 1921, the Lake Union Steam Plant at 1241 Eastlake Ave. East is a two-story concrete frame structure. It has a rectangular plan and flat roof with a decorative parapet. Cladding is brick and stucco. Decorative glazed terracotta panels adorn the southern half of the western elevation. Windows have been replaced in a sympathetic manner.

Major Bibliographic References:

Artifacts Consulting, Inc.

2011 1241 Eastlake Ave. East – Historic Property Inventory Form. On file, DAHP, Olympia

Berner, Richard C. and Paul Dorpat

1991 Seattle 1900-1920: From Boomtown, Urban Turbulence, to Restoration. Seattle in the Twentieth Century Series, Vol. 1. Charles Press, Seattle.

Boyle, Susan

1987 City of Seattle Landmarks Preservation Board Nomination Form for the Lake Union Steam Plant. On file, Seattle Landmarks Preservation Board.

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Sanborn Map Company

1917 1905 Seattle corrected to 1917, Vol. IV, Sheets 443, 450, 492. On file, Seattle Public Library.

1950 1905 Seattle corrected to 1950, Vol. IV, Sheets 443, 447, 450, 492. On file, Seattle Public Library.

Unknown

1995 1203 East Lake Ave. East, Lake Union Steam Plant – Historic Property Inventory Form. On file, DAHP, Olympia.

Wilson, William H.

2009 Shaper of Seattle: Reginald Heber Thomson's Pacific Northwest. Washington State University Press, Pullman.

Photos

Southeast Elevation
2013

Northeast Elevation
2013

East Elevation Powerhouse
2013

Northwest Elevation
2014

Historic Inventory Report

Location

Field Site No. DAHP No.

Historic Name:

Common Name: 1514 Fairview Ave. East

Property Address: 1514 Fairview Ave E, Seattle, WA 98102

Comments:

Tax No./Parcel No. 210770-0270

Plat/Block/Lot

Acreage

Supplemental Map(s)

Township/Range/EW	Section	1/4 Sec	1/4 1/4 Sec	County	Quadrangle
T25R04E	20			King	SEATTLE NORTH

Coordinate Reference

Easting: 1190043

Northing: 843837

Projection: Washington State Plane South

Datum: HARN (feet)

Identification

Survey Name: Fairview Ave. Bridge Project

Date Recorded: 12/09/2013

Field Recorder: Erin Claussen

Owner's Name: Lake Union Dry Dock Co.

Owner Address: 1514 Fairview Ave. East

City: Seattle State: WA Zip: 98102

Classification: Building

Resource Status: Survey/Inventory

Comments:

Within a District? No

Contributing? No

National Register:

Local District:

National Register District/Thematic Nomination Name:

Eligibility Status: Not Determined - SHPO

Determination Date: 1/1/0001

Determination Comments:

Historic Inventory Report

Description

Historic Use: Commerce/Trade - Business

Current Use: Commerce/Trade - Business

Plan: Rectangle

Stories: 2

Structural System: Unknown

Changes to Plan: Intact

Changes to Interior: Unknown

Changes to Original Cladding: Intact

Changes to Windows: Moderate

Changes to Other: Slight

Other (specify):

Style:	Cladding:	Roof Type:	Roof Material:
Other - Industrial	Wood - Vertical	Shed	Unknown

Foundation:	Form/Type:
Unknown	Industrial

Narrative

Study Unit	Other

Date of Construction: 1943 Built Date

Builder:

Engineer:

Architect:

Property appears to meet criteria for the National Register of Historic Places: No

Property is located in a potential historic district (National and/or local): No

Property potentially contributes to a historic district (National and/or local): No

Statement of Significance:	This property was evaluated at the reconnaissance level in a cultural resources survey completed Seattle Department of Transportation (SDOT)'s proposed Fairview Ave. N. Bridge Project in the City of Seattle, King County, Washington. Although the property was recorded on a Historic Property Inventory Form in 2011 (Artifacts Consulting 2011), this was done at the informational-only level and no recommendation of National Register eligibility was provided. This form is being prepared to provide an eligibility recommendation per DAHP requirements and to record the building at a reconnaissance level. The building was constructed in 1943 according to the King County Assessor. The original architect, builder and occupant are unknown, although the King County Assessor lists the owner as the Lake Union Dry Dock Co., suggesting that the building was originally associated with this still extant company/complex of structures located directly across Fairview Ave. East. It would appear that most elements of the building's exterior are original. Exceptions include a second-floor window at the center of the western elevation of the structure and an entry door at the southern end of the western elevation. In light of these minor alterations, the building's integrity is considered good. With its shed roof and large sliding garage doors/sliding garage door bays (it is clear at least one door no longer functions), the building exhibits elements of the Industrial Vernacular style. However, it does not appear to embody stylistic characteristics or a method of construction that would warrant special recognition. Therefore the property does not appear eligible for listing in the NRHP based upon its architectural qualities.
Description of Physical Appearance:	Built in 1943, the building at 1514 Fairview Ave. East is a two-story wood frame commercial building with a rectangular plan, shed (half-gabled) roof with moderate eaves at the front (west) and side (north and south) elevations. Cladding is board on board vertical wood siding with whitewashed rectangular wood paneling present at the southern elevation, possibly to cover damage to the vertical board or to facilitate signage at this end of the building. Siding on front (western) elevation is unpainted. Siding on side (north) elevation is whitewashed. One metal replacement window (only window visible during survey) is located at the second-floor, center of the western elevation. With the exception of one modern entry door at the southern end of the western elevation, all doors appear to be original wood doors including four large sliding garage doors, though it appears at least one of these garage doors no longer functions, as an entry door has been cut into it.
Major Bibliographic References:	Artifacts Consulting, Inc. 2011 1514 Fairview Ave. E. - Historic Property Inventory Form. On file, DAHP, Olympia.

Photos

Southwest Elevation
2013

West Elevation
2013

Northwest Elevation
2013

Historic Inventory Report

Location

Field Site No. DAHP No.

Historic Name:

Common Name:

Property Address: 1514 Fairview Ave E, Seattle, WA 98102

Comments:

Tax No./Parcel No. 210770-0270

Plat/Block/Lot

Acreage

Supplemental Map(s)

Township/Range/EW	Section	1/4 Sec	1/4 1/4 Sec	County	Quadrangle
T25R04E	20			King	SEATTLE NORTH

Coordinate Reference

Easting: 1190043

Northing: 843837

Projection: Washington State Plane South

Datum: HARN (feet)

Identification

Survey Name: Fairview Ave. Bridge Project

Date Recorded: 12/09/2013

Field Recorder: Erin Claussen

Owner's Name: Lake Union Dry Dock Co.

Owner Address: 1514 Fairview Ave. East

City: Seattle State: WA Zip: 98102

Classification: Building

Resource Status: Survey/Inventory

Comments:

Within a District? No

Contributing? No

National Register:

Local District:

National Register District/Thematic Nomination Name:

Eligibility Status: Not Determined - SHPO

Determination Date: 1/1/0001

Determination Comments:

Historic Inventory Report

Description

Historic Use: Commerce/Trade - Business

Current Use: Commerce/Trade - Business

Plan: Rectangle

Stories: 2

Structural System: Unknown

Changes to Plan: Intact

Changes to Interior: Unknown

Changes to Original Cladding: Intact

Changes to Windows: Moderate

Changes to Other: Slight

Other (specify):

Style:	Cladding:	Roof Type:	Roof Material:
Other - Industrial	Wood - Vertical	Shed	Unknown

Foundation:	Form/Type:
Unknown	Industrial

Narrative

Study Unit	Other

Date of Construction: 1943 Built Date

Builder:

Engineer:

Architect:

Property appears to meet criteria for the National Register of Historic Places: Yes

Property is located in a potential historic district (National and/or local): No

Property potentially contributes to a historic district (National and/or local): No

Statement of Significance:	This property was evaluated at the reconnaissance level in a cultural resources survey completed Seattle Department of Transportation (SDOT)'s proposed Fairview Ave. N. Bridge Project in the City of Seattle, King County, Washington. Although the property was recorded on a Historic Property Inventory Form in 2011 (Artifacts Consulting 2011), this was done at the informational-only level and no recommendation of National Register eligibility was provided. This form is being prepared to provide an eligibility recommendation per DAHP requirements and to record the building at a reconnaissance level. The building was constructed in 1943 according to the King County Assessor. The original architect, builder and occupant are unknown, although the King County Assessor lists the owner as the Lake Union Dry Dock Co., suggesting that the building was originally associated with this still extant company/complex of structures located directly across Fairview Ave. East. It would appear that most elements of the building's exterior are original. Exceptions include a second-floor window at the center of the western elevation of the structure and an entry door at the southern end of the western elevation. In light of these minor alterations, the building's integrity is considered very good. With its shed roof and large sliding garage doors/sliding garage door bays (it is clear at least one door no longer functions), the building exhibits elements of the Industrial Vernacular style. Alone it does not appear to embody stylistic characteristics or a method of construction that would warrant special recognition. However if an original association with the Lake Union Dry Dock Company could be determined, it may be considered eligible for listing in the NRHP. The Lake Union Dry Dock Company was determined NRHP eligible in 1998 under Criteria A due to its prominence in early maritime industry on Lake Union, its role in shipbuilding as related to important twentieth century political, social and economic events including Prohibition and WWII, and its status as one of the oldest continuous commercial ventures in Seattle.
Description of Physical Appearance:	Built in 1943, the building at 1514 Fairview Ave. East is a two-story wood frame commercial building with a rectangular plan, shed (half-gabled) roof with moderate eaves at the front (west) and side (north and south) elevations. Cladding is board on board vertical wood siding with rectangular wood paneling also present at the southern elevation. Siding on front (western) elevation is unpainted. Siding on side (north) elevation is whitewashed. One metal replacement window (only window visible during survey) is located at the second-floor, center of the western elevation. With the exception of one modern entry door at the southern end of the western elevation, all doors appear to be original wood doors including four large sliding garage doors, though it appears at least one of these garage doors no longer functions, as an entry door has been cut into it.
Major Bibliographic References:	Artifacts Consulting, Inc. 2011 1514 Fairview Ave. E. - Historic Property Inventory Form. On file, DAHP, Olympia.

Photos

Southwest Elevation
2013

West Elevation
2013

Northwest Elevation
2013

Historic Inventory Report

Location

Field Site No. DAHP No.

Historic Name: Washington Laundry Company

Common Name: 1165 Eastlake Ave. East

Property Address: 1165 Eastlake Ave E, Seattle, WA 98109

Comments:

Tax No./Parcel No. 216390-0955

Plat/Block/Lot

Acreage

Supplemental Map(s)

Township/Range/EW	Section	1/4 Sec	1/4 1/4 Sec	County	Quadrangle
T25R04E	29			King	SEATTLE NORTH

Coordinate Reference

Easting: 1189687

Northing: 843038

Projection: Washington State Plane South

Datum: HARN (feet)

Identification

Survey Name: Fairview Ave. Bridge Project

Date Recorded: 12/09/2013

Field Recorder: Erin Claussen

Owner's Name: ARE Seattle No 12 LLC

Owner Address: 1165 Eastlake Ave. E.

City: Seattle State: WA Zip: 98109

Classification: Building

Resource Status: Survey/Inventory

Comments:

Within a District? No

Contributing? No

National Register:

Local District:

National Register District/Thematic Nomination Name:

Eligibility Status: Not Determined - SHPO

Determination Date: 1/1/0001

Determination Comments:

Historic Inventory Report

Description

Historic Use: Commerce/Trade - Business

Current Use: Commerce/Trade - Professional

Plan: L-Shape

Stories: 4

Structural System: Concrete - Reinforced Concrete

Changes to Plan: Intact

Changes to Interior: Unknown

Changes to Original Cladding: Intact

Changes to Windows: Moderate

Changes to Other: Moderate

Other (specify):

Style:	Cladding:	Roof Type:	Roof Material:
Other - Industrial Modern	Veneer - Stucco	Flat with Parapet	Unknown

Foundation:	Form/Type:
Concrete - Poured	Commercial

Narrative

Study Unit

Other

Date of Construction: 1909 Built Date
1946 Remodel

Builder:

Engineer:

Architect:

Property appears to meet criteria for the National Register of Historic Places:Yes

Property is located in a potential historic district (National and/or local): No

Property potentially contributes to a historic district (National and/or local): No

Statement of Significance:	This property was evaluated at the reconnaissance level in a cultural resources assessment completed for the Seattle Department of Transportation (SDOT)'s proposed Fairview Ave. N. Bridge Project in the City of Seattle, King County, Washington. Although the property was previously recorded on a Historic Property Inventory (HPI) Form (year unknown), no recommendation of National Register Eligibility was provided at that time. This updated form is being prepared to provide an eligibility recommendation per DAHP requirements and to document at the reconnaissance level any alterations that may have occurred since the earlier form. The building was constructed in 1909 according to the King County Assessor. The original occupant was the Washington Laundry Company, but the original architect and builder are unknown. The earlier HPI states that the building was altered extensively in a 1946 remodel, particularly the Eastlake elevation. Changes included the removal of several bays of windows and their replacement with a panel of glass blocks which is still present today. Six sloping piers which frame the windows and doors at the Eastlake elevation were also added at this time and are also still present. A smokestack once sat atop the building, similar to those on the adjacent Lake Union Steam Plant, and may have been removed at this time. The architect for this remodel was George W. Stoddard and Associates. George W. Stoddard was a prolific Seattle architect from the 1920s through the 1950s. The remodel of the Washington Laundry Company building coincides with and reflects Stoddard's post-WWII embrace of modernism (DAHP n.d.). The building has seen some less extensive alterations since, namely newer entrances at the Eastlake elevation, and the replacement of some windows throughout. The Fairview Ave. elevation retains more of the feeling of the original 1909 building with bays of three pane high and four pane wide, early (though not original), horizontal pivoting (middle row of panes), metal-frame windows still present. Three of the bays at the top floor of the portion of the building that abuts Fairview Ave. have modern replacement windows in place. In light of the alterations, the building's integrity is considered fair in reference to both its original design and its 1946 Stoddard and Associates remodel. The building exhibits some elements of the commercial/industrial modern style. Given the building's direct link to the early 1900s industrial development of the South Lake Union area and its status as one of the few surviving structures from this era coupled with its association with renown Seattle architect George W. Stoddard and its exemplification of his shift to a purely modern design aesthetic, the building appears to be eligible for listing in the NRHP based on Criteria A and C. At the time of this inventory, documents on file with the Seattle Department of Planning and Development indicate that plans are in place for the demolition and replacement of the Washington Laundry Company building with a mixed-use structure.
Description of Physical Appearance:	Built in 1909, the building at 1165 Eastlake Ave. E. is a four-story (two below grade at the Eastlake Ave. elevation, all above at the Fairview Ave. elevation) commercial building with an L-shaped plan, flat roof, and flat parapet. Cladding is stucco. The building underwent an extensive remodel in 1946, designed by Seattle firm George W. Stoddard and Associates. The Eastlake Ave. elevation of the building retains many features of this modernistic remodel while the Fairview Ave. elevation retains the feel of the original early 1900s structure with bays of three pane high and four pane wide, early (though not original), horizontal pivoting (middle row of panes), metal-frame windows. The three bays at the top floor of the portion of the building that abuts Fairview Ave. have modern replacement windows in place. Some other windows throughout the building are also modern replacements. The Eastlake Ave. elevation features newer entrances.

Major Bibliographic References:	DAHP n.d. George W. Stoddard. Electronic document, http://www.dahp.wa.gov/learn-and-research/architect-biographies/george-w, accessed January 2, 2014. Unknown n.d. 1165 East Lake Ave. East, Washington Laundry Company – Historic Property Inventory Form. On file, DAHP, Olympia.

Photos

Southeast Elevation
2013

East Elevation
2013

Northeast Elevation
2013

Northwest Elevation
2013

Southwest Elevation
2013

Historic Inventory Report

Location

Field Site No. **DAHP No.**

Historic Name: Fairview Avenue North - East Bridge

Common Name: Fairview Avenue North - East Bridge

Property Address: - Fairview Avenue North, Seattle, WA

Comments:

Tax No./Parcel No.

Plat/Block/Lot

Acreage

Supplemental Map(s)

Township/Range/EW	Section	1/4 Sec	1/4 1/4 Sec	County	Quadrangle
T25R04E	29			King	SEATTLE NORTH

Coordinate Reference

Easting: 1189789

Northing: 843278

Projection: Washington State Plane South

Datum: HARN (feet)

Identification

Survey Name: Fairview Avenue North Bridges **Date Recorded:** 11/21/2011

Field Recorder: Bryan Hoyt

Owner's Name: Seattle Department of Transportation

Owner Address: PO Box 34996

City: Seattle **State:** WA **Zip:** 98124-4996

Classification: Structure

Resource Status: **Comments:**

Survey/Inventory

Within a District? No

Contributing? No

National Register:

Local District:

National Register District/Thematic Nomination Name:

Eligibility Status: Not Determined - SHPO

Determination Date: 1/1/0001

Determination Comments:

Historic Inventory Report

Description

Historic Use: Transportation - Road-Related (vehicular)
Current Use: Transportation - Road-Related (vehicular)

Plan: Rectangle
Stories: N/A
Structural System: Concrete - Reinforced Concrete

Changes to Plan: Not Applicable
Changes to Interior: Not Applicable

Changes to Original Cladding: Not Applicable
Changes to Windows: Not Applicable

Changes to Other: Slight

Other (specify): The wooden handrails and guardrails were replaced in 1988; seismic retrofitting occurred in 1993-1995.

Style:	Cladding:	Roof Type:	Roof Material:
None	None	None	None

Foundation:	Form/Type:
None	Bridge - Pre-stressed Concrete

Narrative

Study Unit	Other
Transportation	

Date of Construction: 1963 Built Date

Builder: Unknown

Engineer: Carl M. West

Architect: N/A

Property appears to meet criteria for the National Register of Historic Places: No

Property is located in a potential historic district (National and/or local): No

Property potentially contributes to a historic district (National and/or local): No

Statement of Significance:

This property was evaluated at a reconnaissance level during a cultural resources survey completed for the Seattle Department of Transportation (SDOT). The existing East Bridge was built in 1963 and is a replacement of an earlier trestle bridge previously constructed at this location (reference to the former East trestle bridge can be found on improvement plans for the West Bridge prepared in 1923). Sawed pilings visible beneath the East Bridge are likely associated with the original trestle foundations (Photo 5). The property has been evaluated according to the eligibility criteria for listing in the National Register of Historic Places (NRHP). The East Bridge will meet the minimum age requirement for historic properties in 2013. Reconnaissance-level research did not identify W. T. Robertson or Carl M. West as notable for their contributions to the science of civil engineering, nor are they associated with other historical or architecturally significant structures. The East Bridge of Fairview Avenue North does not appear to embody architectural design characteristics or methods of construction that would warrant special recognition, and it is not located in a cohesive neighborhood or grouping.

This portion of Fairview Avenue North was originally named Southlake Avenue (Baist Map Company 1912; Kroll Map Company 1920; Sanborn 1905, 1917). It was an elevated route (above Lake Union) which passed in front of wharves and commercial buildings such as the Washington Laundry Company (built 1909) at 1165 Eastlake Avenue North and the Seattle City Light and Power's Lake Union Hydroelectric House (built 1912) at 1241 Eastlake Avenue North. City of Seattle ordinances indicate efforts were underway to construct a bridge along this part of Fairview Avenue North beginning in 1913 and continuing through 1915 (Ordinance No. 31471, 32538, 33032, 33633, 34922). As early as 1917 a wooden piling trestle bridge existed along the eastern side of Fairview Avenue North directly in front of the Washington Laundry Company and the Hydroelectric House (Photo 6). By 1923 two wooden piling trestle bridges were located along Fairview Avenue North, built in parallel with a 3' wide gap between.

In 1962-1963 the existing eastern wooden piling bridge was removed and the current concrete piling bridge was built in its place (Photos 7, 8). Engineering plans for the 1963 East Bridge were drawn by W. T. Robertson with Carl M. West as supervising bridge engineer. During construction, the wooden handrails on the east side of the sidewalk were replaced with a metal handrail along the length of the bridge, but not at the approaches. The handrails at the approaches were eventually replaced in 1988 with the current steel pipe handrails (Photos 1, 3). The current metal traffic guardrail was also installed in 1988, replacing the wooden traffic curb along the west side of the sidewalk (Photo 1). In 1993-1995 the East Bridge underwent seismic retrofitting.

Description of Physical Appearance:

Fairview Avenue North consists of two bridges built in parallel. The northbound lanes are known as the East Bridge and southbound lane as the West Bridge. The bridges pass directly in front of the historic Seattle City Light and Power's Lake Union Steam Plant and the Washington Laundry Company building. The East Bridge of Fairview Avenue North currently carries two northbound traffic lanes (Photos 1-5). It features a concrete deck on concrete pile supports which span Lake Union. The East Bridge is 481' long and 33' 7" wide. The widths of the northbound traffic lanes are 10' 9" wide and 10' wide. The East Bridge shares a median (7' 3" wide) with the West Bridge and includes a raised sidewalk (8' wide) on the east side. The superstructure consists of 32' long prestressed concrete girders spaced 5' 6" apart. The concrete deck slab measures 5 ¾" thick and is supported by concrete bents 32' apart with four 18" diameter prestressed concrete piles at most bents. Improvements to the East Bridge include handrail replacement in 1988 and seismic retrofitting in 1993-1995.

Major Bibliographic References:

Baist Map Company

1912 Surveys of Seattle. On file, Seattle Public Library.

Kroll Map Company

1920 Atlas of King County. Kroll Map Company, Seattle. On file, Seattle Public Library.

Sanborn Map Company

1905 Seattle, Vol. III, Sheets 329 and 334. On file, Seattle Public Library.

1917 1905 Seattle corrected to 1917, Vol. IV, Sheets 443, 450, 492. On file, Seattle Public Library.

1950 1905 Seattle corrected to 1950, Vol. IV, Sheets 443, 447, 450, 492. On file, Seattle Public Library.

Photos

Photo 1. The wider-gauge traffic guardrail on the west side of the sidewalk is from the 1988 improvements. This southern-most portion of the handrail on the east side of the sidewalk is also part of the 1988 improvements.
View to the north, showing the two northbound lanes of the East Bridge and raised sidewalk.
2011

Photo 2. Note the reflection on the water below and pipes leading from the Steam Plant. The sidewalk handrail seen here is from the 1963 design and is based on Standard Bridge Railing Type 3-A.
View to the south, showing the proximity to the Steam Plant.
2011

Photo 3. The southern portion (left frame) dates to the 1988 improvements, while the northern portion (right frame) dates to the 1963 design.
View to the west, showing the east sidewalk railing of the East Bridge.
2011

Photo 4. Detail of date inscription (1964) on south end of sidewalk (east side); this sidewalk handrail style is part of the 1963 design and is based on Standard Bridge Railing Type 3-A.
View to the east from sidewalk.
2011

Photo 5. The concrete supports from the 1963 bridge and sawed timber piles from the previous (c. 1917) bridge.
View to the north under the East Bridge.
2011

Photo 6. This shows the pilings and cross-beam supports for the original East Bridge (Seattle Municipal Archives Photograph No. 1364).
View to the southwest during expansion of the Steam Plant.
1917

Photo 7. The wooden handrail and traffic curb date to the earlier (c.1917) bridge at this location. This handrail was replaced in 1963 except at the approaches. The traffic curb was replaced in 1988 (Seattle Municipal Archives Photograph No. 70915).
View to the north of the East Bridge sidewalk and traffic curb in 1962 during construction.
1962

Photo 8. The wooden handrail and traffic curb date to the earlier (c.1917) bridge at this location. This handrail was replaced in 1963 except at the approaches. The traffic curb was replaced in 1988 (Seattle Municipal Archives Photograph No. 70916).
View to the south of the East Bridge sidewalk in 1962 during construction.
1962

Historic Inventory Report

Location

Field Site No. **DAHP No.**

Historic Name: Fairview Avenue North - West Bridge

Common Name: Fairview Avenue North - West Bridge

Property Address: - Fairview Avenue North, Seattle, WA

Comments:

Tax No./Parcel No.

Plat/Block/Lot

Acreage

Supplemental Map(s)

Township/Range/EW	Section	1/4 Sec	1/4 1/4 Sec	County	Quadrangle
T25R04E	29			King	SEATTLE NORTH

Coordinate Reference

Easting: 1189755

Northing: 843278

Projection: Washington State Plane South

Datum: HARN (feet)

Identification

Survey Name: Fairview Avenue North Bridges **Date Recorded:** 11/21/2011

Field Recorder: Bryan Hoyt

Owner's Name: Seattle Department of Transportation

Owner Address: PO Box 34996

City: Seattle **State:** WA **Zip:** 98124-4996

Classification: Structure

Resource Status: **Comments:**

Survey/Inventory

Within a District? No

Contributing? No

National Register:

Local District:

National Register District/Thematic Nomination Name:

Eligibility Status: Not Determined - SHPO

Determination Date: 1/1/0001

Determination Comments:

Historic Inventory Report

Description

Historic Use: Transportation - Road-Related (vehicular)
Current Use: Transportation - Road-Related (vehicular)
Plan: Rectangle
Stories: N/A
Structural System: Concrete - Reinforced Concrete
Changes to Plan: Not Applicable
Changes to Interior: Not Applicable
Changes to Original Cladding: Not Applicable
Changes to Windows: Not Applicable
Changes to Other: Slight
Other (specify): The wooden handrails and guardrails were replaced in 1988; seismic retrofitting occurred in 1993-1995.

Style:	Cladding:	Roof Type:	Roof Material:
None	None	None	None

Foundation:	Form/Type:
None	Bridge

Narrative

Study Unit	Other
Transportation	

Date of Construction: 1948 Built Date
Builder: Unknown
Engineer: H. T. D.
Architect: N/A

Property appears to meet criteria for the National Register of Historic Places: No
Property is located in a potential historic district (National and/or local): No
Property potentially contributes to a historic district (National and/or local): No

Statement of Significance:

This property was evaluated at a reconnaissance level during a cultural resources survey completed for the Seattle Department of Transportation (SDOT). The existing West Bridge was built in 1948 and is a replacement of an earlier trestle bridge previously constructed at this location (details of the former bridge can be found on improvement plans for the West Bridge prepared in 1923). It is unknown if the original trestle piling foundations were removed, or remain beneath the existing bridge. The property has been evaluated according to the eligibility criteria for listing in the National Register of Historic Places (NRHP). Reconnaissance-level research did not find W. S. Joseph or H. T. D. to be notable for their contributions to the science of civil engineering, nor are they associated other historical or architecturally significant structures. Although the West Bridge meets the 50 year minimum age threshold for historic properties, it does not appear to embody architectural design characteristics or methods of construction that would warrant special recognition, and it is not located in a cohesive neighborhood or grouping.

This portion of Fairview Avenue North was originally named Southlake Avenue (Baist Map Company 1912; Kroll Map Company 1920; Sanborn 1905, 1917). It was an elevated route (above Lake Union) which passed in front of wharves and commercial buildings such as the Washington Laundry Company (built 1909) at 1165 Eastlake Avenue North and the Seattle City Light and Power's Lake Union Hydroelectric House (built 1912) at 1241 Eastlake Avenue North. City of Seattle ordinances indicate efforts were underway to construct a bridge along this part of Fairview Avenue North beginning in 1913 and continuing through 1915 (Ordinance No. 31471, 32538, 33032, 33633, 34922). As early as 1917 a wooden piling trestle bridge existed along the eastern side of Fairview Avenue North (directly in front of the Washington Laundry Company and the Hydroelectric House).

By 1923 two wooden piling trestle bridges were located along Fairview Avenue North, built in parallel with a 3' wide gap between (Photo 6). Engineering plans improvements to the 1924 West Bridge were drawn by W. S. Joseph of the Seattle Engineering Department and show the addition of planking on the approaches and resurfacing with asphalt concrete. In 1948 the West Bridge was improved upon again, however these improvements essentially resulted in the removal and rebuilding of many of the bridge's defining elements. The improved 1948 bridge was also a timber trestle design with supports consisting of five pilings and cross-braces per bent (Photos 7-9). Plans for the 1948 improvements were drawn by "H.T.D." who is assumed to have been a staff engineer with the City of Seattle. Later improvements to the West Bridge include replacement of the handrail/bicycle rail in 1988 and seismic retrofitting in 1993-1995. The original wooden guardrails were removed from the western (Lake Union) side and replaced by the current pipe railings.

Description of Physical Appearance:

Fairview Avenue North consists of two bridges built in parallel. The northbound lanes are known as the East Bridge and southbound lane as the West Bridge. The bridges pass directly in front of the historic Seattle City Light and Power's Lake Union Steam Plant and the Washington Laundry Company building. The West Bridge of Fairview Avenue North currently carries a southbound traffic lane and a pedestrian/bike lane (Photos 1-5). It features a concrete deck on timber pile supports which span Lake Union. The bridge is 405' long and 26' 6" wide. The West Bridge's reinforced concrete deck consists of a 10" thick longitudinal slab that spans between bents spaced at 16 feet. Each bent comprises five timber piles, with the outer piles battered outward. Pilings feature 4' x 8' plank cross bracing. Engineering plans from 1948 note these pilings were treated with creosote. These piles are partially inundated under normal lake levels. Improvements to the West Bridge include rail replacement in 1988 and seismic retrofitting in 1993-1995.

Major Bibliographic References:

Baist Map Company

1912 Surveys of Seattle. On file, Seattle Public Library.

Kroll Map Company

1920 Atlas of King County. Kroll Map Company, Seattle. On file, Seattle Public Library.

Sanborn Map Company

1905 Seattle, Vol. III, Sheets 329 and 334. On file, Seattle Public Library.

1917 1905 Seattle corrected to 1917, Vol. IV, Sheets 443, 450, 492. On file, Seattle Public Library.

1950 1905 Seattle corrected to 1950, Vol. IV, Sheets 443, 447, 450, 492. On file, Seattle Public Library.

Photos

Photo 1. Building on the far right is the Lake Union Steam Plant. Railing on the left is from the 1988 improvements.
View to the north, showing the pedestrian/bicycle lane and single vehicle lane of the West Bridge (left) and double vehicle lanes of the East Bridge (right).
2011

Photo 2. Note the West Bridge's timber piling supports behind the chain-link fence.
View to the north, showing the bridge in relationship to Lake Union.
2011

Photo 3. View to the north, showing the cross beams and timber piling supports of the West Bridge.
2011

Photo 4. Note the timber pilings and cross-bracing; concrete piling bents for the East Bridge are visible in the background.
View to the east showing a typical bent of the West Bridge.
2011

Photo 5. View to the north showing the timber piling supports for the West Bridge; a concrete support for the East Bridge is visible in the foreground.
2011

Photo 6. Note the original timber trestle supports and the gap between the West and East Bridges (Seattle Municipal Archives Photograph No. 57503).
View to the south showing paving of the original West Bridge in 1924.
1924

Photo 7. Note original wooden guardrails.
View to the south of the East and West Fairview Avenue Bridges (Seattle Municipal Archives Photograph No. 41303).
1948

Photo 8. View to the north; note original wooden guardrail and timber supports (Seattle Municipal Archives Photograph No. 41304).
1948

Photo 9. View to the north, note timber supports (Seattle Municipal Archives Photograph No. 41305).
1948

Historic Inventory Report

Location

Field Site No. DAHP No.

Historic Name: Steinhart, Theriault and Anderson Building

Common Name: 1264 Eastlake Ave. East

Property Address: 1264 Eastlake Ave E, Seattle, WA 98102

Comments:

Tax No./Parcel No. 286960-0125

Plat/Block/Lot

Acreage

Supplemental Map(s)

Township/Range/EW	Section	1/4 Sec	1/4 1/4 Sec	County	Quadrangle
T25R04E	29			King	SEATTLE NORTH

Coordinate Reference

Easting: 1190269

Northing: 843625

Projection: Washington State Plane South

Datum: HARN (feet)

Identification

Survey Name: Fairview Ave. Bridge Project

Date Recorded: 12/09/2013

Field Recorder: Erin Claussen

Owner's Name: 1264 Properties LLC

Owner Address: 1264 Eastlake Ave. East

City: Seattle State: WA Zip: 98102

Classification: Building

Resource Status: Survey/Inventory

Comments:

Within a District? No

Contributing? No

National Register:

Local District:

National Register District/Thematic Nomination Name:

Eligibility Status: Not Determined - SHPO

Determination Date: 1/1/0001

Determination Comments:

DEPARTMENT OF ARCHAEOLOGY & HISTORIC PRESERVATION
Protect the Past, Shape the Future

Historic Inventory Report

Description

Historic Use: Commerce/Trade - Professional

Current Use: Commerce/Trade - Business

Plan: Square

Stories: 1

Structural System: Steel

Changes to Plan: Intact

Changes to Interior: Unknown

Changes to Original Cladding: Intact

Changes to Windows: Intact

Changes to Other: Intact

Other (specify):

Style:	Cladding:	Roof Type:	Roof Material:
Modern - International Style	Glass	Flat with Parapet	Unknown

Foundation:	Form/Type:
Concrete - Poured	Commercial

Narrative

Study Unit: Other

Date of Construction: 1956 Built Date

Builder:

Engineer:

Architect: Steinhart, Theriault and Anderson

Property appears to meet criteria for the National Register of Historic Places: Yes

Property is located in a potential historic district (National and/or local): No

Property potentially contributes to a historic district (National and/or local): No

Statement of Significance:

This property was evaluated at the reconnaissance level in a cultural resources survey completed Seattle Department of Transportation (SDOT)'s proposed Fairview Ave. N. Bridge Project in the City of Seattle, King County, Washington. The property was recorded on a Historic Property Inventory (HPI) Form in 2003 (Forsman 2003). It was also determined eligible for listing on the National Register of Historic Places in 2003. This form is being prepared to confirm this determination and to document at the reconnaissance level any alterations that may have occurred since the earlier form.

The Steinhart, Theriault and Anderson (STA) Building was constructed in 1956 according to the King County Assessor. The original occupant was the Steinhart, Theriault and Anderson architectural firm who also designed the building. The building is a classic early example of the International Style. This modern aesthetic, regionally known as Northwest Modernism, would be widely adopted in post-World War II Seattle. Steinhart, Theriault and Anderson designed prolifically in Seattle in the International Style from the 1950s through the 1970s, specializing in institutional, religious and commercial buildings (Forsman 2003). The STA Building exhibits nearly perfect integrity, having seen virtually no changes to its exterior elements since construction. As stated, the STA Building was determined NRHP eligible in 2003 under Criteria C due to its association with the Post World War II modern architecture movement, specifically the International Style, in Seattle, the Northwest, nation, and world.

Description of Physical Appearance:	Built in 1956, the Steinhart Theriault and Anderson (STA) Building at 1264 Eastlake Avenue East is a single-story, cantilevered glass box/steel frame building with a rectangular plan, flat roof, and flat parapet. The southern elevation is clad in vertical redwood siding. A screen of redwood strips screens a covered balcony and floor-to-ceiling windows at the western elevation. The northern elevation features uncovered floor-to-ceiling windows with the screen resuming at the eastern end. The eastern elevation features the same screen and covered balcony configuration as the western. The foundation is faced in natural stone. The STA Building exhibits nearly perfect integrity, having seen virtually no changes to its exterior elements since construction.
Major Bibliographic References:	Forsman, Leonard A. 2003 1264 Eastlake Ave. E. - Historic Property Inventory Form. On file, DAHP, Olympia.

Photos

Southwest Elevation
2013

North Elevation
2013

Northeast Elevation
2013

Historic Inventory Report

Location

Field Site No. DAHP No.

Historic Name:

Common Name: 1262 Eastlake Ave. East

Property Address: 1262 Eastlake Ave E, Seattle, WA 98102

Comments:

Tax No./Parcel No. 286960-0120

Plat/Block/Lot

Acreage

Supplemental Map(s)

Township/Range/EW	Section	1/4 Sec	1/4 1/4 Sec	County	Quadrangle
T25R04E	29			King	SEATTLE NORTH

Coordinate Reference

Easting: 1190260

Northing: 843572

Projection: Washington State Plane South

Datum: HARN (feet)

Identification

Survey Name: Fairview Ave. Bridge Project Date Recorded: 12/09/2013

Field Recorder: Erin Claussen

Owner's Name: B&BB Properties LLC

Owner Address: 1262 Eastlake Ave. East

City: Seattle State: WA Zip: 98102

Classification: Building

Resource Status: Comments:
Survey/Inventory

Within a District? No

Contributing? No

National Register:

Local District:

National Register District/Thematic Nomination Name:

Eligibility Status: Not Determined - SHPO

Determination Date: 1/1/0001

Determination Comments:

Historic Inventory Report

Description

Historic Use: Domestic - Multiple Family House

Current Use: Domestic - Multiple Family House

Plan: Rectangle

Stories: 2

Structural System: Unknown

Changes to Plan: Intact

Changes to Interior: Unknown

Changes to Original Cladding: Extensive

Changes to Windows: Extensive

Changes to Other: Moderate

Other (specify):

Style:	Cladding:	Roof Type:	Roof Material:
Greek Revival	Veneer - Vinyl Siding	Gable - Gable-on-Hip	Unknown

Foundation:	Form/Type:
Unknown	Multi-Family - Multi-Story Apartment Block

Narrative

Study Unit

Other

Date of Construction: 1909 Built Date

Builder:

Engineer:

Architect:

Property appears to meet criteria for the National Register of Historic Places: No

Property is located in a potential historic district (National and/or local): No

Property potentially contributes to a historic district (National and/or local): No

Statement of Significance:

This property was evaluated at the reconnaissance level in a cultural resources survey completed Seattle Department of Transportation (SDOT)'s proposed Fairview Ave. N. Bridge Project in the City of Seattle, King County, Washington. Although the property was recorded on a Historic Property Inventory Form in 2011 (Artifacts Consulting 2011), this was done at the informational-only level and no recommendation of National Register eligibility was provided. This form is being prepared to provide an eligibility recommendation per DAHP requirements and to record the building at a reconnaissance level.

1262 Eastlake Ave. East is a multi-family dwelling constructed in 1909, according to the King County Assessor. The original architect and builder are unknown. The building's exterior has seen extensive replacement of materials including the cladding, which is currently vinyl siding, and windows, which are metal frame. The full-width, two-story wood porch, which spans the south elevation of the structure, is likely an original element (though probably rebuilt). Its roof consists of the eave overhang of the main structure's roof, and it appears that it also facilitates entry to second floor apartments. Because of these alterations, the building's integrity is considered fair. With its full-width porch and hipped roof, the building exhibits some elements of the Greek Revival style. However, it does not appear to embody stylistic characteristics or a method of construction that would warrant special recognition and it is not located in a cohesive grouping of similar building types. Therefore the property does not appear eligible for listing in the NRHP based upon its architectural qualities or associations.

Description of Physical Appearance:	Built in 1909, the building at 1262 Eastlake Ave. East is a two-story, wood frame, multi-family dwelling with a rectangular plan and low-pitched gable-on-hip roof with a moderate eave on the north and west elevations (east elevation not visible during reconnaissance). A full-width, two-story porch spans the south elevation, the roof of which consists of an extended eave overhang. Cladding is vinyl siding and windows are metal replacement. The full-width, two-story wood porch, which spans the south elevation of the structure, is likely an original element (though probably rebuilt).
Major Bibliographic References:	Artifacts Consulting, Inc. 2011 1262 Eastlake Ave. East - Historic Property Inventory Form. On file, DAHP, Olympia.

Photos

Southwest Elevation
2013

Gable-on-Hip Detail
2013

Northwest Elevation
2013

DEPARTMENT OF ARCHAEOLOGY & HISTORIC PRESERVATION
Protect the Past, Shape the Future

Historic Inventory Report

Location

Field Site No. DAHP No.

Historic Name: Glenwood Apartments

Common Name: Villa Carmela

Property Address: 1258 Eastlake Ave E, Seattle, WA 98102

Comments:

Tax No./Parcel No. 286960-0111

Plat/Block/Lot

Acreage

Supplemental Map(s)

Township/Range/EW	Section	1/4 Sec	1/4 1/4 Sec	County	Quadrangle
T25R04E	29			King	SEATTLE NORTH

Coordinate Reference

Easting: 1190195

Northing: 843476

Projection: Washington State Plane South

Datum: HARN (feet)

Identification

Survey Name: Fairview Ave. Bridge Project

Date Recorded: 12/09/2013

Field Recorder: Erin Claussen

Owner's Name: Meddar Properties LLC

Owner Address: 1258 Eastlake Ave. E

City: Seattle State: WA Zip: 98102

Classification: Building

Resource Status: Survey/Inventory

Comments:

Within a District? No

Contributing? No

National Register:

Local District:

National Register District/Thematic Nomination Name:

Eligibility Status: Not Determined - SHPO

Determination Date: 1/1/0001

Determination Comments:

DEPARTMENT OF ARCHAEOLOGY & HISTORIC PRESERVATION
Protect the Past, Shape the Future

Historic Inventory Report

Description

Historic Use: Domestic - Multiple Family House

Current Use: Domestic - Multiple Family House

Plan: Rectangle

Stories: 3

Structural System: Unknown

Changes to Plan: Intact

Changes to Interior: Unknown

Changes to Original Cladding: Intact

Changes to Windows: Extensive

Changes to Other: Moderate

Other (specify): Doors

Style:	Cladding:	Roof Type:	Roof Material:
Spanish	Veneer - Stucco	Flat with Parapet	Unknown

Foundation:	Form/Type:
Unknown	Multi-Family - Multi-Story Apartment Block

Narrative

Study Unit

Other

Date of Construction: 1908 Built Date

Builder:

Engineer:

Architect:

Property appears to meet criteria for the National Register of Historic Places: No

Property is located in a potential historic district (National and/or local): No

Property potentially contributes to a historic district (National and/or local): No

Statement of Significance:

This property was evaluated at the reconnaissance level in a cultural resources assessment completed for the Seattle Department of Transportation (SDOT)'s proposed Fairview Ave. N. Bridge Project in the City of Seattle, King County, Washington. Although the property was previously recorded on a Historic Property Inventory (HPI) Form (n.a., n.d.), no recommendation of National Register Eligibility was provided at that time. This updated form is being prepared to provide an eligibility recommendation per DAHP requirements and to document at the reconnaissance level any alterations that may have occurred since the earlier form.

The structure at 1258 Eastlake Ave. East is an apartment building, constructed in 1908 according to the King County Assessor, known historically as the Glenwood Apartments and today as Villa Carmela. The original architect and builder are unknown. The exterior of the building appears to have been maintained in keeping with the building's Spanish style. It would appear that all windows and doors have been replaced, albeit in a sympathetic manner. Built into the hillside, the structure sits atop a garage that is at street level at the western (front) elevation. Gates at garage level and wrought metal fencing atop the garage as well as decorative tilework around an entry door to the garage appear to be modern. Despite these alterations, the building's integrity is considered good. However, it does not appear to embody stylistic characteristics or a method of construction that would warrant special recognition and it is not located in a cohesive grouping of similar building types. Therefore the property does not appear eligible for listing in the NRHP based upon its architectural qualities or associations.

Description of Physical Appearance:	Built in 1908, the building at 1258 Eastlake Ave. East is a three-story wood frame multi-family dwelling atop a street-level garage. It has a rectangular plan and flat roof with decorative parapet. The façade is symmetrical and appears to be two units wide. It features oriel-type bay windows toward the outer edges spanning the second and third floors. They are capped with red architectural shingled hipped roofs. A bracketed roof with the same red architectural shingles overhangs the front entry. A bracketed top window echoing the roof over the front entry and also with red architectural shingles is at the center of the façade at the third floor. Cladding is stucco. It would appear that all windows are new vinyl replacements and doors modern decorative steel. Gates at garage level and wrought metal fencing atop the garage as well as decorative tilework around an entry door to the garage appear to be modern.
Major Bibliographic References:	N.A. n.d. 1258 Eastlake Ave. East - Historic Property Inventory Form. On file, DAHP, Olympia.

Photos

Northwest Elevation
2013

West Elevation
2013

Northwest Elevation
2013

Historic Inventory Report

Location

Field Site No. DAHP No.

Historic Name:

Common Name: 1150 Eastlake Ave. East

Property Address: 1150 Eastlake Ave E, Seattle, WA 98109

Comments:

Tax No./Parcel No. 216390-1066

Plat/Block/Lot

Acreage

Supplemental Map(s)

Township/Range/EW	Section	1/4 Sec	1/4 1/4 Sec	County	Quadrangle
T25R04E	29			King	SEATTLE NORTH

Coordinate Reference

Easting: 1189731

Northing: 842822

Projection: Washington State Plane South

Datum: HARN (feet)

Identification

Survey Name: Fairview Ave. Bridge Project Date Recorded: 12/09/2013

Field Recorder: Erin Claussen

Owner's Name: ARE-Seattle No. 27 LLC

Owner Address: 1150 Eastlake Ave. E.

City: Seattle State: WA Zip: 98109

Classification: Building

Resource Status: Comments:
Survey/Inventory

Within a District? No

Contributing? No

National Register:

Local District:

National Register District/Thematic Nomination Name:

Eligibility Status: Not Determined - SHPO

Determination Date: 1/1/0001

Determination Comments:

Historic Inventory Report

Description

Historic Use: Industry/Processing/Extraction - Industrial Storage

Current Use: Industry/Processing/Extraction - Industrial Storage

Plan: Irregular

Stories: 2

Structural System: Concrete - Block

Changes to Plan: Intact

Changes to Interior: Unknown

Changes to Original Cladding: Intact

Changes to Windows: Moderate

Changes to Other: Moderate

Other (specify): Some windows and doors replaced

Style:	Cladding:	Roof Type:	Roof Material:
Other - Industrial	Shingle - Coursed	Flat with Parapet	Unknown
	Concrete - Block		
	Other		

Foundation:	Form/Type:
Concrete - Block	Industrial
Concrete - Poured	

Narrative

Study Unit	Other

Date of Construction: 1948 Built Date

Builder:

Engineer:

Architect:

Property appears to meet criteria for the National Register of Historic Places: No

Property is located in a potential historic district (National and/or local): No

Property potentially contributes to a historic district (National and/or local): No

Historic Inventory Report

Statement of Significance:

This property was evaluated at the reconnaissance level in a cultural resources survey completed Seattle Department of Transportation (SDOT)'s proposed Fairview Ave. N. Bridge Project in the City of Seattle, King County, Washington. Although the property was recorded on a Historic Property Inventory Form in 2011 (Artifacts Consulting 2011), this was done at the informational-only level and no recommendation of National Register eligibility was provided. This form is being prepared to provide an eligibility recommendation per DAHP requirements and to record the building at a reconnaissance level.
The building was constructed in 1948 according to the King County Assessor. The original architect, builder and occupant are unknown. It would appear that most elements of the building's exterior are original. An exception is the windows on the building's second story front (western) elevation which appear to have been replaced at some point. Double metal doors on the western elevation are also most likely not original. An attached garage at the southern end of the building appears to be an original part of the structure, but is fitted with a newer overhead door and entry door. The building's integrity is considered good, however its current condition is only fair. The building exhibits some elements of the commercial/industrial vernacular style, however it does not appear to embody stylistic characteristics or a method of construction that would warrant special recognition and it is not located in a cohesive grouping of similar building types. Therefore the property does not appear eligible for listing in the NRHP based upon its architectural qualities or associations.
At the time of this inventory, documents on file with the Seattle Department of Planning and Development indicate that plans are in place for the demolition and replacement of this structure.

