Discipline Report

Traffic & Transportation

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and
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Draft EIS

Magnolia Bridge Replacement

City of Seattle

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Purpose and Need

Purpose

The purpose of this project is to replace the existing Magnolia Bridge structure, approaches, and related arterial connections with facilities that maintain convenient and reliable vehicular and non-motorized access between the Magnolia community and the rest of the City of Seattle. The bridge provides an important link to the Magnolia community in Seattle (see Figure 1 and Figure 2). Since the existing bridge also provides the only public vehicular access to the land between North Bay, also referred to as Terminal 91, Smith Cove Park, Elliott Bay Marina, and U.S. Navy property, the project purpose also includes maintenance of access to these areas.

Need

Structural Deficiencies

The City of Seattle has identified the Magnolia Bridge as an important bridge that should remain standing following a "design" seismic event (an earthquake with a peak ground acceleration of 0.3g that is anticipated to happen every 475 years and may measure 7.5 on the Richter Scale). Even with the repairs completed following the February 2001 earthquake, the existing bridge is susceptible to severe damage and collapse from an earthquake that is less severe than the "design" seismic event.

The original bridge was constructed in 1929 and has been modified, strengthened, and repaired several times. The west end of the bridge was damaged by a landslide in 1997, requiring repair and replacement of existing bridge columns and bracing, the construction of six additional supports, and a retaining wall north of the bridge to stabilize the bluff from further landslides. Repairs after the 2001 earthquake included replacement of column bracing at 27 of the 81 bridge supports. A partial seismic retrofit of the single-span bridge structure over 15th Avenue West was completed in 2001. The other spans were not upgraded.

Inspections of the bridge conclude that the concrete structure is showing signs of deterioration. The concrete is cracking and spalling at many locations, apparently related to corrosion of the reinforcing steel. The bridge requires constant maintenance in order to maintain its load capacity, but there does not appear to be any immediate load capacity problem. The existing foundations have insufficient capacity to handle the lateral load and uplift forces that would be generated by a "design" seismic event. The existing foundations to not extend below the soils that could liquefy during a "design" seismic event. If the soils were to liquefy, the foundations would loose their vertical load carrying ability and the structure would collapse.

System Linkage

There are three roadway connections from the Magnolia community, of over 20,000 residents, to the rest of Seattle. As the southernmost of the three connections, the Magnolia Bridge is the most direct route for much of south and west Magnolia to downtown Seattle and the regional freeway system.

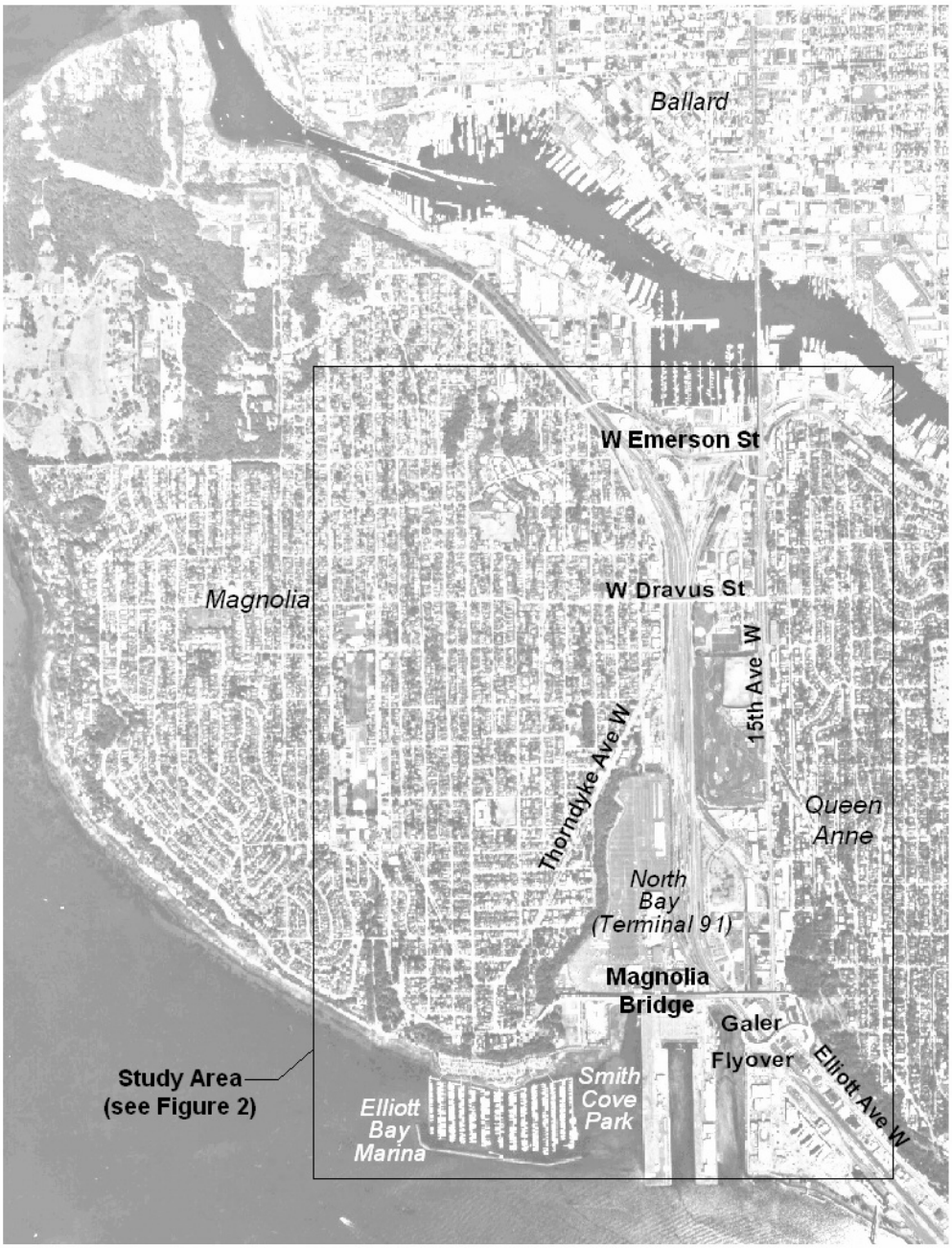


Figure 1
Vicinity Map

In meetings with the public and the Seattle Fire Department, the importance of this route for emergency services has been emphasized. The loss of use of this bridge in 1997 and again in 2001 demonstrated to the City that the remaining two bridges do not provide acceptable operation. During the bridge closure following the February 2001 earthquake, the City addressed community concerns about reduced emergency response time to medical facilities outside of Magnolia by 24-hour stationing of paramedics at Fire Station 41 (2416 34th Avenue West).

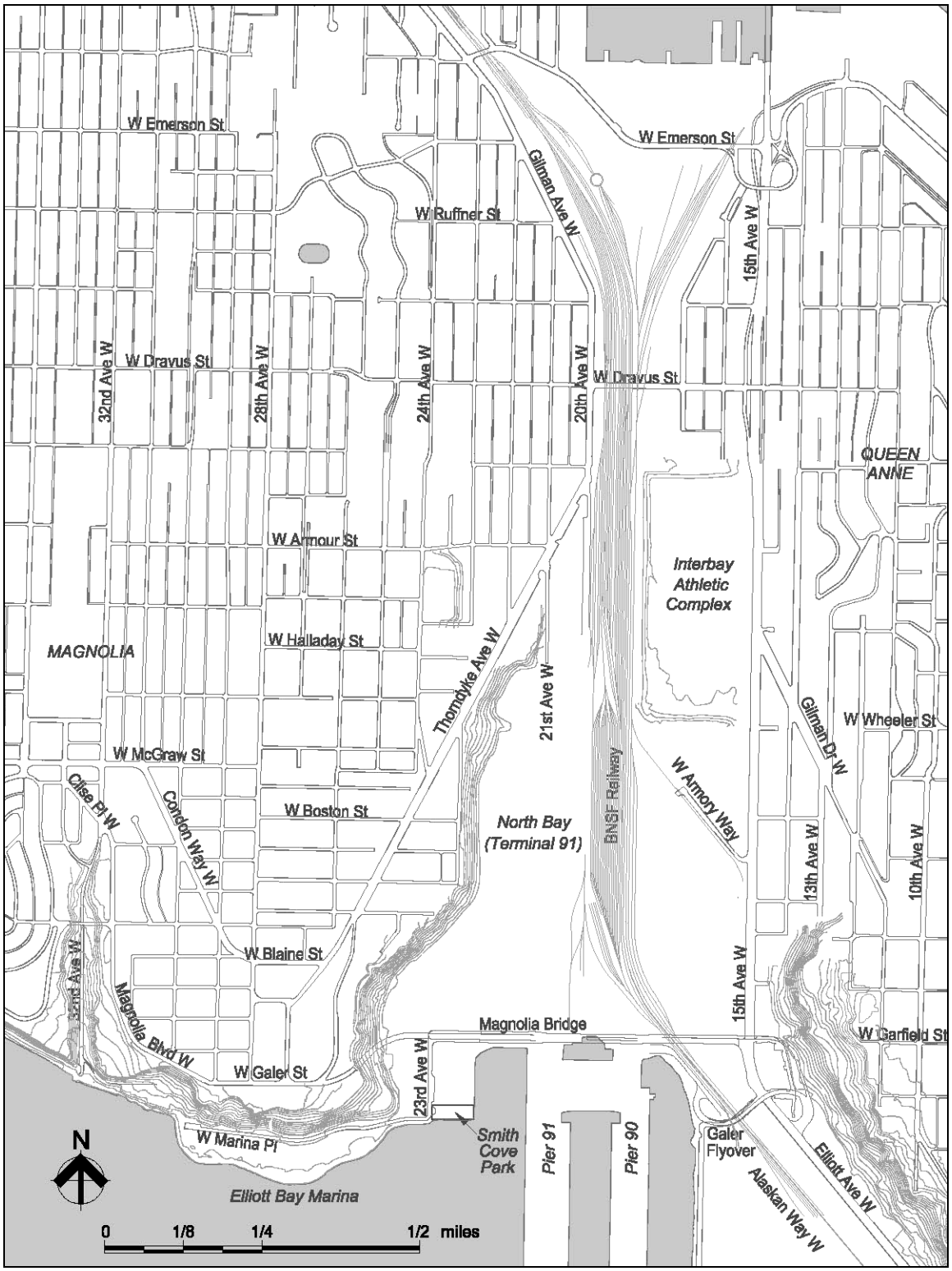


Figure 2
Study Area

Traffic Capacity

The three Magnolia community connections to the 15th Avenue West corridor are adequate for the present volume of traffic. Each of the three connections carries about 30 to 35 percent of the 60,100 daily vehicle trips (2001 counts) in and out of the Magnolia community. Loss of the use of the Magnolia Bridge for several months after the February 2001 earthquake, and in 1997 following the landslide at the west end of the bridge, resulted in lengthy 15 to 30 minute delays and increased trip lengths for many of the users of the Magnolia Bridge. These users were required to use one of the two remaining bridges at West Dravus Street and West Emerson Street. Travel patterns in the Magnolia community changed substantially resulting in negative impacts on local neighborhood streets. The increase of traffic through the West Dravus Street and West Emerson Street connections also resulted in congestion and delay for the regular users of these routes. Losing the use of any one of these three bridges would result in redirected traffic volumes that would overwhelm the capacity of the remaining two bridges.

Modal Interrelationships

The Magnolia Bridge carries three of the four local transit routes serving Magnolia and downtown Seattle destinations. The topography of the east side of Magnolia, East Hill, would make access to the 15th Avenue West corridor via the West Dravus Street bridge a circuitous route for transit. Use of the West Emerson Street connection to 15th Avenue West would add significant distance and travel time for most trips between Magnolia and downtown Seattle.

The Magnolia Bridge has pedestrian facilities connecting the Magnolia neighborhood to Smith Cove Park and Elliott Bay Marina as well as to 15th Avenue West/Elliott Avenue West. These facilities need to be maintained. The Elliott Bay multi-use trail connects Magnolia with downtown Seattle through Myrtle Edwards Park. The trail passes under the Magnolia Bridge along the west side of the BNSF rail yard, but there are no direct connections to the bridge.

Bicycle facilities on the Magnolia Bridge need to be maintained or improved. Even with the steep (about 6.3 percent) grade, bicyclists use the Magnolia Bridge in both directions. There are no bike lanes on the bridge, so bicyclists use the traffic lanes and sidewalks. Once bicyclists cross the bridge, they must either travel with motor vehicles on Elliott Avenue West or find a way back to the Elliott Bay Trail using local east-west streets such as the Galer Flyover.

Transportation Demand

The existing Magnolia Bridge provides automobile access for Port of Seattle North Bay (Terminal 91) to and from the Elliott Avenue West/15th Avenue West. Truck access between Terminal 91 and Elliott Avenue West/15th Avenue West is accommodated via the Galer Flyover. Future planned expansion of the Amgen facility on Alaskan Way West and redevelopment of underutilized portions of North Bay and other areas of Interbay will increase demand for traffic access to the Elliott Avenue West/15th Avenue West corridor. The Port of Seattle has a master planning process underway (July 2003) for its North Bay property (Terminal 91) and the Washington National Guard property east of the BNSF Railway between West Garfield Street and West Armory Way. This area contains 82 acres available for redevelopment. There are also 20 or more acres of private property available for

redevelopment east of the BNSF Railway between West Wheeler Street and West Armory Way. Redevelopment of the North Bay property will include public surface streets with connections to the replacement for the Magnolia Bridge. Forecasts of future (year 2030) traffic demand indicate that the access provided by the Galer Flyover and West Dravus Street would be inadequate. The capacity provided by the existing Magnolia Bridge or its replacement would also be needed.

Legislation

Seattle Ordinance 120957, passed in October 2002, requires the Magnolia Bridge Replacement Study: identify possible additional surface roads from Magnolia to the waterfront (avoiding 15th Avenue West and the railroad tracks); obtain community input on the proposed roads; and identify the cost for such road and include it in the total cost developed in the Magnolia Bridge Replacement Study.

Description of Alternatives

An alignment study process was implemented to help identify the specific bridge replacement alternatives to be studied in the EIS. Twenty-five concepts were developed and screened against the project goals and objectives. This resulted in nine alignment alternatives, identified as A through I, that merited further analysis. These nine went through an extensive public review and comment process as well as project screening criteria and prioritization. Initially, the top four priority alternatives, A, B, D, and H, were identified to be studied in the EIS. Early on, Alternative B was eliminated because it became clear that it violated City shoreline policies and Federal section 4(f) criteria. Upon detailed traffic analysis Alternative H was eliminated because two key intersections were predicted to function at a level of service F and could not be mitigated. The next priority, Alternative C, was then carried forward for analysis in the EIS.