Description of Physical Appearance:

Built in 1948, the building at 1150 Eastlake Ave. East is a two-story wood and concrete block frame industrial building with an irregular plan and flat roof with a parapet at the north elevation. Cladding is coursed painted or stained wood shingles at the front (western) and part of the southern elevation; painted concrete block on the side (north and south) elevations. There is also fiberglass or some other kind of composite paneling present on the south elevation. The windows on the building's second story front (western) elevation appear to have been replaced at some point. Windows on the first story front (western) elevation are wood frame; the sashes are possibly original though aluminum screens present in two upper sashes are likely a later addition. Double metal doors on the eastern elevation are also most likely not original. An attached garage at the southern end of the building is also concrete block and though it appears to be original to the structure, is fitted with a newer overhead door and entry door.

Major Bibliographic References:

Artifacts Consulting, Inc.

2011 1150 Eastlake Ave. E. - Historic Property Inventory Form. On file, DAHP, Olympia.

Photos

West Elevation
2013

Northwest Elevation
2014

Southwest Elevation
2013

APPENDIX C

XXXXXXXXXX

REDACTED

City of Seattle (SDOT)

REVISED DRAFT Noise and Vibration Discipline Report

Fairview Avenue North Bridge
Final Design & Environmental

August 2014

The Greenbusch Group, Inc.
1900 W Nickerson St, Ste 201
Seattle, WA 98119
1.855.476.2874 / 206.378.0569

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EXECUTIVE SUMMARY

The Fairview Avenue North Bridge Project ("Project") is part of the City of Seattle's Bridge Rehabilitation, Replacement and Seismic Retrofit Program funded by Bridging the Gap, a nine-year levy for transportation maintenance and improvement. The Project is also federally funded by the Highway Bridge Program funds.

This report provides an assessment of traffic noise, construction noise, and construction and vibration impacts at properties near the Project, based on methodologies defined by the Washington State Department of Transportation ("WSDOT") Traffic Noise Policy, Federal Highway Administration Construction Noise Handbook ("FHWA Handbook"), and Federal Transportation Administration Transit Noise and Vibration Impact Assessment document ("FTA Manual"). Mitigation recommendations are also presented for consideration to reduce or control noise and vibration impacts from the Project.

Traffic noise levels from the Project are not anticipated to present any impacts to nearby receivers, therefore noise abatement is not required. Construction noise emissions are expected to impact the closest buildings, ZymoGenetics and the Gunn Building (see Figure 2). However, identified noise impacts are moderate and mitigation of these impacts is feasible. Construction sound levels are expected to exceed nighttime City of Seattle Code limits, which would warrant a pursuit of a construction noise variance for nighttime work.

While construction vibration impacts are not commonly assessed for roadway projects, the proximity of vibration sensitive receivers, namely ZymoGenetics, a biotechnology research company, motivated an assessment of construction vibration impacts in accordance with guidance in the FTA Manual. The result of this analysis shows that construction vibration levels are likely to impact the ZymoGenetics facility, due to the nature of the long-term experiments being conducted in their facility. However, several mitigation measures are proposed to reduce this level of impact, including establishing construction vibration limits and monitoring vibration levels during construction.

Figure 1 – Vicinity Map

Source: King County GIS, Bing Maps

NOMENCLATURE

Noise

The auditory response to sound is a complex process that occurs over a wide range of frequencies and intensities. The Decibel level, or “dB,” is a form of shorthand that compresses this broad range of intensities into a convenient numerical scale. The decibel scale is logarithmic. For example, using the decibel scale, a doubling or halving of energy causes the sound level to change by 3 dB; it does not double or halve the perceived loudness as might be expected.

The minimum sound level variation perceptible to a human observer is generally around 3 dB. A 5-dB change is clearly perceptible, and an 8 to 10-dB change is associated with a perceived doubling or halving of loudness. Common sound pressure levels are reported in Table 2.1. Mathematical descriptors have been developed to provide better assessment of sounds that vary over time and the human response to them.

- A-weighted Decibel (dBA)

The human ear has a unique response to sound pressure. It is less sensitive to those sounds falling outside the speech frequency range. Sound level meters and monitors utilize a filtering system to approximate human perception of sound. Measurements made utilizing this filtering system are referred to as “A weighted” and are called “dBA”.

- Sound Pressure Level (SPL)

Sound pressure level correlates with what is heard by the human ear. SPL is defined as the squared ratio of the sound pressure with reference to 20 micropascal (μPa). Sound pressure is affected by distance, path, barriers, directivity, etc. All sound pressure levels referenced in this document utilize this reference pressure.

- Equivalent Sound Level (Leq)

Equivalent Sound Level is the A-weighted level of a constant sound having the same energy content as the actual time-varying level during a specified interval. The Leq is used to characterize complex, fluctuating sound levels with a single number. Typical intervals for Leq are hourly, daily and annually

- Maximum Sound Level (Lmax)

Lmax is the maximum recorded root mean square (rms) A-weighted sound level for a given time interval or event. Lmax can be defined for two time weightings, “slow” and “fast.” “Slow” uses 1-second time constant, and “fast” uses a 125-millisecond time constant. For transient events of very short duration, Lmax “fast” will be greater than Lmax “slow.” The Seattle Noise Control Code, SMC 25.08.165, requires the use of Lmax “fast”. When describing Lmax values over multiple time periods, an overall maximum (highest Lmax for all periods) or range in period Lmax values are often reported. Alternatively, the median periodic value also establishes typical Lmax values at a given location and is often a more representative single-value number that the overall maximum.

- Percent Sound Level (Ln)

Percent Sound Level is the sound level that is exceeded n percent of the time; for example, L08 is the level exceeded 8% of the time. L25 is the sound level exceeded 25% of the time. The percent sound level proposed for the Variance, L01, represents the level exceeded 1% of the time, or 36 seconds in an hourly period. This metric is very useful for identifying louder construction noise emissions with minimal influence of ambient conditions.

Vibration

- Peak Particle Velocity (PPV)

Peak Particle Velocity (PPV) describes the maximum instantaneous vibration velocity of a measurement surface within a specified time period. The value is expressed in inches-per-second and is commonly used to assess building damage from vibration. Values in this document refer to PPV values in 1/3 octave bands between 5 and 100 Hz.

- Vibration Velocity Level (VdB)

The Vibration Velocity Level (Lv) describes the maximum level of root-mean-square (RMS) vibration velocity of a measurement surface within a specified time period and frequency band. The value is expressed in decibels (VdB) referenced to 1 micro(μ)-inch per second and is commonly used to assess building occupant annoyance and equipment interference from vibration.

Table 1 – A-weighted Sound Levels of Common Sounds, dBA

Sound	Sound Level	Approximate Relative Loudness (compared to 60 dBA)
Jet Plane @ 100'	130	128
Rock Music with Amplifier	120	64
Thunder, Danger of Permanent Hearing Loss	110	32
Boiler Shop, Power Mower	100	16
Orchestral Crescendo at 25 feet	90	8
Busy Street	80	4
Interior of Department Store	70	2
Ordinary Conversation @ 3'	60	1
Quiet Car at Low Speed	50	1/2
Average Office	40	1/4
City Residence, Interior	30	1/8
Quiet Country Residence, Interior	20	1/16
Rustle of Leaves	10	1/32
Threshold of Hearing	0	1/64

Source: US Department of Housing and Urban Development, Aircraft Noise Impact Planning Guidelines for Local Agencies, November 1972.

INVENTORY OF NOISE AND VIBRATION SENSITIVE RECEIVERS

The Fairview Avenue North Bridge is located in an Industrial zone (IC-45). ZymoGenetics is located next to the bridge and is also zoned Industrial (IC-45). The properties located directly north are zoned Industrial. Apartments are located to the northeast and are zoned Commercial (C1-65). The properties to the south are all zoned Commercial (C2-40 and C2-65). Lake Union is to the West of the Project.

Noise and Vibration Sensitive Receivers

Representative noise sensitive receivers were selected based on proximity to the construction site and nighttime noise sensitivity. These locations were identified using King County iMap and a site walk of the Project area.

The three representative noise sensitive receivers were identified near the construction area. ZymoGenetics was selected due to its proximity to the Site, elevated level of sensitivity during daytime hours, and sensitivity of testing equipment used in their business. Equinox Apartments and Silver Cloud Inn were selected based on their nighttime noise sensitivity as well as proximity to the construction area. A map of the selected noise sensitive receivers is presented in Figure 2 and Photos 1, 2, and 3.

ZymoGenetics was identified as the dominant vibration sensitive receiver due to its proximity to the Site as well as the vibration sensitive laboratory equipment in use in the various labs. While properties listed in the Table above are identified as sensitive to vibration, the equipment in use at ZymoGenetics establishes the lowest threshold for determining vibration impact and therefore governs overall vibration impacts from the Project.

Figure 2 – Representative Noise Sensitive Receivers

Photos 1, 2, and 3 – ZymoGenetics, Equinox Apartments, and Silver Cloud Inn

MEASUREMENTS OF EXISITING NOISE AND VIBRATION CONDITIONS

Measurements were made at nearby noise and vibration sensitive receivers to document existing sound and vibration levels. These measurements were conducted between January 7, 2013 and February 25, 2013.

The following equipment was used during measurements of existing ambient noise and vibration, typical equipment setups are shown in Photos 4 and 5. All equipment was laboratory calibrated within 1 year of the measurement date. Field calibrations were also performed before and verified immediately after the measurements.

- Rion NL-32 sound level meter, baseline noise
- Rion NL-52 sound level meter, ambient noise
- Brüel and Kjær 2250, sound level analyzer, ambient noise and vibration
- Brüel and Kjær 2270, sound level analyzer, ambient noise and vibration
- Instantel Mini-Mate Pro IV vibration analyzer, ambient vibration
- PCB 393C accelerometer, ambient vibration
- Endevco 7707 accelerometer, ambient vibration

The results of the baseline sound level measurements show that average hourly exterior sound levels in the area surrounding the bridge range between 58 and 74 dBA (Leq) during the day and between 53 and 73 dBA (Leq) at night. Baseline sound level measurements made on floors 1 through 4 inside ZymoGenetics documented average daytime sound levels between 42 and 54 dBA during the day and between 30 and 57 dBA at night. Additional baseline noise measurement information is presented Table 2.

Baseline vibration measurements were made on all seven floors of the ZymoGenetics building, including both levels of the parking garage and one location in the ground near the existing bridge structure. Interior measurements show maximum vibration levels between 26 and 82 VdB at frequencies between 6.3 and 100 Hz and exterior levels between 25 and 75 VdB. Interior peak particle velocities reached 0.054 inches per second and exterior values were as high as 0.048 inches per second. Interior levels appeared to be governed by activities such as bus passbys, foot traffic, and equipment within the building, which contributed to interior levels being above exterior levels. Measurement results show that, within ZymoGenetics, the highest vibration levels occur in the vertical (Z) axis, which is typical response for a structure. Additional baseline vibration measurement information is presented in Table 3.

Photo 4 – Typical Ambient Noise Monitoring Station

Photo 5 – Typical Ambient Vibration Monitoring Station

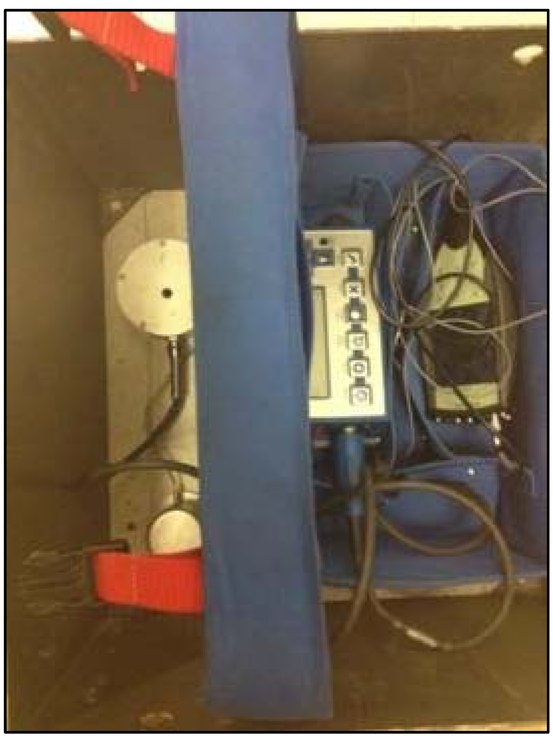


Table 2 – Existing Ambient Noise Conditions

Measurement Location	Daytime 7 a.m. – 10 p.m.		Nighttime 10 p.m. – 7 a.m.		Late-Nighttime Midnight – 5 a.m.	
	L_{eq}	L_{max}	L_{eq}	L_{max}	L_{eq}	L_{max}
ZymoGenetics – rooftop patio	62	74	58	68	56	67
ZymoGenetics – interior, floor 1	71	81	68	75	65	75
ZymoGenetics – interior, floor 2	69	79	65	72	63	72
ZymoGenetics – interior, floor 3	62	74	58	68	56	67
ZymoGenetics – interior, floor 4	71	81	68	75	65	75
Equinox Apartments – rooftop	69	79	65	72	63	72
Silver Cloud Inn – rooftop	62	74	58	68	56	67

Table 3 – Existing Ambient Vibration Conditions at ZymoGenetics

Measurement Location	Peak Particle Velocity. Inches per second			Highest RMS value, 6.3 – 100 Hz, VdB
	Longitudinal (X)	Transverse (Y)	Vertical (Z)	
Outside	0.048	0.038	0.043	75
Lower Parking Level	0.008	0.007	0.012	68
Floor 1	0.020	0.008	0.054	82
Floor 2	0.007	0.005	0.041	75
Floor 3	0.006	0.005	0.024	74
Floor 4 Laboratory	0.008	0.006	0.040	75
Floor 4 Hallway	0.009	0.004	0.025	70

SPECIAL MEASUREMENTS RELATED TO THE PROJECT

The amount of ground vibration mitigated by a building foundation is known as "coupling loss". The FTA Manual outlines generic values for use in an analysis but the methodology also allows for measured values to be used in place of the typical generic losses identified. Given the unique soil properties at the Site and the high level of vibration sensitivity of the ZymoGenetics equipment, it was determined that measuring the actual values for the coupling loss was preferred over using the generic FTA values for this Study. Measurements were performed on two different occasions, the first focused on determining the coupling loss from the ground to the building structure, the second documented vibration energy losses from floor-to-floor within the ZymoGenetics building.

No specific methodology for measuring coupling loss is defined in the FTA Manual. Therefore, the methodology for characterizing vibration propagation through the ground outlined in the FTA Manual was adapted to accommodate actual Site conditions and measurement constraints. A 16-pound sledge hammer was used to strike an abandoned wood pile ("impact test pile") that was located approximately eight feet from a support pile for the ZymoGenetics building. To measure the coupling loss, one accelerometer was installed on a ground stake eight feet from the impact test pile to estimate the level of vibration incident on the building pile. A second accelerometer was located on the top of the building pile and at several locations on the lower and upper garage floors. The coupling loss for the building was derived by taking the difference in vibration level between the in-ground and on-structure accelerometers. Propagation characteristics within the ground were also estimated by comparing vibration levels at eight feet and 17 feet. Typically a greater distance between points is preferred, but 17 feet was the greatest feasible test distance given the measurement access constraints during the testing.

To measure vibration attenuation from floor-to-floor, accelerometers were installed on two vertically adjacent floors to measure strike events on the impact test pile simultaneously. The transmissibility of the vibration between the two floors produced an estimate of the floor-to-floor attenuation for the building.

For all measurements, the 16 pound sledge hammer struck the test pile not less than five times per test scenario. Any measurement data found to be insufficiently above background vibration levels were discarded during data reduction and analysis.

When applying the field data to the Detailed Construction Vibration Analysis Section of this document, 10 dB was subtracted from the coupling loss, thereby assuming the structure responded 10 dB more efficiently to groundborne vibration than what was actually measured in the field. The intent of applying this 10 dB safety margin was to reduce the risk of not identifying potential vibration impacts in the detailed analysis.

TRAFFIC NOISE

Current WSDOT policy considers a receiver "impacted" when the predicted sound level approaches (within 1 dB of) the Noise Abatement Criteria (NAC) for a specific receiver activity category or when the traffic sound levels associated with the project are expected to increase by 10 dB or more. Activity Categories near the Project are defined as follows:

- Activity Category B – Residential (single and multi-family units)
- Activity Category C – Active sport areas, amphitheaters, auditoriums, campgrounds, cemeteries, day care centers, hospitals, libraries, medical facilities, parks, picnic areas, places of worship, playgrounds, public meeting rooms, public or nonprofit institutional structures, radio studios, recording studios, recreation areas, Section 4(f) sites, schools , television studios, trails, and trail crossings
- Activity Category E – Hotels, motels, offices, restaurants/bars, and other developed lands, properties or activities not included in A-D or F. Includes undeveloped land permitted for these activities.

Analysis locations are limited to "areas of frequent outdoor human use." Interior noise impacts are only assessed for Category D receivers (hospitals, libraries, schools, etc.) if there are no outdoor areas of frequency human use. However, no Category D receivers have been identified in the Project vicinity,

A review of traffic noise emissions from the project was conducted in accordance with the current WSDOT Policy. Since the Project replaces an existing bridge structure without a significant change in horizontal or vertical alignment, increase in capacity, or substantial alteration to the nearby ground contours, it is not considered a Type I project that would be eligible for FHWA funding for noise abatement. Therefore, in accordance with WSDOT Policy, a straight line model was developed using the FHWA Traffic Noise Model (TNM) Version 2.5 to verify that no noise impacts would be associated with the Project.

The modeled straight line roadway was extended 1,500 feet past each receiver, in both directions, for a total of 3,000 feet. Receivers were centered on the roadway at the nearest representative distances to the roadway and peak-hour volumes for the 2040 design year were used. No noise impacts were identified. Therefore, no further investigation with respect to traffic noise impacts or abatement is required.

Noise model input is summarized in Table 4. Receiver locations, impact criteria, predicted traffic noise levels are shown in Table 5.

Table 4 – Straight Line Noise Model Input

Roadway	Speed, mph	Peak Hour Volumes				
		Autos	Medium Trucks	Heavy Trucks	Buses	Motorcycles
Fairview Ave N – NB	35	713	27	2	10	7
Fairview Ave N – SB	35	634	24	1	7	14

Table 5 – Straight Line Noise Model Analysis Results

Receiver Description	Distance to Roadway, ft	Activity Category	Impact Criteria (NAC – 1 dB)	Predicted Sound Level	Impacted?
Zymogenetics rooftop patio	40	E	71	66	No
Irwin's Café patio	50	E	71	65	No
Public dock	220	C	66	54	No
Equinox Apartments rooftop patio	500	B	66	46	No

CONSTRUCTION NOISE

Construction Noise Regulatory Criteria

The Seattle Municipal Code (SMC) Section 25.08 specifies permissible sound levels within the City of Seattle. SMC 25.08.410 defines allowable exterior sound level limits based on zoning, not land use. The zoning of the Project site is Industrial; zonings near the site include Industrial and Commercial, as shown in Table 9. Reductions to these baseline exterior sound level limits are for certain times of the day, classification of receiving properties, and the type of sound generated are outlined in SMC 25.08.420 as follows:

- 10 dB during the nighttime hours between the hours of 10 p.m. and 7 a.m. during weekdays and 10 p.m. and 9 a.m. on weekends and legal holidays when the receiving property is within a Residential district.
- 5 dB for sources that carry a pure tone component.
- 5 dB for impulsive sources not measured with an impulse sound level meter.

These reductions are cumulative and independent of one another. Therefore, the permissible nighttime exterior sound level in a Residential district for an impulsive, tonal source would be 20 dB less than the baseline exterior sound level limits.

Increases to the exterior sound level limits are allowed for construction activities. Daytime construction is subject to SMC 25.08.425 for non-impact construction activities. For a "public project" the Non-Impact Construction and Maintenance Equipment modifications increase the exterior sound level limits within all residential and neighborhood commercial zones between 7:00 a.m. and 10:00 p.m. on weekdays and between 9:00 a.m. and 10:00 p.m. on weekends and legal holidays as follows:

- 25 dB for heavy construction equipment.
- 20 dB for light construction equipment.
- 15 dB for residential maintenance.

The resulting exterior construction sound level limits are defined at the adjacent property line or 50 feet from the equipment making the sound, whichever is greater.

SMC 25.08.425 applies the permissible exterior sound level limits established by Section 25.08.410 to sound levels inside a building within a Commercial district adjacent to the construction site between the hours of 8 a.m. and 5 p.m. "after every reasonable effort, including but not limited to closing windows and doors, is taken to reduce the impact of the exterior construction noise." Typically, the noise reduction (NR) due to the envelope of an average building is approximately 25 dBA, therefore these interior limits are typically satisfied when work takes places at least 50 feet away from the building. This limit does not apply to buildings in Industrial districts, such as ZymoGenetics.

Table 6 – City of Seattle Code Summary for Daytime Exterior Construction Noise, dBA

District of Sound Source	District of Receiving Property					
	Residential		Commercial		Industrial	
	L_{eq}	L_{max}	L_{eq}	L_{max}	L_{eq}	L_{max}
Residential	80	95	82	97	85	100
Commercial	82	97	85	100	90	105
Industrial	85	100	90	105	95	110

Table 7 – City of Seattle Code Summary for Nighttime Exterior Construction Noise, dBA

District of Sound Source	District of Receiving Property					
	Residential		Commercial		Industrial	
	L_{eq}	L_{max}	L_{eq}	L_{max}	L_{eq}	L_{max}
Residential	45	60	57	72	60	75
Commercial	47	62	60	75	65	80
Industrial	50	65	65	80	70	85

Table 8 – City of Seattle Code Summary for Daytime Interior Construction Noise, dBA

District of Sound Source	District of Receiving Property					
	Residential		Commercial		Industrial	
	L_{eq}	L_{max}	L_{eq}	L_{max}	L_{eq}	L_{max}
Residential	-	-	57	72	-	-
Commercial	-	-	60	75	-	-
Industrial	-	-	65	80	-	-

Table 9 – Land Use and Zoning of Nearby Properties

Property Address	Land Use	Zoning
Equinox Apartments	Residential	Commercial
Silver Cloud Inn	Residential	Commercial
1262 Eastlake Avenue East	Residential	Commercial
1264 Eastlake Avenue East	Residential	Commercial
ZymoGenetics	Commercial	Industrial
1000 Eastlake Avenue East	Commercial	Commercial
1103 Fairview Avenue North	Commercial	Commercial
1124 Eastlake Avenue East	Commercial	Commercial
1140 Eastlake Avenue East	Commercial	Commercial
1150 Eastlake Avenue East	Commercial	Commercial
Gunn Building	Commercial	Commercial
1200 Eastlake Avenue East	Commercial	Industrial
1258 Eastlake Avenue East	Commercial	Commercial
1500 Eastlake Avenue East	Commercial	Commercial
1500 Fairview Avenue East	Commercial	Industrial
1508 Fairview Avenue East	Commercial	Industrial
214 East Galer Street	Commercial	Commercial
900 Fairview Avenue North	Commercial	Commercial

Construction Noise Impact Criteria

Chapter 12.1.3 of the Federal Transportation Administration (FTA) Transit Noise and Vibration Impact Assessment Handbook (FTA Manual) provides sound level limits to be used to assess noise impacts due to construction noise.

The FTA Manual offers guidelines for a general assessment of construction noise. This general assessment only takes into account the two loudest pieces of construction equipment operating at the same time for one hour. For this Project a more detailed assessment is warranted due to the quantity and proximity of noise sensitive receivers and heightened public concerns expressed during outreach efforts.

The FTA Manual provides criteria for a more detailed assessment of construction noise. The detailed assessment takes into account the existing ambient sound conditions of the area as well as all pieces of construction equipment and results in a predicted 8-hour L_{eq} during daytime and nighttime hours and a 30 day L_{dn} level. However, the FTA Manual also states that in urban residential use areas with high existing ambient sound conditions, the construction operations should not exceed ambient noise conditions by more than 10 dB. Therefore, existing ambient sound levels can be applied to the baseline FTA construction noise impact thresholds to develop Project-specific criteria.

Baseline FTA construction noise impact thresholds are presented in Table 10, Project-specific impact criteria (based on ambient noise conditions) are listed in Table 11.

Table 10 – FTA Noise Impact Thresholds, dBA

Land Use	8-hour L_{eq}		30-day L_{dn}	24-hour L_{eq}
	Day	Night		
Residential	80	70	75	-
Commercial	85	85	-	80
Industrial	90	90	-	85

Table 11 – Project-Specific FTA Noise Impact Criteria, dBA

Receiving Property	Land Use	Project Criteria (8-hour L_{eq})	
		Day	Night
ZymoGenetics	Commercial	85	85
Equinox Apartments	Residential	80	78[1]
Silver Cloud Inn	Residential	80	75[1]
All other properties	Commercial	85	85
	Residential	80	77[1]

1. Ambient sound level + 10 dB

Construction Noise Analysis Methodology

The primary approach used for predicting construction sound levels is a 3-D computer noise model. The model was created using the acoustic modeling software Cadna/A, established construction equipment sound levels, site drawings and anticipated construction phasing. The computer noise model used the acoustic modeling software Cadna/A. Cadna/A utilizes the CADNA (Control of Accuracy and Debugging for Numerical Applications) computation engine developed by the Pierre et Marie Curie University of Paris. The model accounts for the effects of distance, topography and surface reflections on sound levels predicted for construction activities. Each individual piece of equipment was modeled as an individual noise source to allow for the identification of which pieces of equipment dominate the construction sound emissions. Topographical and zoning information was used from the Seattle Department of Planning and Development's website. Building heights were measured during a site visit and building locations were found on Google Earth Pro.

The construction noise analysis was based upon site drawings, construction staging plans, and projected construction equipment information detailed in the Construction Methods Technical Memorandum. Phase numbers described herein are for organizational purposes only; this numbering scheme is not used in the source memorandum.

Equipment sound levels were based upon levels defined in the Federal Highway Administration Construction Noise handbook (FHWA Handbook). FHWA Handbook sound levels are maximum sound levels (L_{max}) 50 feet from the sound source. While the FTA also publishes sound levels for construction equipment the FHWA data are more comprehensive, and were selected for use in the analysis. The FHWA construction equipment sound levels and the predicted percent of an hour each piece of equipment is in use (acoustical usage factor) which were used in our analysis are shown in Appendix Table A-1.

Construction during the Project is broken into five phases of work. Many of these phases are broken into sub-phases where specific construction activities will occur. Modeling analysis was conducted for each phase and sub-phase of work where noise is expected to impact the adjacent properties. For each phase of work, construction activities were identified and the equipment expected to be required to complete the work for each activity was input into the model. Equipment activity locations were identified as points where the work is likely required to be performed. While precise equipment locations will be at the discretion of the Contractor, for this analysis, equipment was generally placed at locations where higher sound levels at sensitive receivers would be expected, intending to yield conservative results.

A summary of construction phases and activities modeled for each phase are presented in Appendix Tables A-2 and A-3.

Construction Noise Analysis Results

Actual construction equipment, locations and staging of construction activities will be at the discretion of the Contractor. For mobile equipment, sound pressure levels at nearby properties will vary depending upon the actual location of the equipment at any given time. For our analysis, equipment was modeled at locations intended to yield conservative predictions, given the likely site layout and staging.

For each phase of work, results were generated for all sub-phases of work at nearby properties. Predicted sound levels represent on-site construction activities only and do not include contributions from existing or future ambient conditions, or for haul trucks once they have left the Site.

Table 12 presents the highest predicted unmitigated sound level for each Phase of work compared with SMC sound level limits. As shown in the Table, while all Project phases comply with daytime SMC limits, Project phases are expected to exceed nighttime limits by as much as 24 dB (Gunn Building, Phase 4). Given the practical issues with reducing construction sound emissions by this amount, a noise variance would likely need to be acquired from the City of Seattle to permit nighttime work. Noise model configurations for all phases and sub-phases of construction are included in the Appendix.

Construction Noise Impact Assessment

Table 13 presents the results of a comparison of predicted levels in Table 12 with Project-Specific FTA Noise Impact Criteria shown in Table 11. As shown in Table 13, noise impacts from unmitigated construction noise are anticipated at ZymoGenetics and the Gunn Building, the two receivers closest to the Project. Noise impacts at ZymoGenetics range from 3 dB (Phase 3) to 6 dB (Phase 4). Noise impacts at the Gunn Building range from 2 dB (Phase 3) to 4 dB (Phase 4). These impacts would be considered moderate and could be reasonably mitigated by implementing some of the measures proposed in the following Section.

Table 12 – Predicted Unmitigated Construction Sound Levels and Code Limits

Receiving Property	Highest Predicted Sound Level by Phase						SMC Limits	
	Utility Relo	Phase 1	Phase 2	Phase 3	Phase 4	Phase 5	Day	Night
Residential Use								
Equinox Apartments	66	62	66	64	64	66	90	65
Silver Cloud Inn	71	73	68	73	73	69	90	65
1262 Eastlake Avenue East	68	49	67	65	66	69	90	65
1264 Eastlake Avenue East	69	52	67	64	65	67	90	65
Commercial Use								
ZymoGenetics	79	84	90	88	91	90	95	70
Gunn Building	83	88	75	87	89	80	90	65
900 Fairview Avenue North	64	65	63	66	66	64	90	65
214 East Galer Street	65	55	64	62	62	65	90	65
1508 Fairview Avenue East	68	58	62	60	60	62	95	70
1500 Fairview Avenue East	72	64	67	66	66	67	95	70
1500 Eastlake Avenue East	67	63	66	64	64	66	90	65
1258 Eastlake Avenue East	69	50	68	67	67	68	90	65
1200 Eastlake Avenue East	71	65	50	65	69	55	95	70
1150 Eastlake Avenue East	70	69	44	63	66	46	90	65
1140 Eastlake Avenue East	68	70	46	70	66	51	90	65
1124 Eastlake Avenue East	59	64	42	64	64	53	90	65
1103 Fairview Avenue North	60	62	58	62	63	60	90	65
1000 Eastlake Avenue East	59	65	45	65	65	55	90	65

Table 13 – Anticipated Unmitigated Construction Noise Impacts

Receiving Property	Highest Predicted Sound Level by Phase						Project-Specific FTA Noise Impact Criteria	
	Utility Relo	Phase 1	Phase 2	Phase 3	Phase 4	Phase 5	Day	Night
Residential Use								
Equinox Apartments	-	-	-	-	-	-	80	78
Silver Cloud Inn	-	-	-	-	-	-	80	75
1262 Eastlake Avenue East	-	-	-	-	-	-	80	77
1264 Eastlake Avenue East	-	-	-	-	-	-	80	77
Commercial Use								
ZymoGenetics	-	-	Day/Night	Day/Night	Day/Night	Day/Night	85	85
Gunn Building	-	Day/Night	-	Day/Night	Day/Night	-	85	85
900 Fairview Avenue North	-	-	-	-	-	-	85	85
214 East Galer Street	-	-	-	-	-	-	85	85
1508 Fairview Avenue East	-	-	-	-	-	-	85	85
1500 Fairview Avenue East	-	-	-	-	-	-	85	85
1500 Eastlake Avenue East	-	-	-	-	-	-	85	85
1258 Eastlake Avenue East	-	-	-	-	-	-	85	85
1200 Eastlake Avenue East	-	-	-	-	-	-	85	85
1150 Eastlake Avenue East	-	-	-	-	-	-	85	85
1140 Eastlake Avenue East	-	-	-	-	-	-	85	85
1124 Eastlake Avenue East	--	-	-	-	-	-	85	85
1103 Fairview Avenue North	-	-	-	-	-	-	85	85
1000 Eastlake Avenue East	-	-	-	-	-	-	85	85

Construction Noise Mitigation Measures

Below are possible noise mitigation measures that could be used to reduce the impact of noise generated during construction.

- Establish a daytime exterior construction sound level limit of 85 dBA (hourly Leq) for the Project at Industrial properties with Commercial use (10 dB less than required by Code), measured 50 feet from the noise generating activity or the nearest receiving property boundary, whichever is farther.
- Establish a daytime interior construction sound level limit of 65 dBA (hourly L_{eq}) for the Project at Industrial properties with Commercial use (no such limit established by Code) when all doors and windows are closed.
- Require the Contractor to prepare and submit a Noise Control Plan that includes predicted construction sound levels for their proposed means, methods, and equipment and any mitigation measures that would be required to satisfy Project noise limits.
- Monitor sound levels during construction.
- When construction is taking place in front of ZymoGenetics, conduct work during nighttime hours to reduce impacts on building occupants.
- Line truck beds with rubber bed liners, or keep one foot of dirt in the bottom of the dump trucks to reduce impact noise from loading excavated materials.
- Change all backup warning devises to the least intrusive broadband type, or use backup observes as permitted by law.
- Direct light plants, generators, air compressors and other stationary equipment away from noise sensitive receivers.
- Remove any debris spilled on pavement by hand and not using scraping type equipment or activities, where practical.
- Use rubber tired equipment in lieu of track type equipment whenever possible and safe to do so.
- Limit engine idling to not more than five minutes when vehicle or equipment is not directly engaged in work activity, such as on-site pickup trucks and cued haul trucks.
- Fit equipment with high grade engine exhaust silencers and/or engine shrouds to help lower noise emissions.
- Enclose stationary equipment such as generators, pumps and compressors, or use noise curtains when barriers are infeasible.
- Use electric equipment in lieu of pneumatics or diesel equipment, where feasible.
- Install noise barriers to reduce or block line of sight to neighboring noise sensitive receivers, where feasible.

CONSTRUCTION VIBRATION

Construction Vibration Impact Criteria

Vibration levels are not controlled by the City of Seattle, therefore no local regulatory requirements defining acceptable levels of vibration apply to this Project.

Thresholds for determining vibration impacts will be used based on the Federal Transportation Administration Transit Noise and Vibration Impact Assessment manual (FTA Manual). While the FTA Manual is intended for use on transit projects that include busses, light rail, heavy rail, and subway, the Federal Highway Administration (FHWA) defers to the FTA Manual for predicting vibration levels and subsequent impacts from construction of roadway projects. The FTA Manual divides construction vibration impact assessment criteria into two classes: building damage and occupant annoyance.

According to our understanding of building construction of nearby buildings, the 0.5 PPV limit (Building Category I) would apply near building foundations near the work area to prevent cosmetic damage to existing structures. Table 14 summarizes building damage criteria presented in the FTA Manual based on building construction type.

Based on information ZymoGenetics provided the design team, equipment currently installed would fall under the vibration sensitivity classification of VC-A, which is defined with limits of 72 VdB at a frequency of 4 Hz and 66 VdB at 8 Hz and above. Other nearby structures with less sensitive uses, would be assigned less stringent annoyance criteria. Table 15 describes impact assessment criteria throughout ZymoGenetics based on understood vibration sensitivity of each floor. However, it’s important to note that existing vibration levels within ZymoGenetics occasionally exceed the proposed impact assessment criteria. Comparisons of these impact criteria and ambient conditions are presented in Figures 3 – 7.

Table 14 – FTA Building Damage Criteria (in the soil, near the foundation)

Building Category	Construction Description of Building	PPV Limit, in/sec
I	Reinforced-concrete, steel or timber (no plaster).	0.5
II	Engineered concrete and masonry (no plaster).	0.3
III	Non-engineered timber and masonry buildings.	0.2
IV	Buildings extremely susceptible to vibration damage.	0.12

Table 15 – ZymoGenetics Annoyance Criteria (inside the building, on the floor)

Location	FTA Criteria	RMS limit, VdB			
		4 Hz	5 Hz	6.3 Hz	8 Hz and above
Garage	Workshop	96	94	92	90
Floor 1	Office	90	88	86	84
Floor 2 and above	VC-A	72	70	68	66

Figure 3 – ZymoGenetics Floor 1

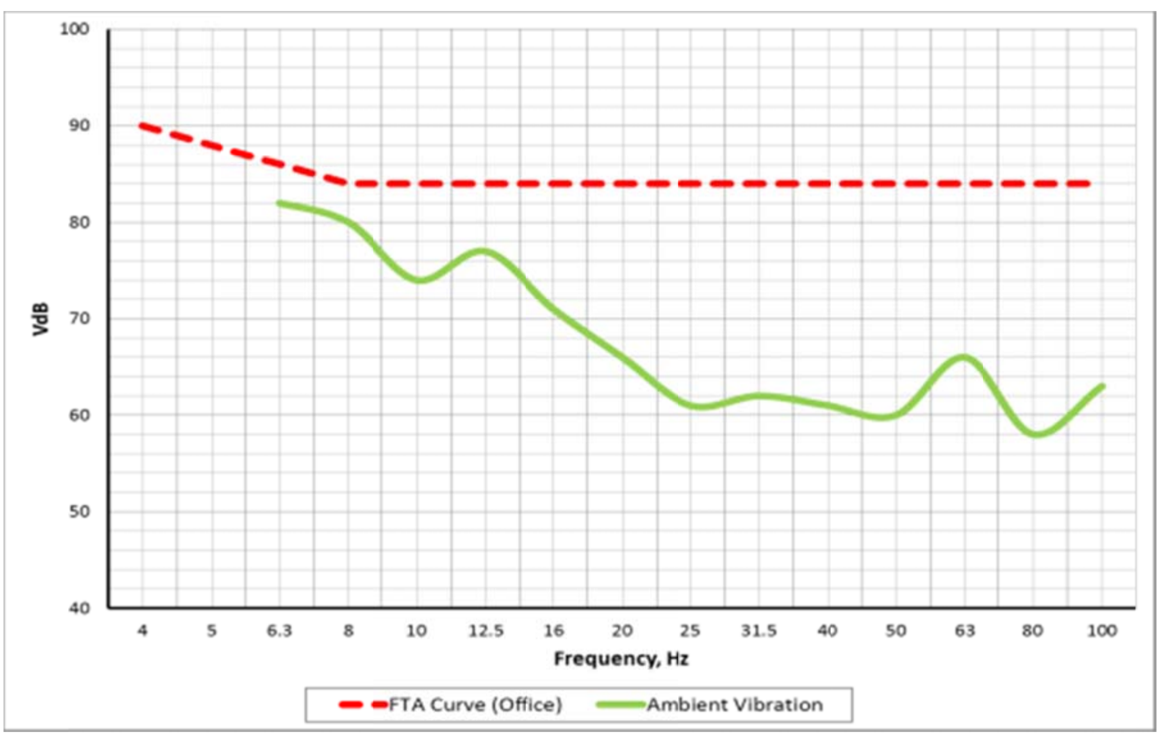


Figure 4 – ZymoGenetics Floor 2

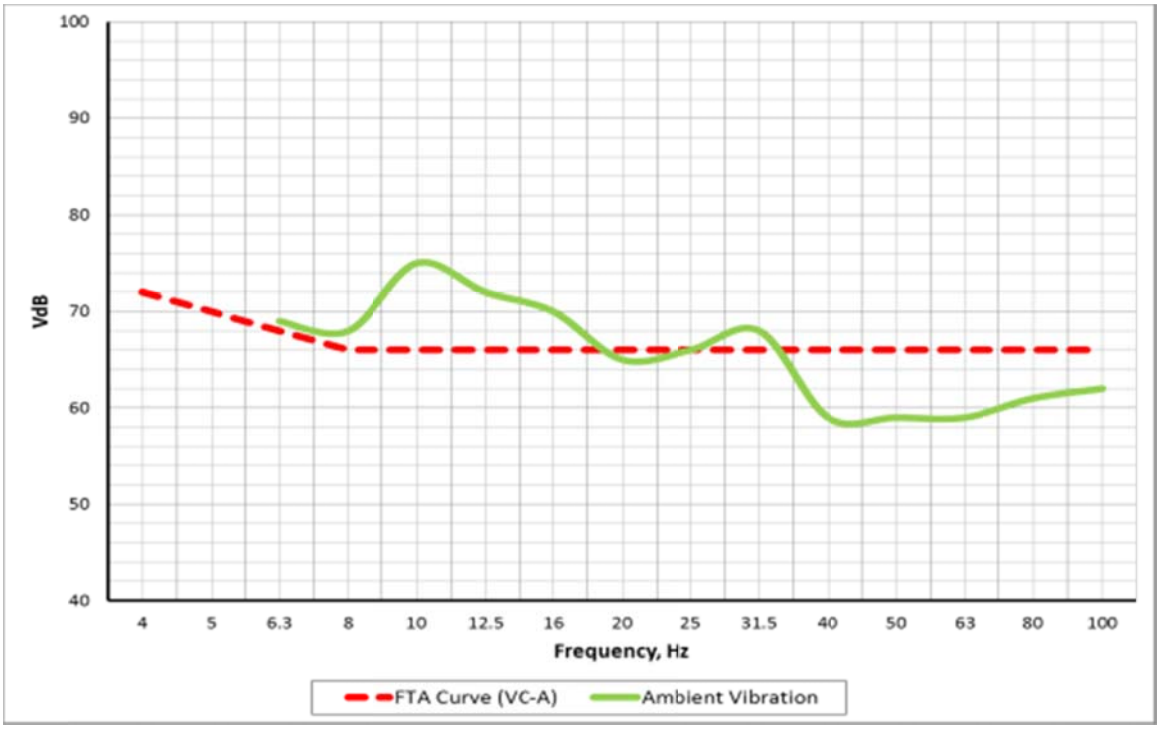


Figure 5 – ZymoGenetics Floor 3

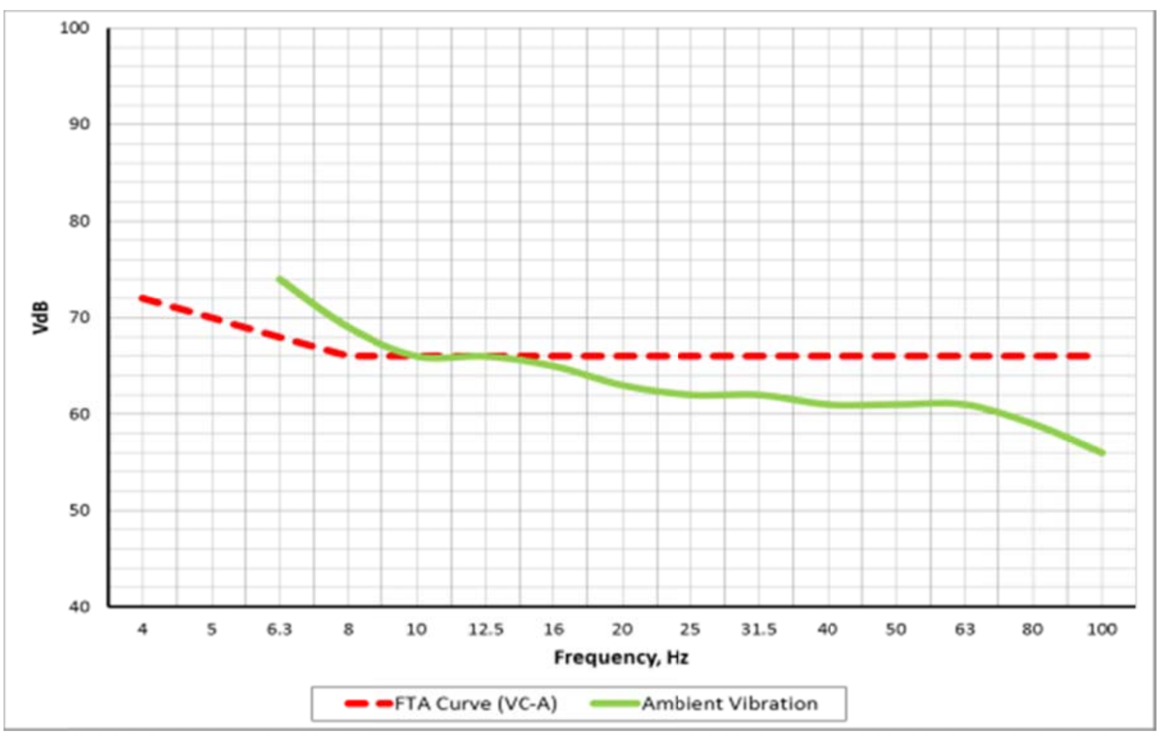


Figure 6 – ZymoGenetics Floor 4

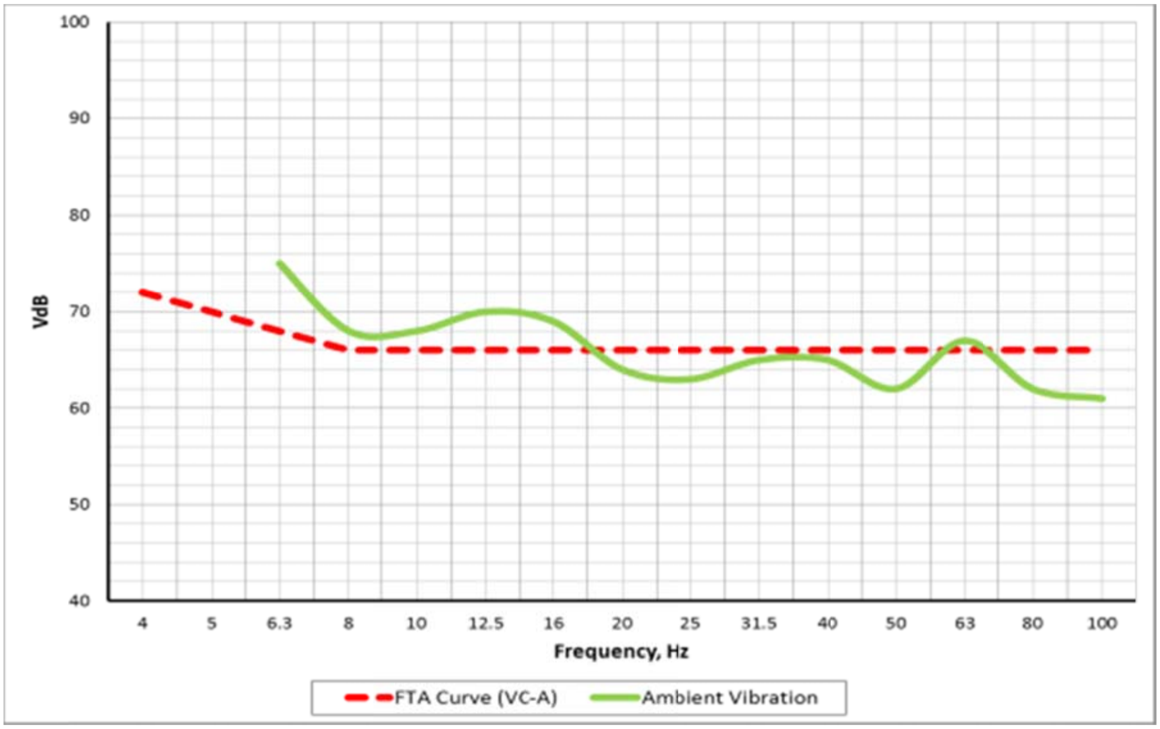
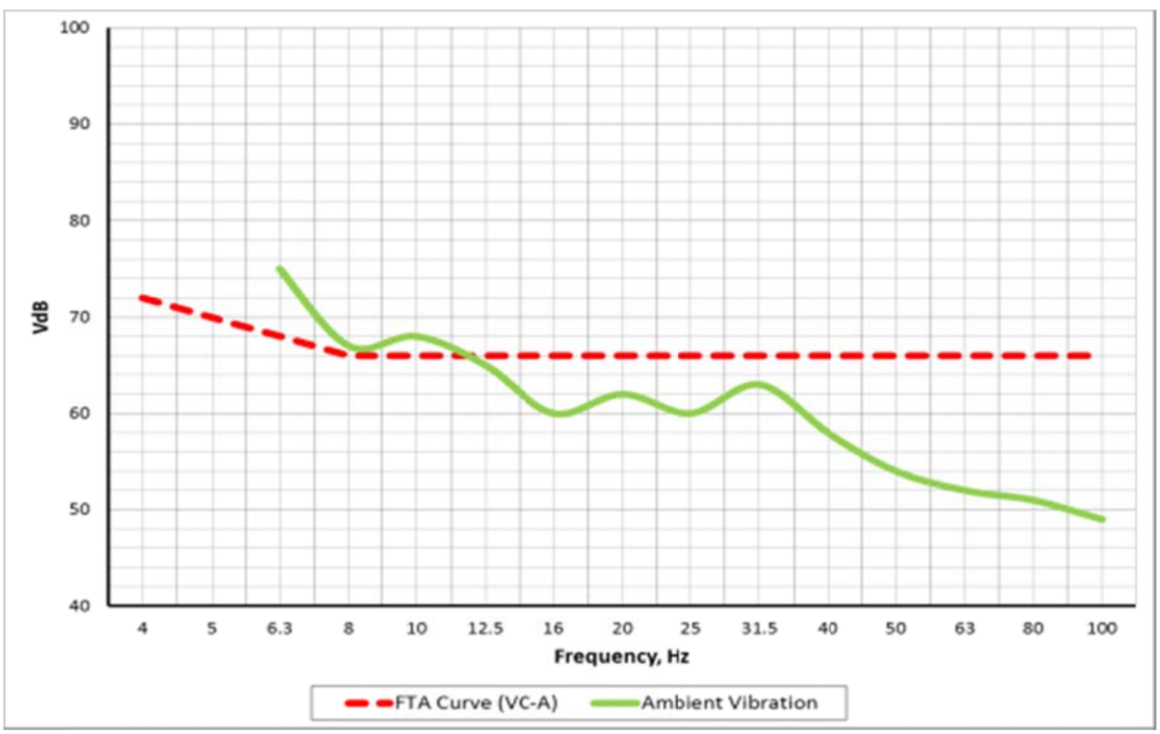


Figure 7 – ZymoGenetics Floor 5



Construction Vibration Analysis Methodology

Vibration levels at nearby receivers were calculated in accordance with FTA guidelines and field measurements. Calculations for general building damage, which are based on PPV (peak velocity) vibration levels, were conducted as follows:

$$PPV = PPV_{ref} * (25/D)^{1.5}$$

Where: PPV is the predicted peak vibration level at a nearby receiver
PPVref is the reference peak equipment vibration level at 25 feet
D is the distance between the equipment and nearby receiver

General annoyance calculations at nearby receivers, which are based on Lv (RMS velocity) vibration levels, were conducted as follows:

$$L_v = L_{v,ref} - 30\log_{10}(D/25)$$

Where: L_v is the predicted RMS vibration level at a nearby receiver
$L_{v,ref}$ is the reference RMS equipment vibration level at 25 feet
D is the distance between the equipment and nearby receiver

Detailed vibration analysis was performed for the ZymoGenetics building based on soil propagation, coupling loss values, and floor-to-floor attenuation properties measured at the Site. The analysis was focused on equipment expected to create the most vibration and was modeled as follows:

$$L_v = L_{v,ref} - C_l\log_{10}(D/25) + C_{build}$$

Where: L_v is the predicted RMS vibration level on a particular floor of the building
$L_{v,ref}$ is the reference RMS equipment vibration level at 25 feet
C_l is the soil propagation loss term, as measured in the field
D is the distance between the equipment and nearby receiver
C_{buil}d accounts for building coupling loss, floor-to-floor attenuation, and structural resonances.

Reference vibration velocity levels (PPV and L_v) used in the general and detailed analyses are presented in Tables 16 and 17.

Table 16 – Reference Vibration Levels for General Vibration Analysis

Equipment	Vibration Velocities at 25 feet	
	Peak (PPV, in/sec)	RMS (L_v, V_{dB})
Concrete Mixer Truck	0.076	86
Concrete Pump Truck	0.076	86
Crawler Crane	0.089	87
Drilling Operation	0.126	90
Dump Truck	0.076	86
Forklift	0.076	86
Track Hoe	0.089	87
Paver	0.210	94
Vibratory Pile Driver	0.170	93

Table 17 – Reference Vibration Levels for Detailed Vibration Analysis, L_v at 25 feet, V_{dB}

Equipment	1/3 Octave Band Center Frequency												
	6.3	8	10	12.5	16	20	25	31.5	40	50	63	80	100
Crawler Crane	51	57	65	74	80	82	80	74	75	72	65	63	57
Drilling Operation	75	78	80	82	83	81	79	79	78	76	72	69	69
Track Hoe	51	57	65	74	80	82	80	74	75	72	65	63	57
Paver	37	37	43	50	64	88	93	68	72	78	65	59	48
Vibratory Pile Driver	-	-	-	-	-	-	-	64	63	64	77	93	68

Construction Vibration Analysis Results

Cosmetic Building Damage

Horizontal distances between construction activities and the nearest pile supporting the ZymoGenetics building were calculated to determine minimum distances to prevent cosmetic building damage and are summarized in Table 18. Equipment used within these minimum distances are expected to exceed the damage criteria of 0.5 PPV in the FTA Manual for "reinforced-concrete, steel or timber (no plaster)" buildings and may result in cosmetic building damage. Drilled shafts will be used near the building. If vibratory pile driving occurs, it would be farther away from the building than the minimum distance shown in Table 18.

Detailed Annoyance Analysis

The intent of the detailed annoyance analysis was to predict 1/3-octave band vibration levels at various locations throughout the ZymoGenetics building based on methodologies in the FTA Manual, applied empirically to the Site based on field measurements. The five pieces of equipment expected to dominate vibration emissions from the site were the focus of the detailed analysis. It was assumed that the soil was generally firm clay and silts. Table 19 summarizes predicted vibration levels for major construction equipment at various floors of the ZymoGenetics building. Predicted values are conservative, in that they assume the listed equipment is located within 5 horizontal feet of the nearest ZymoGenetics building pile.

Table 18 – Building Damage Analysis (in the soil, near the foundation)

Equipment	Criteria PPV, in/sec	Minimum Distance, feet
Concrete Mixer Truck	0.5	3
Concrete Pump Truck		3
Crawler Crane		4
Oscillatory Drill		10
Dump Truck		3
Forklift		3
Track Hoe		4
Paver		7
Vibratory Pile Driver (upper range)		32

Table 19 – Detailed Vibration Annoyance Analysis (inside the building, on the floor)

Equipment	Lower Garage	Upper Garage	Floor 1	Floor 2	Floor 3	Floor 4	Floor 5
	L_v at 6.3 Hz – equipment 5 feet from ZymoGenetics pile						
Crawler Crane[1]	80	63	61	59	57	55	53
Drill Operation	104	87	85	83	81	79	77
Track Hoe[1]	80	63	61	59	57	55	53
Paver[1]	65	48	46	44	42	40	38
	L_v between 8 and 100 Hz– equipment 5 feet from ZymoGenetics pile						
Crawler Crane[1]	91	92	89	87	85	83	81
Drill Operation	99	106	104	102	100	98	96
Track Hoe[1]	79	92	89	87	85	83	81
Paver[1]	90	95	89	87	85	83	81
Vibratory Pile Driver	113	103	87	84	80	78	76

1. Assumes use on existing bridge only.

Construction Vibration Impact Assessment

Potential vibration impacts were determined for equipment expected to dominate vibration emissions from the Project. Given the proximity and sensitivity of the ZymoGenetics building, the detailed vibration analysis results presented in the previous Section are compared to vibration impact criteria developed previously in this document. Due to decreasing vibration levels with increasing height in the ZymoGenetics building, the governing impact assessment location is the lowest floor with the most stringent criteria, Floor 2.

The piece of construction equipment anticipated to generate the highest vibration levels within ZymoGenetics is the oscillatory drilling operation. The distance required between the unmitigated oscillatory drilling operation and the closest pile of the Zymogenetics structure to mitigate vibration impacts is 75 feet. Drilling activities taking place within the following distances are expected to present a vibration impact inside the Zymogenetics building. Impact radii for all other unmitigated equipment are shown in Table 20.

Table 20 – Equipment Impact Threshold Distances, feet

Equipment	6.3 Hz	8 Hz – 100 Hz	Overall
Crawler Crane	2	32	32
Drill Operation	21	75	75
Track Hoe	2	32	32
Paver	1	32	32
Vibratory Pile Driver	-	33	33

Construction Vibration Mitigation Measures

Below are possible vibration mitigation measures that could be used to reduce the impact of vibration generated during construction.

- Develop vibration level limits by 90% design to control impacts at the ZymoGenetics building.
- Require the Contractor to prepare and submit a Vibration Control Plan that includes predicted vibration levels for their proposed means, methods, and equipment and any mitigation measures that would be required to satisfy Project vibration limits.
- Monitor vibration levels during construction.
- Limit distances between vibration-generating equipment and sensitive receiving properties.
- Locate stationary vibrating equipment (oscillatory drill power pack, etc.) away from sensitive receiving properties, ideally on a construction barge, if feasible.
- Line the top of the drill casing to mitigate impacts between excavation equipment (clamshell, etc.) and the drill casing.

REFERENCES

1. Federal Highway Administration, "Construction Noise Handbook", 2006 ("FHWA Handbook")

2. Federal Transportation Administration, "Transit Noise and Vibration Impact Assessment", 2006 ("FTA Manual")

3. ATS Consulting, "Construction Noise and Vibration Mitigation and Monitoring Plan, Evergreen Point Floating Bridge and Landings Project", 2012 ("ATS Study")

4. Wilson Ihrig and Associates, "Superconducting Super Collider Environmental Ground Vibration Study", 1987 ("Wilson Ihrig Study")

5. Washington State Department of Transportation, "2011 Traffic Noise Policy and Procedures", 2011 ("WSDOT Policy")

6. Draft Construction Methods Technical Memorandum, Bill Ott, January, 2014

APPENDIX A

Construction Noise Analysis Scenarios

Table A-1 – Construction Equipment Sound Emission Levels

Equipment	Sound Level	Acoustical Usage Factor
Concrete Mixer Truck	85	40
Concrete Pump Truck	82	20
Concrete Saw	90	20
Crane	85	16
Drill Power Pack5	74	100
Drill Operation4	84	100
Dump Truck	84	40
Excavator	85	40
Forklift	84	40
Paver	85	50
Welder	73	40

Table A-2 – Modeled Construction Equipment by Phase

Equipment	Utility Relo.	Phase 1	Phase 2	Phase 3	Phase 4
Concrete Mixer Truck		-	Day/Night	-	Day/Night
Concrete Pump Truck		-	Day/Night	-	Day/Night
Concrete Saw		Day	-	Day/Night	-
Crane	Day	-	-	Day/Night	Day/Night
Drill Power Pack		-	Day/Night	-	Day/Night
Drill Operation	Day	-	Day/Night	-	Day/Night
Dump Truck	Day	Day	-	Day/Night	Day/Night
Excavator		Day	-	Day/Night	-
Forklift		-	Day/Night	Day/Night	Day/Night
Paver		-	-	-	-
Welder		-	Day/Night	Day/Night	Day/Night

Table A-3 – Modeled Construction Phases

Phase	Activity Description	Construction Period
Utility Relo.	Relocation of electrical utilities near Site.	Daytime
Phase 1	On-Site Activities after NTP but Prior to April 1, 2015	
Phase 1.1	Preconstruction Activities	Daytime
Phase 2	Temporary Drilled Shafts for Work Trestle	Daytime/Nighttime
Phase 3	Westbound Bridge Deck Removal and Work Trestle	
Phase 3.1	Concrete Bridge Deck Removal	Daytime/Nighttime
Phase 3.2	Sand Blanket	Daytime/Nighttime
Phase 3.3	Work Bridge	Daytime/Nighttime
Phase 3.4	Remove Existing Timber Piles	Daytime/Nighttime
Phase 4	West Bridge Substructure	
Phase 4.1	Drill New Shafts/Rebar Cage/Place Concrete	Daytime/Nighttime
Phase 4.2	Pier Columns at Piers 2, 3, and 4	Daytime/Nighttime
Phase 4.3	Crossbeams	Daytime/Nighttime
Phase 4.4	Abutments	Daytime/Nighttime
Phase 5	West Bridge Superstructure	
Phase 5.1	Remove Work Bridge Superstructure	Daytime
Phase 5.2	Set Girders	Nighttime
Phase 5.3	Roadway Deck	Daytime/Nighttime
Phase 5.4	Place Roadway Deck	Daytime
Phase 5.5	Deck Improvements	Daytime/Nighttime

Figure A-1 Utility Relocation Construction Noise Model

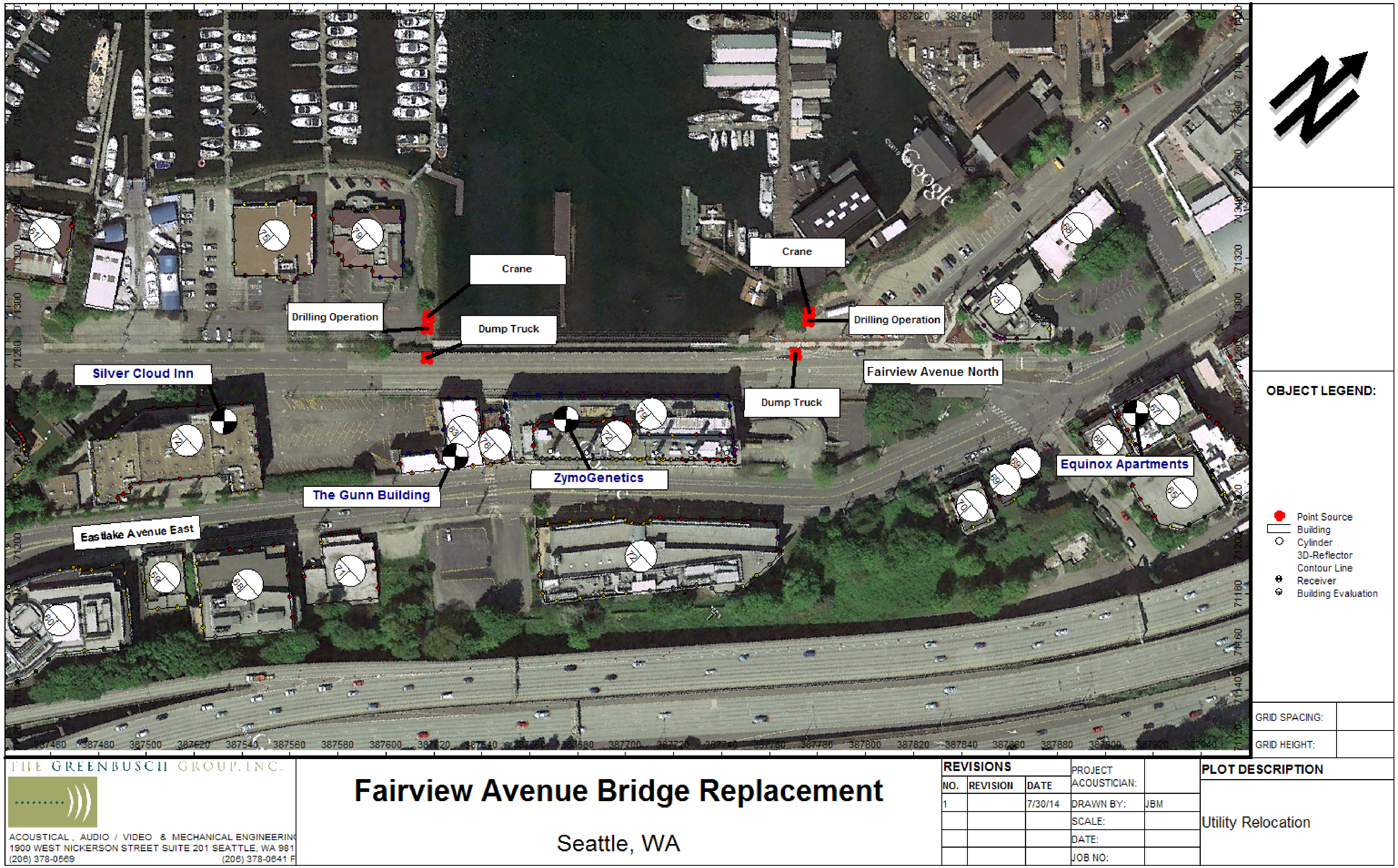


Figure A-2 Phase 1.1 Construction Noise Model

THE GREENBUSCH GROUP, INC.

ACOUSTICAL, AUDIO / VIDEO & MECHANICAL ENGINEERIN
1900 WEST NICKERSON STREET SUITE 201 SEATTLE, WA 981
(206) 378-0569 (206) 378-0641 F

Fairview Avenue Bridge Replacement

Seattle, WA

REVISIONS		
NO.	REVISION	DATE
1		7/30/14

PROJECT ACOUSTICIAN:	
DRAWN BY:	JBM
SCALE:	
DATE:	
JOB NO:	

PLOT DESCRIPTION

Utility Relocation

Daytime only

Figure A-3 Phase 2 Construction Noise Model

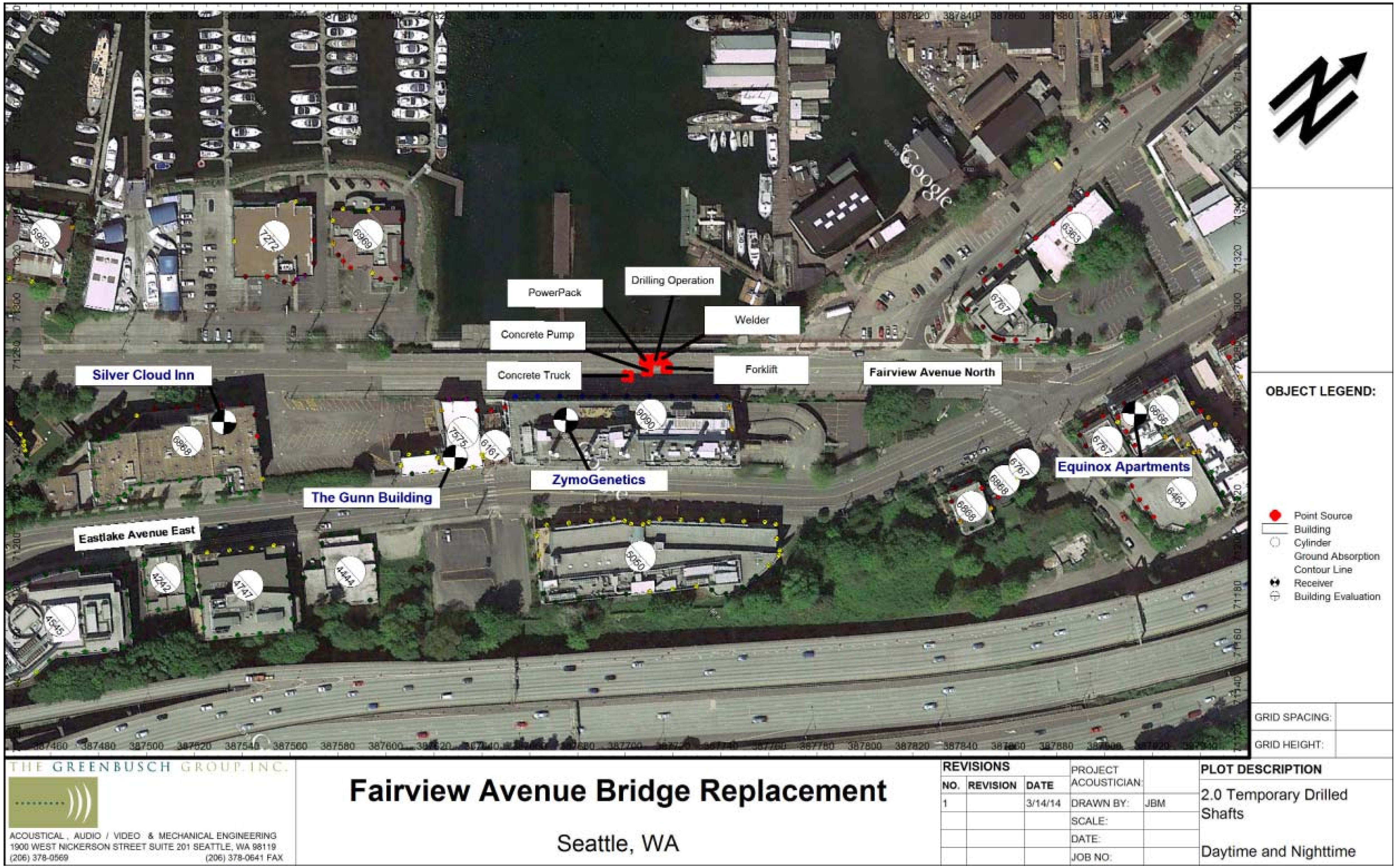


Figure A-4 Phase 3.1 Construction Noise Model

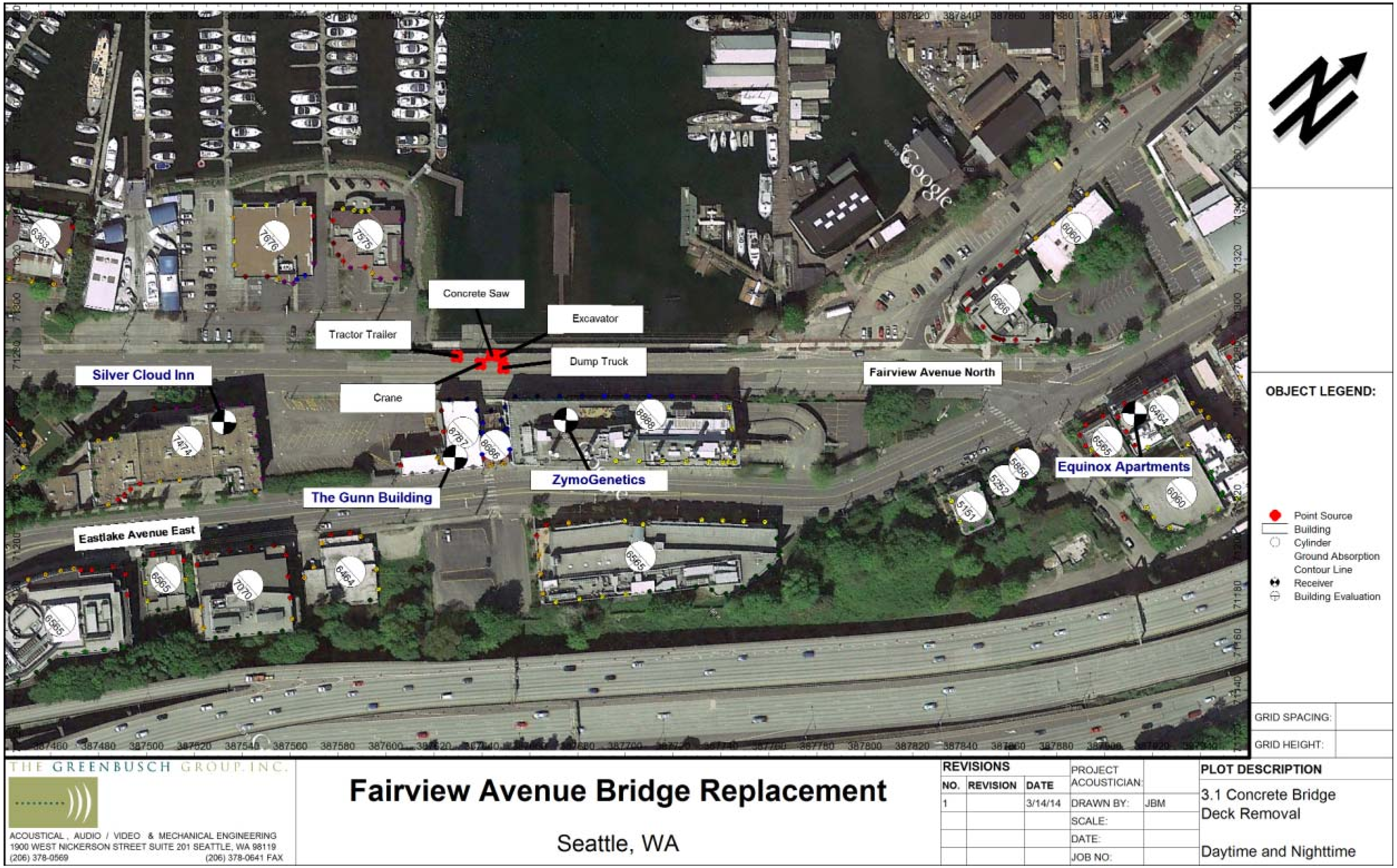


Figure A-5 Phase 3.2 Construction Noise Model

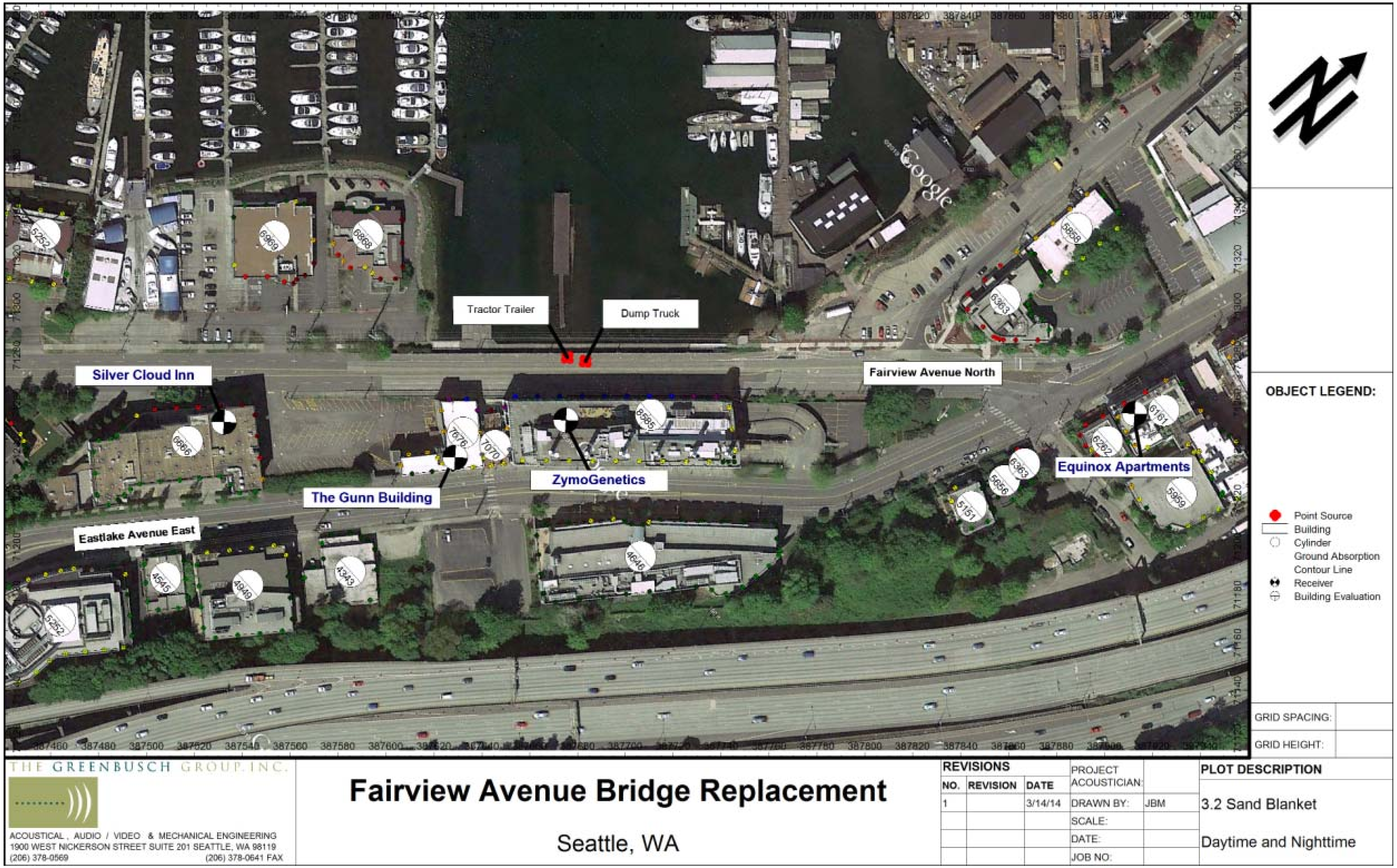


Figure A-6 Phase 3.3 Construction Noise Model

THE GREENBUSCH GROUP, INC. ACOUSTICAL, AUDIO / VIDEO & MECHANICAL ENGINEERING 1900 WEST NICKERSON STREET SUITE 201 SEATTLE, WA 98119 (206) 378-0569 (206) 378-0641 FAX	**Fairview Avenue Bridge Replacement** Seattle, WA	REVISIONS			PROJECT ACOUSTICIAN:		PLOT DESCRIPTION
		NO.	REVISION	DATE			3.3 Work Bridge
		1		3/14/14	DRAWN BY:	JBM	
					SCALE:		Daytime and Nighttime
					DATE:		
					JOB NO:		