Independent of this project, A new north-south surface street will be constructed on Port of Seattle property connecting 21st Avenue West at the north end of North Bay with 23rd Avenue West near Smith Cove Park. In addition, a southbound ramp will be added to the Galer Flyover to accommodate eastbound to southbound Elliott Avenue West traffic movements. The Galer Flyover ramp has been identified as a needed improvement for expected future development of property west of the railroad tracks. New surface streets through the Port of Seattle property will be located through the Port's master planning process for the North Bay property. The north-south surface street and ramp are assumed to exist in any build alternative, but are not part of this environmental process.

Typical sections and plans of the build and no-build alternatives are located at the end of this section.

No Build Alternative

The No Build Alternative, shown in Figure 3 and Figure 5, would maintain the existing bridge structure in place with the existing connections at the east and west ends. Long term strategies for maintaining the existing structure would be required for the No Build alternative. To keep the existing bridge in service for over ten years, the following would need to be accomplished:

- An in-depth inspection of the bridge would be required to determine needed repairs and a long-term maintenance program.
- Concrete repairs would be required. These repairs could include injection of cracks with epoxy grout, repair of spalled concrete, and replacement of deficient concrete and grout.
- Preservation measures to slow corrosion of the reinforcement would be required. These measures could include a cathodic protection system.
- Any structural elements that lack the capacity to carry a tractor-trailer truck with a 20-ton gross trailer weight would need to be identified, modeled, and strengthened.

Alternative A

Alternative A would replace the existing bridge with a new structure immediately south of the existing bridge as shown in Figure 4 and Figure 6. The alternative would construct a signalized elevated intersection (Alternative A – Intersection) in the bridge's mid-span to provide access to the waterfront and the Port of Seattle North Bay property from both the east and the west. Connections at the east and west ends of the bridge would be similar to the existing bridge.

An optional half-diamond interchange (Figure 7 Alternative A – Ramps) could be constructed in lieu of the elevated intersection to provide access to the waterfront and the Port of Seattle North Bay property to and from the east only.

Alternative C

Alternative C would provide 2,200 feet of surface roadway within the Port of Seattle North Bay property between two structures as shown in Figure 4 and Figure 8. The alternative would descend from Magnolia Bluff on a structure running along the toe of the slope. The alignment would reach the surface while still next to the bluff, before turning east to an intersection with the north-south surface street. The alignment would continue east from the intersection, turning south along the west side of the rail yard. The alignment would rise on fill and structure, turning east to cross the railroad tracks and connect to 15th Avenue West.

Alternative D

Alternative D would construct a new bridge in the form of a long arc north of the existing bridge, as shown in Figure 4 and Figure 9. Connections at the east and west ends of the bridge would be similar to the existing bridge. This alternative would construct a signalized elevated intersection (Alternative D – Intersection) in the bridge mid-span to provide access to the waterfront and Port of Seattle North Bay property from both the east and the west.

An optional half-diamond interchange (Figure 10 Alternative D – Ramps) could be constructed in lieu of the elevated intersection to provide access to the waterfront and the Port of Seattle North Bay property to and from the east only.

Alternative H

Alternative H would provide a fourth crossing between the Magnolia community and 15th Avenue West as shown in Figure 11.

South Crossing:

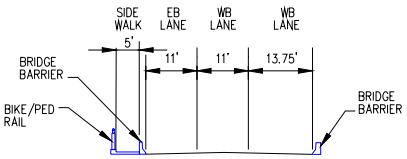
A surface road from the west end of the Galer Flyover would cross under the existing Magnolia Bridge, run north along the west side of the railroad tracks for approximately 1,700 feet and turn west to connect with a new structure ascending to Magnolia at West Galer Street (the existing bridge connection locations). Access to the waterfront and Port of Seattle North Bay property would be provided at an intersection along the surface road.

No improvements would be made to the Galer Flyover other than a southbound ramp to accommodate eastbound to southbound traffic movements. This

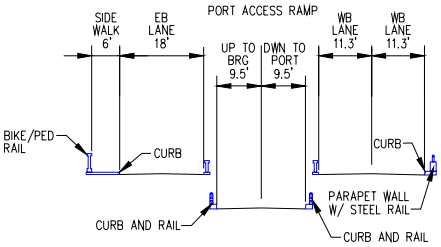
construction is already planned and would be included in any build alternative. This ramp is not part of this environmental process.

North Crossing:

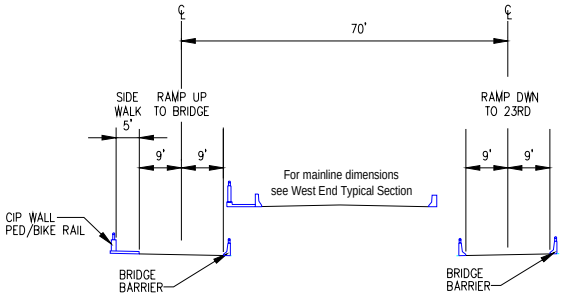
Traffic bound for Magnolia from 15th Avenue West would use a bridge at West Wheeler Street. Southbound motorists on 15th Avenue West would turn right onto West Wheeler Street. Northbound motorists would cross under 15th Avenue West and connect with West Wheeler Street using a tunnel ramp. The alignment would continue on an elevated structure and connect to Thorndyke Avenue West at West Halladay Street. Eastbound traffic from Magnolia would use the western portion of the West Halladay/West Wheeler Street alignment, but would veer to the south at West Armory Way to connect with 15th Avenue West.



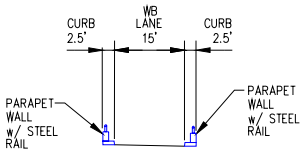
Bridge West End



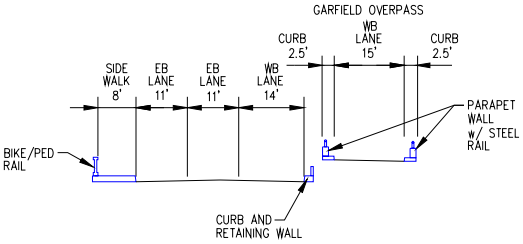
Ramp to Port Access



Ramps to 23rd Avenue West



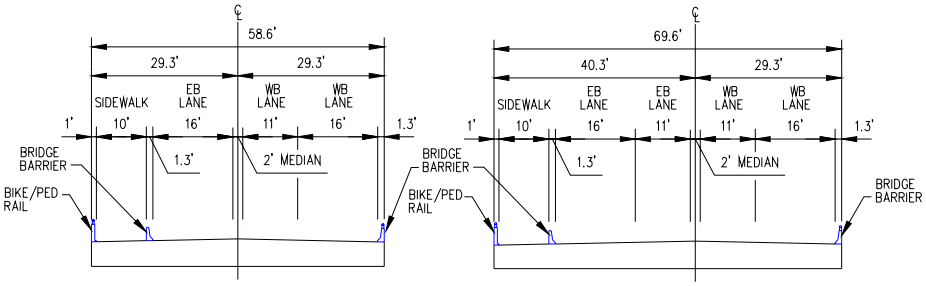
Garfield Overpass



15th Avenue West Connection
Eastbound Off-Ramp
Westbound On-Ramp

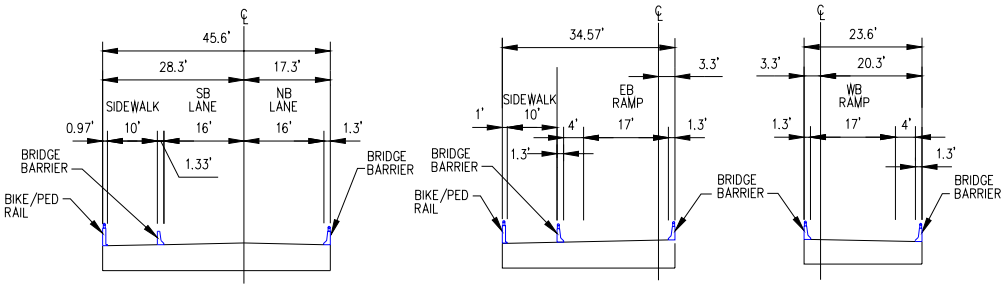
NOTE:
Dimensions are approximate and obtained from construction plans and aerial photographs. The information shown has not been field verified.