Figure A-7 Phase 3.4 Construction Noise Model

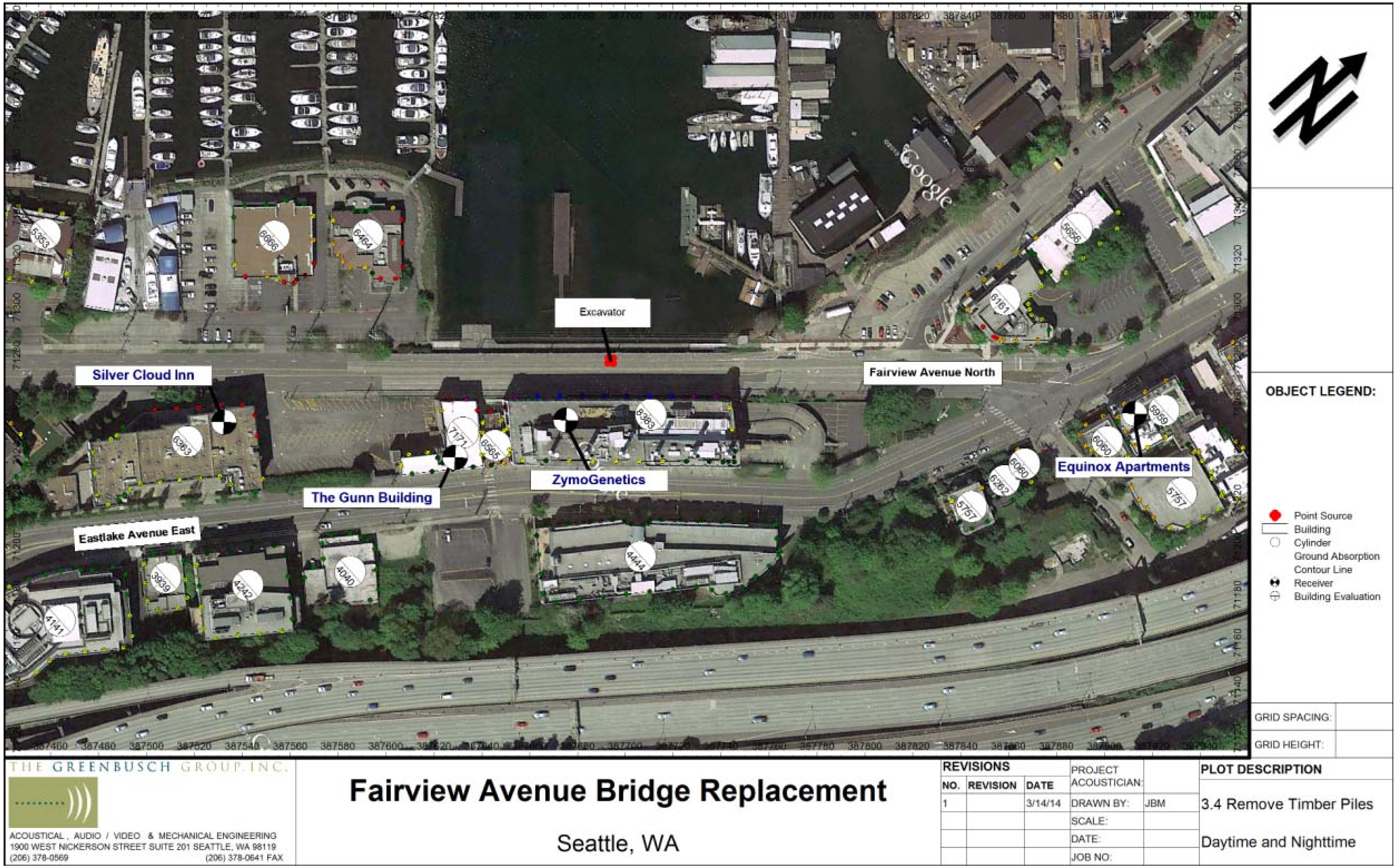


Figure A-8 Phase 4.1 Construction Noise Model

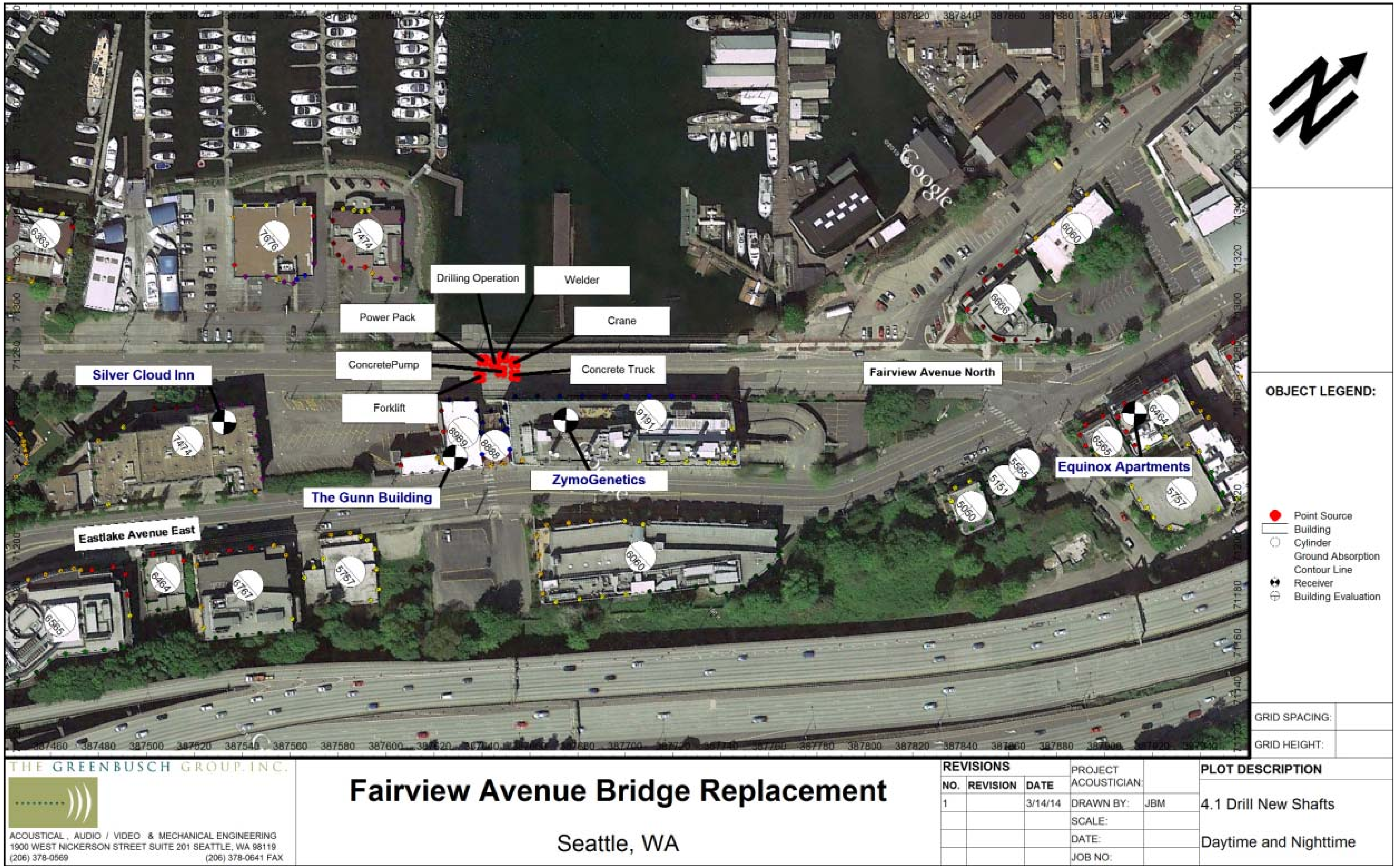


Figure A-9 Phase 4.2 Construction Noise Model

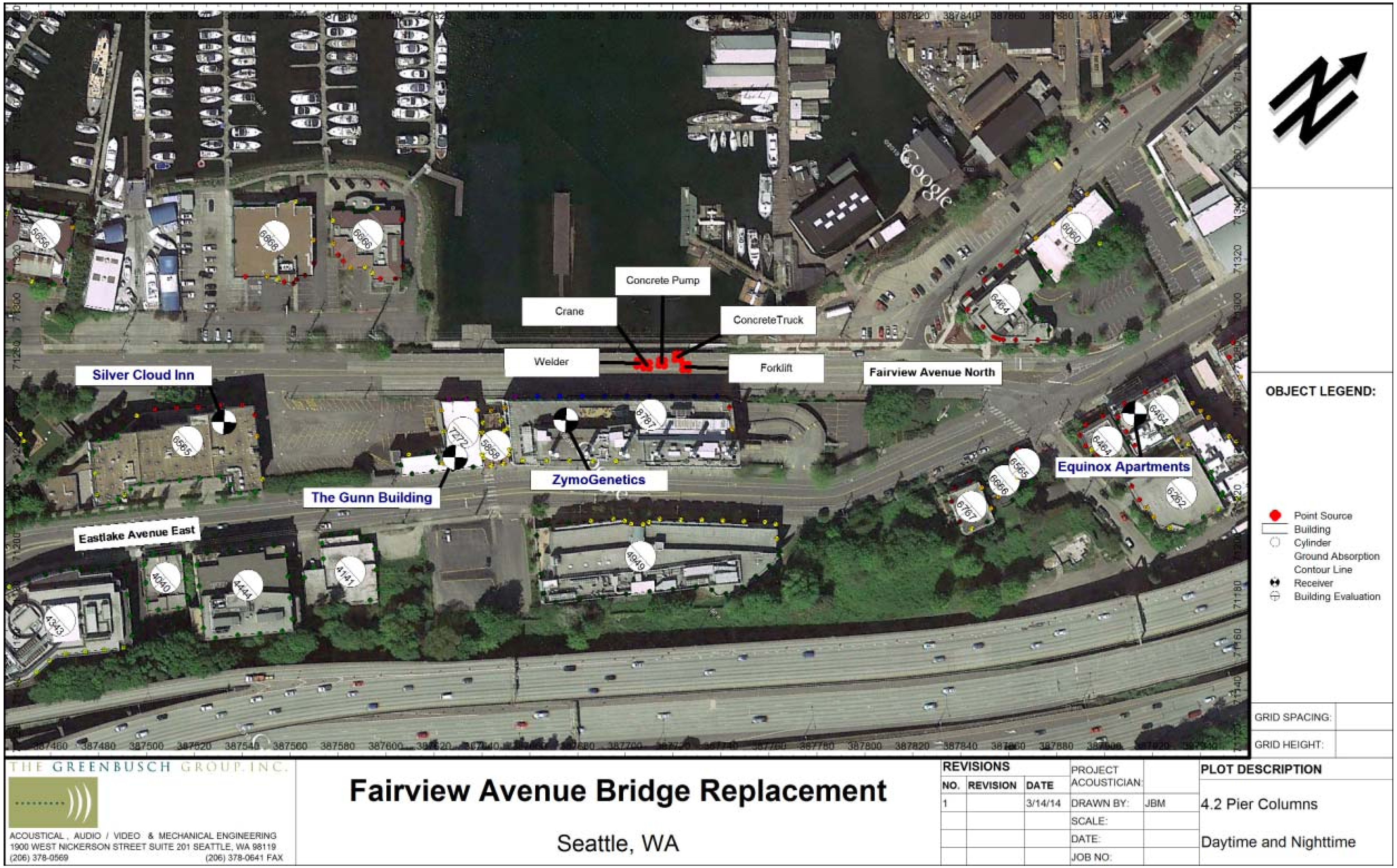


Figure A-10 Phase 4.3 Construction Noise Model

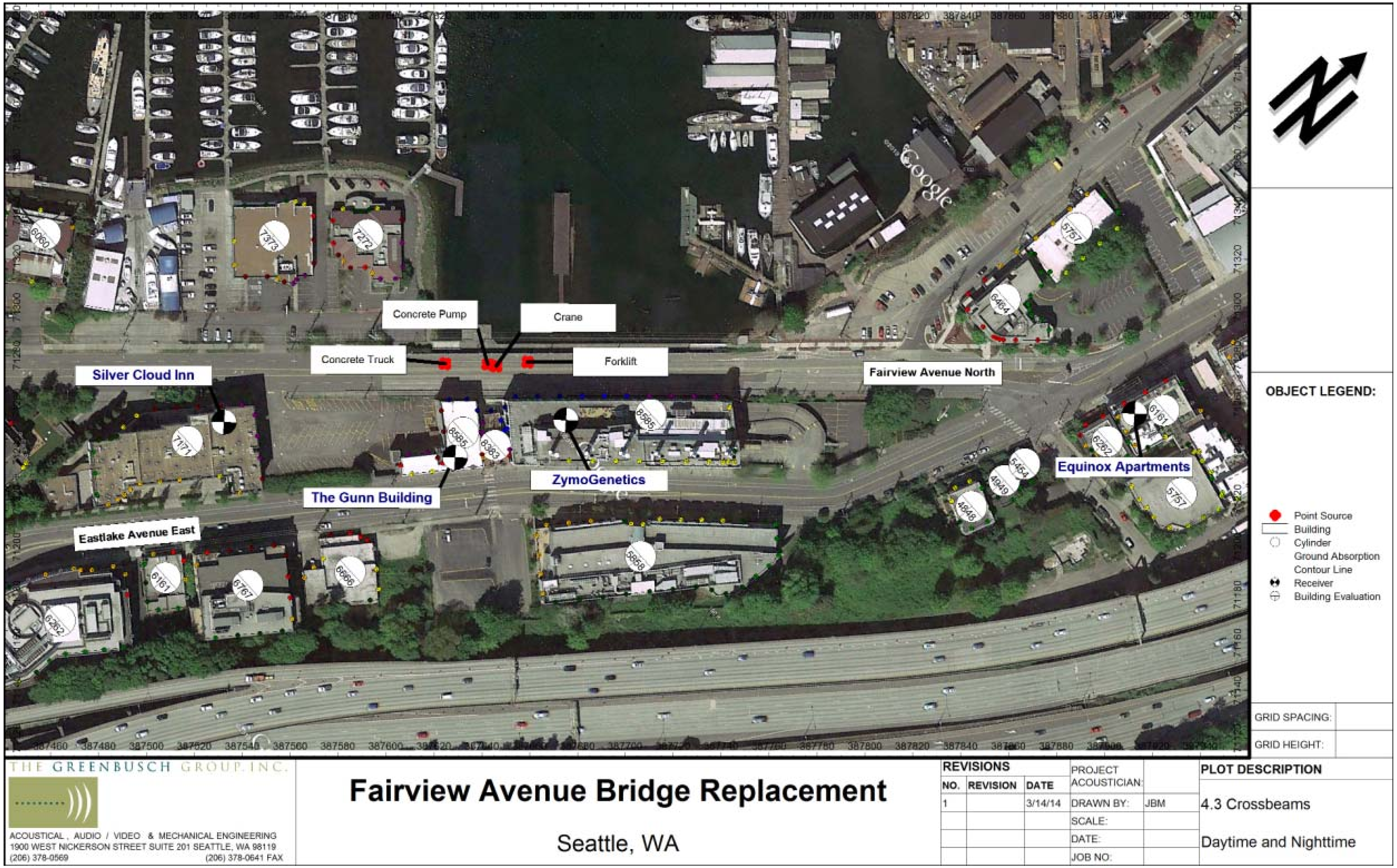


Figure A-11 Phase 4.4 Construction Noise Model

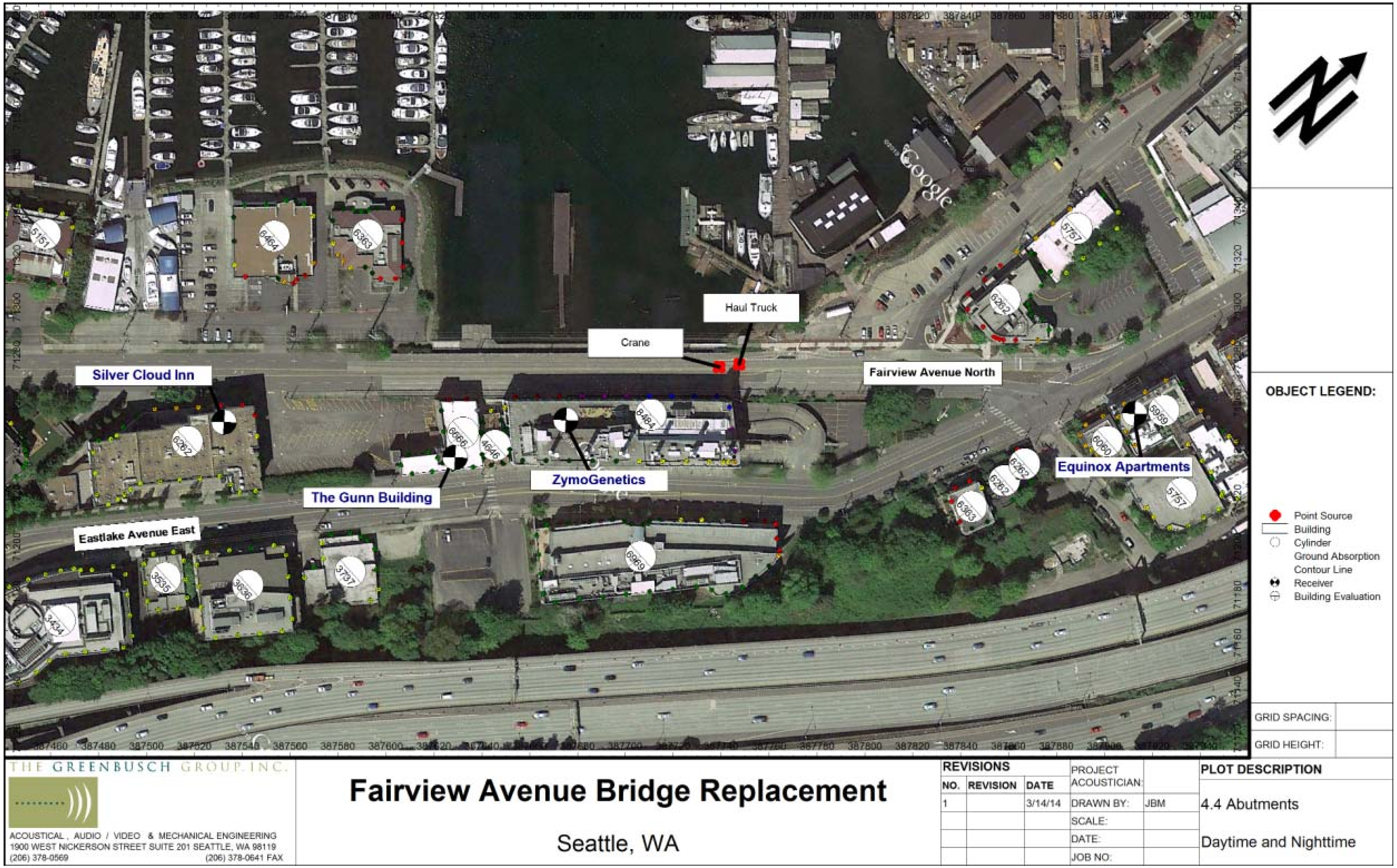


Figure A-12 Phase 5.1 Construction Noise Model

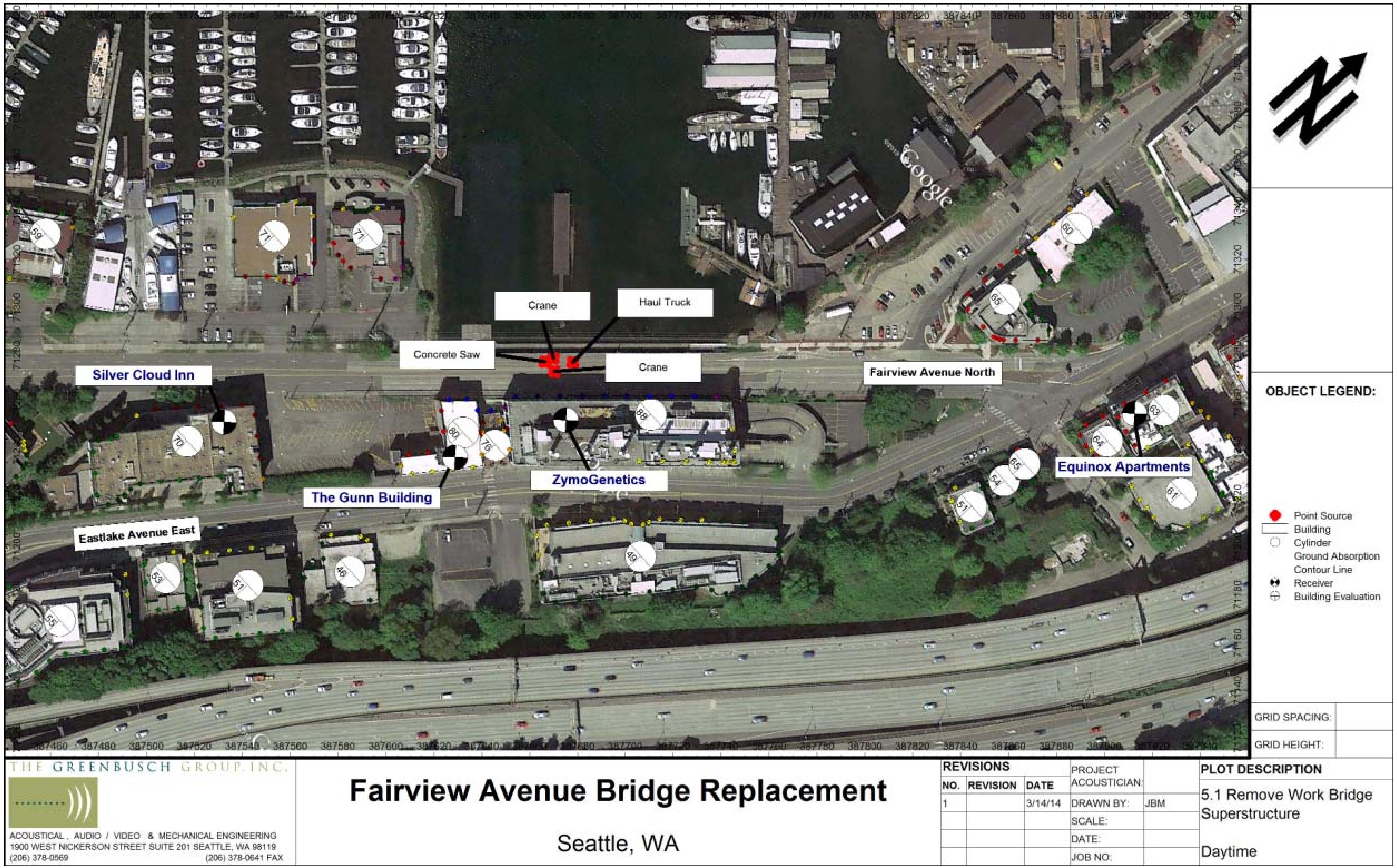


Figure A-13 Phase 5.2 Construction Noise Model

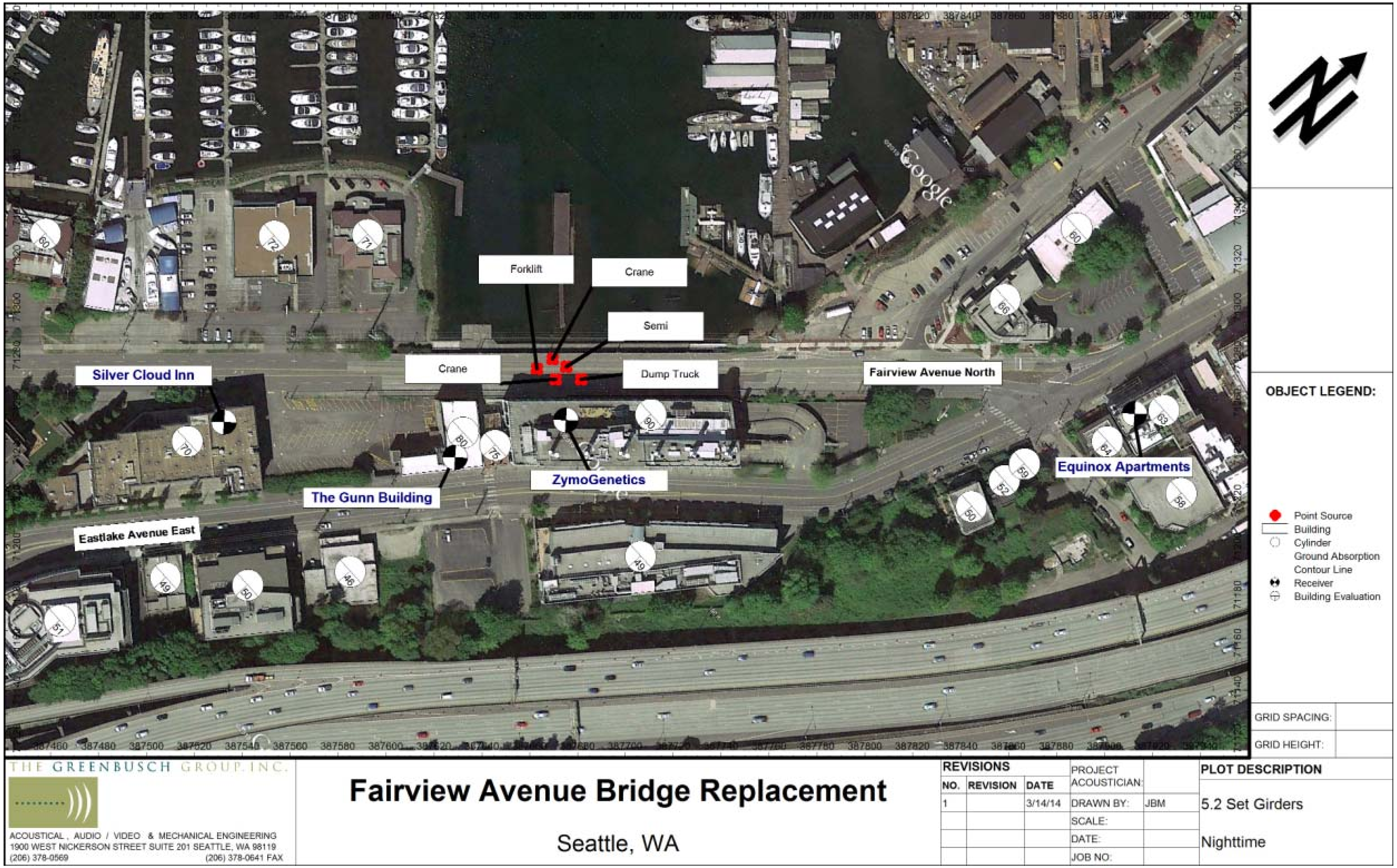


Figure A-14 Phase 5.3 Construction Noise Model

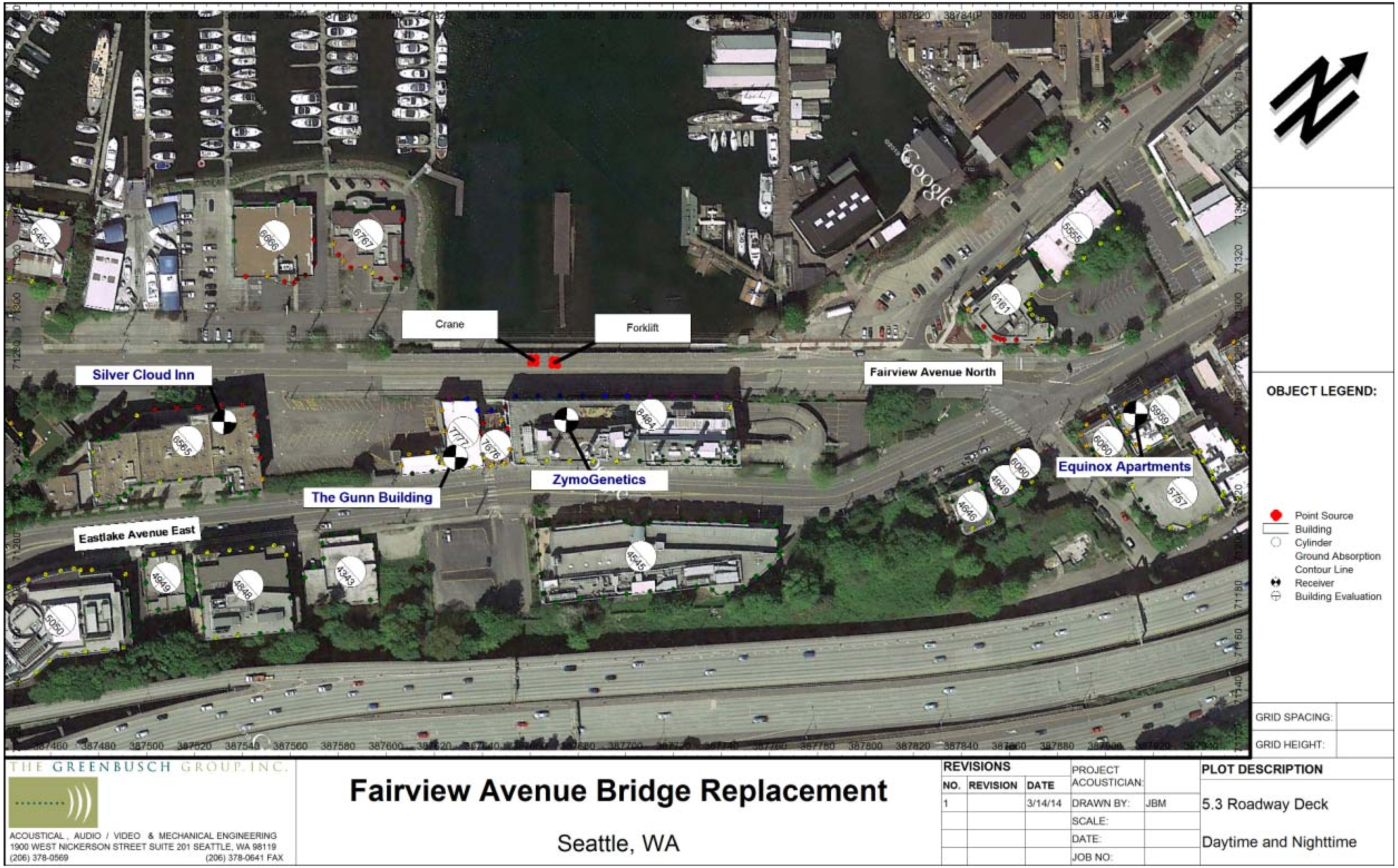


Figure A-15 Phase 5.4 Construction Noise Model

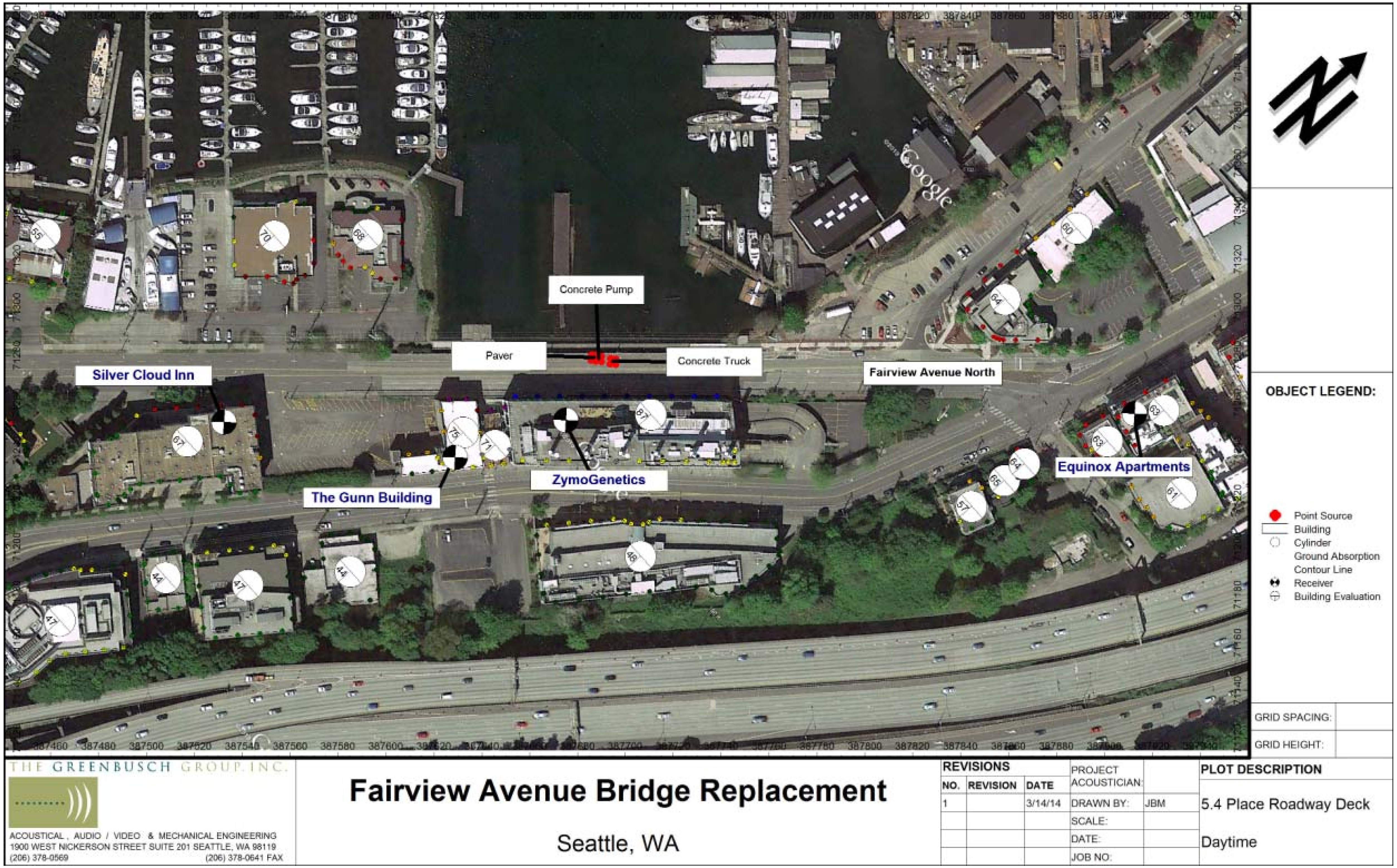
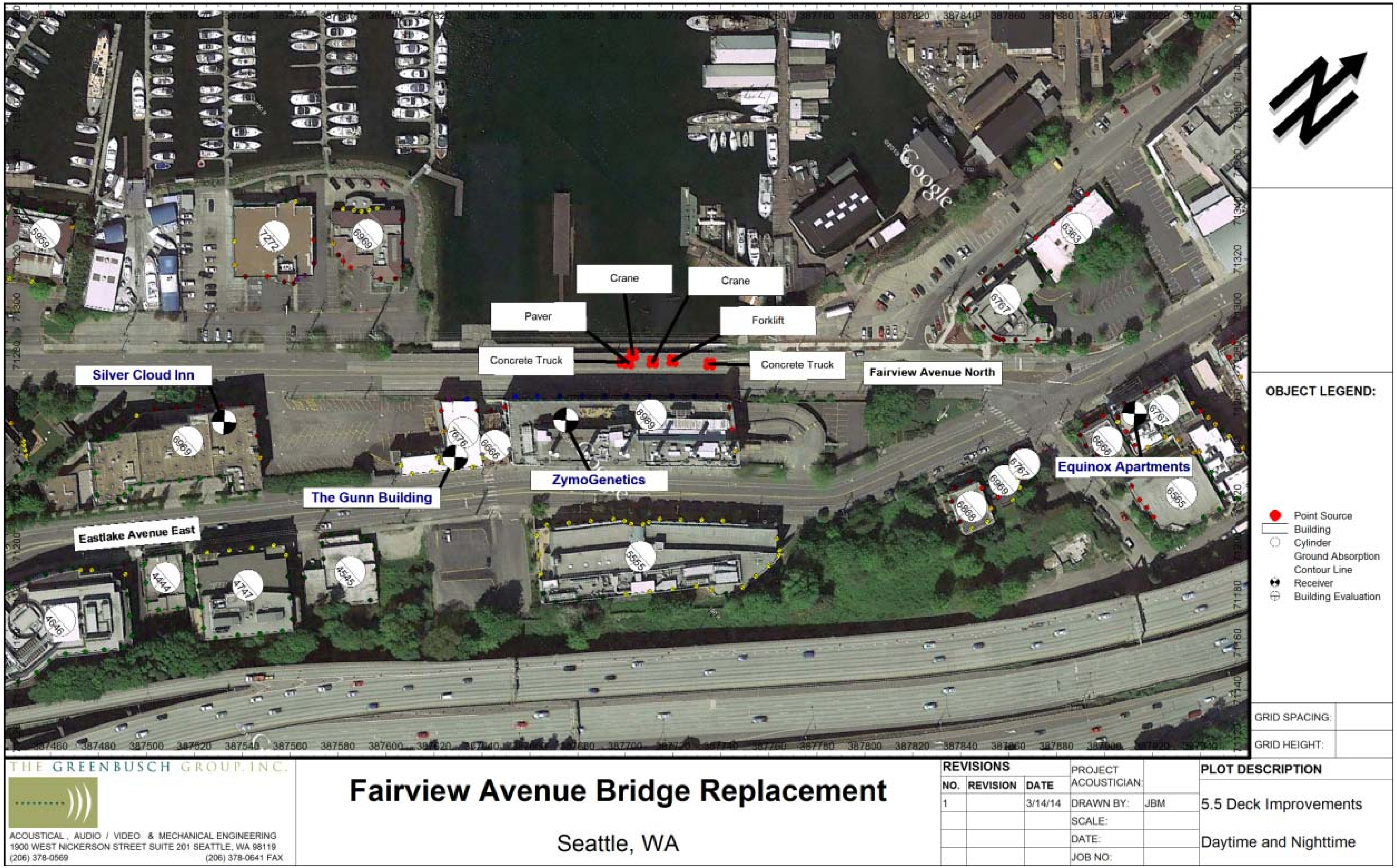


Figure A-16 Phase 5.5 Construction Noise Model



FAIRVIEW AVENUE NORTH BRIDGE PROJECT

TYPE, SIZE AND LOCATION REPORT
(FINAL)

July 2013

PREPARED FOR:

SDOT

Seattle Department of Transportation
700 Fifth Avenue, Suite 3900
Seattle, WA 98124-4996
Phone: (206) 684-7623

PREPARED BY:

HNTB Corporation
600 108th Avenue, N.E., Suite 900
Bellevue, WA 98004
Phone: (425) 455 – 3555

Perteet, Inc.
505 Fifth Avenue South, Suite 300
Seattle, WA 98104-3894
Phone: (206) 436-0515

HNTB

Perteet

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FAIRVIEW AVENUE NORTH BRIDGE

TYPE, SIZE AND LOCATION REPORT

(FINAL)
July 2013

I hereby certify that this report was prepared by me or under my direct supervision and that I am a duly licensed Professional Engineer under the laws of the state of Washington.

Signed: ___________________________________ Lic. No.: 39878

Printed Name: Kiva Lints Date: ___________

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1 EXECUTIVE SUMMARY

The City of Seattle Department of Transportation Capital Project and Roadway Structures Division propose to replace one or both bridges of the Fairview Avenue North Bridge to address deterioration of the existing west bridge. This Type, Size and Location (TS&L) report is provided to summarize and compile all the analysis and investigation completed to establish a preferred alternative for advancing the project to final design and construction.

Approximately ten (10) concepts were reviewed during the initial screening phase. Based on the initial screening meeting discussions, the concepts were narrowed down to three (3). The following concepts were investigated in more detail to determine the preferred alternative:

- Fill Alternative (F1) – Roadway fill section supported by retaining walls with a fill slope extending 175' feet into Lake Union from approximately the existing floating walkway.

- Complete Replacement (C5) – Full replacement of the West and East Bridges with a prestressed concrete girder superstructure supported on 8-foot-diameter shaft foundations.

- Replace West Bridge and Rehabilitate East Bridge (R4) – Replace the West Bridge with a new bridge adjacent to the existing East Bridge constructed with a prestressed concrete girder superstructure supported on 8-foot-diameter shaft foundations.

After the second screening meeting and additional geotechnical analysis was performed, it was determined that the preferred option would be to completely replace both existing bridges with one bridge using Alternative C5.

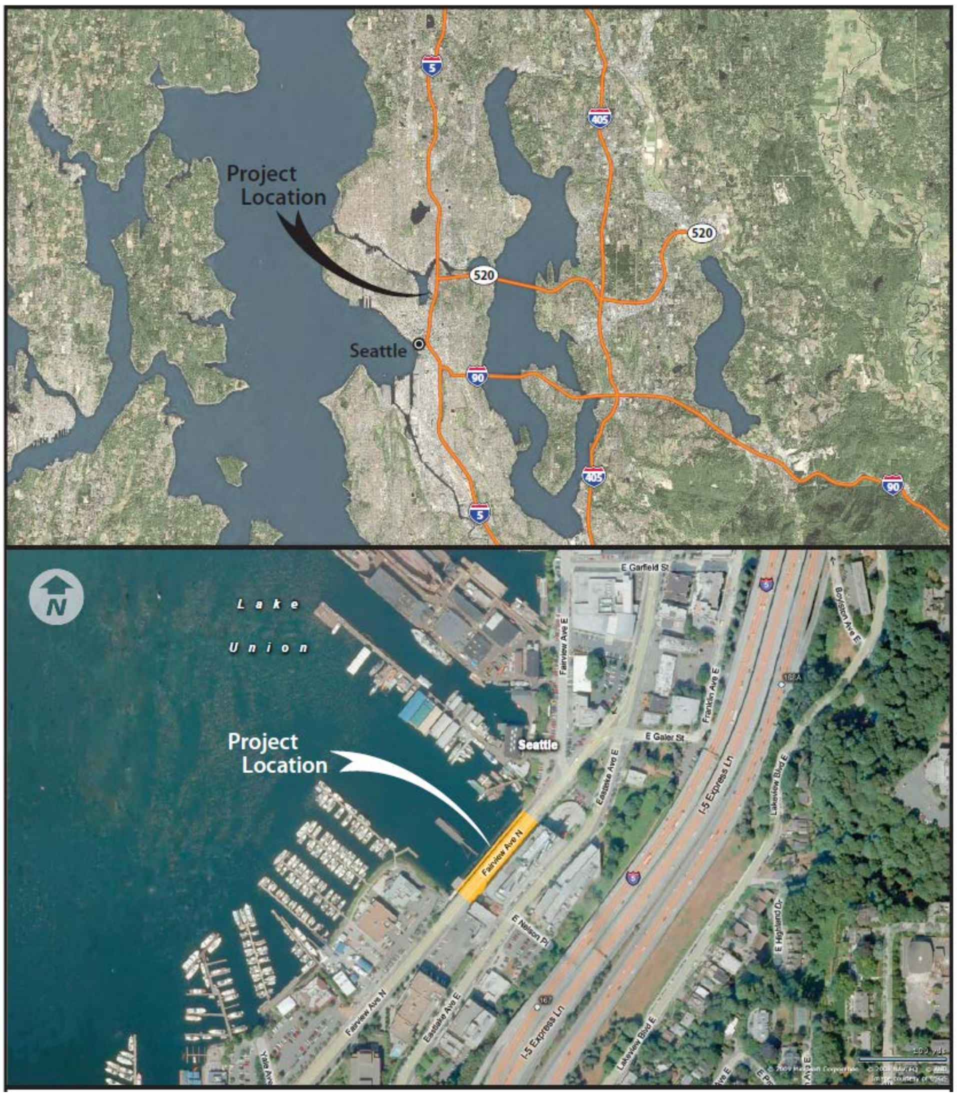
The fill alternative, Alternative F1, was deemed not feasible due to the risk of a global stability slope failure during the design seismic event and the costs associated with mitigating this risk. The replacement of West Bridge and rehabilitation of the East Bridge (R4) option was not selected because the East Bridge does not meet current seismic design criteria and, given the age of the East Bridge (over 50-years), it was determined not to be cost effective to perform a seismic rehabilitation to address the seismic deficiencies. Furthermore, replacing the East Bridge in the future would be costly and result in further disruption to the public.

The complete replacement option, Alternative C5, has an estimated cost of $25.0 million (2014 dollars) with partial closure of the roadway during construction. During final design, a traffic analysis will be performed to evaluate the impacts of staged construction versus full closure of the roadway.

2 INTRODUCTION

2.1 Background

The Fairview Avenue North Bridge is located along the southeast shore of Lake Union near the 1200 block of Fairview Avenue North in Seattle. There are two parallel bridges at this location, the West Bridge and the East Bridge. The bridges are adjacent to the historic Lake Union Steam Plant building, which is currently owned by Alexandria Real Estate Equities and occupied by ZymoGenetics.



Source: Fairview Avenue N Bridge Rehabilitation Program Concept Design Report and Cost Estimate, HDR., March 2009

Figure 1 – Project Location

The West Bridge was built in 1948 and carries one lane of southbound traffic and a bike lane. Traffic and bicyclists are separated by a 12-inch-wide curb. The West Bridge has a concrete deck and is supported on timber piles. Over the past 64 years, the piles have deteriorated and are in poor condition. With limited options to repair or replace the piles, the West Bridge needs to be replaced.

The East Bridge was built in 1963 and carries two lanes of northbound traffic and one raised 8-foot-wide sidewalk for pedestrians. The East Bridge has a prestressed concrete girder superstructure supported on prestressed concrete piles.

Figure 2 – Fairview Avenue North

In March 2009, a design report was prepared to evaluate options for both bridges that would allow for the extension of the South Lake Union Streetcar across the bridge. The report recommended replacement of the West Bridge and retrofit of the East Bridge to accommodate the extension.

2.2 Purpose of the Project

The purpose of this project is to maintain the transportation function and capacity on Fairview Avenue North by replacing the existing deteriorating bridge(s) with a new structure. The purpose of this report is to document the Type, Size, and Location (TS&L) study to evaluate alternatives for replacing one or both of the existing bridge structures. The overarching goal is to replace the West Bridge. Extension of the streetcar is not part of this project; however, any new structure would have to be designed to accommodate the future extension of the streetcar line. Retrofitting existing structures, such as the existing East Bridge, is not a practical solution to support the streetcar extension.

The project evaluated the following concepts:

- Fill Alternative (F1) – Roadway fill section supported by retaining walls with a fill slope extending 175’ feet into the lake from the existing floating walkway.

- Complete Replacement (C5) – Full replacement of the West and East Bridge with a prestressed concrete girder superstructure supported on 8-foot-diameter shaft foundations.

- Replace West Bridge and Rehabilitate East Bridge (R4) – Grade separate a new West Bridge constructed with a prestressed concrete girder superstructure supported on 8-foot-diameter shaft foundations.

The project goal is to determine the preferred alternative for the Fairview Avenue North Bridge to carry forward into final design. This TS&L report documents the evaluation process for the selection of the preferred replacement alternative.

2.3 Previous Studies

A number of previous studies have been conducted relating to the rehabilitation, retrofit, and/or replacement of the existing Fairview Avenue North Bridge. These studies include the following:

- *Fairview Avenue N Bridge Rehabilitation Program, Concept Design Report and Cost Estimate,* March 2009 HDR

- *Fairview Avenue N Bridge Rehabilitation, Preliminary Geotechnical Report*, March 2009, Aspect Consulting, LLC.

- *Field Testing and Load Rating Report: Fairview Ave N East Bridge, Seattle, Washington DRAFT*, December 2008, Bridge Diagnostics, Inc.

- 2012 West Bridge & 2010 East Bridge Inspection Reports, Seattle Department of Transportation

2.4 Current Studies

The following reports have been prepared as part of this study:

- *Final Geotechnical Report, Fairview Avenue Bridge replacement Project, Seattle, Washington*, April 2013 HWA GeoSciences Inc. – Appendix F

- *Final Environmental Permitting, Impact Assessment, and Mitigation Inventory Technical Memorandum*, April 2013, Environmental Science Associates – Appendix G

- *Fairview Bridge Replacement Cultural Resources Discipline Report for TS&L Phase*, May 2012 ESA Paragon. – Appendix H

- *Baseline Noise and Vibration Monitoring Report, February 2013 Greenbusch* – Appendix I

3 EXISTING CONDITIONS

3.1 Existing Roadway

Fairview Avenue North is a three-lane roadway connecting the South Lake Union neighborhood to Eastlake Avenue East. Fairview Avenue North is classified as a

Principal Arterial, Regional Connector and a Minor Transit Street by the City of Seattle. The posted speed is 30 miles per hour (mph). The roadway across the bridge consists of two 10.5-foot-wide lanes northbound and a 12-foot-wide lane southbound separated by a 7-foot-wide striped median. There is an 8-foot-wide raised concrete sidewalk on the east side and a 9-foot-wide bicycle/pedestrian path on the west side separated from the roadway by a 12-inch-wide traffic curb (see Figure 3).

In addition, the Seattle Department of Transportation (SDOT) recently constructed improvements at the intersection of Fairview Avenue North and Fairview Avenue East. These improvements, at the northern limits of the bridge replacement project, will realign the intersection and construct another section of the Cheshiahud Trail.

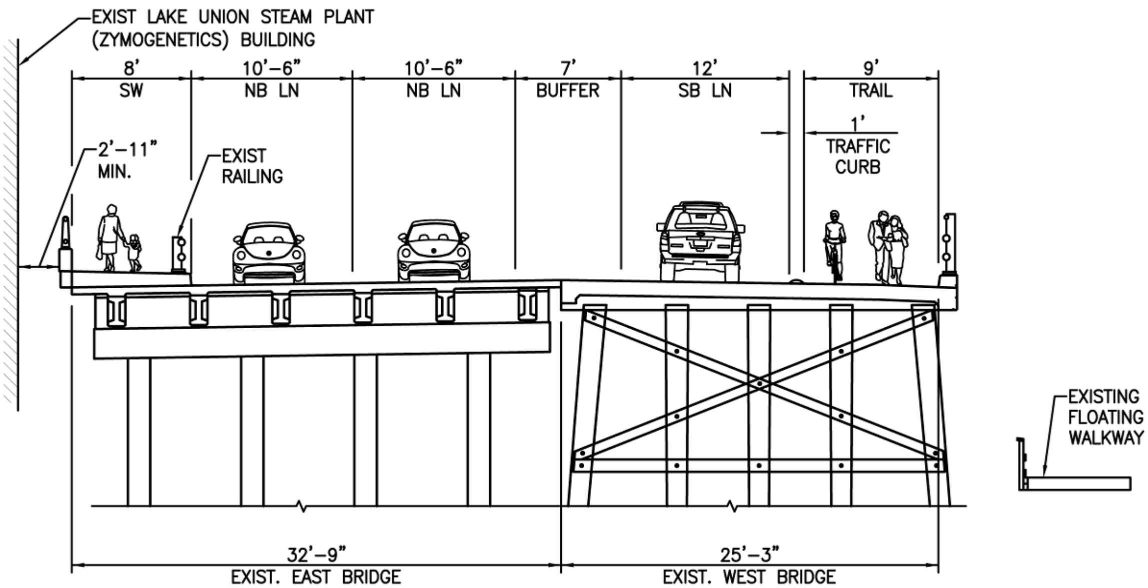


Figure 3 – Existing Typical Section

The bridge and approaches are relatively flat. The roadway grade on the south approach is less than 0.3% and it is about 1% on the north approach.

Fairview Avenue North carries 12,500 vehicles per day. According to SDOT's Automatic Traffic Count in 2007, Average Daily Traffic (ADT) on Fairview Avenue North at the intersection with Aloha Street was as follows:

- Southbound ADT = 7,200; AWDT 8,000, PM Peak of 720 vehicles per hour (vph) (July 31, 2007)
- Northbound ADT = 5,300, AWDT 6,100, AM Peak 600 vph

The 2011 Traffic Data from the City of Seattle at the intersection of Fairview Avenue North and Eastlake Avenue East indicated peak hour traffic of 400 to 600 vph southbound and 500 to 650 vhp northbound. Truck Percentage = 6.8 % AM Peak (May 5, 2011); 2.3% PM Peak (April 20, 2011).

During final design, actual traffic counts would need to be conducted to evaluate traffic impacts during construction.

Five King County Metro Transit bus routes use Fairview Avenue North: 70, 71, 72, 73 and 83.

3.2 Existing Bicycle and Pedestrian Facilities

The Cheshiahud Trail is operated by the City of Seattle Parks Department as a recreational loop around Lake Union. The trail is classified as an Urban Trail by the City. In the area of the Fairview Avenue North Bridge, the trail consists of an 8-foot-wide floating walkway on the west side of the bridge. The floating walkway is accessed by stairs and ramps on the north and south ends of the bridge.

Figure 4 – Stairway/Ramp access to Floating Walkway

In addition to the Cheshiahud trail and the bicycle/pedestrian facilities on the bridge, there is a private-pedestrian access under the Fairview Avenue North Bridge. The access was created as part of the redevelopment of the Lake Union Steam Plant building to the east of the bridge. The gated access allows ZymoGenetics employees to use the Cheshiahud trail and provides kayak access to Lake Union.

Figure 5 – ZymoGenetics Kayak Access

3.3 Existing Bridge

There have been a number of bridges constructed on Fairview Avenue North at the project location. The as-built plans for the bridge constructed in 1927, a pile supported timber trestle, shows that it was constructed just west of a then existing timber trestle. Both of these bridges were removed to allow for the construction of the existing East and West Bridges which are separated by a 1-inch-wide longitudinal joint.

The West Bridge, built in 1948, carries the one southbound lane of Fairview Avenue North. The bridge consists of one 12-foot-wide southbound traffic lane and a 9-foot-wide multi-use bicycle/pedestrian path. The bridge is 504 feet long and 25.25 feet wide. The bridge deck is comprised of a 10-inch-thick reinforced concrete slab that spans between pile-supported bents spaced at 16 feet. Each bent is constructed with a minimum five timber piles with the west-exterior piles battered outward. The piles are partially submerged, many are in poor condition, and a number of piles have been repaired over the years. The bridge is rated as structurally deficient (SD) with a sufficiency rating of 24 SD (see Appendix C). The primary driver of the low rating is the condition of the piles. Since 1989, the bridge has been posted for a 40-ton weight limit.

The East Bridge, built in 1963, carries the two 10.5-foot-wide northbound traffic lanes of Fairview Avenue North. The bridge is 481 feet long and 32.75 feet wide. The East Bridge shares a 7-foot-wide median with the West Bridge and has an 8-foot-wide raised sidewalk. The superstructure consists of fifteen spans of 32-foot-long prestressed concrete girders at a 5.5-foot spacing. The concrete deck slab is 5.75 inches thick. The substructure consists of concrete bents spaced 32 feet apart, with four 18-inch-diameter prestressed concrete piles at most bents. Bent 2 is missing one pile and as a result governs the load rating for the East Bridge. The bridge has a sufficiency rating of 85 (see Appendix C).

3.4 Existing Drainage

The existing stormwater system consists of scuppers on the West Bridge and bridge drains on the East Bridge. There is no conveyance from the bridge or treatment of the water. Stormwater from the bridges discharges directly into Lake Union.

Roadway drainage runoff south of the bridge flows away from the bridge deck. Two systems collect drainage runoff from the roadway at the south bridge approach. The first system is a catch basin located at the center of the roadway. The catch basin discharges to Lake Union via an 8-inch outfall running underneath the bridge. The second system involves a series of catch basins located along the west side of the road. These catch basins connect to a 12-inch trunk line that runs underneath the existing sidewalk. Stormwater from this trunk line runs south to connect to a 72-inch outfall located at the intersection of Ward Street and Fairview Avenue North. This outfall discharges into Lake Union via “Waterway No.6” as classified from Sewer Cards.

Roadway drainage runoff north of the bridge flows south down from Eastlake Avenue East toward the Fairview Avenue North/Fairview Avenue East intersection. The water then turns the corner down either toward Fairview Avenue East or ponds at the traffic island at the intersection. We assume the pond at the traffic island eventually drains to

Lake Union. Existing drainage features could not be confirmed from GIS, sewer cards, survey, or field observations. Additional survey would be required during final design to determine the actual drainage path.

3.5 Existing Utilities

A number of existing utilities run through the project area either overhead, underground or attached to the bridges. These include: storm drains, Metro Transit trolley lines, fiber optic cable conduits, communication lines, natural gas pipes, and major electric power lines. The interested parties include the City of Seattle, Seattle City Light, Puget Sound Energy, Seattle Public Utilities, and three bandwidth/network providers. The following utilities exist on the project and could potentially be impacted.

Seattle Public Utilities (SPU)

- There is a 30-inch-diameter storm outfall that discharges under the east bridge adjacent to the ZymoGenetics pedestrian lake access. If a fill option were selected, the 30-inch-diameter pipe would need to be extended.

- A 12-inch-diameter storm drain outfall discharges under the east bridge south of the 30-inch diameter outfall. This pipe may also need to be extended if a fill option is selected.

- Stormwater collection - There are no existing stormwater collection systems on the bridge. The west bridge drainage consists of scuppers that discharge directly into Lake Union while the east bridge drainage consists of bridge drains that also discharge directly into the lake without any treatment. For all alternatives, the drainage will need to be captured and treated prior to discharging into Lake Union.

- An 8-inch-diameter enclosed storm drain outfall that runs underneath the bridge from the south end will be impacted by construction.

- An 8-inch-diameter sanitary sewer line runs underneath the sidewalk on the west side south of the bridge. This sewer line does not continue onto the bridge but its terminus has not been located and needs to be confirmed with SPU during final design.

- Other than the one sanitary sewer line, there are no known existing water or sewer facilities within the project limits.

Bandwidth/Network Providers

- There are three bandwidth/network providers with buried fiber optic transmission lines in the project vicinity: Zayo, Sprint and GBLX (note, some of these companies may have been acquired since receiving as-builts and coordination will be required during final design). The conduits carrying these private fiber optic lines are believed to be buried on the west side of the existing West Bridge. These conduits have been located north and south of the bridge. The exact location of these conduits where they cross Lake Union parallel to the bridge is not clear. Utility locating is needed to identify the exact location and determine utility impacts and relocation needs for the various project alternatives.

Gas Line

- There is a gas line under the west sidewalk, south of the bridge. This line terminates prior to the southern limits of the bridge. The owner of the gas line will be confirmed during final design.

Seattle City Light (SCL) Power

- Two electrical conduits are attached to the west side of the West Bridge. One conduit conveys power to the existing street lighting; the other could potentially be a spare conduit.
- A third conduit is attached underneath the roadway slab between the East and West Bridge.
- Two more conduits are attached to the East Bridge under the roadway slab on the east side of the bridge.
- There is an existing transformer vault located at the southeast corner of the bridge directly underneath the bridge. There are plans to relocate the vault as part of the 1165 Eastlake Avenue North redevelopment project.
- Illumination along the west side of the West Bridge will need to be removed and replaced.
- Various catenary wires running across the roadway will be impacted during construction.

Other Utilities

- Conduit and overhead lighting for the ZymoGenetics pedestrian walkway are located under the existing bridge.
- Overhead Metro Transit trolley lines are above each bridge and will need to be removed and replaced.
- Major overhead transmission lines are located west of the West Bridge. These transmission lines are supported by two large towers at either end of the bridge.
- According to the as-builts, there are two 60-inch-diameter pipes and one 48-inch-diameter pipe below the water that are assumed to be abandoned. These pipes are believed to be remnants of the old steam power plant. They will need to be removed if in conflict with construction.

During the final design phase of the project, the design team will coordinate with Seattle Public Utilities, Seattle City Light, Metro Transit, Puget Sound Energy, and the various fiber optic bandwidth/network providers.

3.6 Adjacent Properties

The properties adjacent to the Fairview Avenue North Bridge are a mix of commercial, office, and public uses. These adjacent properties are shown in Figure 6.

Figure 6 – Adjacent Properties

Seattle Seaplanes

Seattle Seaplanes operates from a dock 100 feet to the northwest of the project. They own a parking lot about 50 feet north of the existing bridge.

ZymoGenetics Building

The building at 1201 Eastlake Avenue East is currently owned by Alexandria Real Estate Equities and occupied by ZymoGenetics, a biotechnology/pharmaceutical company. This building is the landmark Lake Union Steam Plant building built between 1914 and 1921. The building is located approximately 3 feet to the east of the Fairview Avenue North Bridge. As discussed in Section 9, the building is a City of Seattle Landmark and historic property. Due to its landmark status and its proximity to the project, the building and its sensitive laboratory equipment and experiments will need to be considered during construction. See Baseline Noise and Vibration Monitoring Report (Appendix I).

Source: Seattle Municipal Archives

Figure 7 – 1921 Lake Union Steam Plant Building

1165 Eastlake

The property at 1165 Eastlake Avenue North is located south of the ZymoGenetics building. The existing office building on the north third of the property is located approximately three feet from the existing bridge and the southern two-thirds of the property is a parking lot. The property owner is currently working on a Master Use Permit and plans to develop the entire property. No definite timeline has been established for construction of the improvements. Due to its proximity to the project, the building will need to be protected during construction.

Silver Cloud Hotel

South of the 1165 Eastlake Avenue North property is a Silver Cloud Hotel. The hotel is approximately 1000 feet south of the existing bridge on the east side of Fairview Avenue North.

1177 and 1151 Fairview

To the southwest of the Fairview Avenue North Bridge are two office buildings. There is an existing parking lot between the buildings and the roadway. The buildings are approximately 120 feet from the back of the existing sidewalk. There is a pedestrian trail along the waterfront behind the two office buildings that connects to the Cheshiahud trail near the south approach.

Cheshiahud Trail

The Cheshiahud trail runs along the west side of Fairview Avenue North below the existing bridge, is owned by the City of Seattle and operated by the Seattle Parks Department.

4 DESIGN CRITERIA

The final *Design Criteria Technical Memorandum* documents the design criteria used to prepare this report and the proposed design criteria to be used for final design for structural and roadway design improvements to Fairview Avenue North Bridge (See Appendix A). The design criteria for the project were established based on the following publications.

City of Seattle Publications:

- *Standard Plans for Municipal Construction*
- *Standard Specifications for Road, Bridge and Municipal Construction*
- *Right-of-Way Improvement Manual*
- *Vehicles and Traffic*, Title 11, Seattle Municipal Code
- *Traffic Control Manual for In-Street Work*
- Seattle Parks and Recreation Standards (http://www.ci.seattle.wa.us/parks/projects/standards/)
- *Street and Sidewalk Pavement Restoration Guidelines* (refer to City of Seattle Right-of-Way Improvements Manual)
- *Stormwater Code*, Title 22, Subtitle VIII, Seattle Municipal Code
- *The Stormwater Flow Control and Water Quality Treatment Best Management Practices Technical Requirements Manual*, Volume 3 of the Joint DPD/SPU Directors' Rules
- SDOT *Bridge Seismic Retrofit Philosophy, Policies and Criteria* (PCC), revision zero

Washington State Department of Transportation (WSDOT) Publications:

- *Standard Specifications for Road, Bridge, and Municipal Construction*, English Edition, M41-10
- *Standard Plans for Road, Bridge, and Municipal Construction*, English Edition M21-01
- *Design Manual,* M22-01
- *Bridge Design Manual*, M23-50
- *Geotechnical Design Manual*, M 46-03
- *Environmental Procedures Manual,* M31-11

American Association of State Highway and Transportation Officials (AASHTO) Publications:

- *A Policy on Geometric Design of Highways and Streets,* Sixth Edition
- *LRFD Bridge Design Specifications*, Fifth Edition
- *LRFD Bridge Construction Specifications*, Third Edition
- *Guide Specifications for LRFD Seismic Bridge Design*, Second Edition.
- *Manual for Bridge Evaluation*, 2nd Edition.
- AASHTO/AWS *Bridge Welding Code*, D1.5M/D1.5

U.S. Department of Transportation (USDOT) Publications:

- *Manual on Uniform Traffic Control Devices for Streets and Highways*
- *Seismic Retrofitting Manual for Highway Structures,* Publication No. FHWA-HRT-06-032, 2006.
- *Recommended Procedures for the Safety Performance Evaluation of Highway Features,* National Cooperative Highway Research Program (NCHRP) Report 350

Other Publications / Design Guides:

- *Americans With Disabilities Act* (ADA), Title III regulations (28 CFR Part 36)
- *Stormwater Management Manual for Western Washington*, Washington State Department of Ecology
- *Highway Capacity Manual 2000*, Transportation Research Board
- *Guidelines on Foundation Loading and Deformation Due to Liquefaction Induced Lateral Spreading, January 2012,* California Department of Transportation

Sound Transit:

- *Link Light Rail Design Criteria Manual*, May 2011.

5 ROADWAY, TRAFFIC, DRAINAGE, AND UTILITIES CONSIDERATIONS

5.1 Roadway

Several alternative roadway sections were evaluated to determine a preferred roadway section. All alternative sections included two northbound lanes and one southbound lane, typically 11 feet wide, with various configurations to accommodate bicyclists, pedestrians, and a possible future streetcar extension.

Four alternative roadway sections were developed and presented to City staff. With feedback from City staff, the preferred alternative in Figure 8 – Proposed Roadway Section was developed for use in evaluating bridge replacement alternatives.

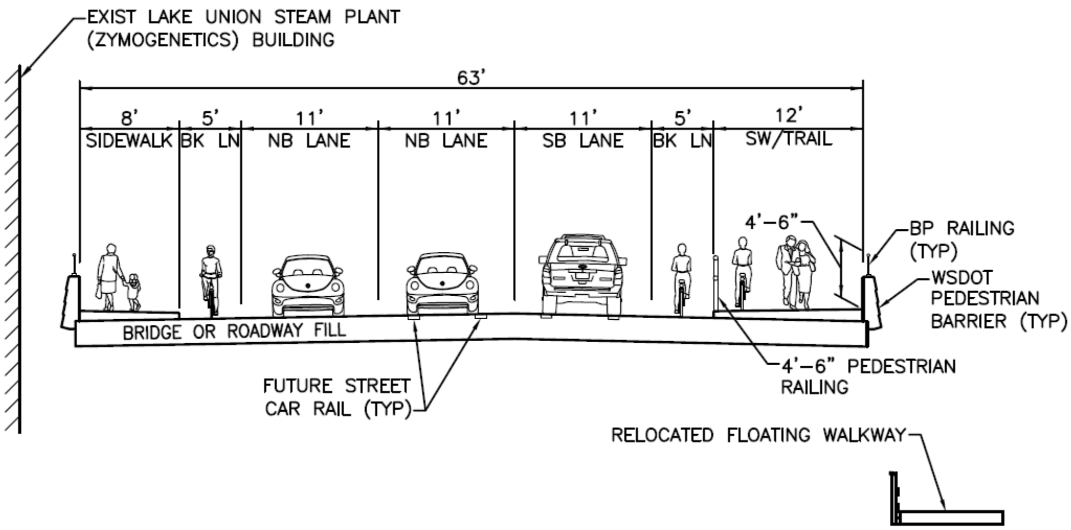


Figure 8 – Proposed Roadway Section

The proposed roadway section includes three 11-foot-wide lanes (two northbound and one southbound), one 5-foot-wide bike lane in each direction, an 8-foot-wide sidewalk on the east side and a 12-foot-wide mixed-use trail on the west side. The project would either replace or relocate the existing floating pedestrian walkway to the west of the bridge that is part of the Cheshiahud Trail.

According to the Seattle Transit Master Plan, Fairview Avenue North is considered a High Capacity Transit (HCT) Rail Corridor. The proposed roadway section would not preclude the future extension of the rapid streetcar. Streetcar track could be placed in the middle of two 11-foot-wide lanes and would require no additional separation because the bridge is in a tangent section of the roadway.

Subsequent to the selection of a preferred roadway section and the evaluation of the bridge alternatives, Fairview Avenue North was identified by the City as a possible route for a cycle track. Figure 9 was developed to show that the current proposed width of 63-feet does not preclude the addition of a cycle track across the bridge. The proposed roadway section with the cycle track includes three 11-foot-wide lanes (two northbound and one southbound), a 6-foot wide northbound (east side) cycle track separated by a 2-foot wide buffer, an 8-foot-wide sidewalk on the east side and a 14-foot-wide mixed-use trail on the west side.

The impact of the cycle track and how it would tie-in to the roadway north and south of the bridge has not been evaluated at this time. While fatal flaws are not expected, it will likely require the modification of the intersection at Eastlake north of the bridge, as well as roadway and sidewalk modifications extending south of the bridge. The discussions under the Bridge Replacement Alternative Evaluation section are based on Figure 8. All three alternatives can accommodate Figure 9; however, Alternative R4 would require a wider section.

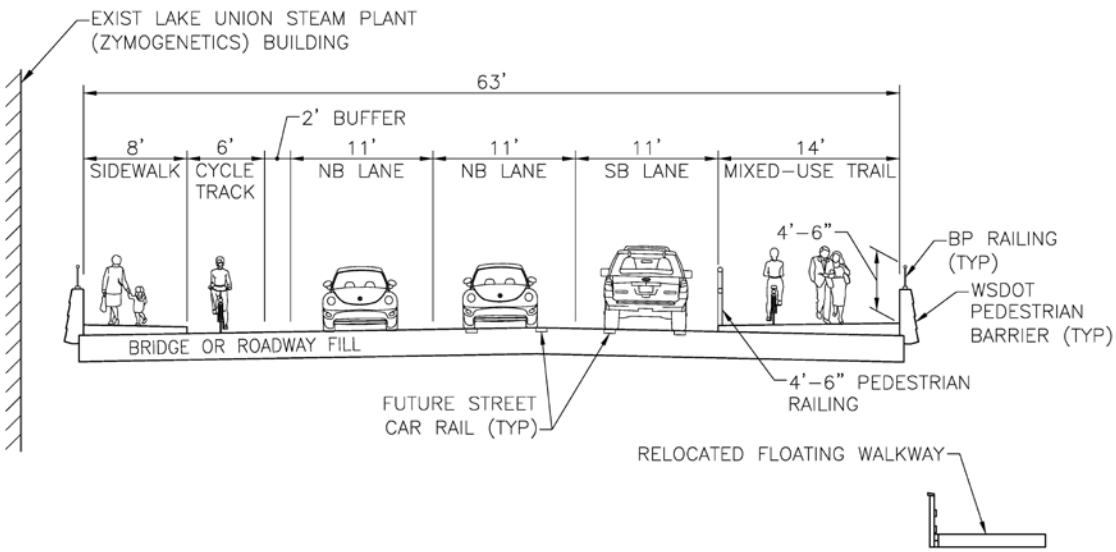


Figure 9 – Proposed Roadway Section with Cycle Track

5.2 Maintenance of Traffic (MOT)

During construction of either a new bridge or the fill option, it has been assumed that a northbound and southbound traffic lane and a sidewalk would be maintained. Closures would be required for select construction activities. These closures would be limited to nights and weekends, and a detour would be provided. During final design, the project team will explore the benefits and impacts of longer term single-lane closures and complete bridge closure in an effort to minimize overall construction duration, traffic impacts and cost. A southbound detour could be accomplished by routing traffic to nearby Eastlake Avenue North. A northbound detour would be more complicated because the nearest arterial connection to Eastlake Avenue North is Denny Way.

5.3 Drainage Considerations

Lake Union is part of the Lake Washington Drainage Basin, located in the Water Resource Inventory Area (WRIA) 8 – Lake Washington/Sammamish Watershed. This project will confirm to the 2009 *Stormwater Municipal Code* (SMC 22.800-22.808) and the 2009 City of Seattle *Stormwater Flow Control and Water Quality Treatment Technical Requirements Manual*. Because Lake Union has been identified as a *Designated Receiving Water* by Washington State Department of Ecology (SMC 22.801.050), flow control is not required. Lake Union is also designated as a basic treatment receiving water and therefore will not be subject to enhanced treatment, only basic treatment criteria.

According to Ecology, Lake Union is a 303(d) listed for total phosphorus, fecal coliform bacteria, lead, and aldrin. The City of Seattle does not currently require phosphorus treatment for water discharging into any receiving water body; therefore, the water quality treatment system will not consider requirements for phosphorus.

As part of the proposed design, the bridge profile will be raised to allow for positive drainage; hence, collection and treatment systems will not be required on the bridge and will be located in the roadway section adjacent to each bridge approach. Due to the various constraints of the project (limited pervious surface availability, space limitations, and utility conflicts) the use of Green Stormwater Infrastructure (GSI) implementation has limited feasibility within the project. However, the use of bioretention, particularly Filterra biorentention facilities, can be used and will present a number of opportunities advantageous to the project. These advantages include; an urban solution for low impact development, smaller footprints, aesthetically pleasing, and meets the WSDOE list for General Use Level Designation (GULD) on basic treatment of emerging technologies. Other such GSI infrastructures not feasible are rain gardens, biorentention cells, conveyance swales, green roofs, and permeable pavement.

For final design, the use on a variety of media filtration devices will be examined. Much like bioretention, media filtration is approved by WSDOE, is GULD, and meets basic treatment requirements. These media filtration devices can be a low impact design of catch basins, manholes, vaults, and/or curb inlets. Media filtration cartridges will be sized accordingly and pipes will be routed to each device and eventually outfall into Lake Union where space is available.

5.4 Utilities Considerations

The following utilities could be impacted by the preferred alternative and could require coordination for replacement or relocation:

- Two electrical conduits attached to the west side of the bridge.
- One conduit underneath the road deck, attached between the East and West Bridge.
- Two conduits attached to the east side of the East Bridge.
- In the event that the transformer vault, located under the southeast corner of the existing bridge, is not relocated as part of the 1165 Eastlake Avenue N redevelopment, this project would have to coordinate the relocation.
- Illumination along the west side of the bridge.
- Various catenary wires crossing the roadway.
- Conduit and overhead lighting for the ZymoGenetics pedestrian walkway under the existing bridge.
- Overhead Metro trolley lines above each bridge.

- Buried conduit for fiber optic lines (potentially for only F1, depending on their buried location).
- Outfall pipe to Lake Union from south approach to the bridge.

6 BRIDGE REPLACEMENT ALTERNATIVES EVALUATION

6.1 Roadway Fill Alternative (F1)

Alternative F1 would completely replace the existing East and West Fairview Avenue North Bridges (Bridge No. 069 & 070) with a roadway fill section that would place an extensive amount of fill in the lake and a small structure to maintain the existing private-pedestrian walkway. The roadway fill would completely replace the bridges and would extend into Lake Union approximately 175 feet. Fill above the ordinary high water mark would be retained using structural earth walls. A preliminary typical section can be seen in Figure 10. A preliminary layout for Alternative F1 can be seen in Appendix D.

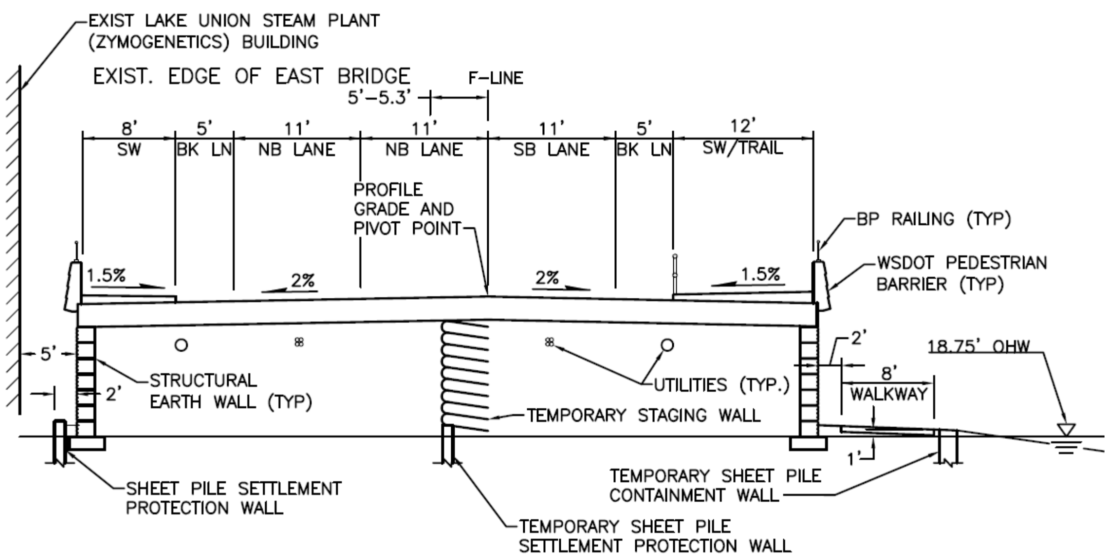


Figure 10 – Alternative F1 Typical Section

The roadway section would be shifted west to facilitate the staging needed to maintain two lanes of traffic and one sidewalk during construction. For reference the 8-foot east sidewalk would be shifted 3½-feet west. The wider roadway section will impact the Cheshiahud Trail at the ends of the existing West Bridge. The bottom of the floating walkway could be replaced with a trail on fill set a minimum 1-foot above the ordinary high water line. This would provide opportunities to improve ADA accessibility to the lakeside trail by replacing the stairway with ADA accessible trail profile.

A raised roadway profile would provide positive stormwater drainage to the ends of the fill via gutter flow and enable the existing private-pedestrian walkway to remain under the roadway. During final design, options, such as a three-sided concrete box, for maintaining the existing private-pedestrian walkway that is under the existing bridge would be explored. The three-sided box would have a standard waterproofing applied to the outside of the box to prevent water intrusion into the box. Given the length of the box, approximately 65-feet, ventilation would not be required.

In order to mitigate for settlement and liquefaction, ground improvement would be required. Sensitivity to the ZymoGenetics building and its operation would be considered when selecting type of ground improvement. For further discussion, see Section 7 and Appendix F for the geotechnical report.

Construction of the fill alternative and ground improvements would require temporary relocation of underground utilities mounted on the existing bridge and extension of the 12-inch and 30-inch storm outfalls.

The roadway fill alternative would be constructed in two phases. During the first phase, the existing West Bridge would be demolished followed by construction of the western half of the fill, walls, and ground improvements. The second phase would demolish the East Bridge and construct the remaining portion of the fill, walls, and ground improvements.

The construction would require a permanent sheet pile settlement protection wall to protect the ZymoGenetics building foundation from down drag induced by the placement of the large quantity of fill adjacent to the building. A temporary sheet pile settlement protection wall may be required between the first phase of fill and the existing east bridge to protect the east bridge piles from down drag during construction. In addition, a temporary containment wall would be required west of the project to contain the spoils from the jet grouting to prevent them from entering the lake. A preliminary layout, typical section, and construction staging for Alternative F1 can be found in Appendix D.

6.2 Full Bridge Replacement Alternative (C5)

Alternative C5 would completely replace the existing East and West Fairview Avenue North Bridges (Bridge No. 069 & 070) with a single bridge. The replacement bridge would have a length of 410 feet, a width of 66 feet, and consist of three 135-foot-long spans with the northern abutment located at the northern end of the existing bridges. The new southern abutment would be north of the existing East and West Bridge abutments by approximately 72 feet and 91 feet respectively. This would result in placing fill below the ordinary-high-water mark at the southern end of the replacement bridge. A typical section of Alternative C5 can be seen in Figure 11. A preliminary layout and typical section for Alternative C5 can be seen in Appendix D

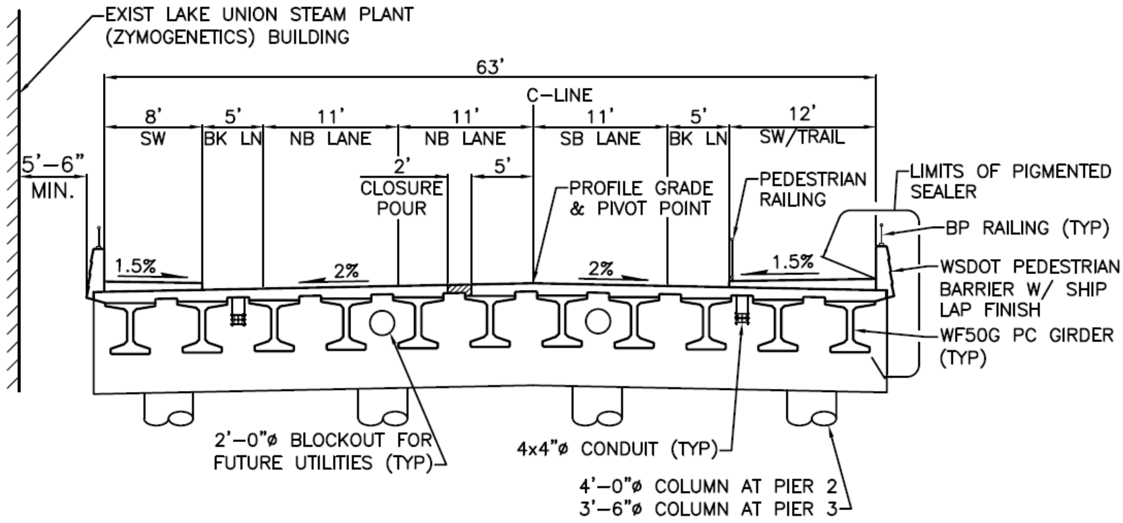


Figure 11 – Alternative C5 Typical Section

The roadway section would be shifted west to facilitate the staging needed to maintain two lanes of traffic and one sidewalk during construction. For reference the 8-foot east sidewalk would be shifted 3½-feet west. The wider bridge would impact the Cheshiahud Trail at the ends of the existing West Bridge and would require relocation of the floating walkway. This would provide opportunities to improve ADA accessibility to the floating walkway. The bridge would include three 11-foot wide traffic lanes, two 5-foot wide bike lanes, one 8-foot wide sidewalk, and one 12-foot wide shared-use path. A raised bridge profile would provide positive stormwater drainage to the ends of the bridge via gutter flow and enable the existing private-pedestrian walkway to remain under the bridge.

The superstructure would be constructed with WF50G precast prestressed concrete girders and a cast-in-place concrete deck with traffic barriers and sidewalks on each side. The superstructure would provide access for current utilities as well as block outs for future utilities to be installed on the bridge.

The substructure would consist of two intermediate piers and two abutments. The intermediate piers would consist of four 8-foot-2-inch-diameter (2.5-meter) drilled shaft foundations supporting columns extending to the superstructure. The top of the drilled shafts would be set at a consistent elevation for all of the shafts within a pier. The top of the eastern most drilled shaft would be set approximately 3 feet below the existing mudline. However, due to the fact the lake bottom slopes down to the west, the western most drilled shaft would extend up from the mudline on the order of 15 to 17 feet.

The abutments would have full-height abutment walls supported on drilled shaft foundations, whose size and spacing would be determined during final design. The bottom of the northern and southern abutments would likely be set at Elevation 18. This would allow construction of the abutments in the dry, depending on the time of year.

In order to mitigate local and potential global stability issues associated with the geotechnical conditions, deep seated jet grouting, vibration free stone columns, and deep soil mixing (DSM) methods are being explored as a means of ground improvement.. See the geotechnical report in Appendix F for details of the ground conditions and mitigation options.

Accommodation for the future extension of the South Lake Union Streetcar would be provided by designing the bridge to accommodate a future 2-inch-thick concrete overlay across the entire structure, including the sidewalks, and the live load associated with the streetcar. The 2-inch-thick concrete overlay is intended to accommodate the future installation of streetcar rails, using block rail, in a 3½-inch-deep rail pocket. A depth of 1½ inches will need to be ground out of the existing bridge deck within the 2½ inches of clearance provided to the top mat of reinforcing steel.

The full replacement bridge would be constructed in two phases. During the first phase, the existing West Bridge would be demolished followed by construction of the western half of the new bridge. The second phase would demolish the East Bridge and construct the remaining portion of the replacement bridge. Further details of the staging can be found in Appendix D.

6.3 West Bridge Replacement and East Bridge Rehabilitation Alternative (R4)

Alternative R4 would replace only the existing West Bridge (Bridge No. 070). The bridge configuration and layout would be nearly identical to Alternative C5 except that only the first phase of the bridge would be constructed during this project and would have a width of 32 feet. The second phase could be constructed at later date when it becomes necessary to replace the existing East Bridge. This would be required if the South Lake Union Streetcar line were extended across the bridge because the existing East Bridge is not capable of supporting the streetcar loading. A typical section of Alternative R4 can be seen in Figure 12. A preliminary layout, typical section, and construction staging for Alternative R4 can be found in Appendix D.

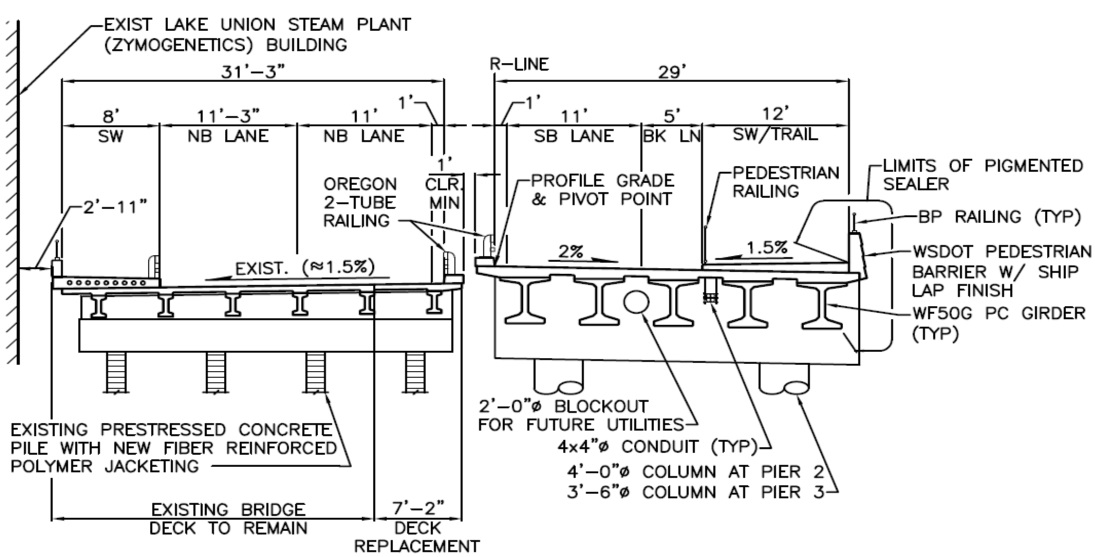


Figure 12 – Alternative R4 Typical Section

The key difference between Phase 1 of Alternative C5 and Alternative R4 would be the placement of median barriers on the new West Bridge and the existing East Bridge due to the raised profile of the new West Bridge. A portion of the East Bridge deck would need to be reconstructed to support the barrier. In addition to this change, the existing East Bridge would be evaluated during final design for strengthening and seismic retrofit which could include jacketing of the existing prestressed pile supports.

The roadway section would be shifted west to facilitate the staging needed to maintain two lanes of traffic and one sidewalk during construction. For reference the 8-foot east sidewalk would be shifted 1½-feet west. The wider bridge would impact the Cheshiahud Trail at the ends of the existing West Bridge and would require relocation of the floating walkway. This would provide opportunities to improve ADA accessibility to the floating walkway. The West Bridge would include one 11-foot-wide traffic lane, one 5-foot-wide bike lane, and one 12-foot-wide shared-use path. The East Bridge would have two 11-foot-wide traffic lanes and the existing 8-foot-wide sidewalk. A raised West Bridge profile would provide positive stormwater drainage to the ends of the bridge via gutter flow and enable the existing private-pedestrian walkway to remain under the bridge.

7 GEOTECHNICAL

7.1 Existing Conditions

The bridge site is underlain by a complex stratigraphy, which varies significantly from north to south and east to west. Below lake level, loose liquefiable sand extends across the entire bridge alignment. The continuous (non-discrete) liquefiable materials vary from about 20 to 35 feet thick along the bridge alignment. Due to the inclination of the submarine slope dipping westward under the bridge alignment, the upper continuous zone of liquefiable material could potentially undergo flow failure during a design level earthquake.

The southern two-thirds of the bridge site are underlain by a previously unidentified ancient landslide area. The landslide area appears to extend from project Station 12+25 in the north to some southern terminus located an unknown distance north of the Fred Hutchison Cancer Care facility. In the east-west direction, the slide area extends from under the ZymoGenetics building to approximately 330 feet west of the existing bridge structure. The extent of the landslide is delineated by a weak zone (shear zone) of fine-grained soil that was identified near the base of the slide mass. This weak zone was identified to be approximately 3 to 5 feet thick in most areas and was characterized by uncharacteristically low Standard Penetration Test (SPT) blow counts, increased moisture content and a highly disturbed and jumbled appearance.

The equilibrium and finite element stability analyses indicate the residual shear strength along this shear zone to be less than the driving forces associated with the design level earthquake. During a major earthquake, the ground below the bridge and surrounding vicinity could move up to a couple of feet, which would damage the bridge/roadway and adjacent properties and improvements. Potentially damaging ground movements could occur along a large portion of Fairview Avenue North during the design earthquake. Further analysis to quantify the magnitude of anticipated displacements across the shear zone during a design level seismic event are proposed for final design.

Environmental sampling and analytical testing of samples taken from the borings indicates some of the lake sediments within 10 feet of the mudline, contain elevated levels of petroleum hydrocarbons and metals. Excavations of this material may require special handling, characterization, and disposal.

The depth to competent, stable bearing material varies significantly from the north end of the bridge to the south. Coarse-grained glacial deposits, consisting of very dense sand with gravel, exist below Elevation 25 feet at the north end of the bridge. From the center of the bridge to the south, fine grained glacial deposits, consisting primarily of hard clay, underlie the landslide deposits at and below Elevation -115 feet (center of the bridge) to -85 feet (southern abutment). Foundations for a new bridge structure would need to extend a sufficient distance into these deposits.

7.2 Geotechnical Considerations

Fill Alternative (F1)

The fill alternative would involve engineered fill placed in the wet up to lake level, and mechanically stabilized earth (MSE) fill walls extending from lake level up to the roadway elevation. An opening in the fill would be required for kayak access to ZymoGenetics, and periodic culverts would be installed perpendicular to the embankment to maintain lake water below the ZymoGenetics parking garage structural slab as it presently exists.

With the fill alternative, ground improvement would be required to mitigate potentially liquefiable soils within 35 feet of the mudline in order to mitigate a potential flow slide. Vibration sensitivity from the adjacent building tenant would require low-vibration construction methods. Jet grouting or vibration free stone columns are considered to be the most appropriate methods of ground improvement at the site. In the event that jet grouting was chosen as the preferred ground improvement method, a sheet pile containment wall would be required along the lakeside of the ground improvement area to protect Lake Union from jet grout spoils.

Construction of the fill alternative would result in applying additional load to the driving side of the underlying landslide mass. The application of this load would result in a reduction in the stability of the slope with respect to the current condition. According to the Final Geotechnical Report, with the fill alternative, potential ground movement associated with re-mobilization of the deep-seated failure plane would not represent a life-safety issue (See Appendix F). The fill would move and deform along with the surrounding ground, whereas a bridge would need to resist such deformation. However, global stability mitigation measured would be required to offset the reduction in stability associated with construction of the fill alternative. Two large diameter cylindrical pile walls with 8-foot diameter shafts on16-foot centers are considered an appropriate global stability mitigation option if the fill alternative is chosen.

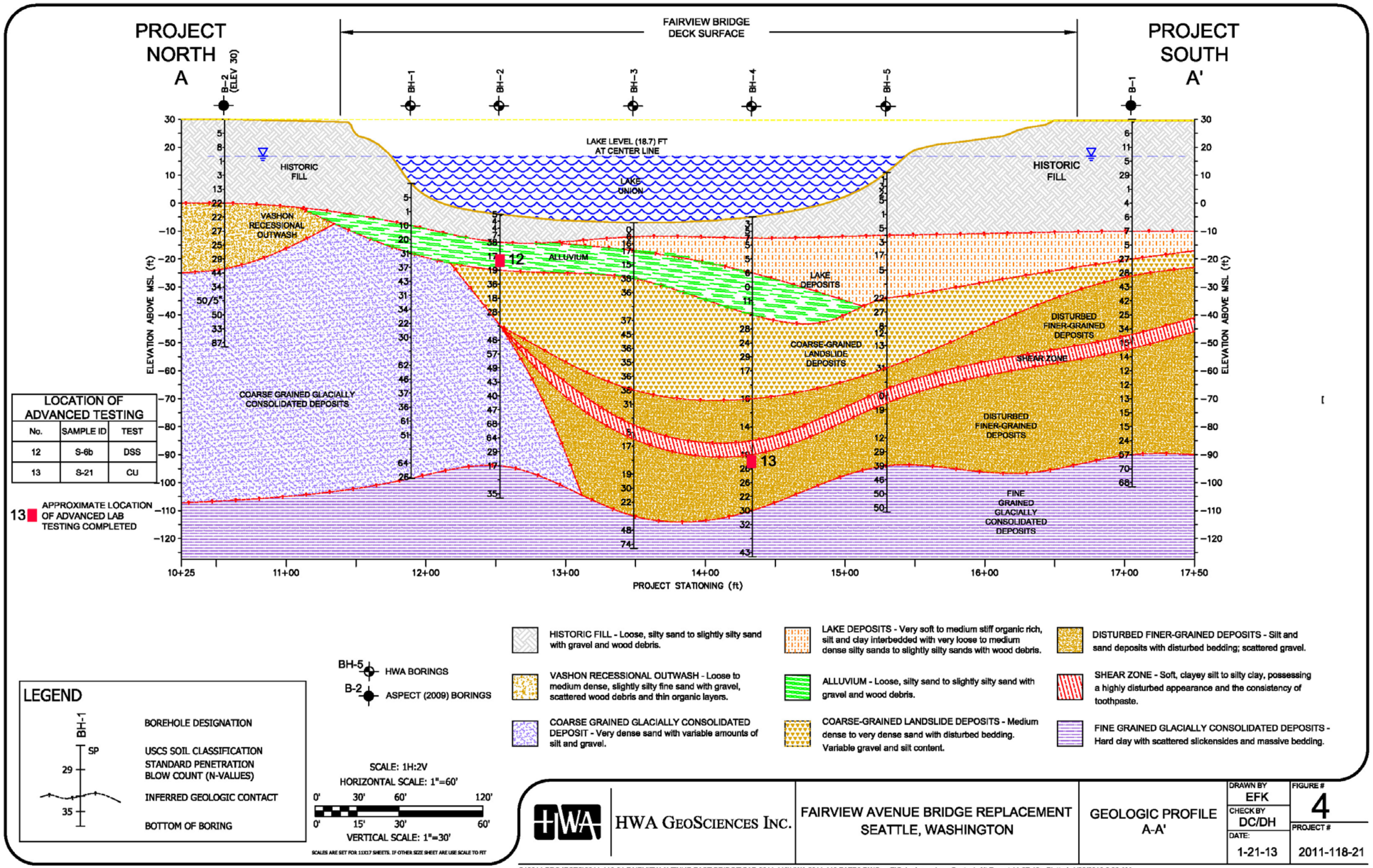


Figure 13 – North-South Geologic Profile

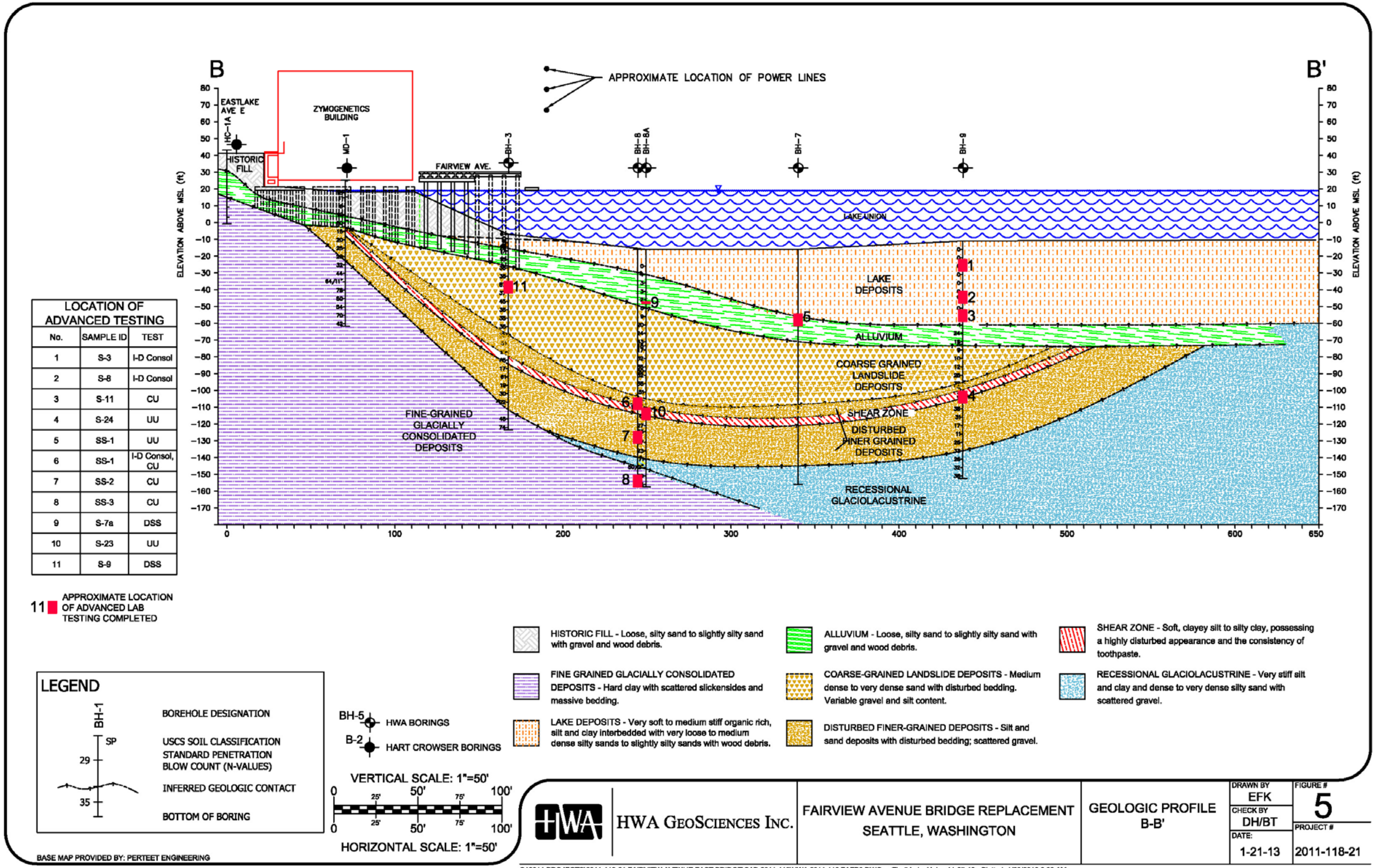


Figure 14 – East-West Geologic Profile

In addition, with the F1 alternative, a settlement protection wall would be required along the ZymoGenetics building. This could be a sheet pile wall, installed by vibratory or push-in methods, to depths at or below the existing timber piles supporting the ZymoGenetics building. Push-in methods will produce the least amount of vibration and impact to ZymoGenetics. However, there is a high likelihood of encountering obstructions at this site (in the form of old bridge and construction pilling) and it may be necessary to vibrate or drive the sheet pile through the obstruction. This wall would reduce or eliminate the potential for consolidation settlement in the disturbed deposits below the ZymoGenetics building. With staged construction, a settlement protection wall could also be required along the centerline of the roadway to protect the eastern bridge during construction.

Complete Replacement (C5) and Rehabilitation (R4)

Foundations for a new bridge structure would consist of drilled shafts installed by oscillatory methods. To the extent possible, the existing bridge structure would be utilized to support drilled shaft construction equipment. However, given the long-span lengths and large drilled shafts being considered, additional temporary piling would likely be necessary to support the construction equipment.

Preliminary structural analysis indicates that during the AASHTO-specified 1,000-year design earthquake, a deep-seated slope failure could cause shear failure in the drilled shafts at depth. Subsequent flow failure in the upper liquefied sand layers could then push the bridge over, leading to a total collapse. Additional structural analysis is required to determine if the bridge structure will remain stable and satisfy AASHTO life safety requirements during the design earthquake. If this analysis determines that AASHTO life safety requirements are not satisfied, global stability mitigation measures will need to be implemented. Preliminary analyses indicate two parallel large diameter cylindrical pile walls with 8-foot diameter shafts on 24-foot centers would be an appropriate method of global stability mitigation for the bridge alternatives.

Both C5 and R4 alternatives have short sections (up to 100 feet) of fill at the south approach to the proposed bridge. Ground improvement and settlement protection walls, as discussed for the fill option, would also be required in the fill areas.

8 ENVIRONMENTAL

8.1 Existing Conditions

The combination of waterfront development, bridge construction, water shed modification and dredging to allow barge access to the former steam plant have directly and indirectly degraded aquatic habitats in the project area. Existing shoreline and aquatic habitat conditions do not provide properly functioning shoreline or near shore areas. Subsurface slopes and edges have been steepened and the lake bottom in the project area is littered with debris. No areas of natural shoreline vegetation remain in the project area. The combination of deepened near shore areas, vertical surfaces, artificial overwater structure, lack of a natural shoreline, and uneven lakebed substrates create conditions that are generally unsuitable for native salmonids and increased risk of predation by native and non-native predatory fish.

8.2 Permitting /Environmental Documentation Process

The main difference between bridge replacement alternatives relative to the permitting and environmental documentation process is the anticipated duration and complexity of the permitting and environmental process for each alternative. The identification and evaluation of these differences was the focus of the primary and secondary screening processes.

Roadway Fill Alternative (F1)

Alternative F1 could have the most complex and longest duration permitting and environmental documentation process of the bridge replacement alternatives. Alternative F1 would exceed various prescriptive thresholds for fills of waters of the United States under the current Clean Water Act Section 404 Nationwide Permit Program. Alternative F1 is also not likely to be considered an in-kind replacement. For the purpose of this evaluation, a Corps of Engineers Clean Water Act Section 404 Individual Permit is expected. This permit could involve a more schedule intensive and higher level of effort by both the City's team and regulatory staff. Acquisition of an Individual Permit could double both the time period and level of effort compared with gaining approval under a Nationwide Permit.

A fill alternative is unlikely to qualify for the same categorical exemptions, exclusions, and other more streamlined reviews as an in-kind bridge replacement. If Alternative F1 were selected an Environmental Assessment or Environmental Impact Statement is anticipated to be required. Alternative F1 could also result in a more complex and longer review process under SEPA including the acquisition of a Shoreline Management Act required permit from the City of Seattle and a Hydraulic Project Approval (HPA) from the Washington Department of Fish and Wildlife (WDFW).

Full Bridge Replacement Alternative (C5)

Alternative C5 would trigger a similar number of permits and environmental review processes as Alternative F1, but Alternative C5 would likely be considered an in-kind replacement and would qualify for reviews that are more streamlined. The C5 alternative is anticipated to qualify for categorical exclusions under NEPA. In addition, this alternative is likely to be authorized under a Clean Water Act Section 404 Nationwide Permit rather than Individual Permit. Generally, authorization under a Nationwide Permit has a shorter duration for acquiring approval than the time it takes to secure an Individual Permit. Because Alternative C5 would not require extensive permanent fill to be placed within jurisdictional limits of Lake Union, less effort and time would be required to obtain an HPA and a Shoreline permit.

West Bridge Replacement and East Bridge Rehabilitation Alternative (R4)

Alternative R4 would represent the same level of risk for a complicated permitting and environmental documentation process as Alternative C5. The reduced footprint size could reduce the overall impact of the project, but the entire permitting and environmental documentation process would still be required.

8.3 Environmental Impacts / Mitigation

The Environmental Report (Appendix G) includes a brief discussion of the type and extent of anticipated environmental impacts associated with each alternative. Each of the bridge replacement alternatives would have similar types of environmental impacts on habitat. Socio-economic impacts would be differentiated by construction techniques and duration.

Mitigation for the F1 Alternative would include both on-site and off-site elements. It is anticipated that all of the C5 and R4 alternatives' mitigation for environmental impacts could be performed on-site and incorporated as part of the project. Off-site mitigation temporary traffic and/or socio-economic impacts may be required during construction, but the extent and scope of these are not able to be quantified at for this report and would be similar for all alternatives.

Roadway Fill Alternative (F1)

Alternative F1 would result in little, if any, overwater shading structure or in-water vertical surfaces (both of which are detrimental to juvenile salmonid fish). Though filling in the lake would constitute taking of the lake area and habitat, Alternative F1 would have the highest potential to provide off-setting habitat mitigation in the form of shoreline creation and enhancement.

Due to the amount of fill that would be required, large numbers of trucks hauling fill material could present a noise impact, particularly if construction were restricted to nights and weekends. Vibration from heavy trucks could also have a detrimental impact on the sensitive equipment in the adjacent ZymoGenetics building.

Full Bridge Replacement Alternative (C5)

The new structure resulting from Alternative C5 would provide an amount of overwater structure similar to the existing condition, although the proposed bridge may be slightly wider. Alternative C5 would not provide the same level of near shore and shoreline habitat restoration potential as Alternative F1 unless that were specifically added as a project element.

Alternative C5 would require construction techniques and equipment (primarily pile driving) with the greatest potential to impact adjacent business and other sensitive receptors. Alternative C5 would also have the longest construction duration resulting in longer impacts to adjacent businesses and the general public.

West Bridge Replacement and East Bridge Rehabilitation Alternative (R4)

Alternative R4 would have the lowest level of impact to existing habitat conditions because it represents the smallest project footprint. However, it would also do the least in terms of correcting sub-optimal habitat conditions because the existing east structure would remain in place.

The impact to adjacent businesses from construction would be less than with Alternative C5 because it would be a smaller project further from adjacent businesses with a shorter duration.

9 CULTURAL AND HISTORIC RESOURCES

9.1 Cultural and Historic Resources Overview

As part of the alternatives screening process, background research was conducted to identify ethnographic places, recorded archaeological sites, recorded historic resources (including buildings, structures, and ships), and previous cultural resources surveys in the project vicinity. In addition, geotechnical information was reviewed by a geo-archaeologist to evaluate the likelihood for buried cultural resources. No buried prehistoric cultural resources were identified during review of geotechnical information for this project.

As part of this process, both the East and West Bridges were recorded in the State's Historic Property Inventory as built in 1963 and 1948 respectively. However, neither is considered eligible for listing in any historic registers. There are numerous historic buildings in the area surrounding the Fairview Avenue North Bridge as well as submerged resources and historic vessels that are moored nearby. The recorded submerged resources are not expected to be impacted by the fill option. Once the APE is defined, additional Historic Property Inventories are expected to be required.

9.2 Cultural and Historic Resources Regulatory Process

The Fairview Bridge Replacement Project would be subject to Section 106 of the National Historic Preservation Act, although the lead federal agency has not yet been determined. Once the lead federal agency is identified, the Area of Potential Effects (APE) will be defined and Section 106 consultation will be initiated. Consultation should include the Department of Archaeology and Historic Preservation (DAHP) and area tribes as well as the City of Seattle Historic Preservation Program. The Historic Preservation Program would be involved due to Seattle City Landmarks status of the Lake Union Steam Plant Building (built in 1914, currently occupied by ZymoGenetics), immediately adjacent to the bridge.

Following consultation, historic properties within the APE will need to be documented and their eligibility to the National Register of Historic Places (NRHP) will need to be evaluated. The results of this effort will be summarized in a cultural resources assessment report. Historic properties are anticipated to be identified within the APE, so the next step will be to determine if the project would affect the historic properties. If historic properties would be affected, then continued consultation would be required to resolve the adverse effect. Potential adverse effects might include increased vibration or dust during construction.

Because the Lake Union Steam Plant building (ZymoGenetics) is a City of Seattle Landmark, the project may require a Certificate of Approval (COA) from the Landmarks Preservation Board. This process is separate from Section 106 review. Further discussion with the Seattle Historic Preservation Program will clarify this issue for all alternatives. If a COA were required, it would have to be secured before construction could begin.

Based on our research to date, up to eight additional historic properties will need to be documented once the APE is defined under all three alternatives. All eight properties are potentially eligible for listing on the NRHP; however, the bridge replacement would not likely have an effect on the historic properties. The Fill alternative (F1) could require recording and evaluating the coal dock/wharf pilings that would be removed.

10 CONSTRUCTABILITY

Due to the existing site and bridge layout there will be a number of constructability challenges for the project regardless of the alternative. These include:

- High voltage power lines
- Fiber optic transmission lines
- Drilled shafts construction
- Adjacent buildings
- Ground Improvement
- In-water work
- Contaminated Materials

10.1 High voltage power lines

The overhead high voltage power lines, approximately 20 feet west of the existing bridge, will present challenges for construction of drilled shafts, placement of girders and sheet pile walls, jet grouting, and other activities. The Seattle Department of Transportation requires a working clearance of 10 to 16.5 feet from overhead electrical power lines depending on the transmission voltage. This clearance requirement will restrict the mobility of cranes and other equipment needed for construction. Therefore, power outages will be necessary for some construction activities, and will need to be coordinated and permitted with Seattle City Light well in advance of construction.

10.2 Fiber Optic Transmission Lines

Ground improvement work near or under the buried conduit carrying the fiber optic transmission lines may require these conduits to be relocated. The conduits could be moved about 10 feet, if enough slack is available in each fiber optic cable. However, moving conduit carrying fiber optic cable will require careful construction techniques and carries the risk of disrupting communications for multiple users. Older fiber optic cable can become brittle and could break if handled incorrectly.

The alternative would be to pull new fiber optic cables. This would require coordination with every cable owner or user. The distance between splices in fiber optic cable is typically measured in thousands of feet and the locations of splice points in the existing cables are unknown. Adding new splice points at either end of the bridge would introduce two points of signal degradation in every fiber optic strand.

10.3 Drilled Shaft Construction

Construction of the drilled shafts from the deck of the existing bridge could require additional driven piles to support the equipment. The western-most shafts, located just west of the existing bridge, would require the construction of a small work platform supported on driven piles. This pile driving would impact ZymoGenetics as noted below as well as potentially conflict with the power lines.

Furthermore, construction of the drilled shafts would present their own challenges due their length. With a depth of approximately 130-feet, the shafts would be pushing the limits of what local drilling contractors think is feasible with 8-foot-diameter shafts. Furthermore, to support the loads from the equipment and drilled shaft construction, it could be necessary to drive additional piling and to construct supplemental work platforms on the deck of the existing bridges.

10.4 Adjacent buildings

Due to ZymoGenetics location adjacent to the bridge and the sensitive nature of the work they perform, there will likely be noise and vibration constraints placed on construction activities. These constraints are needed to protect their equipment, experiments, lab animals, and workers. Based on the coordination conducted to date, it may not be feasible to meet all of their needs with any alternative and they will experience some form of impact during construction. Noise impacts would be limited to occupant annoyance during normal working hours, while vibration impacts would include occupant annoyance and potential disruption of vibration-sensitive equipment and experiments.

The fill option (F1) would require multiple sheet pile walls to be installed, one directly adjacent to their building. It could be possible to install some of the sheet piles using a “press-in” method with minimal to no vibration. However, due to the high likelihood of encountering obstructions, it would be necessary to vibrate or drive some of the sheet piles in, causing potential vibration and noise impacts to ZymoGenetics. Mitigating these sorts of vibration impacts may require non-standard vibration control methods, such as installation of vibration isolation tables in critical areas within the ZymoGenetics facility.

For the bridge alternatives, temporary pipe piles would likely be required to facilitate drilled shaft construction. Pile driving required to install the piles would likely cause vibration and noise impacts to ZymoGenetics. While a noise variance could be secured to allow impact pile driving between six(6) and ten(10) pm to minimize noise and vibration impacts to ZymoGenetics workers, additional vibration mitigation, such as installation of vibration isolation tables in critical areas, would be needed during nighttime hours to minimize impacts on long-term experiments and vibration-sensitive equipment.