Figure 3
Typical Sections, No Build Alternative



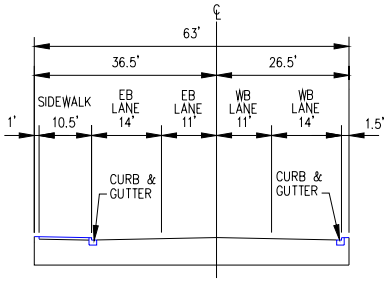
West End East End

Typical Bridge Structure

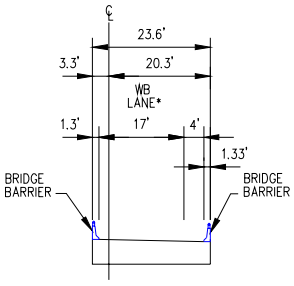


T-Ramp On-Ramp Off-Ramp

Typical A & D Intersection Option Typical A & D Ramp Option

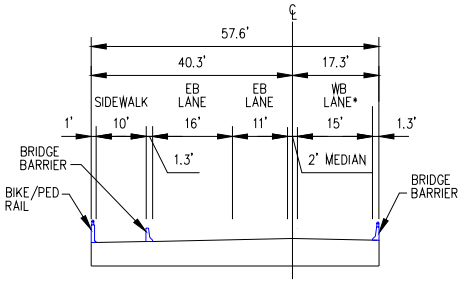


Typical Alternative C Surface Road



Garfield Overpass

* 15' Alternative C
19' Alternative D