In addition to the activities described above, many standard construction activities that would be required for all of the alternatives, such as fill compaction, demolition of the existing bridges, and crane and heavy equipment operations have the potential to cause noise and/or vibration impacts to ZymoGenetics.

Preliminary vibration and noise monitoring and analyses has been conducted and documented (see Appendix I) to better understand the potential construction vibration and noise impacts and mitigation measures required for the project. The work completed to date includes thorough documentation of baseline noise and vibration conditions inside and outside the Zymogenetics facility. This baseline data was compared to standard FTA construction noise and vibration impact criteria to determine impact thresholds for the Project. Field data was also collected to approximate the propagation of vibration through the soil and ZymoGenetics building structure. Construction noise and vibration models were then developed based on field data and means and methods assumptions to predict sound and vibration levels at ZymoGenetics and other adjacent properties. A list of candidate noise and vibration control measures was also developed, for consideration during Final Design. Additional noise and vibration analysis to be conducted during Final Design include further characterization of vibration propagation through the lake bottom, refinement of noise and vibration control methods based on the final design, potential pursuit of noise variances from the City of Seattle, and development of a noise and vibration monitoring program to track noise and vibration impacts during construction.

10.5 Ground Improvement

Ground improvement to mitigate liquefaction will either consist of vibration free stone columns, Deep Soil Mixing (DSM) or jet grouting. Ground improvement will be limited to the vicinity of the bridge abutments for the bridge replacement alternatives and will extend along the entire alignment for the fill alternative.

Ground improvement to improve soil conditions would require careful containment measures to prevent migration of spoils into Lake Union.

Ground improvement for the bridge replacement alternatives would need to be done from the deck of the existing bridges. This would require the contractor to drill through the deck for ground improvement installation. Depending on the spacing of the ground improvement columns, the contractor may need to provide a decking platform to support the jet grouting equipment.

The interior piers are capable of resisting the anticipated flow slide load and approximately 40 percent of the inertial loads from the bridge superstructure. During final design, additional analysis will be completed to determine the appropriate load combinations given the loose soils and potential for a large earthquake event. If it is determined that the bridge foundations cannot handle the determined load combination, ground improvement will be required for the interior piers. Because ground improvement around the interior piers would be completed over water and there is a large potential for obstructions, jet grouting may be a more feasible alternative for mitigating liquefaction. If the bridge foundations are determined to be able to resist the anticipated load combination, then jet grouting will not be required for the interior piers. In addition to the interior piers, vibration free stone columns or DSM method is currently proposed at the abutment locations to avoid potentially damaging loads associated with lateral spreading. However, given the potential for encountering obstructions along the project alignment, an evaluation will need to occur during final design as to the feasibility of stone columns, DSM and/or jet grouting at the abutment locations.

For the fill alternative, the existing bridges could be removed and permanent fill placed above the lake elevation prior to commencing the ground improvement. This would make installation easier because it could be done from on top of the fill.

10.6 In-Water Work

In-water work will be required regardless of the preferred alternative. In-water work includes drilled shaft installation, construction of containment structures, debris removal, contaminated soils removal, ground improvement, streambed gravel backfill, and shoreline mitigation. Scheduling this work will have to take into account designated work windows, which will affect the construction schedule. It may be possible to conduct some of this in water work, outside the in water work season, behind a containment wall, once it is installed. However, a containment wall and any work performed behind it would be dependent on permit requirements.

10.7 Contaminated Soil

As noted in Section 7.1 some of the lake sediments beneath the bridge contain potentially hazardous materials. For the bridge alternatives, it may be possible to fill over the contaminated soil and cap the material in place. This would constitute fill within the lake and would depend on environmental permit requirements. If capping is not an option, it may be necessary to remove and dispose of this material and replace the lake sediments with clean fill. This would be a challenging construction activity to accomplish from the surface of the existing bridge decks.

For the fill alternative, the material could likely be capped in place by the fill and removal would not be required. However, removal of the existing timber piles to below the mudline may be required and affect the ability to cap hazardous materials in place.

11 ALTERNATIVE EVALUATION AND SCREENING

The alternatives evaluation and screening process involved identifying, evaluating and screening a range of roadway fill, bridge replacement, and bridge rehabilitation alternatives to identify a preferred alternative. This process included:

- Developing design criteria and alternative conceptual designs,
- Identifying evaluation criteria for the alternatives screening,
- Evaluating the feasibility of alternatives, and
- Conducting a series of alternatives screening meetings with the City to select a preferred alternative.

The screening meeting summaries are included in Appendix D.

Ten conceptual alternatives were developed for consideration at the preliminary screening meeting. During this meeting, three alternatives (F1, C5, and R4) were selected for further evaluation as part of the secondary screening process. This process consisted of advancing the design of the alternatives to a level necessary to identify and resolve potential fatal flaws, to develop preliminary cost estimates and to identify constructability issues, advantages and disadvantages for each alternative.

This information was then used during the secondary screening to evaluate and screen the three alternatives based on a range of criteria including constructability, environmental impacts and permitting, structural performance, geotechnical challenges, land use, long-term maintenance, and construction cost. The evaluation matrix, which illustrates the evaluation results, can be found in Appendix D.

A summary comparison of advantages and disadvantages for the alternatives is outlined in Table 1. All of the alternatives involve significant design and constructability challenges relating to in-water work, ground improvement below the lake bottom, construction under traffic, and physical constraints such as adjacent buildings and overhead high voltage power lines.

Table 1 – Alternative Advantages and Disadvantages

	Roadway Fill (F1)	Replace West and East Bridges (C5)	Replace West Bridge, Rehab East Bridge (R4)
Advantages	• Restore shoreline, improve fish habitat and public lake access • Minimize long-term maintenance • Easily accommodate future streetcar	• Few environmental challenges • Minimize fill within OHWM • Low risk of adjacent building settlement. • Good seismic performance • Ground improvement limited to bridge abutments • Accommodate future streetcar • More streamlined permit process	• Lowest initial construction cost • Fewest environmental challenges • Minimize fill within OHWM • Lowest risk of adjacent building settlement • Ground improvement limited to bridge abutments • More streamlined permit process
Disadvantages	• More complex permit process • Greater risk of construction claims • Greatest risk of adjacent building settlement • Reduces stability of slope • Consolidation settlement expected • Sheet pile cut off wall required • Risk of vibration impacts to ZymoGenetics equipment/ operations • Greater impact to the buried fiber optic lines • Need to perform ground improvement along entire alignment to account for liquefiable soils. • Poor seismic performance • Global stability mitigation required to offset reduction in stability	• Highest risk of vibration impacts to ZymoGenetics equipment/ operations • Many in-water work activities. • Longest construction schedule.	• Limited future channelization flexibility • Would not accommodate future streetcar without replacement of the East Bridge. • Highest life-cycle costs • Poor seismic performance for the existing East Bridge • Risk of vibration impacts to ZymoGenetics equipment/ operations
Construction Estimate	$52.1M	$25.0M	$16.8M

12 AESTHETIC CONSIDERATIONS

The bridge plans in Appendix D, call for pigmented sealer and weathered plank finish on the walls and abutments and a ship lap finish on the outside face of the barriers. This would be a starting point for the bridge aesthetic discussion. The architectural treatment for the entire project will be considered during final design to recognize the historic context of the old steam plant blending in with the character of the South Lake Union neighborhood.

13 RECOMMENDATIONS

13.1 Preferred Alternative

The TS&L deemed that both the existing West Bridge and East Bridge need to be replaced. Based on the evaluation matrix, along with input received from SDOT and the project team, the preferred alternative is to replace West and East Bridges using Alternative C5. Alternative R4 was not selected because the existing east bridge does not meet current seismic criteria and, given the age of the East Bridge (over 50-years), it is not cost effective to replace one bridge today and replace the second bridge in the future. The fill option, Alternative F1, was not selected because it is not feasible due to global instability slope failure concerns.

If Fairview Avenue North is selected to include a cycle track, the recommended cross section is a 63-foot wide roadway with an 11-foot wide southbound lane and two11-foot wide northbound lanes with a 6-foot wide northbound (east side) cycle track separated by a 2-foot wide buffer. An 8-foot wide sidewalk is proposed on the east side and a 14-foot wide side multi-use trail is proposed on the west side. In the event that Fairview Avenue North is not selected to include a cycle track, the 63-foot wide roadway section shown in Figure 8 should be used.. The existing floating walkway will need to be relocated west to avoid a conflict with the proposed bridge but will remain much the same configuration that it is today. The replacement of both bridges would also provide opportunities to improve ADA accessibility to the floating walkway.

The replacement option C5 has an estimated cost of $25.0 million (2014 dollars) with staged construction. Staged construction will allow one lane in each direction to remain open.

13.2 Final Design Considerations

Several design, permitting, and construction challenges will need to be studied early during final design to develop a successful work plan and schedule that addresses these challenges and associated risks. Early Final Design tasks may include:

- Conduct a detailed constructability review of all major work elements including: in-water work (excavation, fill placement, wall construction, and containment measures), drilled shaft foundations, ground improvement and construction activities in close proximity to high voltage overhead power lines and adjacent buildings.

- Conduct a bridge displacement analysis to determine the anticipated impact of a seismic event upon the proposed bridge substructure design and determine the need for ground mitigation measures.

- Identify the capacity of the existing structure piling and the need for temporary piles to support construction equipment during drilled shaft installations and other construction activities.

- Prepare a supplemental ZymoGenetics vibration and noise impacts study that will update the baseline measurements to better understand potential impacts and mitigation measures. This study will be directly followed by coordination with ZymoGenetics and Alexandria Real Estate Equities to address impacts and develop acceptable mitigation.

- Confirm utility impacts and service disruptions and coordinate with utility owners.

- Further coordination with the utility owner is required to determine if the transmission lines can be de-energized at times during select construction activities.

- Coordinate on fire protection system in accordance with the latest fire code.

- Perform traffic study to determine average daily traffic at the project location and to evaluate the possibility of full closure or impacts of the south bound closure during construction.

- Confirm traffic staging and sequencing approach to maintain two lanes of traffic and one lane of pedestrian access across the bridge.

- Develop an environmental documentation and permitting strategy.

- Perform drainage evaluations to determine drainage outfall locations to the lake and ascertain stormwater treatment methods.

14 REFERENCES

American Association of State Highway and Transportation Officials (AASHTO), *AASHTO LRFD Bridge Design Specifications*, with customary U.S. units, 6th edition, 2012.

American Association of State Highway and Transportation Officials (AASHTO), *AASHTO Guide specifications for LRFD Seismic Bridge Design*, 2nd Edition, 2011.

City of Seattle, Department of Planning and Development, in partnership with Restore our Waters, *Green Shorelines - Bulkhead Alternatives for a Healthier Lake Washington*.

City of Seattle Department of Transportation (SDOT), *Transit Master Plan, Final Summary Report,* April 2012.

MacLeod Reckord Landscape Architects, *Cheshiahud Lake Union Master Plan*, May 2009

Washington State Department of Transportation (WSDOT), *Bridge Design Manual LRFD*, May 2008.

15 APPENDICES

APPENDIX A DESIGN CRITERIA

APPENDIX B OPINION OF PROBABLE COSTS

APPENDIX C BRIDGE INSPECTION REPORTS

APPENDIX D SCREENING MATRIX AND MEETING MINUTES - INITIAL AND SECONDARY ALTERNATIVES

APPENDIX E CONCEPT PLANS – 3 ALTERNATIVES

APPENDIX F FINAL GEOTECHNICAL REPORT (under separate cover)

APPENDIX G FINAL ENVIRONMENTAL REPORT (under separate cover)

APPENDIX H CULTURAL AND HISTORIC RESOURCES REPORT (under separate cover)

APPENDIX I BASELINE NOISE AND VIBRATION MONITORING REPORT (under separate cover)

FAIRVIEW AVENUE NORTH BRIDGE

TYPE, SIZE AND LOCATION REPORT

APPENDIX A

DESIGN CRITERIA

CITY OF SEATTLE - FAIRVIEW AVE N BRIDGE
DESIGN CRITERIA

Roadway Criteria	
Functional Class of Roadway	Principal Arterial (Seattle Arterial Classifications Map) Regional Connector (Seattle Street Types Map) Minor Transit Street (Seattle Transit Classifications Map) Identified as a Bike Route (Seattle Bicycle Master Plan) Cheshiahud Trail Classified as an Urban Trail (Seattle Bicycle Classifications Map)
Posted Speed	30 mph
Design Speed	35 mph (Right-of-Way Improvements Manual (RWIM), Section 4.4.2)
ADT	SB: ADT 7,200, AWDT 8,000, PM Peak 720 (7-31-07) NB: ADT 5,300, AWDT 6,100, AM Peak 600 Truck Per.: 6.8% AM Peak (5-5-2011), 2.3% PM Peak (4-20-2011)
Design Vehicle	Intersection specific, will coordinate with SDOT traffic if needed.
Superelevation	Standard 2% crown (RWIM, Section 4.4.2) Min 1% (RWIM, Section 4.5.2) Max 4% (RWIM, Section 4.5.2)
Grade	9% maximum (RWIM, Section 4.4.2) 6% maximum desirable on bridges 1% minimum asphalt roadways (RWIM, Section 4.4.2) 1/2% minimum concrete roadways (RWIM, Section 4.4.2)
Through-Lane Width	11 feet (RWIM, Section 4.6.2 and AASHTO, 2011) 14 feet curb lane if no bike lane
Turn-Lane Width	12 feet (RWIM, Section 4.6.2 and AASHTO, 2011)
Travel Lane Configuration on Fairview Bridge	2 northbound lanes 1 southbound lane Bike Lane both directions Per email dated 1-4-2012
Bike Lane Width	5 Feet Preferred 4 feet Min. (RWIM, Section 4.13.3)
Sidewalk Width	6 feet Min (RWIM, Section 4.11.2)
Sidewalk Cross Slope	2% (RWIM, Section 4.5.2)
Mixed Use Trail Width	12' Preferred Per email dated 1-4-2012
Planting Strip & Buffers	Planting Strip, 5.5 feet (RWIM, Section 4.11.2) None on Bridge **Buffers:** Sidewalks and walkways should be buffered from the motor vehicle lane by a planting strip, street furniture, parked cars or a bike lane. (RWIM, Section 4.11.3)
Sidewalk Grade	5% Max, or the grade of the existing roadway (PROWAG R302.5)
Pedestrian Railing Height	3'-6" (Std. Plan 442)
Bike Path Railing Height	4'-6" (Std. Plan 443a)
Lane Transitions	L=(WS^2)/60 (RWIM, Section 4.6.2)

Vertical Curves	3 times the design speed (V d) where V d is 5 mph greater than the posted speed limit(RWIM, Section 4.4.2)
Horizontal Curves	420 foot radius (RWIM, Section 4.4.2)
Sidewalk Cross-slope	2% (RWIM, Section 4.5.2)
Side Slopes	2:1 maximum (RWIM Figure 4-10)
On-street Parking	none
Clear Zone	1.5 feet (min) with curb and gutter, 10 feet from fog line if no curb and gutter (AASHTO 2011, page 319). 3.0 feet (preferred) per RWIM, Section 4.21.2)
Min. Horizontal Clearance from structure to Zymogenetics Building	2'-11" Min. (maintain existing) Direction from Screening meeting 1-6-2012
Zymogentics Walkway Elevation	1' Above ordinary high water level or 10" if floating
Roadway Pavement	20 year pavement design for asphalt 40 year pavement design for cement concrete (RWIM, Section 4.7.2)
Driveways	Per Standard Plans 430 and 431
Construction Traffic and Access Criteria	
Minimum Lane Configuration	One NB lane One SB lane We would like to discuss the possibility of detouring the SB direction with the traffic group. This could be highly beneficial depending on the bridge rehab strategy selected.
Minimum Pedestrian Access	5' continuous ADA route on one side
Minimum Bike Access	11' NB lane to accommodate shared lane on bridge
Minimum Lane Width	11' (CAM 2111, Checklist for Traffic Control Plan Submittal) 10' minimum, plus 1' shy distance, for traffic on existing bridge for phasing
Zymogenetics/Kayak Access	Closed during construction To be coordinated prior to construction
Bridge Criteria	
Vertical Clearance above OHWM	Minimum vertical distance to finish grade below the bridge or to the mean high water elevation of Lake Union shall be 5.0 feet to the bottom of the superstructure in order to provide inspection access.
Pedestrian Tunnel Height	6'8" Gate/Door (Existing) Maintain existing 7' height. Per on-site meeting with Zymogenetics and Kit Loo 1-13-2012
Pedestrian Tunnel Width	Maintain existing 6' width, excluding handrails and 5' width on gang plank up on the east side. If access is relocated, design for ability to turn with a 20' boat. Per on-site meeting with Zymogenetics and Kit Loo 1-13-2012

Pedestrian Railing Height	3'-6" Standard plan 442
Bicycle Railing Height	4'=2" Standard Plan 443a
Streetcar Criteria	
Lane Width with Streetcar	11'
Track Placement	Tracks to be accommodated in the middle of 11' lanes.
Buffer between Streetcars	Not required in tangent section
Drainage Criteria	
Detention Requirements	None (Lake Union is a Designated Receiving Water)
Water Quality	Phosphorus Treatment (Lake Union is listed by WSDOE) Basic Treatment (Lake Union is designated Basic Treatment Receiving Water) GSI (Maximum Extent Feasible per SMC)
Conveyance	25-Year Storm per Rational Method

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Technical Memorandum

Date: May 30, 2012

To: Kit Loo, P.E., SDOT

Cc: Brian Sperry, P.E., Perteet Inc.

From: Kiva Lints, P.E., S.E., HNTB

Subject: Fairview Avenue N. Bridge TS&L
SDOT Agreement 10-39/Perteet Job Number 20100169
HNTB Job Number 55928-PL-001
Task 13 – Bridge Type Size and Location Report
Fairview Ave. Bridge Design Criteria

OBJECTIVE

This memo will provide criteria and direction for the design and plan preparation of the Fairview Avenue Bridge replacement and rehabilitation and any associated structures such as retaining walls.

PREREQUISITES

Codes and Standards

The following codes and standards shall be used for the design and detailing of the structures and are listed in order of precedence. The dates listed are for the type, size and location report. The versions and dates shall be updated during final design for preparation of the PS&E.

- City of Seattle Standard Specifications for Road, Bridge and Municipal Construction, 2011 Edition with Amendments through January 2012
- City of Seattle Standard Plans for Municipal Construction, 2011 Edition with Amendments through January 2012
- City of Seattle Right-of-Way Improvement Manual version 2.0 (May 9, 2011)
- WSDOT Bridge Design Manual (M23-50) (BDM) with updates and applicable design memos through January 2012.
- WSDOT Geotechnical Design Manual (M46-03) (GDM) with updates and applicable design memos through January 2012.
- WSDOT Design Manual (M22-01) with updates through January 2012.
- AASHTO Guide Specifications for LRFD Seismic Bridge Design (AASHTO Guide Specs), 2nd Edition, 2011.

- AASHTO LRFD Bridge Design Specifications (AASHTO LRFD), Customary U.S. Units, 5th Edition, with Interim Revisions through 2010.
- AASHTO LRFD Bridge Construction Specifications, 3rd Edition, with Interim Revisions through 2011.
- AASHTO Manual for Bridge Evaluation, 2nd Edition, with Interim Revisions through 2011.
- SDOT Bridge Seismic Retrofit Philosophy, Policies and Criteria, (PCC) Revision 0, August 2008.
- NCHRP Report 350
- FHWA Seismic Retrofitting Manual for Highway Structures (FHWA Publication No. FHWA-HRT-06-032), 2006.
- WSDOT Standard Specifications for Road, Bridge, and Municipal Construction 2012 (M41-10) (Standard Specifications)
- WSDOT Standard Plans (M21-01) (Standard Plans) current through November, 2011.
- Sound Transit Link Light Rail Design Criteria Manual, May 2011 (as noted below).

Input provided by other disciplines

- Roadway geometry and design (alignment, profile, cross slope, and roadway sections)
- Geotechnical data and report
- Existing topographical data
- Existing bridge as-built plans
- Existing utility as-built plans
- Existing overhead powerline profile envelope (Min. vert. and horiz. Clearance)
- Proposed utility locations
- Environmental constraints and requirements
- Proposed drainage system
- Right of way plans

Design Criteria

Bridge Geometry

Minimum vertical clearance to finish grade below the bridge or to the mean high water elevation of Lake Union shall be 5.0-feet to the bottom of the superstructure in order to provide inspection access.

Vertical clearance of new superstructure to the ZymoGenetics access beneath the bridge shall match the existing minimum clearance of 7.0-feet above the walking surface. The walking surface shall be designed to be 1-foot above the mean high water elevation of Lake Union or 10-inches above the water surface if it is a floating walkway.

Vertical clearance for rehabilitated portions of the existing superstructure shall maintain existing clearances to the ZymoGenetics access.

Horizontal clearance to the existing buildings walls east of the bridge shall at a minimum maintain the existing clearance of 2-feet 11-inches. This shall exclude the portions of the existing building foundations that project beyond the face of the building wall.

Horizontal clearance to the ZymoGenetics access beneath the bridge shall maintain an access width of 6-feet, outside to outside excluding handrails. If a ramp/gang way is used to access a floating walkway under the bridge the ramp shall match the existing width of 5-feet 0-inches (4-feet 9-inches between handrails).

The bridge deck thickness shall be determined in accordance with the requirements in the WSDOT BDM.

Installation of future streetcar rails, using block rail, shall be made in a 3½-inch rail pocket. The rail pocket shall be formed by grinding/removing 1½-inches out of the bridge deck at the rail pocket and placing a 2-inch overlay on the bridge. Grinding of the bridge deck will be accommodated within the 2½- inches clearance provided to the top mat of reinforcing steel.

The bridge width shall be sized to accommodate the typical sections developed according to the Roadway Design Criteria.

Drilled shafts shall be designed and detailed using the imperial equivalent of metric sizes to accommodate oscillator/rotator drilled shaft construction.

The bridge length shall be determined in accordance with the option selected during the TS&L phase of the project.

Barriers and Railings

New traffic barriers shall meet a railing test level performance criterion of TL-4 as defined by the AASHTO LRFD Bridge Design Specifications and NCHRP Report 350. The height of the barriers shall be 2-inches above the required minimum to accommodate a future 2-inch concrete overlay for the addition of the street car rails.

If the east bridge is rehabilitated the traffic railing currently dividing the sidewalk and the traffic shall be investigated to confirm that it meets the requirements of WSDOT BDM section 10.4. New traffic barriers attached to the East Bridge and the deck supporting the barrier may be designed for the requirements specified above for new traffic barriers or they may designed to meet the requirements of WSDOT BDM Section 10.4.

Pedestrian/bike railings shall be provided on top of barriers placed on the edge of the bridge or on top of retaining walls. The railings shall have a minimum height of 56-

inches above the adjacent walking surface (note, this assumes a future overlay of 2-inches for the street car rails will be placed across the entire bridge). The railing shall have a maximum opening of 4-inches.

New Bridge Design Loads (Non-Seismic)

Design loads shall be as specified in the WSDOT BDM and the AASHTO LRFD Bridge Design Specifications and supplemented with the South Lake Union Street Car loading as specified below.

The following are selected requirements from the required codes or additional requirements:

- Live Load:
  - Vehicular Live Load = HL-93
  - Pedestrian Load = 75 psf, applied in accordance with AASHTO LRFD C3.6.1.1.2
- The optional live load deflection criteria specified in AASHTO LRFD Section 2.5.2.6.2 shall be met.
- South Lake Union Street Car Loading:
  - Applied in place of the HS20 truck using the HL-93 loading
  - 94 kip crush load distributed evenly to four (4) axles
  - Two axle pairs, 6-feet 2-inches apart and 32-feet 6-inches between pair centers.
  - Wheel Lines 4-feet 8½-inches apart.
  - AASHTO LRFD Live Load Distribution factors shall be used
  - Additional design criteria (impact, breaking force, live load deflection, etc.) for the streetcar shall be in accordance with the Sound Transit Link Light Rail Design Criteria Manual.
- A load equivalent to a 2-inch concrete overlay weighing 155 pcf shall be placed across the entire bridge (including sidewalks) to accommodate installation of future street car rails.
- Concrete Unit Weight:
  - Precast Pretensioned or Post-tensioned Spliced Girders = 165 pcf
  - All Other Normal-Weight Reinforced Concrete = 155 pc
- Bridge deck protection system shall conform to WSDOT BDM Section 5.7.4 and shall be a Type 1 protection system.
- Future wearing surface is not required due to the proposed sidewalks on the bridge (BDM Table 3.8-2)
- Dead load of utilities to be supported on the bridge and future utilities noted below:
  - Future utilities: 15 psf

- Earth pressures shall be as specified in the geotechnical report.

New Bridge Seismic Design Criteria

The design of the new bridge shall meet the performance criteria of the AASHTO Guide Specifications for LRFD Seismic Bridge Design. Section 3.2, Performance Criteria, of this code address the life safety performance criteria expected for a bridge designed to this code.

The following criteria shall apply to the seismic design:

- The bridge is classified as non-critical or non-essential.
- The load factor for live load shall be 0.0 when pushover analysis is used to determine the displacement capacity. The live load factor shall be 0.5 for all other extreme event cases. Response spectrum input variables, (PGA, FPGA, S_S, etc.) as defined in the geotechnical report.
- Additional design criteria as defined in the geotechnical report.
- Unless directed otherwise by SDOT, the balanced stiffness requirements in the AASHTO Guide Specifications for LRFD Seismic Bridge Design shall be met. The primary tools to meet this requirement shall be adjustments to pier placement and column length. Secondary tools to meet this requirement shall include, different column diameters (up to 1-foot in diameter), and revised concrete strengths and reinforcing ratios. Other options may be available with SDOT's approval.

Foundation design and the design for liquefiable soils shall be in accordance with the BDM and GDM except as revised in these design criteria.

Design for lateral spread due to liquefaction shall be performed as follows:

1. Determine the required shaft diameter to support the bridge in accordance with the GDM and BDM without combining the forces from lateral spread and the seismic bridge inertia.

2. Reinforce the shaft to the maximum extent permitted by AASHTO and the BDM.

3. Determine the maximum percentage of seismic bridge inertia that can be combined with the lateral spread forces and be resisted by the shafts and report this value to SDOT.

Existing Bridge Design & Retrofit

Design Loading

Rehabilitated or replaced portions of the superstructure on the existing East Bridge shall meet the design and loading requirements specified above for the new bridge.

Should SDOT elect to do so, the remaining superstructure and substructure shall be evaluated for conformity with the WSDOT BDM and AASHTO LRFD Bridge Design Specification and the loading specified above for the new bridge. Retrofit options shall be developed to bring the structure into conformity of the required codes.

Seismic Retrofit

Should SDOT elect to do so, the existing east bridge shall be evaluated for upgrades necessary to bring it into conformance with the PCC, AASHTO Guide Specs, and FHWA Seismic Retrofitting Manual for Highway Structures.

The following criteria shall apply to the seismic retrofit:

- Importance Classification = Standard
- Anticipated Service Life = 16 - 50 Years (ASL 2 per FHWA Seismic Retrofitting Manual)
- Performance Level:
  - PL1 (Life Safety) During Upper Level Earthquake (1,000 year return period)
  - PL3 (Fully Operational) During Lower Level Earthquake (100 year return period)
- Site classification and other response spectrum input variables as defined in the geotechnical report.

Existing Bridge Material Properties for analysis (as per the as-built plans and 1963 WSDOT Standard Specifications):

- Reinforcement: fy = 33 ksi, fye = 1.25(33 ksi) = 41.25 ksi (fye is the effective yield for seismic analysis)
- Cast-in-place concrete footings: f'c = 3,000 psi, f'ce = 1.5 (3,000 psi) = 4,500 psi (f'ce is the effective yield for seismic analysis)
- All other Cast-in-place concrete: f'c = 4,000 psi, f'ce = 1.5 (4,000) = 6,000 psi (f'ce is the effective yield for seismic analysis)
- Precast Concrete for Girders: f'c = 6,000 psi
- Precast Concrete for Piles: f'c = 6,000 psi, f'ce = 1.5(6,000) = 9,000 psi (f'ce is the effective yield for seismic analysis)

Walls

Walls shall be designed in accordance with the requirements of the WSDOT BDM and GDM and the City of Seattle Standard Specifications and the design criteria specified in the geotechnical report.

Material Properties (New Construction)

All materials shall be in accordance with the WSDOT BDM and the City of Seattle Standard Specifications with the specific requirements noted below.

Concrete

- Precast, prestressed concrete:
  - f'c at 28 days = 10.0 ksi maximum,
  - f'ci at release, 7.8 ksi maximum unless approved by the bridge lead and the City of Seattle.
- Cast-in-place bridge deck concrete: Class 4000D
- Concrete in the shafts or piles: Class 4000P
- Concrete in approach slabs: Class 4000A
- All other cast-in-place concrete: Class 4000

Reinforcing Steel

Non-prestressed reinforcing will be ASTM A706, Grade 60, except where ASTM A 615 Grade
60 is permitted in accordance with WSDOT Standard Specification 9-07.2. The reinforcing in cast-in-place deck slabs will be epoxy-coated per BDM Memo 01-2006.

Prestressing Strands

Prestressing steel, if applicable, will be 0.6-inch diameter, 7-wire, low-relaxation strands conforming to ASTM A416, Grade 270, Supplement I (f'y = 270,000 psi).

Interdisciplinary Coordination

Interdisciplinary coordination is required with all disciplines as the bridge and walls will be an integral part of the full project. Indiscipline reviews shall be conducted prior to each milestone submittal.

FAIRVIEW AVENUE NORTH BRIDGE

TYPE, SIZE AND LOCATION REPORT

APPENDIX B

OPINION OF PROBABLE COSTS

City of Seattle

Fairview Ave. North Bridge Replacement

Alternative F1- Fill Option

HNTB Project No. 55928

March 2012

PLANNING LEVEL ENGINEER'S ESTIMATE
OF PROBABLE CONSTRUCTION COSTS

This estimate is the opinion of the Engineer of the probable construction cost of the project, and is supplied as a guide only. Since the Engineer has no control over the costs of labor and materials or over competitive bidding and market conditions, the Engineer does not guarantee the accuracy of such opinion as compared to contractor's bids or actual costs to the Owner. Estimate is calculated in 2012 dollars.

HNTB Corporation
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Bellevue, WA 98004
(425) 455-3555

Perteet
505 Fifth Avenue South, Suite 300
Seattle, WA 98104
(206) 436-0515

PLANNING LEVEL OPINION OF COST SUMMARY

Project Description: Fairview Ave N Bridge
Alternative F1 - Roadway Fill
Location: Seattle

Client: City of Seattle
Date: Apr-12
Date of Cost Index: 2012

		ITEM	UNIT	ESTIMATED UNIT COST	QTY	COST
A.		**RIGHT OF WAY**				
		RIGHT OF WAY (AQUISITION)	SF	$45	-	$0
		RIGHT OF WAY TOTAL				**$0**
B.		**CONSTRUCTION**				
1		**PREPARATION/GRADING/DRAINAGE**				
	1.1	**PREPARATION**				
		WEST BRIDGE DEMO	LS	$665,000	1	$665,000
		EAST BRIDGE DEMO	LS	$810,000	1	$810,000
	1.2	**EARTHWORK**				
		FILL, INCL. HAUL	TON	$30	24,900	$747,000
		IN WATER FILL, INCL. HAUL (CLEAN GRAVEL)	TON	$50	16,700	$835,000
		IN WATER FILL, INCL. HAUL (4"-6" ROCK)	TON	$50	70,000	$3,500,000
	1.3	**STORM DRAINAGE**				
		WATER QUALITY	EA	$80,000	2	$160,000
		CONVEYANCE	LS	$40,000	1	$40,000
2		**STRUCTURE**				
		BRIDGE	SF	$110	-	$0
		EAST BRIDGE REHABILITATION	SF	$175	-	$0
		BRIDGE RAIL	LF	$100		
		RETAINING WALL	SF	$50	12,000	$600,000
		WEST CONTAINMENT WALL	SF	$40	27,000	$1,080,000
		CENTER TEMPORARY SHEET PILE WALL	SF	$35	12,250	$428,750
		EAST SEPARATION WALL	SF	$35	17,500	$612,500
		CENTER TEMPORARY WALL FOR PHASING	SF	$50	6,000	$300,000
		DEEP AND SHALLOW GROUND IMPROVEMENTS	LS	$1,650,000	1	$1,650,000
		GLOBAL STABILITY MITIGATION - DRILLED SHAFTS	LS	$15,000,000	1	$15,000,000
		METAL RAILING, PEDESTRIAN	SF	$110	1,400	$154,000
		REINFORCED CONCRETE RIGID FRAME (TUNNEL)	SF	$150	1,700	$255,000
3		**SURFACING**				
		CEM CONC. PAVEMENT	SY	$110	2,800	$308,000
		HOT MIX ASPHALT	TON	$100	-	$0
		MIN. AGGREGATE TYPE 2	TON	$25	900	$22,500
4		**ROADSIDE DEVELOPMENT**				
		ENVIRONMENTAL MITIGATION	LS	$730,000	1	$730,000
		TEMPORARY WATER POLLUTION & EROSION CONTROL	LS	$200,000	1	$200,000
5		**TRAFFIC**				
		ILLUMINATION	LS	$75,000	1	$75,000
		CURBS	LF	$15	1,530	$22,950
		SIDEWALKS	SY	$25	2,100	$52,500
		TRAFFIC CONTROL	LS	$400,000	1	$400,000
6		**OTHER ITEMS**				
		SURVEYING	LS	$100,000	1	$100,000
7		**MISCELLANEOUS *(25%)***	LS	$7,188,000	1	$7,188,000
8		**CONSTRUCTION SUBTOTAL (ITEMS 1 THRU 7)**				**$35,936,200**
9		**MOBILIZATION**				
		10.00% OF ITEM 8	EST	$3,593,700	1	$3,593,700
10		**SUBTOTAL (ITEMS 8 & 9)**				**$39,529,900**
11		**CONSTRUCTION**				
		ENGINEERING (10% OF ITEM 10)	EST	$3,953,000	1	$3,953,000
		CONTINGENCIES (15% OF ITEM 10)	EST	$5,930,000	1	$5,930,000
12		**CONSTRUCTION TOTAL (ITEMS 10 & 11)**				**$49,412,900**
C.		**TOTAL ESTIMATED COST**				
		(ITEMS A & 12)				**$49,413,000**
D.		**FUTURE ESTIMATED COST**				
			Inflation	**Const. Year**	**Cost Index**	**Future Cost**
		FUTURE COST BASED ON INFLATION RATE	0.0266	2014	2012	**$52,077,000**

The above opinion of cost is a planning level estimate only. It is based on best available information and scope at the time, not on the results of a detailed engineering study, and is supplied as a budgeting guide only.

City of Seattle

Fairview Ave. North Bridge Replacement

Alternative C5 - Full Bridge Replacement

HNTB Project No. 55928

March 2012

PLANNING LEVEL ENGINEER'S ESTIMATE
OF PROBABLE CONSTRUCTION COSTS

This estimate is the opinion of the Engineer of the probable construction cost of the project, and is supplied as a guide only. Since the Engineer has no control over the costs of labor and materials or over competitive bidding and market conditions, the Engineer does not guarantee the accuracy of such opinion as compared to contractor's bids or actual costs to the Owner. Estimate is calculated in 2012 dollars.

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505 Fifth Avenue South, Suite 300
Seattle, WA 98104
(206) 436-0515

PLANNING LEVEL OPINION OF COST SUMMARY

Project Description: Fairview Ave N Bridge
Alternative C5 - Complete Bridge Replacement
Location: Seattle

Client: City of Seattle
Date: May-13
Date of Cost Index: 2012

		ITEM	UNIT	ESTIMATED UNIT COST	QTY	COST
A.		**RIGHT OF WAY**				
		RIGHT OF WAY (AQUISITION)	SF	$45	-	$0
		RIGHT OF WAY TOTAL				**$0**
B.		**CONSTRUCTION**				
1		**PREPARATION/GRADING/DRAINAGE**				
	1.1	**PREPARATION**				
		WEST BRIDGE DEMO	LS	$664,000	1	$664,000
		EAST BRIDGE DEMO	LS	$810,000	1	$810,000
	1.2	**EARTHWORK**				
		FILL, INCL. HAUL	TON	$30	7,700	$231,000
	1.3	**STORM DRAINAGE**				
		WATER QUALITY	EA	$80,000	2	$160,000
		CONVEYANCE	LS	$40,000	1	$40,000
2		**STRUCTURE**				
		BRIDGE AND APPROACH ITEMS (SEE ATTACHED DETAILS)	SF	$360	25,900	$9,324,000
		RETAINING WALL	SF	$50	6,600	$330,000
		TEMPORARY CONTAINMENT WALL	SF	$40	20,000	$800,000
		LIQUAFACTION GROUND IMPROVEMENTS	LS	$600,000	1	$600,000
		FLOATING WALKWAY STRUCTURE	LS	$150,000	1	$150,000
		BRIDGE RAILING TYPE BP	LF	$95	350	$33,250
		BRIDGE RAILING TYPE PEDESTRIAN	LF	$105	135	$14,175
		PEDESTRIAN BARRIER	LF	$160	100	$16,000
		SEW PEDESTRIAN BARRIER	LF	$275	250	$68,750
3		**SURFACING**				
		CEM CONC. PAVEMENT	SY	$110	800	$88,000
		HOT MIX ASPHALT	TON	$100	-	$0
		MIN. AGGREGATE TYPE 2	TON	$25	200	$5,000
4		**ROADSIDE DEVELOPMENT**				
		ENVIRONMENTAL MITIGATION	LS	$830,000	1	$830,000
		TEMPORARY WATER POLLUTION & EROSION CONTROL	LS	$200,000	1	$200,000
5		**TRAFFIC**				
		ILLUMINATION	LS	$75,000	1	$75,000
		CURBS	LF	$20	600	$12,000
		SIDEWALKS	SY	$35	600	$21,000
		TRAFFIC CONTROL	LS	$400,000	1	$400,000
6		**OTHER ITEMS**				
		SURVEYING	LS	$100,000	1	$100,000
7		**MISCELLANEOUS *(15%)***	LS	$2,246,000	1	$2,246,000
8		**CONSTRUCTION SUBTOTAL (ITEMS 1 THRU 7)**				**$17,218,175**
9		**MOBILIZATION**				
		10.00% OF ITEM 8	EST	$1,721,900	1	$1,721,900
10		**SUBTOTAL (ITEMS 8 & 9)**				**$18,940,075**
11		**CONSTRUCTION**				
		ENGINEERING (10% OF ITEM 10)	EST	$1,895,000	1	$1,895,000
		CONTINGENCIES (15% OF ITEM 10)	EST	$2,842,000	1	$2,842,000
12		**CONSTRUCTION TOTAL (ITEMS 10 & 11)**				**$23,677,075**
C.		**TOTAL ESTIMATED COST**				
		(ITEMS A & 12)				**$23,678,000**
D.		**FUTURE ESTIMATED COST**				
			Inflation	**Const. Year**	**Cost Index**	**Future Cost**
		FUTURE COST BASED ON INFLATION RATE	0.0266	2014	2012	**$24,955,000**

The above opinion of cost is a planning level estimate only. It is based on best available information and scope at the time, not on the results of a detailed engineering study, and is supplied as a budgeting guide only.

Prepared By: KL
Checked by: MG
Date: 3/21/2012

Fairview Ave. North Bridge Replacement
Schedule A - Precast WF50G Girders

Item No.	Item Description	Std. Item No.	Sec. No.	Approx. Quantity	Unit	Estimated Unit Price	Amount
1	Structure Surveying	7038	1-05	1	LS	$20,000.00	$20,000.00
2	Mobilization	8001	1-09.7	1	LS	$1,088,000.00	$1,088,000.00
3	Removing Existing Bridge No.69	0071	2-02	1	LS	$810,000.00	$810,000.00
4	Removing Existing Bridge No. 70	0071	2-02	1	LS	$664,000.00	$664,000.00
5	Removal of Structure and Obstruction	0050	2-02	1	LS	$10,000.00	$10,000.00
6	Gravel Backfill for Wall	4025	2-03	144	CY	$40.00	$5,760.00
7	Gravel Backfill for Drain	7014	2-03	18	CY	$40.00	$720.00
8	Structure Excavation Class A Incl. Haul	4006	2-09	601	CY	$25.00	$15,025.00
9	Shoring or Extra Excavation Cl. A	4013	2-09	1	LS	$40,293.00	$40,293.00
	6-10' Pier 1			*546*	*SF*	*$8.00*	
	10-20' Pier 1			*975*	*SF*	*$11.00*	
	10-20' Pier 2			*1,575*	*SF*	*$16.00*	
10	Conc. Class 4000W for Foundation Seal	4204	6-02	104	CY	$225.00	$23,400.00
11	Conc. Class 4000 for Bridge	4322	6-02	423	CY	$550.00	$232,650.00
12	St. Reinf. Bar for Bridge	4149	6-02	78,300	LB	$1.15	$90,045.00
13	**Superstructure - Fairview Ave. North Bridge**	4300	6-02	1	LS	$2,630,080.00	$2,630,080.00
	Prestressed Conc. Girder WF50G	*4269*		*4,400*	*LF*	*$275.00*	
	Elastomeric Bearing Pad	*9960*		*22*	*EA*	*$200.00*	
	Girder Stop Pad	*9960*		*40*	*EA*	*$150.00*	
	Concrete Class 4000D	*4380*		*824*	*CY*	*$800.00*	
	Concrete Class 4000	*9906*		*329*	*CY*	*$450.00*	
	Epoxy Coated St. Reinf. Bar	*4147*		*220,600*	*LB*	*$1.50*	
	St. Reinf. Bar for Bridge	*4151*		*6,600*	*LB*	*$1.15*	
	Pedestrian Barrier	*4116*		*820*	*LF*	*$160.00*	
	Bridge Railing Type BP	*4360*		*820*	*LF*	*$95.00*	
	Bridge Railing Type Pedestrian	*4410*		*410*	*LF*	*$105.00*	
	Expansion Joint System Compression Seal	*4338*		*131*	*LF*	*$90.00*	
14	Bridge Approach Slab	5656	6-02	360	SY	$250.00	$90,000.00
15	Deficient Strength Conc. Price Adjustment	4219	6-02	1	CALC	($1.00)	($1.00)
16	Superstructure Installation of 4" Conduit	SP	6-02	2	LS	$50,000.00	$100,000.00
17	Bridge Railing Type BP	4360	6-06	350	LF	$95.00	$33,250.00
18	Bridge Railing Type Pedestrian	4410	6-06	135	LF	$105.00	$14,175.00
19	Pedestrian Barrier	4116	6-10	100	LF	$160.00	$16,000.00
20	SEW Pedestrian Barrier	4120	6-13	250	LF	$275.00	$68,750.00
21	Soil Excavation for Shaft Including Haul	4007	6-19	4,303	CY	$375.00	$1,613,625.00
22	Furnishing and Placing Temp. Casing for 8'-0" Dia. Shaft	4020	6-19	1,954	LF	$250.00	$488,500.00
23	Furnishing Permanent Casing 8'-0" Dia. Shaft	4027	6-19	360	LF	$450.00	$162,000.00
24	Placing Permanent Casing for 8'-0" Dia. Shaft	4034	6-19	8	EA	$2,500.00	$20,000.00
25	Conc. Class 4000P for Shaft	4168	6-19	4,385	CY	$300.00	$1,315,500.00
26	St. Reinf. Bar for Shaft	4152	6-19	1,513,100	LB	$1.15	$1,740,065.00
27	CSL Access Tube	4164	6-19	17,936	LF	$7.00	$125,552.00
28	Removing Shaft Obstructions	0256	6-19	1	EST	$547,000.00	$547,000.00
29	Underdrain Pipe 6 in. Diam.	1160	7-01	158	LF	$15.00	$2,370.00
30	Drain Pipe 6 in. Diam.	1170	7-01	80	LF	$15.00	$1,200.00
31	Construction Geotextile for Underground Drainage	7550	9-33	158	SY	$3.00	$474.00

SCHEDULE A TOTAL **$11,968,433**

City of Seattle

Fairview Ave. North Bridge Replacement

Alternative R4 - West Bridge Replacement and East Bridge Rehabilitation

HNTB Project No. 55928

March 2012

PLANNING LEVEL ENGINEER'S ESTIMATE
OF PROBABLE CONSTRUCTION COSTS

This estimate is the opinion of the Engineer of the probable construction cost of the project, and is supplied as a guide only. Since the Engineer has no control over the costs of labor and materials or over competitive bidding and market conditions, the Engineer does not guarantee the accuracy of such opinion as compared to contractor's bids or actual costs to the Owner. Estimate is calculated in 2012 dollars.

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PLANNING LEVEL OPINION OF COST SUMMARY

Project Description: Fairview Ave N Bridge
Alternative R4 - Replace West Bridge
Location: Seattle

Client: City of Seattle
Date: May-13
Date of Cost Index: 2012

		ITEM	UNIT	ESTIMATED UNIT COST	QTY	COST
A.		**RIGHT OF WAY**				
		RIGHT OF WAY (AQUISITION)	SF	$45	-	$0
		RIGHT OF WAY TOTAL				**$0**
B.		**CONSTRUCTION**				
1		**PREPARATION/GRADING/DRAINAGE**				
	1.1	**PREPARATION**				
		WEST BRIDGE DEMO	LS	$664,000	1	$664,000
		EAST BRIDGE DEMO	LS	$207,000	1	$207,000
	1.2	**EARTHWORK**				
		FILL, INCL. HAUL	TON	$20	3,800	$76,000
	1.3	**STORM DRAINAGE**				
		WATER QUALITY	EA	$80,000	2	$160,000
		CONVEYANCE	LS	$78,000	1	$78,000
2		**STRUCTURE**				
		WEST BRIDGE ITEMS (SEE ATTACHED FOR DETAILS)	SF	$345	13,500	$4,656,150
		EAST BRIDGE ITEMS (SEE ATTACHED FOR DETAILS)	SF	$19	6,300	$120,960
		EAST BRIDGE SEISMIC RETROFIT	LS	$1,000,000	1	$1,000,000
		RETAINING WALL	SF	$50	3,600	$180,000
		TEMPORARY CONTAINMENT WALL	SF	$40	20,000	$800,000
		LIQUAFACTION GROUND IMPROVEMENTS	LS	$405,500	1	$405,500
		FLOATING WALKWAY STRUCTURE	LS	$150,000	1	$150,000
		BRIDGE RAILING TYPE BP	LF	$95	135	$12,825
		BRIDGE RAILING TYPE PEDESTRIAN	LF	$105	135	$14,175
		BRIDGE RAILING TYPE 2-TUBE	LF	$175	482	$84,350
		PEDESTRIAN BARRIER	LF	$160	50	$8,000
		SEW TRAFFIC BARRIER	LF	$290	72	$20,880
		SEW PEDESTRIAN BARRIER	LF	$275	85	$23,375
3		**SURFACING**				
		CEM CONC. PAVEMENT	SY	$110	100	$11,000
		HOT MIX ASPHALT	TON	$100	-	$0
		MIN. AGGREGATE TYPE 2	TON	$25	100	$2,500
4		**ROADSIDE DEVELOPMENT**				
		ENVIRONMENTAL MITIGATION	LS	$590,000	1	$590,000
		TEMPORARY WATER POLLUTION & EROSION CONTROL	LS	$200,000	1	$200,000
5		**TRAFFIC**				
		ILLUMINATION	LS	$75,000	1	$75,000
		CURBS	LF	$15	300	$4,500
		SIDEWALKS	SY	$25	200	$5,000
		TRAFFIC CONTROL	LS	$400,000	1	$400,000
6		**OTHER ITEMS**				
		SURVEYING	LS	$100,000	1	$100,000
7		**MISCELLANEOUS *(15%)***	LS	$1,508,000	1	$1,508,000
8		**CONSTRUCTION SUBTOTAL (ITEMS 1 THRU 7)**				**$11,557,215**
9		**MOBILIZATION**				
		10.00% OF ITEM 8	EST	$1,155,800	1	$1,155,800
10		**SUBTOTAL (ITEMS 8 & 9)**				**$12,713,015**
11		**CONSTRUCTION**				
		ENGINEERING (10% OF ITEM 10)	EST	$1,272,000	1	$1,272,000
		CONTINGENCIES (15% OF ITEM 10)	EST	$1,907,000	1	$1,907,000
12		**CONSTRUCTION TOTAL (ITEMS 10 & 11)**				**$15,892,015**
C.		**TOTAL ESTIMATED COST**				
		(ITEMS A & 12)				**$15,893,000**
D.		**FUTURE ESTIMATED COST**				
			Inflation	**Const. Year**	**Cost Index**	**Future Cost**
		FUTURE COST BASED ON INFLATION RATE	0.0266	2014	2012	**$16,750,000**

The above opinion of cost is a planning level estimate only. It is based on best available information and scope at the time, not on the results of a detailed engineering study, and is supplied as a budgeting guide only.