15th Avenue West Connection

Eastbound Off-Ramp
Westbound On-Ramp

* 16' Alternative D

Figure 4
Typical Sections, Build Alternatives

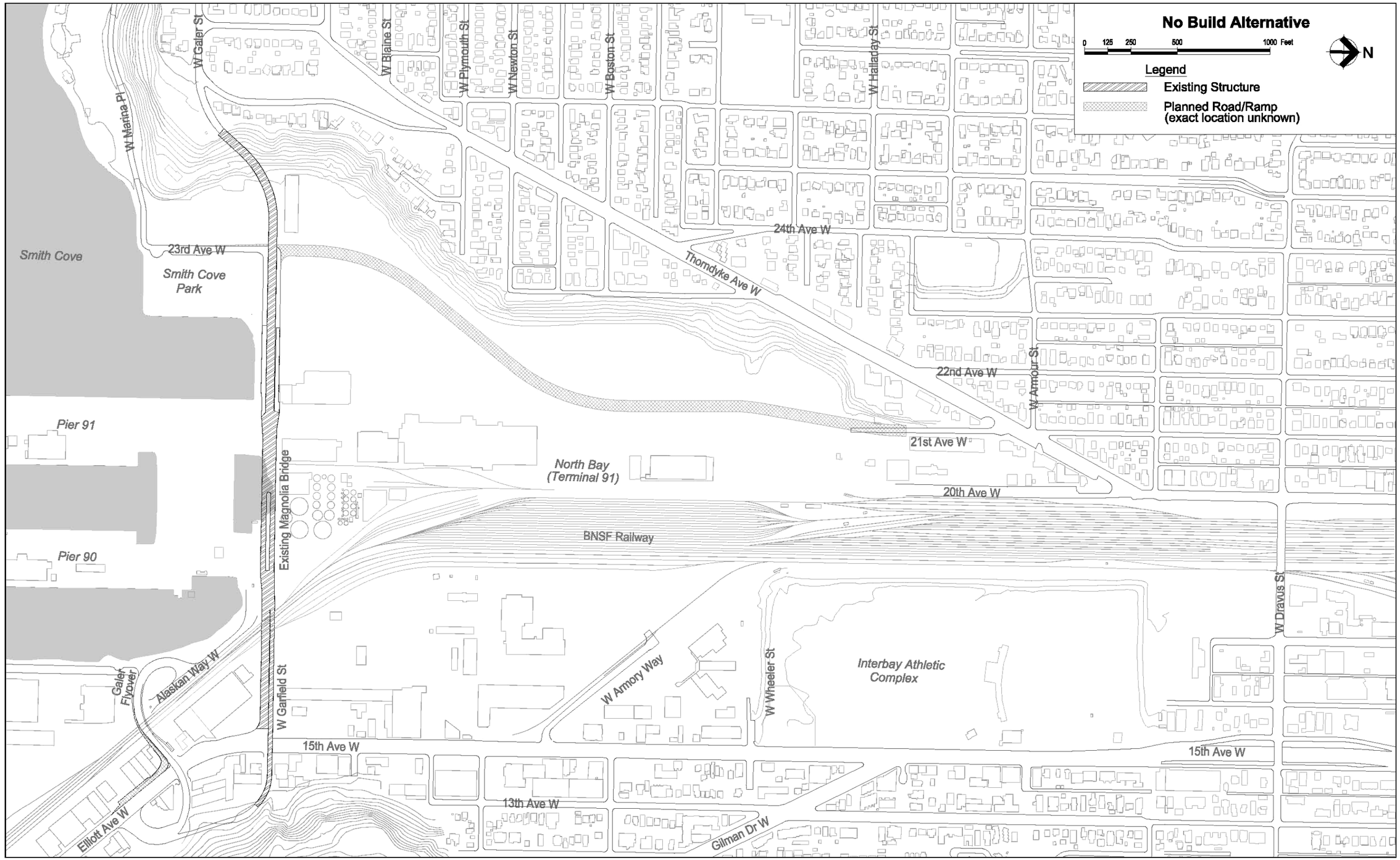


Figure 5 No Build Alternative

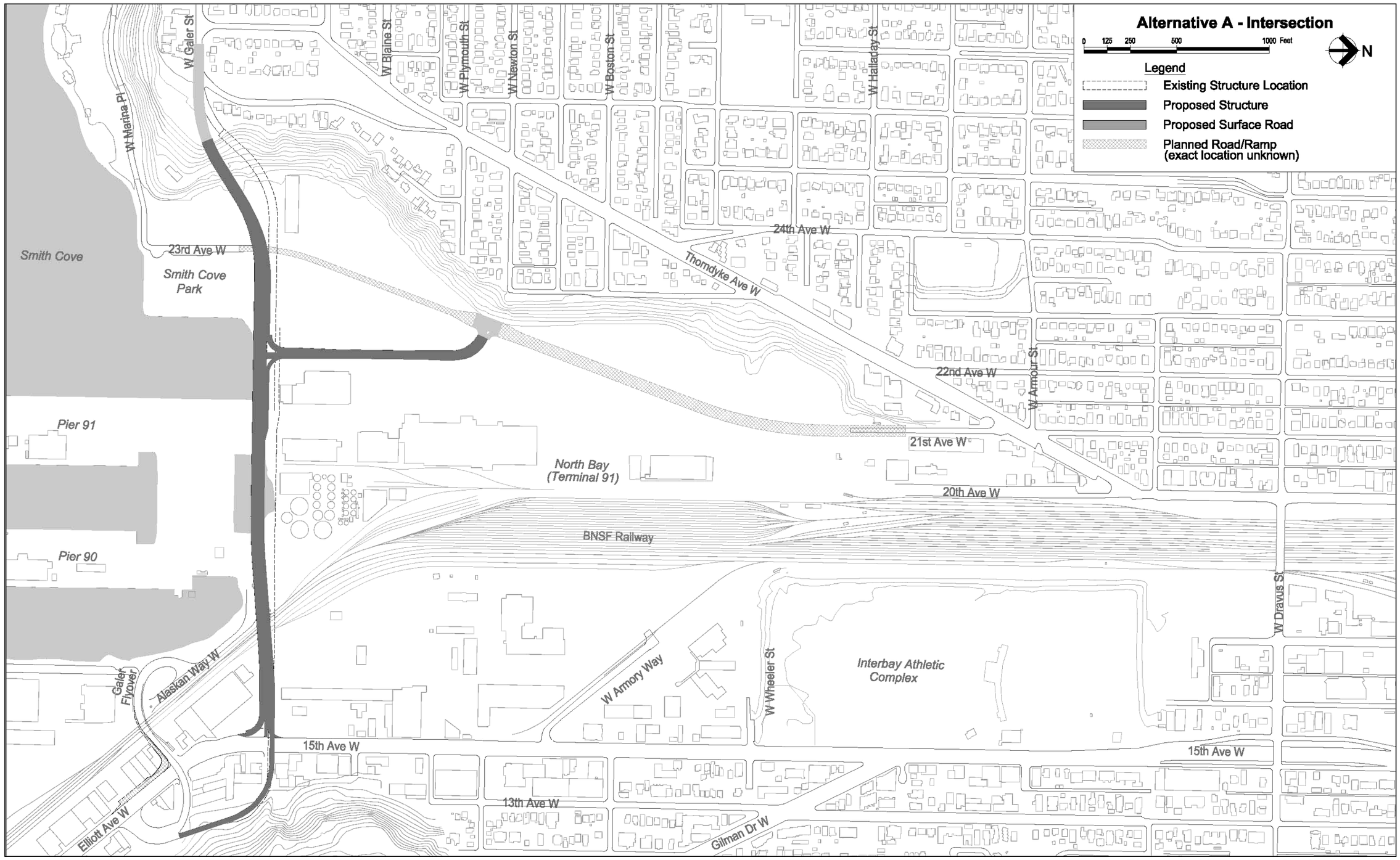


Figure 6 Alternative A – Intersection

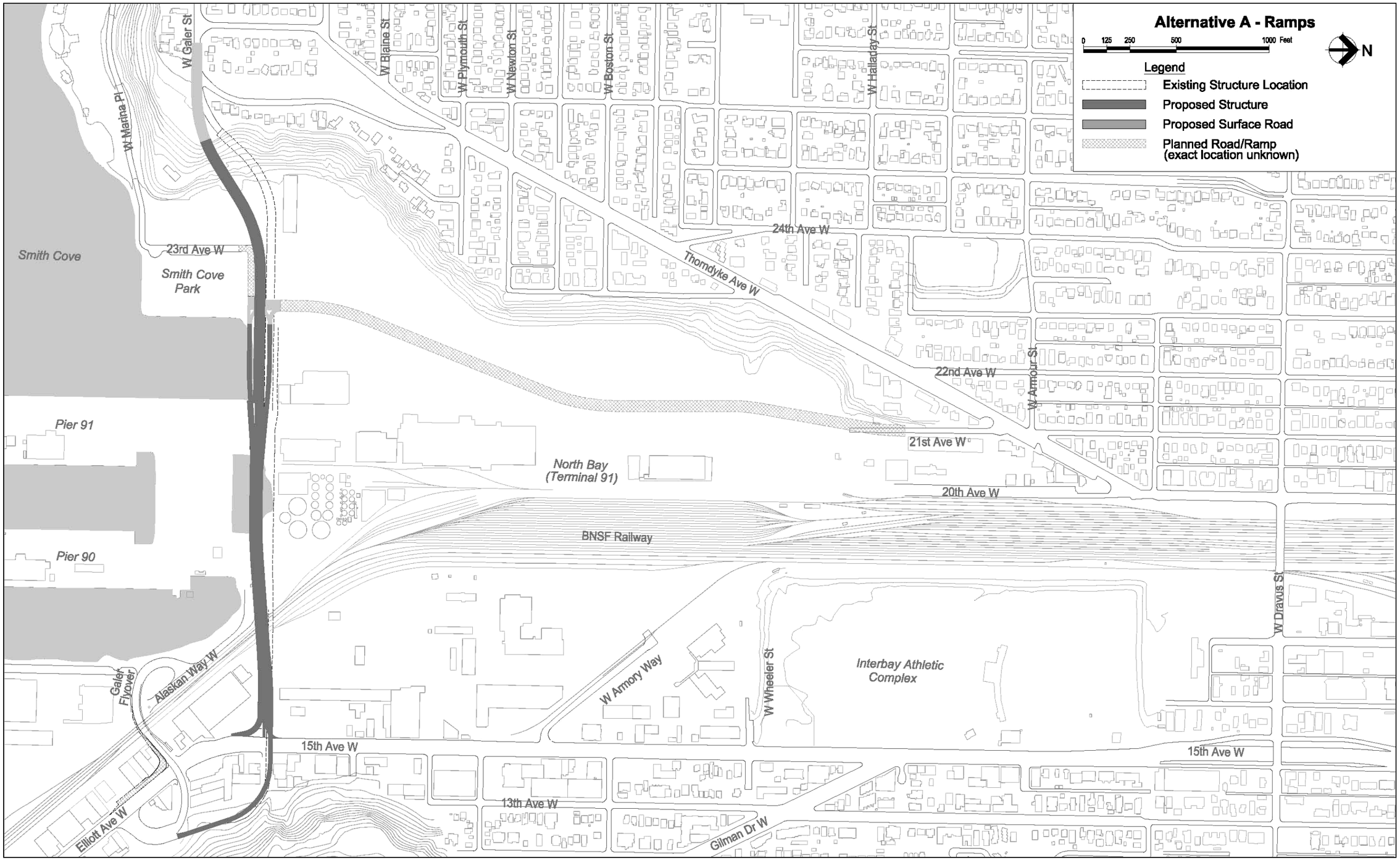


Figure 7 Alternative A – Ramps

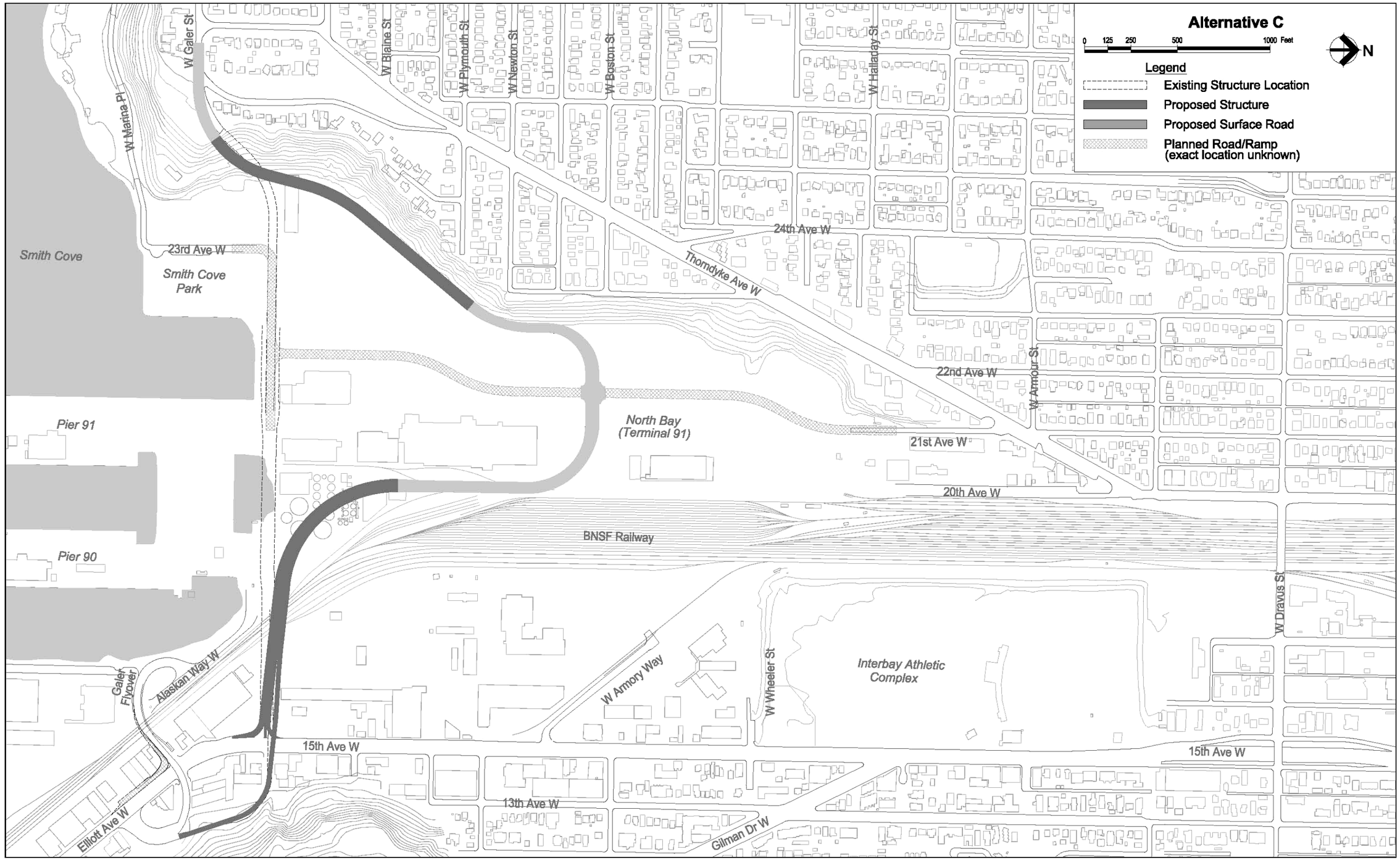