Prepared By: KL
Checked by: MG
Date: 3/21/2012

Fairview Ave. North West Bridge Replacement
Schedule A - Precast WF50G Girders

Item No.	Item Description	Std. Item No.	Sec. No.	Approx. Quantity	Unit	Estimated Unit Price	Amount
1	Structure Surveying	7038	1-05	1	LS	$12,000.00	$12,000.00
2	Mobilization	8001	1-09.7	1	LS	$683,000.00	$683,000.00
3	Removing Portions of Existing Bridge No. 69	0061	2-02	1	LS	$207,000.00	$207,000.00
4	Removing Existing Bridge No. 70	0071	2-02	1	LS	$664,000.00	$664,000.00
5	Removal of Structure and Obstruction	0050	2-02	1	LS	$6,000.00	$6,000.00
6	Gravel Backfill for Wall	4025	2-03	84	CY	$40.00	$3,360.00
7	Gravel Backfill for Drain	7014	2-03	10	CY	$40.00	$400.00
8	Structure Excavation Class A Incl. Haul	4006	2-09	291	CY	$25.00	$7,275.00
9	Shoring or Extra Excavation Cl. A	4013	2-09	1	LS	$21,314.00	$21,314.00
	6-10' Pier 1			*262*	*SF*	*$8.00*	
	10-20' Pier 1			*470*	*SF*	*$11.00*	
	10-20' Pier 2			*878*	*SF*	*$16.00*	
10	Conc. Class 4000W for Foundation Seal	4204	6-02	50	CY	$225.00	$11,250.00
11	Conc. Class 4000 for Bridge	4322	6-02	204	CY	$550.00	$112,200.00
12	Conc. Class 4000D for Bridge	4380	6-02	64	CY	$1,000.00	$64,000.00
13	Epoxy Coated St. Reinf. Bar for Bridge	4148	6-02	34,500	LB	$1.65	$56,925.00
14	St. Reinf. Bar for Bridge	4149	6-02	37,500	LB	$1.15	$43,125.00
15	**Superstructure - Fairview Ave. North Bridge**	4300	6-02	1	LS	$1,358,067.50	$1,358,067.50
	Prestressed Conc. Girder WF50G	*4269*		*2,000*	*LF*	*$275.00*	
	Elastomeric Bearing Pad	*9960*		*10*	*EA*	*$200.00*	
	Girder Stop Pad	*9960*		*16*	*EA*	*$150.00*	
	Concrete Class 4000D	*4380*		*411*	*CY*	*$800.00*	
	Concrete Class 4000	*9906*		*189*	*CY*	*$450.00*	
	Epoxy Coated St. Reinf. Bar for Bridge	*4147*		*107,800*	*LB*	*$1.50*	
	St. Reinf. Bar for Bridge	*4151*		*2,850*	*LB*	*$1.15*	
	Pedestrian Barrier	*4116*		*410*	*LF*	*$160.00*	
	Bridge Railing Type BP	*4360*		*410*	*LF*	*$95.00*	
	Bridge Railing Type Pedestrian	*4410*		*410*	*LF*	*$105.00*	
	Bridge Railing Type Oregon 2-Tube	*4410*		*410*	*LF*	*$175.00*	
	Expansion Joint System Compression Seal	*4338*		*61*	*LF*	*$90.00*	
16	Bridge Approach Slab	5656	6-02	174	SY	$250.00	$43,500.00
17	Deficient Strength Conc. Price Adjustment	4219	6-02	1	CALC	($1.00)	($1.00)
18	Superstructure Installation of 4" Conduit	SP	6-02	1	LS	$50,000.00	$50,000.00
19	East Bridge Seismic Retrofit	SP	6-02	1	LS	$1,000,000.00	$1,000,000.00
20	Bridge Railing Type BP	4360	6-06	135	LF	$95.00	$12,825.00
21	Bridge Railing Type Pedestrian	4410	6-06	135	LF	$105.00	$14,175.00
22	Bridge Railing Type Oregon 2-Tube	4410	6-06	482	LF	$175.00	$84,350.00
23	Pedestrian Barrier	4116	6-10	50	LF	$160.00	$8,000.00
24	SEW Traffic Barrier	4119	6-13	72	LF	$290.00	$20,880.00
25	SEW Pedestrian Barrier	4120	6-13	85	LF	$275.00	$23,375.00
25	Soil Excavation for Shaft Including Haul	4007	6-19	2,152	CY	$375.00	$806,812.50
26	Furnishing and Placing Temp. Casing for 8'-0" Dia. Shaft	4020	6-19	977	LF	$250.00	$244,250.00
27	Furnishing Permanent Casing 8'-0" Dia. Shaft	4027	6-19	180	LF	$450.00	$81,000.00
28	Placing Permanent Casing for 8'-0" Dia. Shaft	4034	6-19	4	EA	$2,500.00	$10,000.00
29	Conc. Class 4000P for Shaft	4168	6-19	2,193	CY	$300.00	$657,750.00
30	St. Reinf. Bar for Shaft	4152	6-19	756,550	LB	$1.15	$870,032.50
31	CSL Access Tube	4164	6-19	8,968	LF	$7.00	$62,776.00
32	Removing Shaft Obstructions	0256	6-19	1	EST	$273,000.00	$273,000.00
33	Underdrain Pipe 6 in. Diam.	1160	7-01	92	LF	$15.00	$1,380.00
34	Drain Pipe 6 in. Diam.	1170	7-01	80	LF	$15.00	$1,200.00
35	Construction Geotextile for Underground Drainage	7550	9-33	92	SY	$3.00	$276.00

SCHEDULE A TOTAL **$7,515,498**

Prepared By: KL
Checked by: MG
Date: 3/21/2012

Fairview Ave. North Future East Bridge Replacement
Schedule A - Precast WF50G Girders

Item No.	Item Description	Std. Item No.	Sec. No.	Approx. Quantity	Unit	Estimated Unit Price	Amount
1	Structure Surveying	7038	1-05	1	LS	$12,000.00	$12,000.00
2	Mobilization	8001	1-09.7	1	LS	$573,000.00	$573,000.00
3	Removing Existing Bridge No.69	0071	2-02	1	LS	$810,000.00	$810,000.00
4	Removing Portions of Existing Bridge No. 70	0061	2-02	1	LS	$100,000.00	$100,000.00
4	Removal of Structure and Obstruction	0050	2-02	1	LS	$6,000.00	$6,000.00
5	Gravel Backfill for Wall	4025	2-03	93	CY	$40.00	$3,720.00
6	Gravel Backfill for Drain	7014	2-03	11	CY	$40.00	$440.00
7	Structure Excavation Class A Incl. Haul	4006	2-09	328	CY	$25.00	$8,200.00
8	Shoring or Extra Excavation Cl. A	4013	2-09	1	LS	$23,848.00	$23,848.00
	6-10' Pier 1			*299*	*SF*	*$8.00*	
	10-20' Pier 1			*528*	*SF*	*$11.00*	
	10-20' Pier 2			*978*	*SF*	*$16.00*	
9	Conc. Class 4000W for Foundation Seal	4204	6-02	54	CY	$225.00	$12,150.00
10	Conc. Class 4000 for Bridge	4322	6-02	225	CY	$550.00	$123,750.00
11	St. Reinf. Bar for Bridge	4149	6-02	41,525	LB	$1.15	$47,753.75
12	**Superstructure - Fairview Ave. North Bridge**	4300	6-02	1	LS	$1,396,330.00	$1,396,330.00
	Prestressed Conc. Girder WF50G	*4269*		*2,400*	*LF*	*$275.00*	
	Elastomeric Bearing Pad	*9960*		*12*	*EA*	*$200.00*	
	Girder Stop Pad	*9960*		*24*	*EA*	*$150.00*	
	Concrete Class 4000D	*4380*		*464*	*CY*	*$800.00*	
	Concrete Class 4000	*9906*		*138*	*CY*	*$450.00*	
	Epoxy Coated St. Reinf. Bar for Bridge	*4147*		*117,700*	*LB*	*$1.50*	
	St. Reinf. Bar for Bridge	*4151*		*3,600*	*LB*	*$1.15*	
	Pedestrian Barrier	*4116*		*410*	*LF*	*$160.00*	
	Bridge Railing Type BP	*4360*		*410*	*LF*	*$95.00*	
	Expansion Joint System Compression Seal	*4338*		*131*	*LF*	*$90.00*	
13	Bridge Approach Slab	5656	6-02	194	SY	$250.00	$48,500.00
14	Deficient Strength Conc. Price Adjustment	4219	6-02	1	CALC	($1.00)	($1.00)
15	Superstructure Installation of 4" Conduit	SP	6-02	1	LS	$50,000.00	$50,000.00
16	Bridge Railing Type BP	4360	6-06	215	LF	$95.00	$20,425.00
17	Pedestrian Barrier	4116	6-10	50	LF	$160.00	$8,000.00
18	SEW Pedestrian Barrier	4120	6-13	165	LF	$275.00	$45,375.00
19	Soil Excavation for Shaft Including Haul	4007	6-19	2,152	CY	$375.00	$806,812.50
20	Furnishing and Placing Temp. Casing for 8'-0" Dia. Shaft	4020	6-19	977	LF	$250.00	$244,250.00
21	Furnishing Permanent Casing 8'-0" Dia. Shaft	4027	6-19	180	LF	$450.00	$81,000.00
22	Placing Permanent Casing for 8'-0" Dia. Shaft	4034	6-19	4	EA	$2,500.00	$10,000.00
23	Conc. Class 4000P for Shaft	4168	6-19	2,193	CY	$300.00	$657,750.00
24	St. Reinf. Bar for Shaft	4152	6-19	756,550	LB	$1.15	$870,032.50
25	CSL Access Tube	4164	6-19	8,968	LF	$7.00	$62,776.00
26	Removing Shaft Obstructions	0256	6-19	1	EST	$273,000.00	$273,000.00
27	Underdrain Pipe 6 in. Diam.	1160	7-01	102	LF	$15.00	$1,530.00
28	Drain Pipe 6 in. Diam.	1170	7-01	80	LF	$15.00	$1,200.00
29	Construction Geotextile for Underground Drainage	7550	9-33	102	SY	$3.00	$306.00

SCHEDULE A TOTAL **$6,298,148**

City of Seattle

Fairview Ave. North Bridge Replacement

Environmental Mitigation Cost for F1, C5 and R4

March 2012

PLANNING LEVEL ESTIMATE BACKUP

This estimate is the opinion of the Engineer of the probable construction cost of the project, and is supplied as a guide only. Since the Engineer has no control over the costs of labor and materials or over competitive bidding and market conditions, the Engineer does not guarantee the accuracy of such opinion as compared to contractor's bids or actual costs to the Owner. Estimate is calculated in 2012 dollars.

ESA
5309 Shilshole Avenue NW, Suite 200
Seattle, WA 98107
(206) 789-9658

City of Seattle
Fairview Avenue North Bridge Replacement
Type, Size and Location Study

April 2012
Mitigation Cost Estimate

Fill Option	Quantity		Unit	Estimate	
Mitigation for Fill	32100	sf	$ 15	$ 481,500	32100 SF X 1:1 Ratio - lower ratio due to on-site habitat creation
Shoreline Restoration	560	lf	$ 35	$ 19,600	
Upland Restoration	6450	sf	$ 3	$ 20,963	
Cut piles 2' below fill line (as mitigation) and remove	150	each	$ 350	$ 52,500	Vibratory removal, assume 150 piles
Pile Disposal	45	cy	$ 50	$ 2,250	Assume 1' diam and 10' long average (.3 cy per each)
Wharf Removal and dispose	236	cy	$ 75	$ 17,700	Assume 2.5 cf per sf of area (2550 sf)
Marine Rubble/Debris removal/disposal	804	cy	$ 128	$ 102,912	Assumes minor area between bridge and building and along margins
Streambed gravel	424	cy	$ 40	$ 16,960	Cap for rubble/sediment removal
Turbidity Curtain	580	lf	$ 25	$ 14,500	Assumes single layer
			Subtotal	$ 728,885	

Replacement Option	Quantity		Unit	Estimate	
Mitigation for Fill	3300	sf	$ 15	$ 49,500	2200SF X 1:5 Ratio
Shoreline Restoration	190	lf	$ 35	$ 6,650	
Upland Restoration	4975	sf	$ 3	$ 16,169	
Cut piles 2' below fill line (as mitigation) and remove	150	each	$ 550	$ 82,500	Cut and Fill - assume 150 piles
Pile Disposal	112.5	cy	$ 50	$ 5,625	Assume 1' diam and 25' long average (.75 cy per each)
Wharf Removal and dispose	236	cy	$ 75	$ 17,700	Assume 2.5 cf per sf of area (2550 sf)
Marine Rubble/Debris removal/disposal	3770	cy	$ 128	$ 482,560	Assumes areas in ROW
Streambed gravel	3390	cy	$ 40	$ 135,600	Cap for rubble/sediment removal
Turbidity Curtain	1140	lf	$ 25	$ 28,500	Assumes double layer
			Subtotal	$ 824,804	

Rehab Option	Quantity		Unit	Estimate	
Mitigation for Fill	1800	sf	$ 15	$ 27,000	1200SF X 1:5 Ratio
Shoreline Restoration	190	lf	$ 35	$ 6,650	
Upland Restoration	5125	sf	$ 3	$ 16,656	
Cut piles 2' below fill line (as mitigation) and remove	100	each	$ 550	$ 55,000	Cut and Fill assume 100 piles
Pile Disposal	75	cy	$ 50	$ 3,750	Assume 1' diam and 25' long average (.75 cy per each)
Wharf Removal and dispose	236	cy	$ 75	$ 17,700	Assume 2.5 cf per sf of area (2550 sf)
Marine Rubble/Debris removal/disposal	2625	cy	$ 128	$ 336,000	Assumes areas in ROW
Streambed gravel	2435	cy	$ 40	$ 97,400	Cap for rubble/sediment removal
Turbidity Curtain	1140	lf	$ 25	$ 28,500	Assumes double layer
			Subtotal	$ 588,656	

FAIRVIEW AVENUE NORTH BRIDGE

TYPE, SIZE AND LOCATION REPORT

APPENDIX C

BRIDGE INSPECTION REPORTS

BRIDGE INSPECTION REPORT

WO	CC	WE	PD			
BAM				Status: Approved	Ver Date 1/18/2012 Printed on: 1/24/2012	Agency: SEATTLE Program Mgr: Grant D. Griffin

Bridge No. BRG-070 **Structure Type**

Bridge Name FAIRVIEW AVE N - W BR **Route** 01140 **Intersecting** LAKE UNION

Structure ID 08550500 **MilePost** 70.00 **Location** 1400 Fairview Ave N

Inspector's Signature HWT IDent# G0506 Co-Inspector's Signature AM

3	Structural Adqcy	(657)	N	Pier/Abut/Protect	(679)	1948		Year Built	(332)
2	Deck Geometry	(658)	N	Scour	(680)	0		Year Rebuilt	(336)
9	Underclearance	(659)	6	Approach Rdwy	(681)	F 38		Oper Rating	(551)
3	Operating Level	(660)	9	Retaining Walls	(682)	F 23		Inv Rating	(554)
8	Alignment Adqcy	(661)	9	Pier Protection	(683)	P		Open Close	(293)
9	Waterway Adqcy	(662)	1	Bridge Rails	(684)	9999		Vert Over Deck	(360)
6	Deck Overall	(663)	0	Transition	(685)	0000		Vert Under	(374)
6	Drains Condition	(664)	0	Guardrails	(686)	N		Vert Und Code	(378)
6	Superstructure	(671)	0	Terminals	(687)	0.00		Asphalt Depth	
1	Number Utilities	(675)		Revise Rating	(688)			Speed Limit	
3	Substructure	(676)		Photos Flag	(691)				
9	Chan/Protection	(677)		Soundings Flag	(693)				
9	Culvert	(678)		Measure Clearance	(694)				

Inspections Performed:

IT	NT	HRS	Date	Rep Type
Y	23	1.5	12/29/2011	Routine
				Fract Crit
				Underwater
				Special
				Interim
				Equipment
				Damage
				Safety
				Short Span

Total: 1.5

Suff Rating: 23.98 SD 23.98 SD

BMS Elements 38 to 407

Element	Element Description	Total	Units	State 1	State 2	State 3	State 4
38	Concrete Slab	12,713	SF	663	12,000	50	C
206	Timber Pile/Column	15	EA	0	15	0	C
215	Concrete Abutment	53	LF	53	0	0	C
228	Timber Submerged Pile/Column	151	EA	11	116	19	5
234	Concrete Pier Cap / Crossbeam	901	LF	901	0	0	C
311	Moveable Bearing (roller, sliding, etc)	6	EA	6	0	0	C
330	Metal Bridge Railing	504	LF	204	300	0	C
407	Steel Angle Header	76	LF	76	0	0	C

WO	CC	WE	PD			
BAM				Status: Approved	Ver Date 1/18/2012 Printed on: 1/24/2012	Agency: SEATTLE Program Mgr: Grant D. Griffin

Bridge No.	BRG-070			**Structure Type**	
Bridge Name	FAIRVIEW AVE N - W BR	**Route**	01140	**Intersecting**	LAKE UNION
Structure ID	08550500	**MilePost**	70.00	**Location**	1400 Fairview Ave N

Notes 0 to 407

0
12/29/2011, HWT & AM, Routine Inspection, 10:30 A.M., Overcast, 46^F +/-

General Notes

Prior condition reports for this structure can be found in the bridge file

38
Concrete Slab

Deck is worn with exposed aggregate over a large portion of the deck. Continue to observe.

Deck has random pattern cracking throughout. Continue to observe.

At the joint between the East and West Bridges there are three spalls with rebar 3exposed. See Work Order #10718.

206
Timber Column/Pile

For sounding results of timber components of the bridge, see O:\Images\Roadway Structures\Bridges\Bridge Inspections\Bridges 51-100\Br-70\BR70 Piles\BR 70 2011 Piles.xls

215
Concrete Abutment

No defects noted

228
Timber Submerged Pile

234
Concrete Pier Cap / Crossbeam

311
Movable Bearing (roller, sliding, etc)

330
Metal Bridge Railing

New Paint on rails

407
Steel Angle Header

All expansion joints closed. Mid span expansion joint is very tight and is causing spall of the deck slab under the bridge. There is also some spall at the rail parapet over the South Abutment bearing area. Cause appears to be inadequate room for expansion of the joint. Continue to observe.

Repairs to

Repair No	Pr	R	Repair Description	Date Noted	Verified
			(No repairs for this structure)		

BRIDGE INSPECTION REPORT

WO	CC	WE	PD			
BAM				Status: Approved	Ver Date 1/18/2012 Printed on: 1/24/2012	Agency: SEATTLE Program Mgr: Grant D. Griffin

Bridge No. BRG-070

Bridge Name FAIRVIEW AVE N - W BR

Structure ID 08550500

Route 01140

MilePost 70.00

Structure Type

Intersecting LAKE UNION

Location 1400 Fairview Ave N

Inspections Performed and Resources Required

Report Type	Date	IT	Frq	Hrs	Insp	CertNo	Coinsp	Note
Routine	12/29/2011		23	1.5	HWT	G0506	AM	12/29/2011, HWT & AM, Routine Inspection, 10:30 A.M., Overcast, 46^F +/-

Sticky Notes

Creator	Created	Table Reference	Notes

12/29/11

FAIRVIEW AVE WEST BRIDGE TIMBER PILE PLAN / FILE #70

N ↗

(O) ENCASED PILE

Os SOFT PILE

Od DELAMINATED PILE

O(x) X = SHELL THICKNESS

MATCH LINE

18	O	O	Os	O	(O)
17	OsOs (O)		O	O	O
16	O	Os	O split, top 6'	●(2)	O
15	(O)	●s (1)	O	O	O
14	O	Od	O	O	(O)
13	O	O	O	O	O
12	(O)	O	O	O	O
11	O	O	O	O	O
10	O	●(<1)	O	Os	Os
9	O	O	O	Os	O
8	Osplit	O	O	(O)	O
7	O	O	O	O	O
6	O	O	O	O	O
5	O	O	Os	O	O
4	O	Os	O	Os	O
3	O	O	O	O	O
2	O	Os	O	O	O
1	O	Os	O	O	Os

32	O	O	O	O	O
31	O	O	(O)	● (1)	O
30	O	O	●(1.5)	O	O
29	O	O	O	O	O
28	O	O	O	O	(O)
27	O	O	O	●(2.5)	O
26	O	Os	O	Os	O O
25	O	O O	O	(O)	O
24	(O)	Os	O	O	Os O
23	(O)	Os	O	O	O O
22	O	(O)	(O)	Os	O
21	O	Os	Os	O	Os
20	(O)	O	O	O	Os
19	O	Os	O	O	O

MATCH LINE

BRIDGE INSPECTION REPORT

	WO	CC	WE	PD		
BAM					Status: Released	

Ver Date 8/1/2011
Printed on: 12/19/2011

Agency: SEATTLE
Program Mgr: Grant D. Griffin

Bridge No.	69			**Structure Type**	
Bridge Name	FAIRVIEW AVE N - E BR	**Route**	01140	**Intersecting**	LAKE UNION
Structure ID	08550400	**MilePost**	69.00	**Location**	1400 Fairview Ave N

Inspector's Signature DAA IDent# G0205 Co-Inspector's Signature GK

4	5	Structural Adqcy	(657)	N		Pier/Abut/Protect	(679)	1964			Year Built	(332)
2	5	Deck Geometry	(658)	8		Scour	(680)	0			Year Rebuilt	(336)
9		Underclearance	(659)	8		Approach Rdwy	(681)	F	32	T 38	Oper Rating	(551)
5		Operating Level	(660)	9		Retaining Walls	(682)	F	19	T 23	Inv Rating	(554)
8		Alignment Adqcy	(661)	9		Pier Protection	(683)	A			Open Close	(293)
8		Waterway Adqcy	(662)	1		Bridge Rails	(684)	9999			Vert Over Deck	(360)
7		Deck Overall	(663)	1		Transition	(685)	0000			Vert Under	(374)
7		Drains Condition	(664)	1		Guardrails	(686)	N			Vert Und Code	(378)
7		Superstructure	(671)	1		Terminals	(687)	0.00			Asphalt Depth	
1		Number Utilities	(675)			Revise Rating	(688)				Speed Limit	
7		Substructure	(676)			Photos Flag	(691)					
8		Chan/Protection	(677)			Soundings Flag	(693)					
9		Culvert	(678)			Measure Clearance	(694)					

Inspections Performed:

IT	NT	HRS	Date	Rep Type
Y	**24**	**2.0**	**11/3/2010**	**Routine**
				Fract Crit
D	60	8.0	10/26/2007	Underwater
				Special
				Interim
				Equipment
				Damage
				Safety
				Short Span

Total: 2.0

Suff Rating: 59.54 FO 84.98

BMS Elements 12 to 407

Element	Element Description	Total	Units	State 1	State 2	State 3	State 4
12	Concrete Deck	11,926	SF	11,676	250	0	0
115	Prestressed Concrete Girder	2,843	LF	2,843	0	0	0
204	Prestressed Concrete Pile/Column	10	EA	10	0	0	0
215	Concrete Abutment	63	LF	63	0	0	0
226	Prestressed Concrete Submerged Pile/Column	48	EA	48	0	0	0
234	Concrete Pier Cap / Crossbeam	427	LF	427	0	0	0
266	Concrete Sidewalk & Supports	2,892	SF	2,892	0	0	0
310	Elastomeric Bearing	36	EA	36	0	0	0
330	Metal Bridge Railing	482	LF	482	0	0	0
341	Concrete Pedestrian Railing	482	LF	482	0	0	0
402	Hot Poured and/or Premolded Joint Filler	50	LF	50	0	0	0
407	Steel Angle Header	50	LF	50	0	0	0

Bridge No.	69			**Structure Type**	
Bridge Name	FAIRVIEW AVE N - E BR	**Route**	01140	**Intersecting**	LAKE UNION
Structure ID	08550400	**MilePost**	69.00	**Location**	1400 Fairview Ave N

Notes 0 to 407

0
General Notes

Routine Inspection, 11/03/2010, DAA / GK, Clear 65^F +/-

* Prior condition reports for this structure are located in the bridge file.

* The bridge runs from North to South. Previous references to the East are interpreted to mean the North. Previous references to the West are interpreted to mean the South.

* At the Northeast corner of the bridge the approach to the sidewalk has settled 3/4 inch. Continue to observe.

* Under the North end of the bridge there is a substantial amount of garbage from the transients.

12
Concrete Deck

* Minor transverse cracking in deck. Continue to observe.

* At the North expansion joint on the bridge deck there are many small spalls. Continue to observe.

* At the second expansion joint from the North there are two spalls adjacent to the joint. See Slip #14051.

115
Prestress Concrete Girder

There are shear cracks in the ends of the girders. This is typical throughout the bridge. Some have been epoxy-injected. Continue to observe.

204
P/S Concrete Column/Pile

No defects noted

215
Concrete Abutment

No defects Noted

226
Prestress Conc Submerged Pile

No defects noted

234
Concrete Pier Cap / Crossbeam

No defects noted

266
Concrete Sidewalk & Supports

No defects noted

310
Elastomeric Bearing

No defects noted

BRIDGE INSPECTION REPORT

	WO	CC	WE	PD
BAM				

Status: Released

Ver Date 8/1/2011

Printed on: 12/19/2011

Agency: SEATTLE

Program Mgr: Grant D. Griffin

Bridge No. 69

Bridge Name FAIRVIEW AVE N - E BR

Structure ID 08550400

Route 01140

MilePost 69.00

Structure Type

Intersecting LAKE UNION

Location 1400 Fairview Ave N

Notes 0 to 407

330
Metal Bridge Railing

Rails have been painted

341
Concrete Pedestrian Railing

No defects noted

402
Poured or Premolded Joint Filler

Both expansion joints on the bridge have failed. They are torn and pushed down. Reissued Slip #9128.

Expansion joints are tight. At the North joint the concrete rail is spalled. Continue to observe.

407
Steel Angle Header

No defects noted

Repairs to

Repair No	Pr	R	Repair Description	Date Noted	Verified
			(No repairs for this structure)		

Inspections Performed and Resources Required

Report Type	Date	IT	Frq	Hrs	Insp	CertNo	Coinsp	Note
Routine	11/3/2010		24	2.0	DAA	G0205	GK	Routine Inspection,
Underwater	10/26/2007	D	60	8.0	MPH	G0611		From Laptop98 database 'H:\LP_Upd\1 to be processed\Seattle Updates 041105.mdb'.

Sticky Notes

Creator	Created	Table Reference	Notes

FAIRVIEW AVENUE NORTH BRIDGE

TYPE, SIZE AND LOCATION REPORT

APPENDIX D

SCREENING MATRIX & MEETING MINUTES
INITIAL AND SECONDARY ALTERNATIVES

505 5th Ave S. Suite 300, Seattle, WA 98104 | P 206.436.0515

Project: Fairview Ave N Bridge
Date: January 6, 2012
Time: 10:00 – 11:30 pm
Location: Seattle Municipal Tower Conf. Room 3940
Attendees: SDOT – Kit Loo, Ehelnesh Woubetu, John Layzer, Mike Terrell, John Buswell, Yuling Teo; Consultant team – Brian Sperry, Jesse Thomsen, Kiva Lints, Salima Hamlin, Benn Burke, Erik Andersen, Bruce Jamieson

Alternatives Initial Screening Meeting

Summary of Decisions

Fill Alternatives (F1 – F3) - SDOT decided to eliminate Alternatives F2 and F3 and advance F1 to the secondary evaluation and screening as it has the advantage of eliminating future bridge maintenance and there are many opportunities for shoreline, environmental and other public benefits that are not associated with bridge replacement and rehabilitation alternatives. F2 and F3 carry as much or more risk as F1 but without the benefits for shoreline and land use enhancement.

Complete Bridge Replacement Alternatives (C1 – C4) – SDOT decided to eliminate C1 (girders too big to be practically constructable) and C4 (SDOT does not like to use voided slabs) and directed the Perteet Team to identify an optimum complete bridge replacement solution. SDOT prefers fewer foundations and longer spans for the optimum solution. Larger drilled shaft foundations (6' to 8' diameter) or group piles may be needed to increase the span length. Larger drilled shafts may require temporary driven piles to strengthen the West Bridge during drilled shaft installation.

Replace West Bridge and Rehabilitate East Bridge Alternatives (R1 – R3)– SDOT prefers to do nothing for the East Bridge since it would not quality for BRAC funding. If the Zymogenetics catwalk can be rerouted, SDOT prefers to replace the West Bridge with the same structure type / layout as the optimum solution developed for the Complete Replacement Alternative. If the catwalk can't be rerouted, SDOT would like the Perteet team to identify and optimum solution between R2 and R3 to replace the West bridge and do nothing on the East bridge.

Meeting Agenda and Comments

1. Introductions (all)

2. Meeting Objectives (Kit/Brian)
   - Evaluate, screen & reduce alternatives to 3
   - Identify critical information needed for secondary screening

3. Site Constraints (Kiva)

4. Key Challenges / Risks
   - Geotechnical (Erik)
     - Unconsolidated soils to 100' to 110' depth at the south end
     - Unconsolidated soils to 30' depth at the north end
     - All 6 borings completed in December are 100' to 120' deep

- Yuling commented on the effects of the soils on stiffness. Kiva said this will need to be studied as part of the secondary evaluation and screening process
- Constructability (Bruce)
  - If too big of substructure or superstructure construction complexity and cost will increase
  - Longitudinal construction techniques will work well given building and OH power line constraints on both sides
- Environmental Impacts (Benn)
  - Alternative F3 is self mitigating as it creates opportunities for mitigation that is fish friendly as well as ability to cap any contaminated sediments. Permitting strategies include: EIS, early agency coordination, submitting for permits early in design process, go through more formal governor's pre-application process
  - City going thru Shoreline Master Plan update now and SDOT team can talk to DPD about how this relates to the Fairview project
  - Bridge options are categorically excluded from NEPA process unless they have significant impacts which are not anticipated on this project
  - Overwater shading is a concern especially for deeper girders and may require mitigation
  - Existing piles can likely be cut off at mud line and may not need to be removed

5. Alternatives Overview (Kiva) – Kiva provided a brief overview of all alternatives

6. Overview of Advantages & Disadvantages (Kiva)
   - Bridge Replacement (C1-C4)
   - Bridge Rehab (R1-R3)
     - Rehab alts require median curb to prevent vehicles from crossing joint between the East and West bridges.
     - Kit commented that the West bridge would be most likely to receive federal funding for replacement and feds would allow partial removal of the East bridge for R3. Rehab alternatives with a wider width than existing would not necessarily require changing the channelization which, could be done at a later time.
   - Roadway Fill (F1-F3)
     - John L. and Kit suggested a hybrid fill / bridge replacement option to address soil conditions. Erik stated that there is still 25' of liquefiable soils at north end that would require ground improvement or other solution. John B. commented that SDOT would consider Geofoam at the south end. Benn commented that hybrid options could be included in an EIS if one is prepared.

7. Evaluation Matrix Discussion (All)
     - John B. had these comments: If a thickened deck is used it should be across entire deck. Every arterial is an emergency route. Does not like to use voided slabs, especially for high ADT or truck routes. R2 works better if the Zymogenetics catwalk can be eliminated
     - Kit had these comments: At this time no commitments have been made regarding this project accommodating the future street car. Seattle Parks would like to keep the walkway along the water.
     - Construction cost estimates for each alternative were developed at a very conceptual level and will be refined for the secondary evaluation and screening

Action Items/Follow-up

- Perteet Team to identify optimum complete replacement alternative

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- Perteet team to investigate rerouting the Zymogenetics catwalk and coordinate with SDOT on preferred rehabilitation alternative to advance to the secondary screening
- Perteet to update the schedule
- SDOT to investigate SCL's obligation to address hazardous materials relating to this project
- SDOT to investigate recent emergency route planning done by the State
- SDOT will arrange site tour with Zymogenetics and look into legal obligations for the catwalk

Fairview Ave. Bridge Replacement
Evaluation Matrix

DRAFT

		Fill Alternatives			Complete Bridge Replacement Full Length / Reduced Length Alternatives				Replace West Bridge, Rehab. East Bridge Alternatives		
Item No.	Criteria	F1	F2	F3	C1	C2	C3	C4	R1	R2	R3
1	**Constructability**										
1.1	Ability to maintain traffic w/ limited night/weekend closures										
1.2	Ability to maintain ZymoGenetics kayak access during constr										
1.3	High voltage overhead power line conflicts										
1.4	Duration of in-water construction										
1.5	Construction complexity										
	Considerations include: *- Construction duration* *- Traffic impacts during construction* *- Use of common construction techniques* *- Potential for construction conflicts (Constructability)* *- Bike/Pedestrian connectivity/access during construction*										
2	**Environmental Impacts**										
2.1	Permit complexity/duration										
2.2	Adverse Impacts										
2.3	Mitigation potential / env. benefits										
	Considerations include: *- Fill below OHWM* *- Shoreline enhancements* *- Overwater structure & shading* *- Open water loss* *- Offsite environmental mitigation* *- Cultural & historic resources*										
3	**Structural**										
3.1	Structural vulnerability/risk										
3.2	Ability to accommodate street car										
3.3	Design Flexibility										
	Considerations include: *- Provides accommodations for current & future utilities* *- Foundation requirements/complexity* *- Total bridge and wall area* *- Ability to accommodate roadway/bike/pedestrian requirements* *- Drainage system complexity*										
4	**Geotechnical**										
4.1	Impacts to adjacent buildings										
4.2	Geotechnical vulnerability/risks										
	Considerations include: *- Geotechnical seismic vulnerability/risks to structure* *- Foundation complexity* *- Long-term settlement potential* *- Vibration during construction* *- Groundwater impacts* *- Potential hazardous material mitigation*										
5	**Land Use Impacts**										
5.1	Opportunity for enhanced aesthetics										
5.2	Opportunity to enhance existing aquatic park										
5.3	Right-of-way impacts										
5.4	ADA Accessibility to Aquatic Park										
6	**Maintenance**										
6.1	Minimizes long-term maintenance										
7	**Project Cost**										
7.1	Initial cost (Engineering, construction) in Millions	$17.5	$19.7	$18.9	$15.5	$15.5	$15.5	$14.1	$11.4	$12.1	$11.6

Legend
Lower risk / positive benefit
Neutral risk / benefit
Higher risk / low benefit
Fatal Flaw

Perteet
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Project:	Fairview Ave N Bridge
Date:	March 23, 2012
Time:	9:00 – 10:30 am
Location:	Seattle Municipal Tower Conf. Room 3940
Attendees:	SDOT – Kit Loo, Ehelnesh Woubetu, John Layzer, Mike Terrell, John Buswell, Yuling Teo, Mark Mazzola, Lorelei Williams, Greg Izzo, Reiner ?; Consultant team – Brian Sperry, Jesse Thomsen, Kiva Lints, Salima Hamlin, Benn Burke, Erik Andersen, Donald Huling, Bruce Jamieson

Secondary Alternatives Screening Meeting

1. Introductions (all)

2. Meeting Objectives (Kit/Brian)

- Evaluate, screen & reduce alternatives from 3 to a single preferred alternative
- Identify critical information needed for documenting secondary screening

3. Geotechnical Conditions (Erik)

- An overview of soil conditions (soil profile along West Bridge) was provided. Alternative designs address local soil conditions. Compressible and liquefiable soils are present and will require ground improvement (jet grouting or possibly compaction grouting) for any alternative involving fill within the OHW, including Alt C5 (complete bridge replacement with 70 feet of new fill).
- Ground improvement for complete fill alternative (F1) and the southern 70 feet of the complete bridge replacement (C5) alternative will address settlement and liquefaction concerns within the ground improvement area (Response to John's question).
- Per Kiva, new bridge drilled shafts would extend to depths of nominally 130 feet

4. Description / Discussion of Alternatives (Kiva)

- All alternatives – 1) new profile (about 3' higher than existing road at crest) to provide positive drainage along curb line without need for drainage structures and vertical clearance for the Zymogenetics kayak catwalk under the bridge, 2) channelization 8' sidewalk, 5' bike lane, 3-11' vehicle lanes, 5' bike lane, 12' shared use path (except no NB bike lane for Rehabilitation alternative)
- Fill Alternative (F1)
    - Construction phasing is designed using cut off and containment walls to protect Zymogenetics building, protect the existing east bridge (to remain open to traffic during construction), and containment of jet grouting to minimize leakage into lake. Cut off walls would extend to about the north and south ends of the existing bridges.
    - Ground improvement (jet grouting or other) would extend to the bottom of the compressible and liquefiable soils.
    - To address contaminated soils, fill would be placed in the lake, capping the contaminated soils prior to jet grouting or other ground improvement. With jet grouting (and most all forms of ground improvement), spoils are generated at the working surface elevation that subsequently must be disposed. It is commonly assumed that jet grout spoil volume will amount to approximately 40% of the jet grout volume, and this has been considered in our cost estimate.
    - John asked about movement of the lakeside trail post earthquake. Erik responded that the trail could move away from the ground improved area but that the fill material would settle to a new equilibrium and the result would be uneven grading that could be repaired.

   - Fill slopes in the lake of 7H:1V and 4H:1V are proposed in accordance with City fish friendly design guidelines and to accommodate public water access (Response to John's questions asked how the decision was made as to where to stop the 7:1 slope and begin the 4:1 slope.)
   - Cutoff and containment wall installation challenges include: vibration sensitivities to Zymogenetics ongoing experiments, existing piles and obstructions, and high voltage OH power lines
   - It is assumed that large fiber optic lines are buried along the west side of the walkway which could be impacted by the fill option.
- Complete Bridge Replacement Alternative (C5)
   - WF50G girders, 8' diameter drilled shafts installed using oscillatory method going through existing bridge deck. Temporary piling/widening will be required for the farthest west shafts as they are outside of the existing bridge. Some temporary piling will likely be needed at all shaft locations because the existing structure solely will not have sufficient capacity to support the extreme forces associated with shaft construction, specifically casing extraction.
   - Proposed bridge is about 70' shorter than the existing East Bridge and 100' shorter than the existing West Bridge. This requires fill with the lake ordinary high water (OHW). All of the seismic stability, settlement, and ground improvement issues and solutions will apply for this partial fill. To avoid the fill within the OHWM, another span could be added and the span arrangement reconfigured.
   - 4' columns at Pier 2 & 3½' columns a Pier 3 are used to address balanced stiffness
   - Columns are supported on 8' (2.5m) diam. drilled shafts that extend into the glacial deposits to elevation -130.
   - Abutments are founded on 8' diam. drilled shafts so that shaft diameters are consistent.
   - Staged construction assumes two lanes (one NB and one SB) of traffic will be remain open during most of the construction
   - The bridge will accommodate street car loads but the deck is not thickened. The proposed bridge deck will allow for a future 2" concrete overlay to install street car rails.
   - The high voltage OH power lines may need to be de-energized for western most drilled shaft installations. There is room to shift the bridge 3.5' closer to building to help with power line clearances. However, this will require reduced lane widths (two 10' lanes with 1' shy to curbs) during phase 1 construction or elimination of the 5' sidewalk during phase 1.
- Rehabilitation Alternative (R4)
   - This alternative is the same bridge configuration as C5 with slightly different girder and shaft spacing but only replaces the west bridge, leaving the east bridge. The east bridge could be replaced in the future.
   - Median barrier are required between the two bridges as the replaced west bridge will be at a higher profile than the east bridge that is to remain.
   - Work on the east bridge includes a new railing with enough new deck to allow for the new railing. Column jacketing is an optional item that has been placed in the cost estimate and its need should be discussed further during final design. The east bridge piles are founded in liquefiable soils, however, retrofitting to address this deficiency may not be cost effective and is not in the current cost estimate.
   - Kit asked if raising the west bridge profile was an issue. Reiner ? responded that this is acceptable as long as the ends are tapered and the profiles match.

5. Construction Staging:

- Question was asked if the bridge could be closed during construction. According to Kit, this will be re-visited once construction duration was identified. If it saves significant time, it would be considered. In addition, north bound detour might be a challenge.

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6. Overview of Alternative Costs, Advantages & Disadvantages (Brian)

- Roadway Fill (F1)
  - Construction cost ($22.2M), fish habitat and shoreline park enhancements, highest permitting risk, involves extensive ground improvement and associated risk. John commented that the life cycle cost for the fill option would be lower than other alternatives
- Complete Bridge Replacement (C5)
  - Construction cost ($21.3M), fewest construction and environmental concerns, more predictable and risk is lower. However, ground improvement and associated risk for the southern 70 to 100 feet is the same as that for alternative F1. The complete bridge replacement full length option is even more predictable and has less overall risk.
- Bridge Rehab (R4 – Replace West Bridge / Rehab East Bridge)
  - Construction cost ($13.8M), highest life cycle cost ($12M to replace East Bridge in future plus maintenance cost for the existing bridge), limited flexibility for future changes in channelization.

7. Global Stability, Potential Mitigation Measures and Costs (Erik)

- Erik presented some evidence, using conservative assumptions, that the bridge area and area to the south could be subject to movement in a design year seismic event. More boring data and analysis needs to be conducted to better evaluate this global stability concern. If a global stability concern does exist further discussion is needed to determine how best to address this issue. Issues raised that would need to be further explored include: BRAC funding requirements, mitigation options, and partnering with adjacent property owners and utility agencies (Alexandria Real Estate, SCL, etc). Lorelei indicated that further discussions with DPD, WSDOT and others will be appropriate .

8. Open discussion (All)

- Issues that were raised included: capturing seismic performance in evaluation (East Bridge may meet life safety), Is Fairview a view corridor? Would SCL underground power lines here?, Add utilities and future channelization flexibility to evaluation matrix, Maintenance for Fill less than other alternatives and highest for Rehab alternative

Action Items/Follow-up

- Kit will confirm with Ethan that a thickened deck is not needed on the bridge to accommodate a future street car
- Kit to schedule a follow up meeting to discuss next steps in completing the alternatives evaluation
- Brian/Erik to develop scope and budget for additional lake borings and analysis

Fairview Ave. Bridge Replacement
Evaluation Matrix

Item No.	Criteria	Fill Alternative: F1 — West and East Sides	Fill Alternative: F1 — West Side Only	Complete Bridge Replacement / Reduced Bridge Length: C5 (Optimum Span Layout) — Fill Below OHWM @ S. End	Complete Bridge Replacement / Reduced Bridge Length: C5 (Optimum Span Layout) — No Fill	Replace West Bridge Only / Reduced Bridge Length: R4 (Similar to C5) — Fill Below OHWM @ S. End	Replace West Bridge Only / Reduced Bridge Length: R4 (Similar to C5) — No Fill
1	**Constructability**						
1.1	Work period impacts relating to ZymoGenetics building	Green	Green	Yellow	Yellow	Green	Green
1.2	In water fill restrictions	Yellow	Yellow	Yellow	Yellow	Green	Green
1.3	Need for temporary work trestle / opportunity to use ex bridge	Green	Yellow	Yellow	Yellow	Yellow	Yellow
1.4	Risk of claim(s) during construction	Red	Red	Yellow	Yellow	Green	Green
1.5	Overall duration of construction	Yellow	Green	Yellow	Yellow	Green	Green
2	**Environmental Impacts**						
2.1	Permitting / Process	Red	Red	Yellow	Green	Yellow	Green
2.2	Environmental Impacts / Mitigation Relating to Habitat	Green	Green	Yellow	Green	Red	Red
2.3	Environmental Impacts / Mitigation Relating to Socio-economic	Red	Yellow	Yellow	Yellow	Green	Green
	Considerations include: *- 2.1 Anticipated duration of permitting, Permit complexity/number of 3rd party approvals necessary, Permit risk/schedule impact* *- 2.2 Post-construction water quality benefits, Overwater cover and shaded area, Vertical structure below the water line, Habitat quality of nearshore areas within the project area* *- 2.3 Duration of Construction/period of closure of pedestrian facilities, Impact of construction on adjoining businesses/access to facilities and parking*						
3	**Structural**						
3.1	Seismic vulnerability/risk	Yellow	Red	Yellow	Yellow	Red	Red
3.2	Structure durability	Green	Red	Green	Green	Red	Red
3.3	Foundation requirements & complexity	Red	Red	Yellow	Yellow	Yellow	Yellow
3.4	Ability to accommodate street car	Green	Red	Green	Green	Red	Red
4	**Geotechnical**						
4.1	Settlement of roadway and / or utilities	Red	Red	Red	Green	Red	Green
4.2	Settlement of adjacent buildings	Red	Yellow	Yellow	Green	Yellow	Green
4.5	Risk of vibration damage to adjacent structures	Yellow	Yellow	Green	Green	Green	Green
4.7	Impacts to lake water below ZymoGenetics building	Yellow	Yellow	Green	Green	Green	Green
5	**Land Use Impacts**						
5.2	Opportunity to enhance existing aquatic park	Green	Green	Yellow	Yellow	Yellow	Yellow
5.3	Right-of-way impacts	Yellow	Yellow	Green	Green	Green	Green
5.4	ADA Accessibility to Aquatic Park	Green	Green	Yellow	Yellow	Yellow	Yellow
6	**Maintenance**						
6.1	Minimizes long-term maintenance	Yellow	Red	Green	Green	Red	Red
7	**Project Cost**						
7.1	Initial Construction Cost in Millions	$22.2	$16.7	$21.3		$13.8	
7.2	Life Cycle Cost	Yellow	Red	Yellow	Yellow	Red	Red

Legend

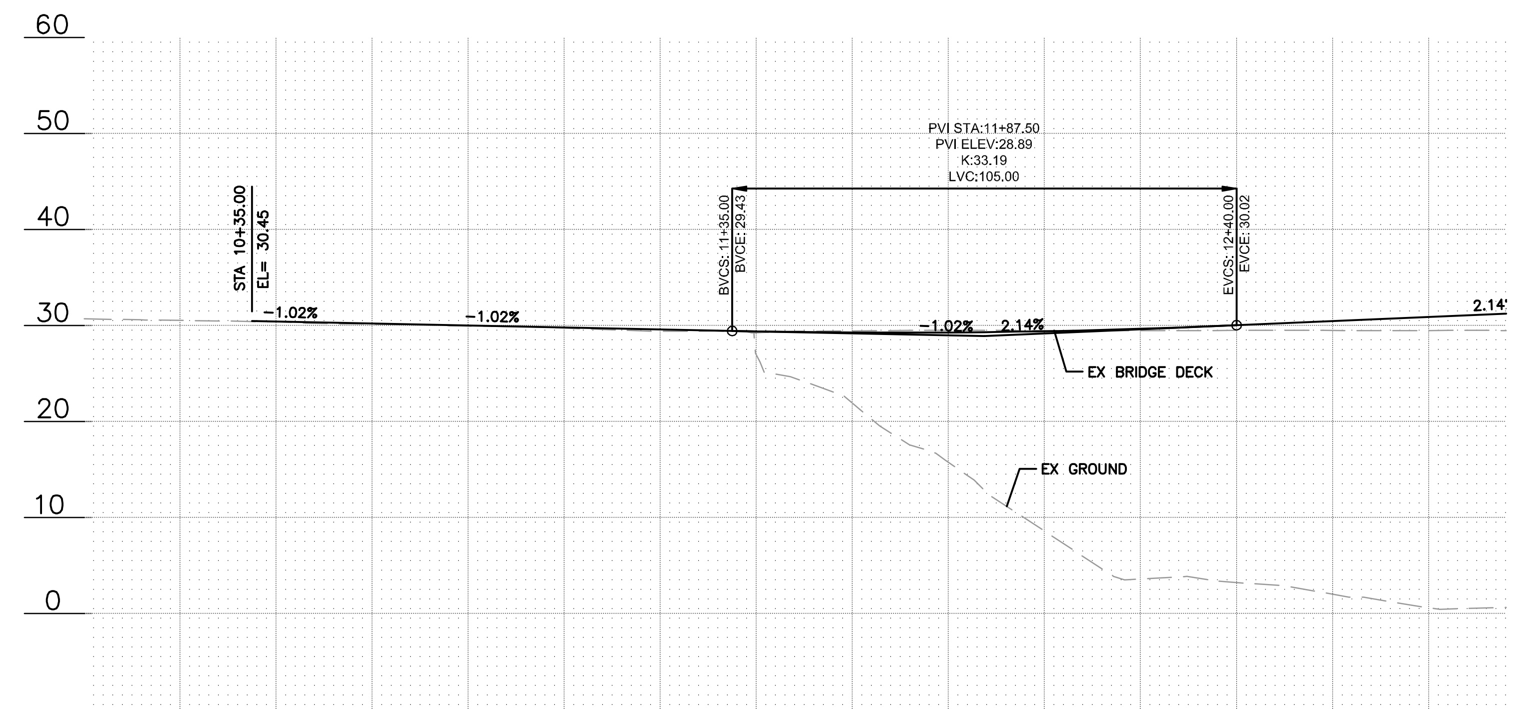
Legend	
Lower Risk / positive benefit	Green
Neutral Risk / benefit	Yellow
Higher Risk / low benefit	Red
Fatal Flaw	Black

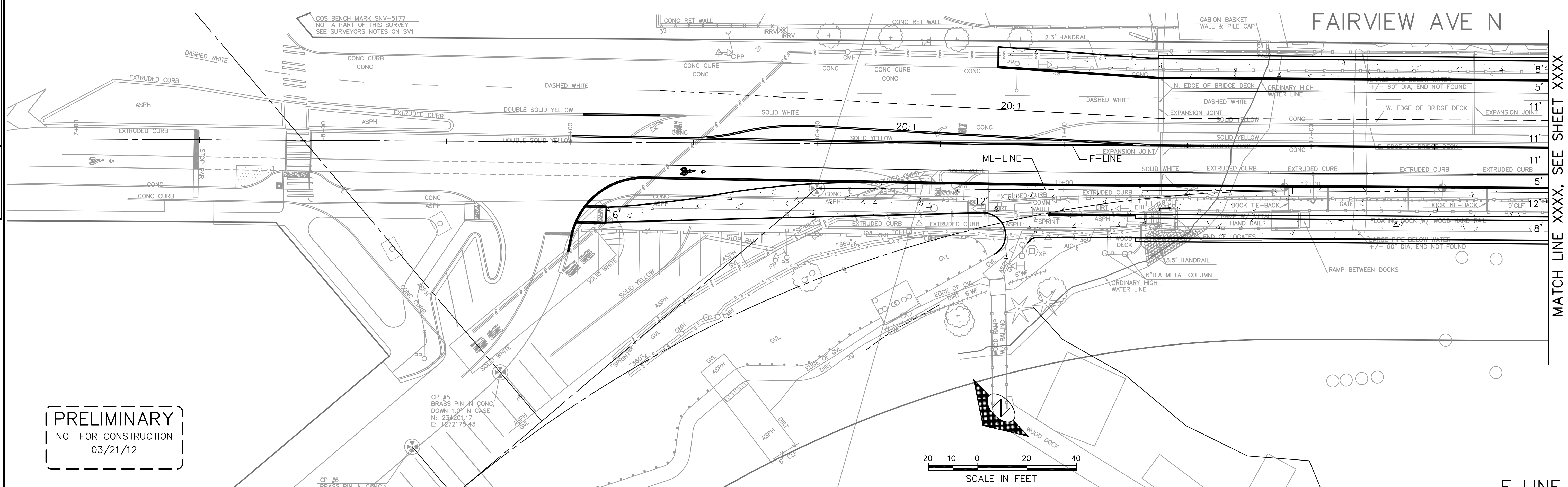
FAIRVIEW AVENUE NORTH BRIDGE

TYPE, SIZE AND LOCATION REPORT

APPENDIX E

CONCEPT PLANS – 3 ALTERNATIVES





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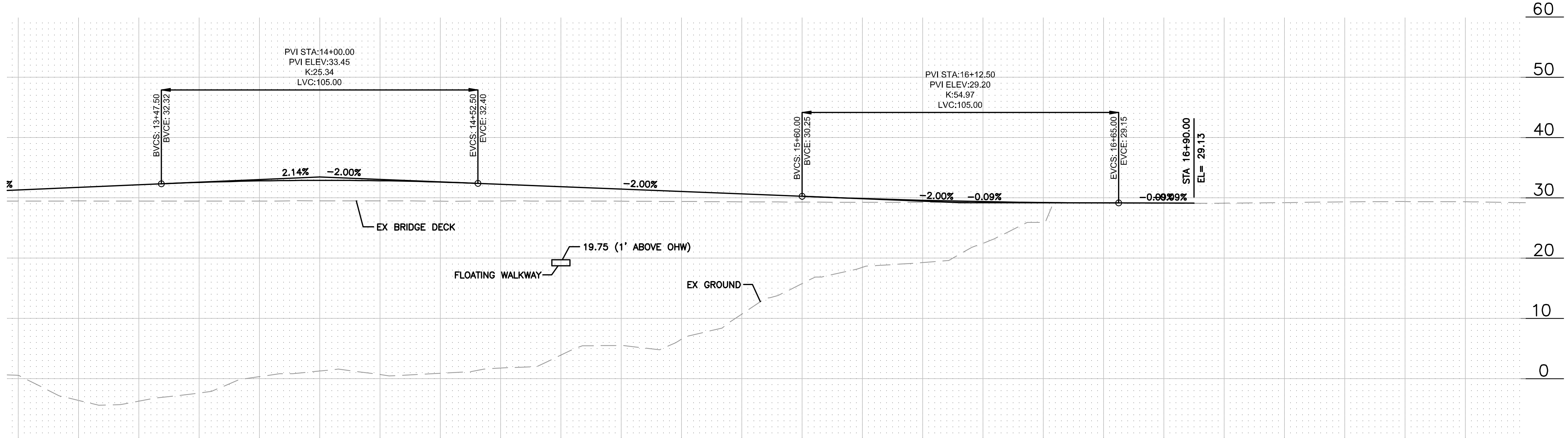

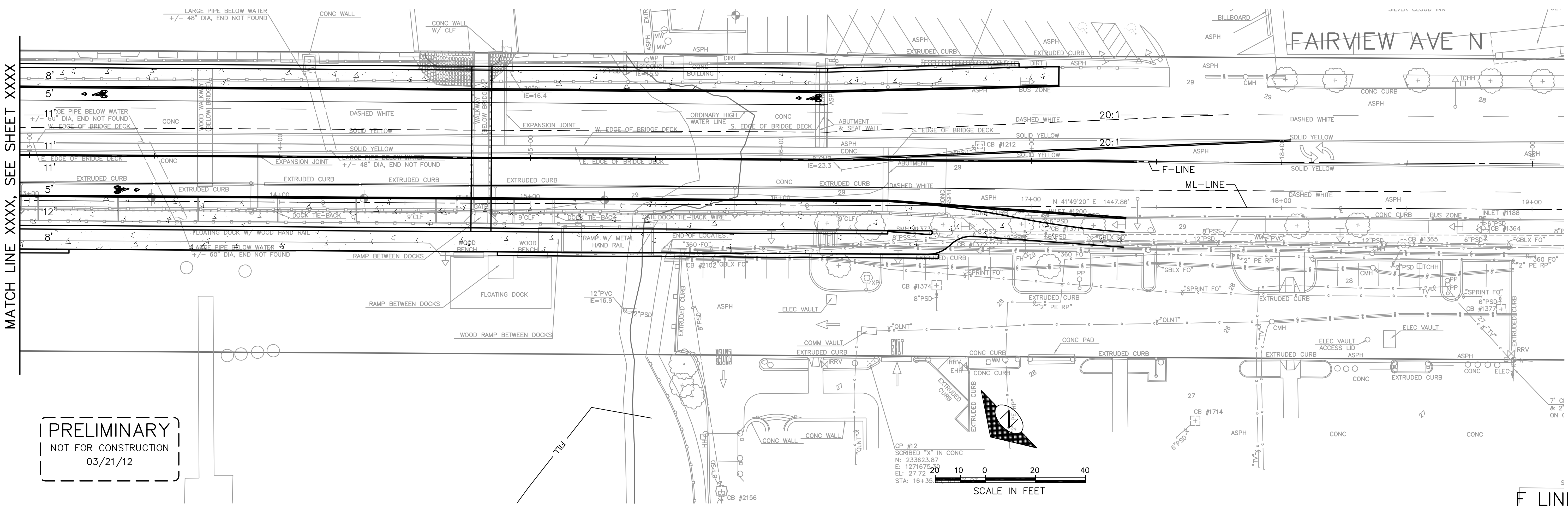

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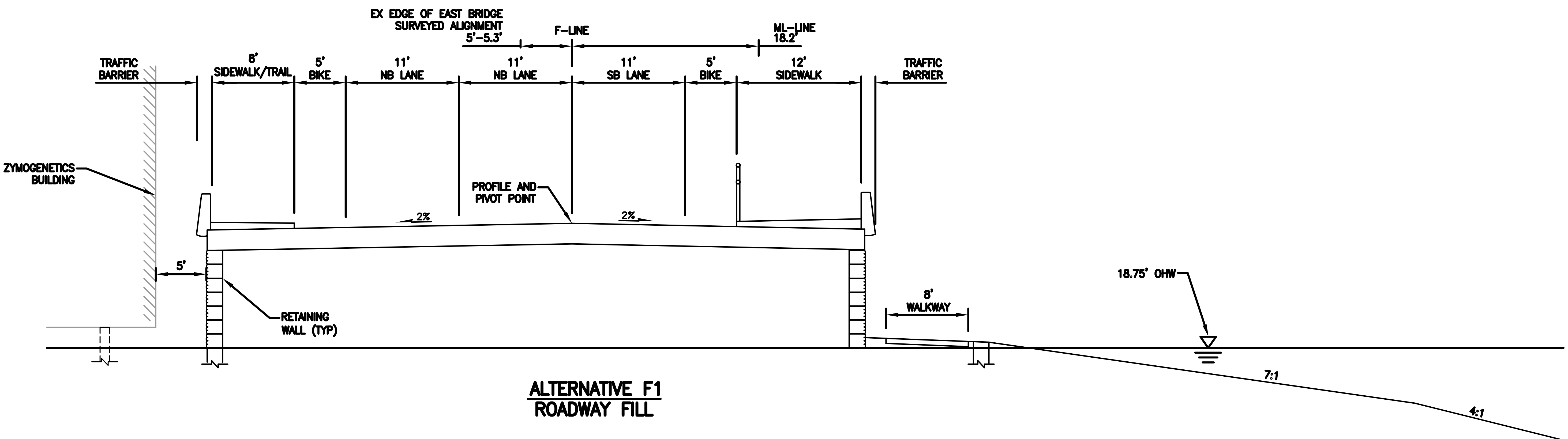

ALTERNATIVE F1
ROADWAY FILL

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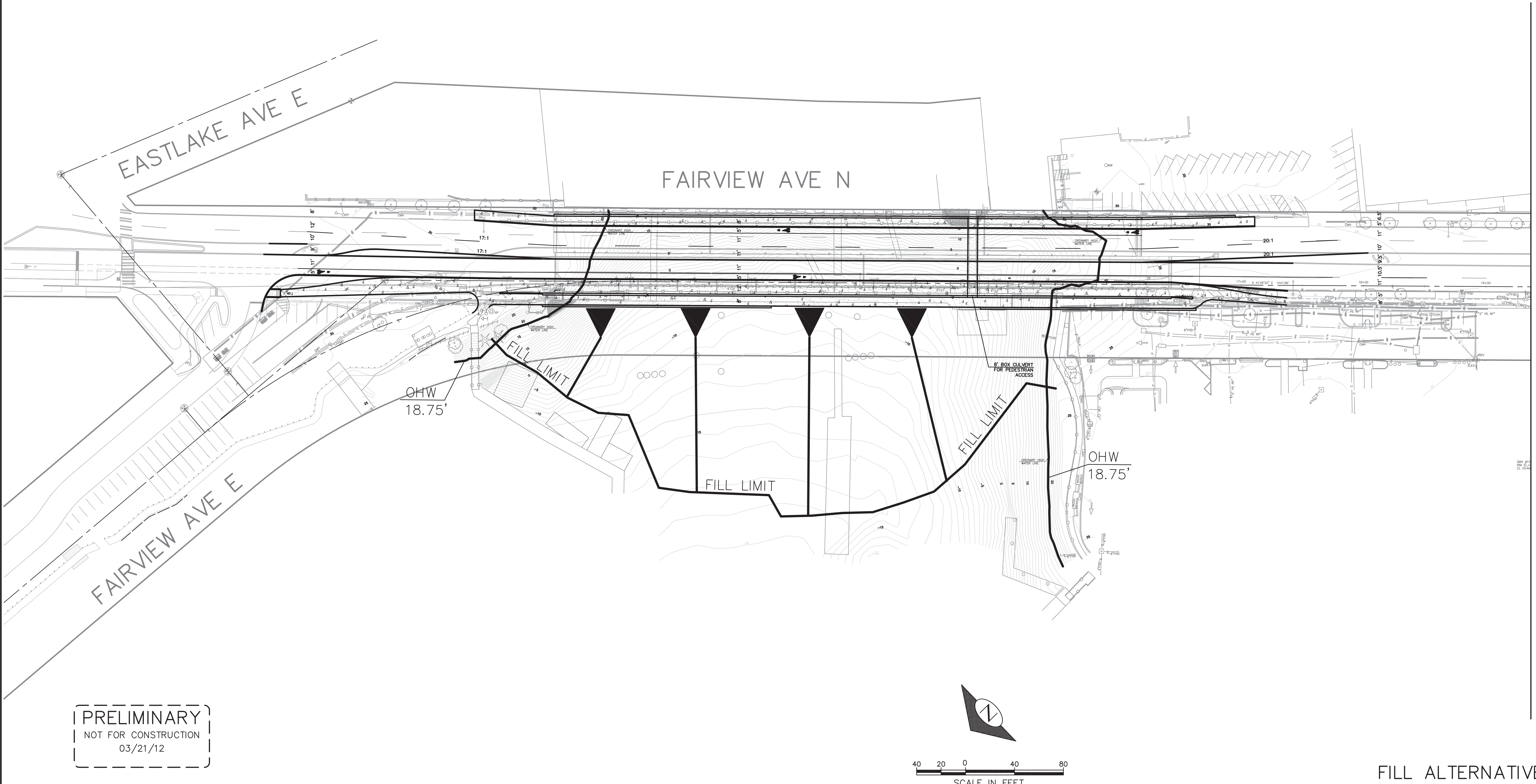

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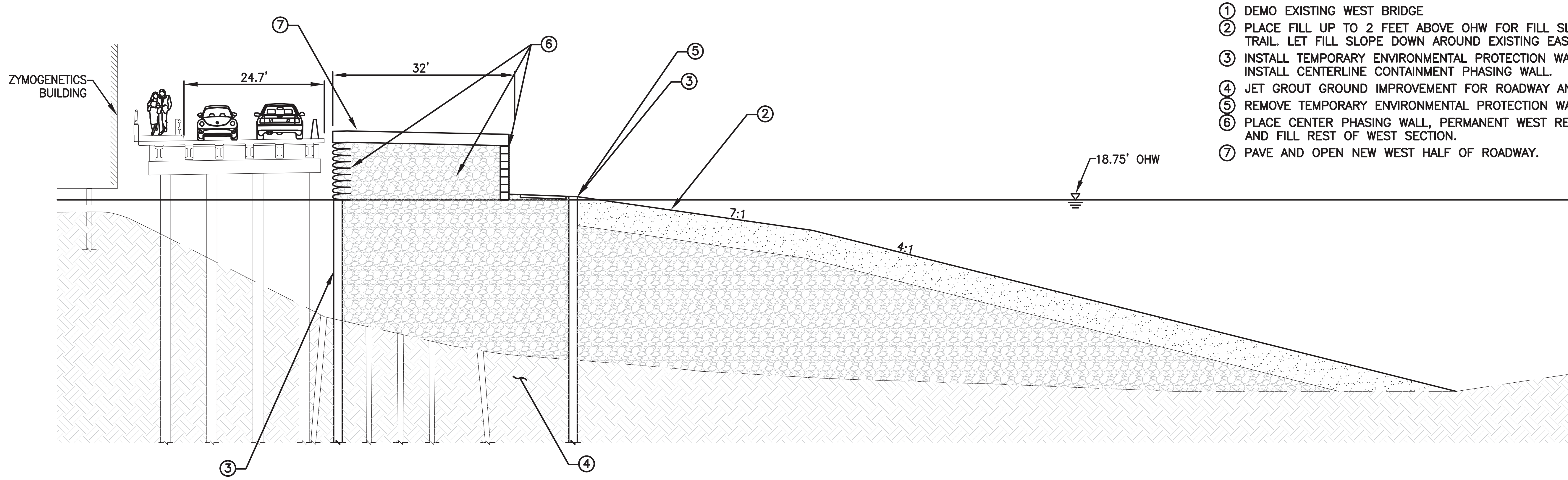
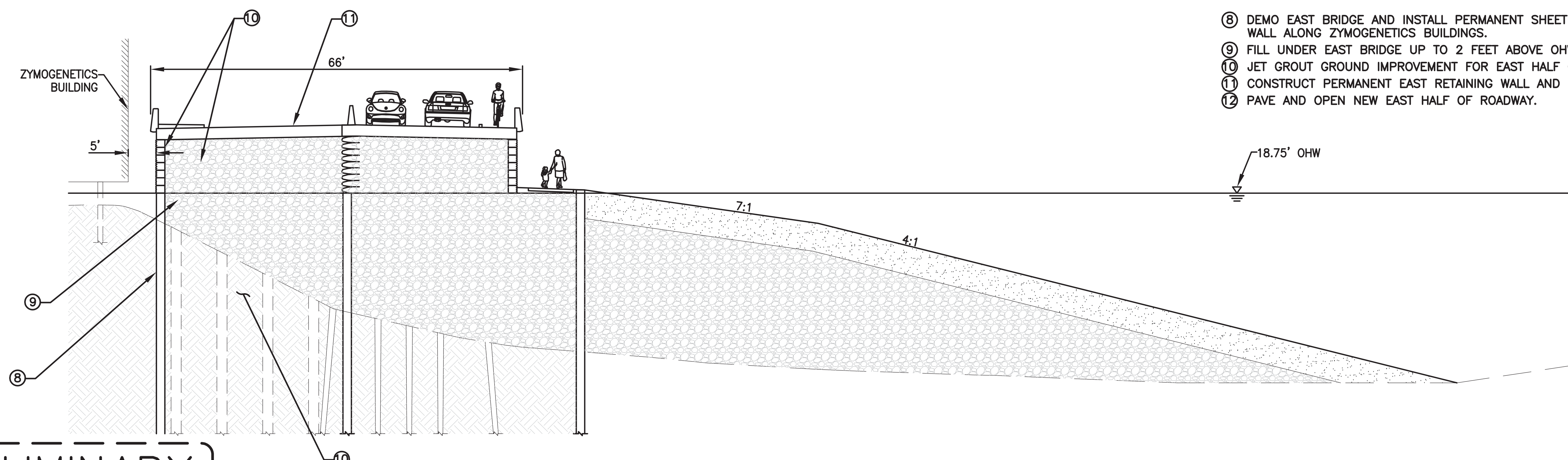


1. DEMO EXISTING WEST BRIDGE
2. PLACE FILL UP TO 2 FEET ABOVE OHW FOR FILL SLOPE AND LAKESIDE TRAIL. LET FILL SLOPE DOWN AROUND EXISTING EAST BRIDGE PILING.
3. INSTALL TEMPORARY ENVIRONMENTAL PROTECTION WALL. INSTALL CENTERLINE CONTAINMENT PHASING WALL.
4. JET GROUT GROUND IMPROVEMENT FOR ROADWAY AND TRAIL FOOTPRINT.
5. REMOVE TEMPORARY ENVIRONMENTAL PROTECTION WALL.
6. PLACE CENTER PHASING WALL, PERMANENT WEST RETAINING WALL, AND FILL REST OF WEST SECTION.
7. PAVE AND OPEN NEW WEST HALF OF ROADWAY.

WEST FILL



8. DEMO EAST BRIDGE AND INSTALL PERMANENT SHEET PILE ISOLATION WALL ALONG ZYMOGENETICS BUILDINGS.
9. FILL UNDER EAST BRIDGE UP TO 2 FEET ABOVE OHW.
10. JET GROUT GROUND IMPROVEMENT FOR EAST HALF OF ROADWAY.
11. CONSTRUCT PERMANENT EAST RETAINING WALL AND COMPLETE FILL.
12. PAVE AND OPEN NEW EAST HALF OF ROADWAY.

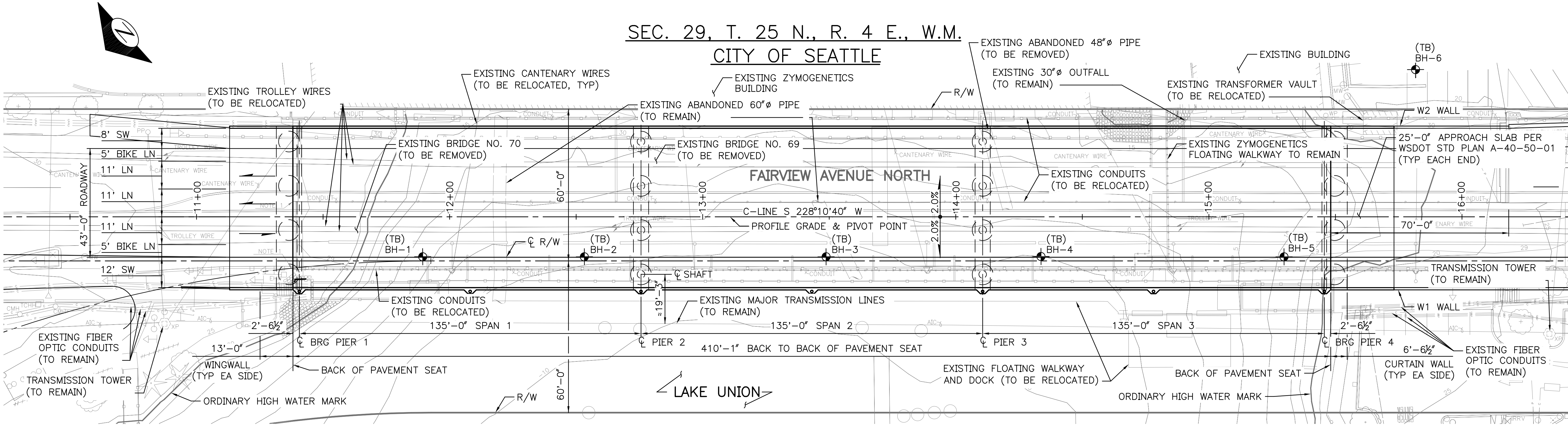
EAST FILL

PRELIMINARY
NOT FOR CONSTRUCTION
03/21/12

Perteet Inc.
206-436-0515 | 1-800-615-990
505 5th Avenue S, Suite 300
Seattle, Washington 98104

FAIRVIEW AVE N
FILL ALTERNATIVE - PHASING

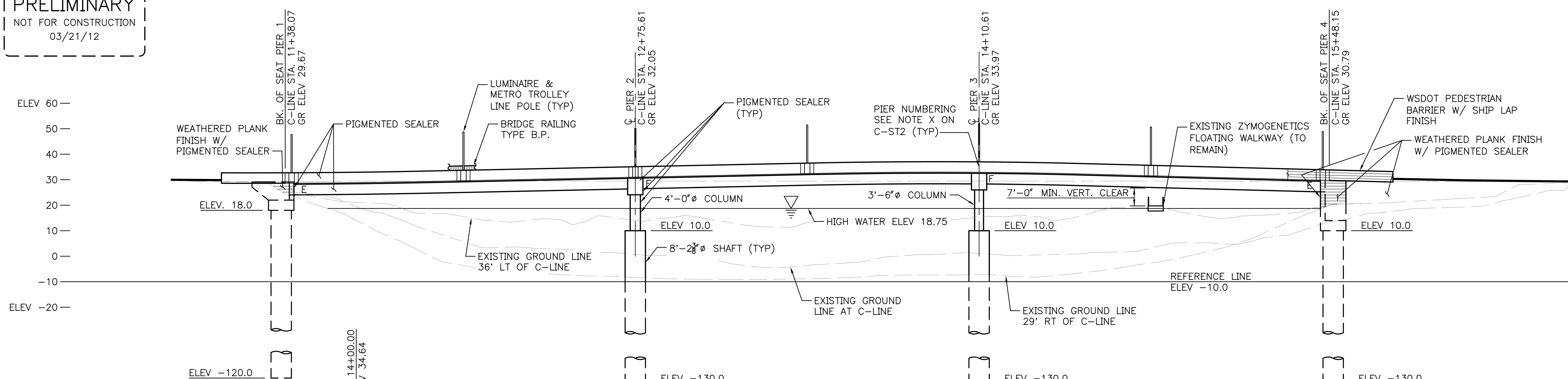
FIGURE X

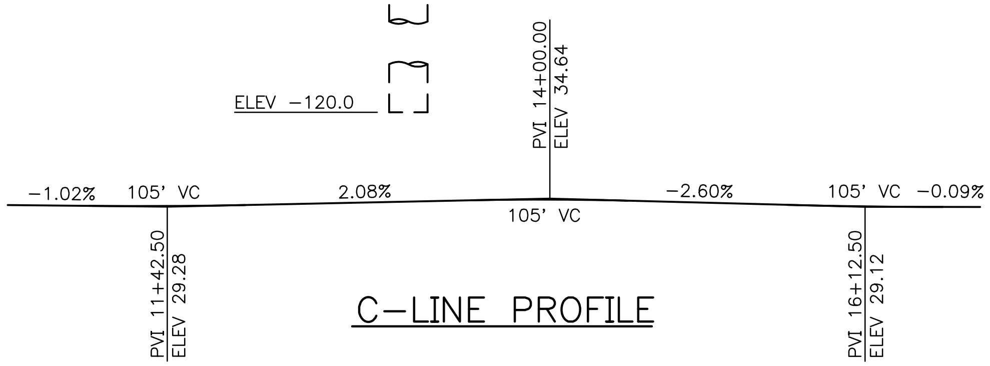


PLAN

(BEARING OF ALL PIERS ARE NORMAL TO C-LINE)

PRELIMINARY
NOT FOR CONSTRUCTION
03/21/12





DATUM
NAVD-88

C-LINE PROFILE

ELEVATION

GRADE ELEVATIONS SHOWN ARE FINNISH GRADE AT TOP OF ROADWAY SLAB ON C-LINE AND ARE EQUAL TO PROFILE GRADE.

20 10 0 20 40
SCALE IN FEET

PC GIRDERS (WF50G)

LOADING:

HL-93 CONC. WITH 2" OVERLAY OR
LAKE UNION STREET CAR WITH 2" OVERLAY

VAULT SERIAL NO.	DATE	MARK	NATURE	MADE	CHK'D	REV'D
XXXXX			REVISIONS			

CALL BEFORE YOU DIG 1-800-424-5555

HNTB

0 ½ 1
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT PLOTTED TO ORIGINAL SCALE.

APPROVED FOR ADVERTISING
NANCY LOCKE
DEPARTMENT OF FINANCE & ADMINISTRATIVE SERVICES
SEATTLE, WASHINGTON . . . . 20 . .
BY: . . . .
PURCHASING AND CONTRACTING SERVICES DIRECTOR

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DESIGNED . JWB X/XX/12
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DRAWN . LBS X/XX/12
CHECKED . JAT X/XX/12

INITIALS AND DATE
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PE . . . . CONST. . . . . .
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ALL WORK DONE IN ACCORDANCE WITH THE CITY OF SEATTLE STANDARD PLANS AND SPECIFICATIONS AND OTHER DOCUMENTS CALLED FOR IN SECTION 0-02.3 OF THE PROJECT MANUAL.

KIVA LINS STATE OF WASHINGTON 39676 PROFESSIONAL ENGINEER STRUCTURAL ENGINEER

City of Seattle
Seattle Department of Transportation
ORDINANCE NO. . . . . APPROVED. . . . .
FUND: . . . .
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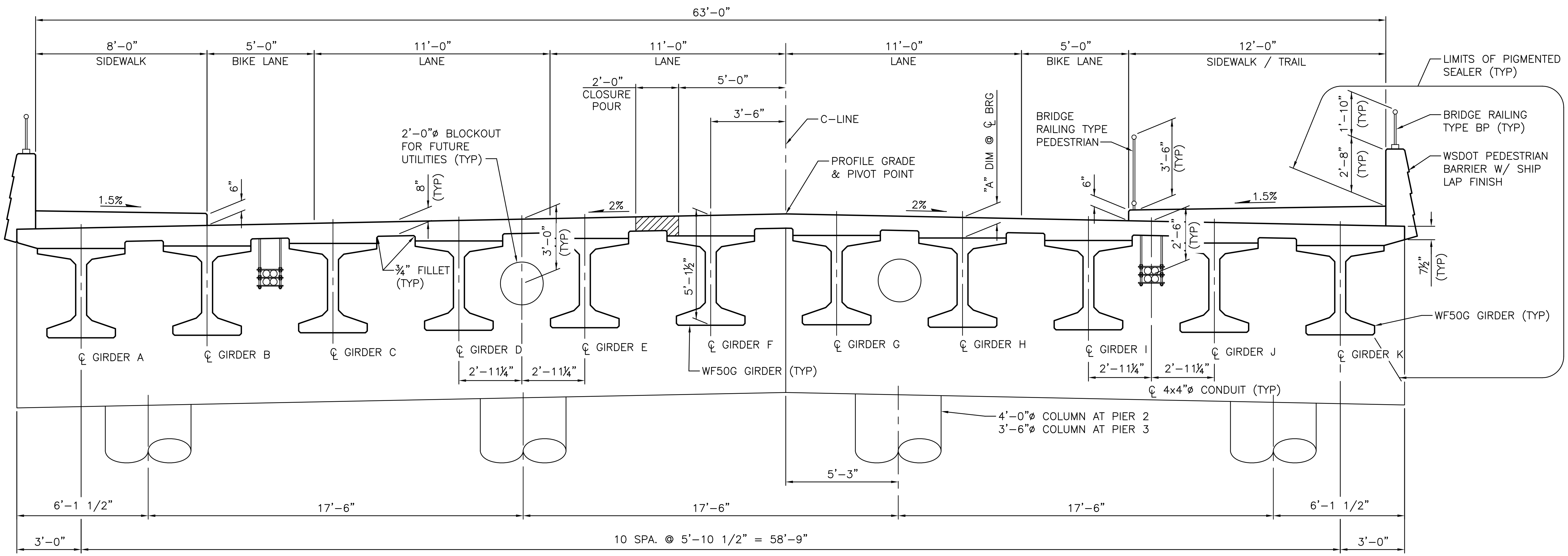
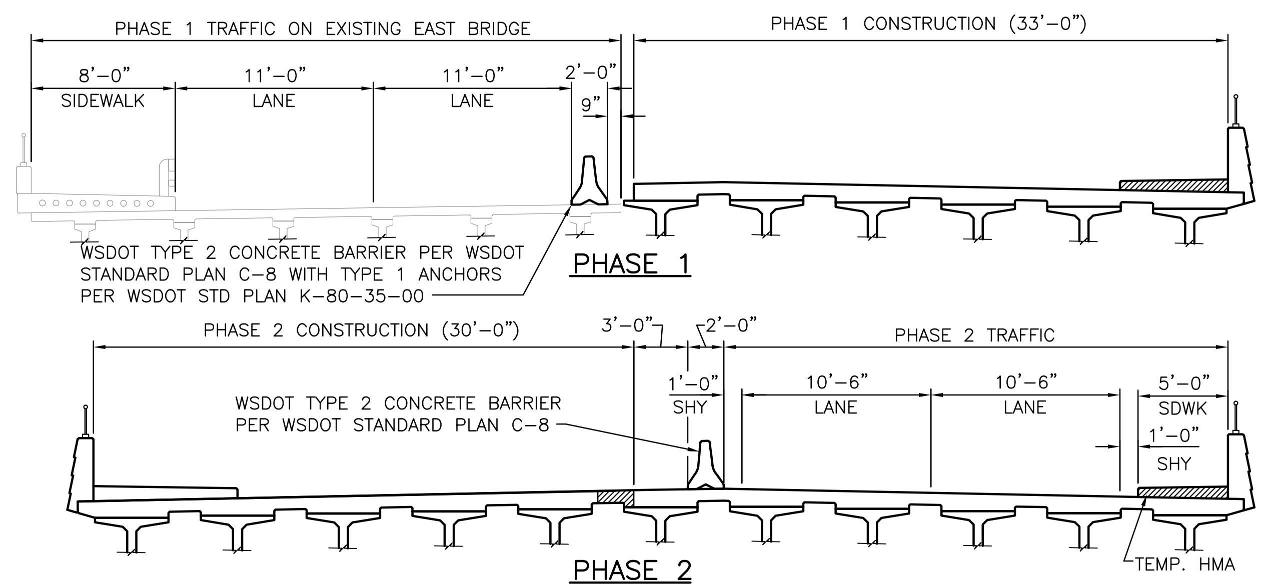
FAIRVIEW AVE N BRIDGE REPLACEMENT
ALTERNATIVE C5
COMPLETE BRIDGE REPLACEMENT

JOB NO. PC TS4986
R/W
CO TSXXXX
VAULT PLAN NO. XXX-XXX
SHEET OF XXX



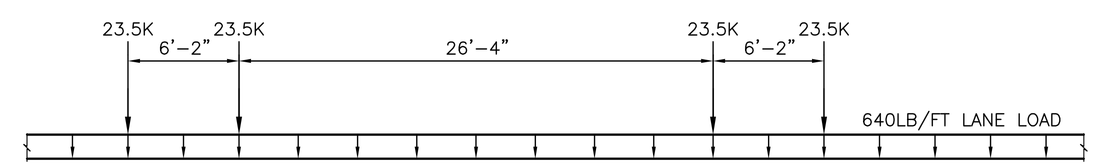
TYPICAL SECTION

SCALE 3/8" = 1'-0"



CONSTRUCTION STAGING

SCALE 3/16" = 1'-0"



LAKE UNION STREET CAR LOADING

SCALE = NTS

PRELIMINARY
NOT FOR CONSTRUCTION
03/21/12

VAULT SERIAL NO. XXXXX | DATE | MARK | NATURE REVISIONS | MADE | CHK'D | REV'D

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DRAWN . LBS X/XX/12
CHECKED . JAT X/XX/12

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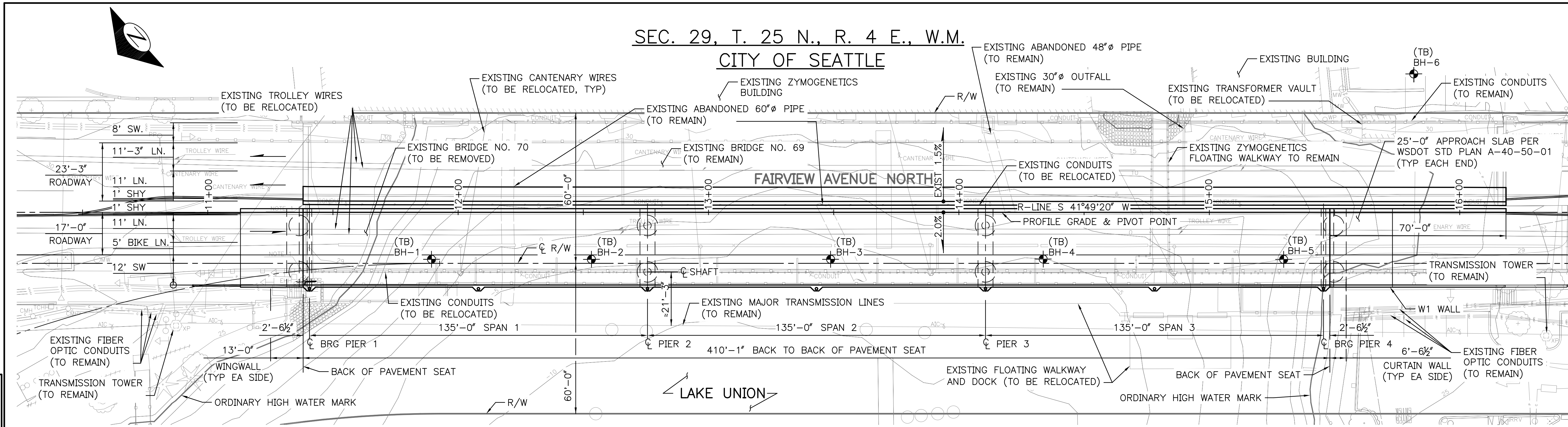
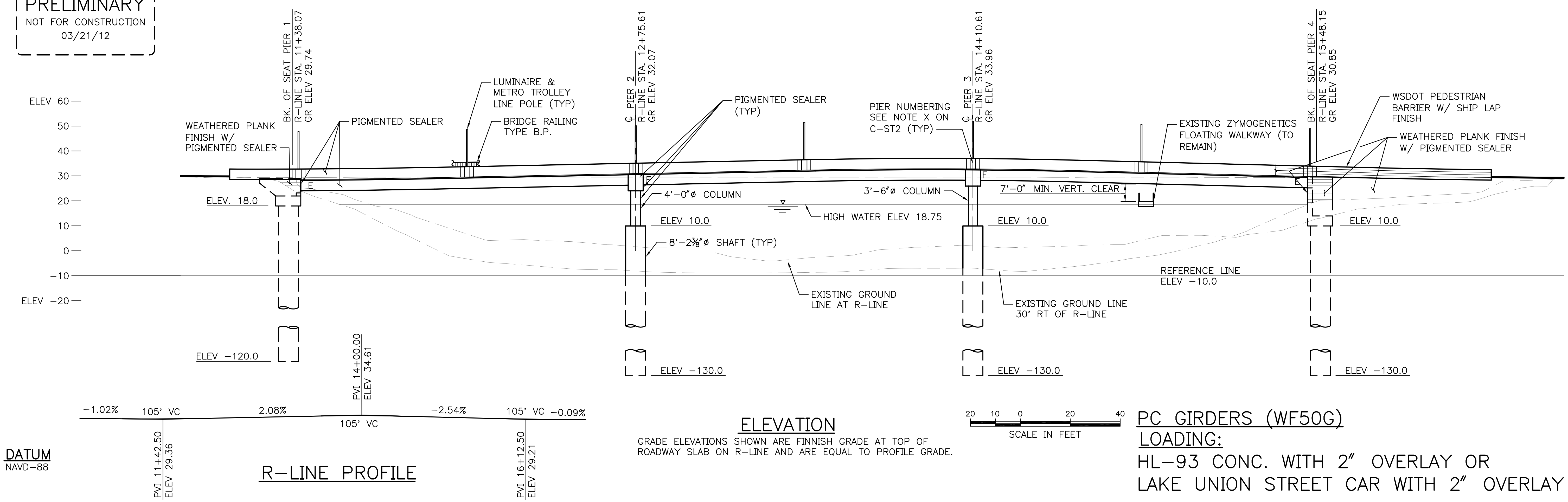
ALTERNATIVE C5
COMPLETE BRIDGE REPLACEMENT

JOB NO. PC TS4986
R/W
CO TSXXXX
VAULT PLAN NO. XXX-XXX
SHEET OF XXX



PLAN
(BEARING OF ALL PIERS ARE NORMAL TO C-LINE)

PRELIMINARY
NOT FOR CONSTRUCTION
03/21/12



DATUM
NAVD-88

R-LINE PROFILE

ELEVATION
GRADE ELEVATIONS SHOWN ARE FINNISH GRADE AT TOP OF ROADWAY SLAB ON R-LINE AND ARE EQUAL TO PROFILE GRADE.

20 10 0 20 40
SCALE IN FEET

PC GIRDERS (WF50G)
LOADING:
HL-93 CONC. WITH 2" OVERLAY OR
LAKE UNION STREET CAR WITH 2" OVERLAY

VAULT SERIAL NO. XXXXX | DATE | MARK | NATURE REVISIONS | MADE | CHK'D | REV'D

CALL BEFORE YOU DIG 1-800-424-5555

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PROJ. MGR. ....
RECEIVED
REVISED AS BUILT ....

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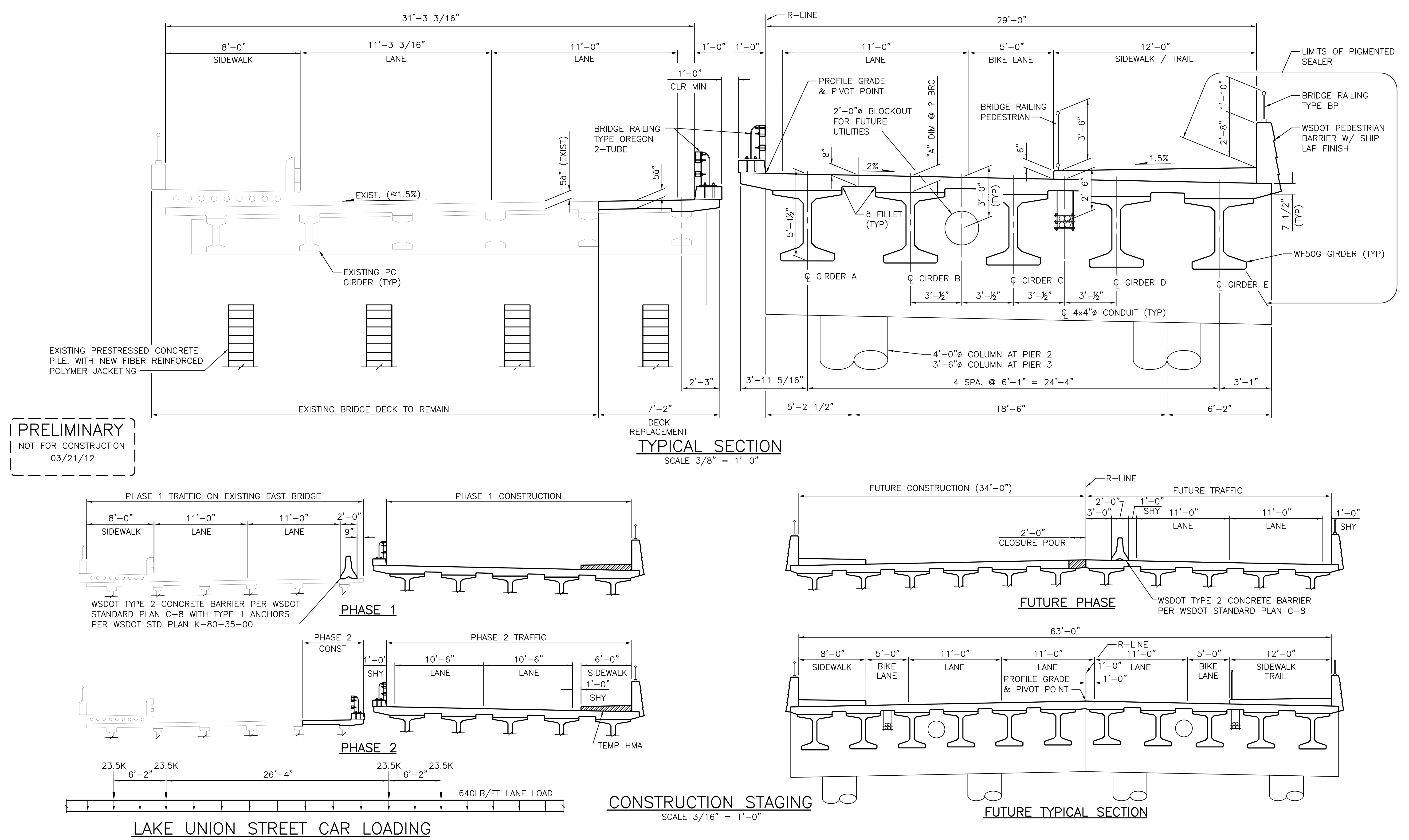
FAIRVIEW AVE N BRIDGE REPLACEMENT
ALTERNATIVE R4
WEST BRIDGE REPLACEMENT
EAST BRIDGE REHABILITATION

JOB NO. PC TS4986
R/W
CO TSXXXX
VAULT PLAN NO. XXX-XXX
SHEET OF XXX



VAULT SERIAL NO.	DATE	MARK	NATURE REVISIONS	MADE	CHK'D	REV'D
XXXXX						

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DRAWN . LBS X/XX/12
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ALTERNATIVE R4
WEST BRIDGE REPLACEMENT
EAST BRIDGE REHABILITATION

JOB NO. PC TS4986
R/W
CO TSXXXX
VAULT PLAN NO. XXX-XXX
SHEET OF XXX