Figure 8 Alternative C

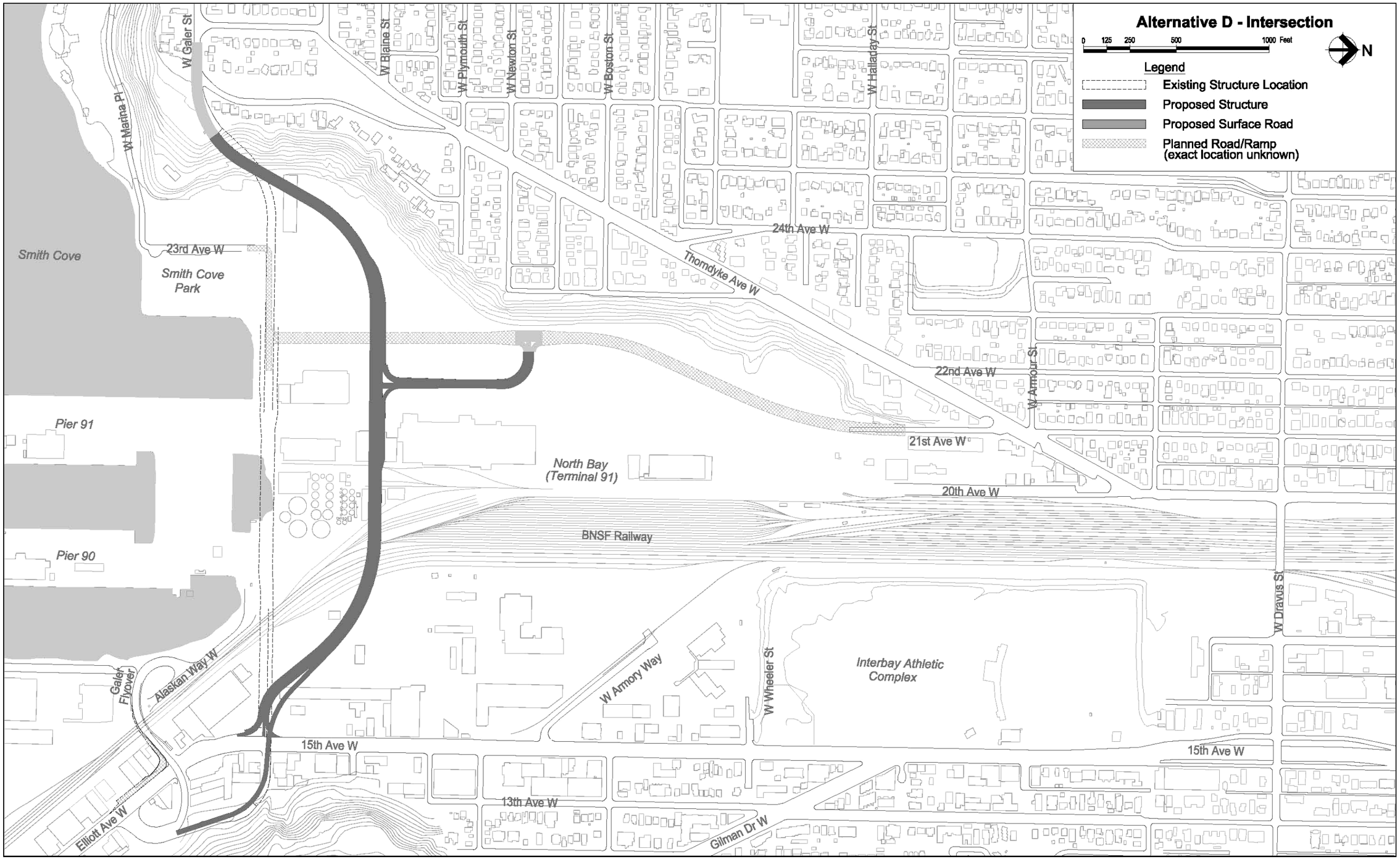


Figure 9 Alternative D – Intersection

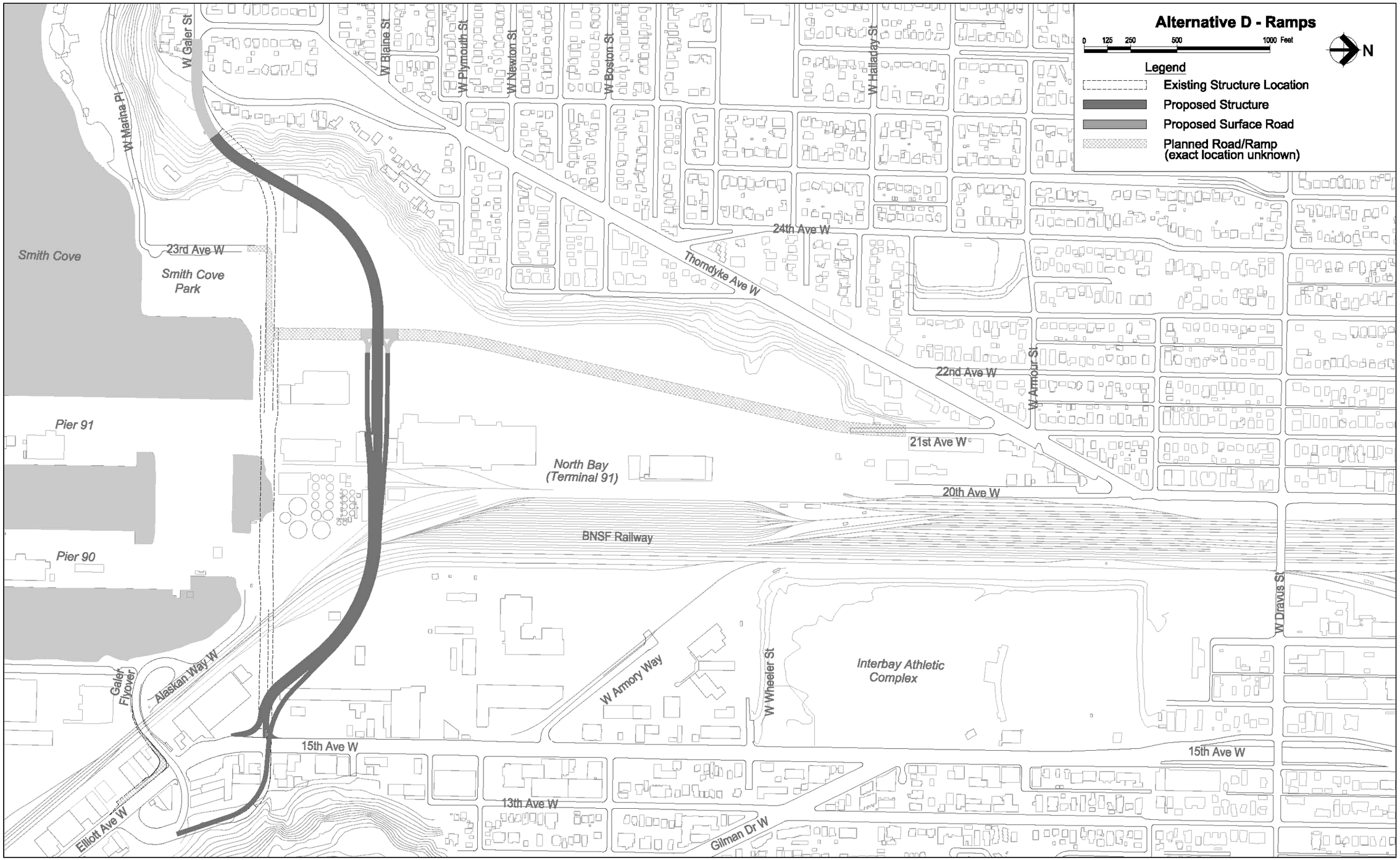


Figure 10 Alternative D – Ramps

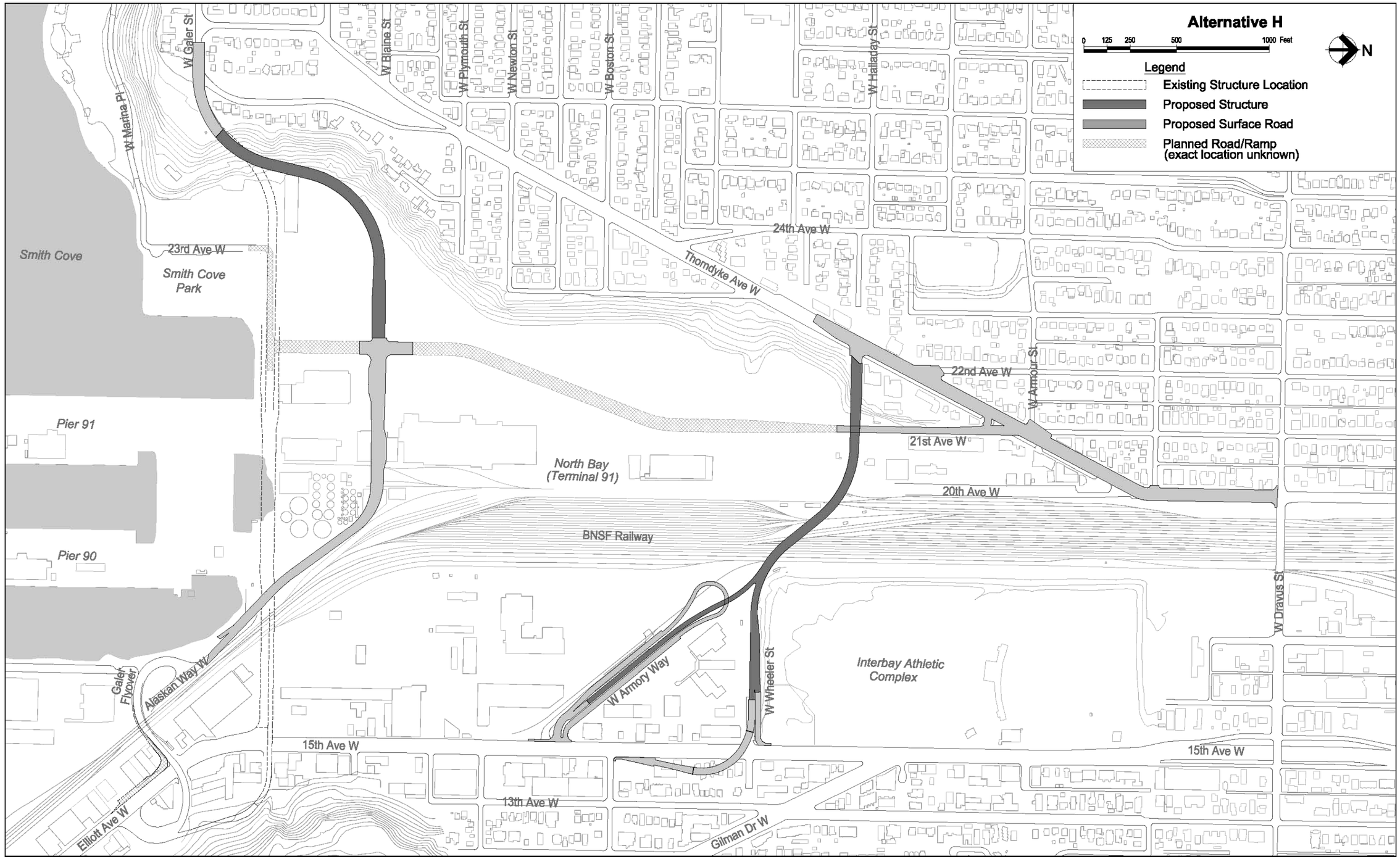


Figure 11 Alternative H

Methods

Data Collection

The traffic data used for the analysis of intersection operations within the study area were obtained from the City of Seattle, traffic counts, video surveys, Port of Seattle, and traffic studies for other projects. The City of Seattle provided seven-day machine count data for several locations within the Magnolia neighborhood for the period between October 31, 2002 and November 6, 2002. The Port of Seattle provided information on traffic originating from and destined for Terminal 90 and Terminal 91.

Data provided by the City included turning movement counts and machine counts on Elliott Avenue West and 15th Avenue West, the Magnolia Bridge, and the ramps at the West Dravus Street overcrossing of 15th Avenue West. Pedestrian counts were included in these surveys. Data were provided on the following intersections:

- Elliott Avenue West at Galer Flyover
- 15th Avenue West at West Garfield Street
- 15th Avenue West at Gilman Avenue West
- 15th Avenue West northbound ramps at West Dravus Street
- 15th Avenue West southbound ramps at West Dravus Street

Manual turning movement counts were performed at six intersection locations between October 29, 2002 and November 7, 2002. These six intersections were:

- Gilman Avenue West at West Emerson Street
- West Nickerson Street at 15th Avenue West
- West Dravus Street at 20th Avenue West
- Thorndyke Avenue West at West Blaine Street
- Thorndyke Avenue West at West Galer Street
- Clise Place West/Magnolia Boulevard West at West Howe Street

Traffic counts were conducted in February and May, 2003 at the following intersections:

- 32nd Avenue West at West McGraw Street
- Thorndyke Avenue West at 21st Avenue West/West Armour Street
- West Armory Way at 15th Avenue West
- Galer Flyover at Alaskan Way West

Automatic (tube) counts were made over one week from December 1 through December 7, 2003 in the Thorndyke Avenue West area at the following intersections:

- West Armour Street at 22nd Avenue West
- Thorndyke Avenue West at 23rd Avenue West
- Thorndyke Place West at Thorndyke Avenue West
- West Boston Street at Thorndyke Avenue West

Vehicle classification information was obtained from a two-day, intersection, video survey conducted on Thursday, October 24, 2002 and Saturday, October 26, 2002. Video data were obtained for the Elliott Avenue West/Galer Flyover intersection,

the 15th Avenue West/West Garfield Street off-ramp intersection, and the unsignalized junction at the Galer Flyover and the westbound ramp to the Magnolia Bridge.

Traffic counts for the Terminal 91 gates were provided for the period October 31 through November 6, 2002. The counts included the center ramps on the Magnolia Bridge and the East Gate on Alaskan Way West.

Forecasting

Traffic Volumes

Travel forecasts were developed from a combination of the City of Seattle model and the Puget Sound Regional Council. Base and future year estimates of peak hour vehicular demand were developed using the City of Seattle EMME/2 travel demand forecasting modeling methodology supplemented with output from the Puget Sound Regional Council (PSRC) multi-modal, regional model. Estimates were prepared for the years 2000, 2010 and 2030.

Land use data for 2000, 2010 and 2030 were obtained from the City of Seattle. The Port of Seattle began two-year master planning process for North Bay, including Terminal 91, in 2003. The planning area includes about 57 acres of Terminal 91 uplands that is underdeveloped. Based on modified future land use assumptions in the North Bay (Terminal 91) vicinity, the study area was split into additional transportation analysis zones with employment types compatible with the existing industrial land use zoning of the Port of Seattle property and commercial zoning along 15th/Elliott Avenue West. Table 1 shows estimated year 2000, and forecast 2010 and 2030 employment for the North Bay planning area and the commercial industrial area west of Elliott Avenue West between the grain terminal and the Magnolia Bridge. These forecasts are based on employment compatible with existing zoning. The City of Seattle's trip generation model was modified to reflect the additional zones. Upon completion of trip distribution, estimates of mode share (for example, single and multiple occupant vehicles, trucks, transit, and pedestrians) were input from the PSRC regional model to develop forecasts of daily and peak hour vehicular demand.

Table 1
Estimated and Forecast Employment,
Terminal 91 and West of 15th/Elliott Avenue West

Area	2000	2010	2030
Terminal 91	881	1,223	2,156
West of 15th Ave W between Magnolia Bridge and W Wheeler St.	511	528	1,391
West of Elliott Ave W between Grain Terminal and Magnolia Bridge	938	1,307	2,800
Totals	2,330	3,058	6,347

Source: HNTB Corporation and Mirai Associates, 2003.

Post-processing of the model output was conducted by adding the modeled growth increment (2000 to 2030) to existing ground counts. Additional manual

modifications were made to reflect the closure of the West Galer Street at-grade railroad crossing in March 2003, to incorporate the impacts of permitted development accessed by Alaskan Way West and the Galer Flyover, and to estimate volumes for intersection minor movements not explicitly modeled. Forecast peak hour demands for the 15th/Elliott Avenue West corridor were also reviewed to determine if capacity constraints of the roadway system north and south of the study area would limit peak traffic flows entering the study area.

Traffic Growth Patterns

The growth patterns for the study area were developed from land use and transportation modeling data provided by the City of Seattle. This information was provided for the opening year of the project 2010 and the design year 2030. Traffic counts for the years 2002 and 2003 were used to establish existing traffic patterns.

Based on the information provided by the City, projected traffic patterns were determined for the routes and intersections that would be affected by the alternatives considered for the replacement for the Magnolia Bridge. Detailed projections for the AM peak hour and PM peak hour were made for the build and no build alternatives.

Transit Ridership

The travel forecasts for the proposed alternatives included forecasts of auto and transit modes. The transit ridership estimates were taken from the 2010 and 2030 PSRC model forecasts. These transit forecasts included assumptions of a monorail system in 2010 and 2030, similar in scale to the Ballard-West Seattle Green Line currently being designed in Seattle. Checks were made of the corridor transit ridership estimates from PSRC compared with the monorail ridership forecasts documented in the *Seattle Monorail Project Green Line, Draft EIS* (August 2003). For consistency, a common study year of 2020 was selected. It was determined that the PSRC monorail forecasts (used as a basis for the Magnolia Bridge analyses) for riders in the section between Mercer Street and Ballard were less than half of the monorail DEIS forecasts. However, when parallel bus service is considered, the total corridor transit ridership totals are fairly comparable between the two studies. The PSRC forecasts assumed that most of the parallel bus service on 15th Avenue West and Elliott Avenue West, the monorail Interbay Segment, would remain once the monorail system is implemented. Conversely, the monorail DEIS assumed that most bus service would be truncated at monorail stations. Both studies also included assumptions that commuter rail would be in place by 2020 between downtown Seattle and Everett. Since the net transit ridership between the two forecasts is similar, there was no need to make refinements in the Magnolia Bridge transit estimates.

Intersection Operations

Modeling

Signalized intersection operations and levels of service were analyzed using Synchro 5.0 modeling software. Synchro implements the methods described in the *2000 Highway Capacity Manual* and calculates intersection capacity and level of service. Unsignalized intersection operations were analyzed using Synchro and Highway

Capacity Software 2000 (HCS 2000). HCS 2000 also implements the analysis methods described in the *2000 Highway Capacity Manual.*

Capacity is evaluated in terms of the ratio of the volume of traffic approaching the intersection to the total capacity of the lanes approaching the intersection (v/c ratio). Level of service (LOS) is evaluated as control delay per vehicle (in seconds per vehicle). Control delay is the time lost when a vehicle has to reduce speed or stop at an intersection. Level of service for the signalized and unsignalized intersections that are analyzed in this report are shown in Table 2. Delay at signalized and all-way stop-controlled intersections is calculated as a volume-weighted average delay for all approaches. Delay at two-way stop-controlled intersections is reported for the approach with the longest delay and lowest level of service.

Table 2
Intersection Level of Service Criteria

Level of Service	Signalized Intersections Control Delay per Vehicle (seconds))	Unsignalized Intersections Average Control Delay per Vehicle (seconds)
A	≤ 10	≤ 10
B	> 10 – 20	> 10 – 15
C	> 20 – 35	> 15 – 25
D	> 35 – 55	> 25 – 35
E	> 55 – 80	> 35 – 50
F	> 80	> 50

Source: 2000 Highway Capacity Manual

Another measure of intersection operations is the Intersection Capacity Utilization (ICU) used by Synchro modeling software. The measure is similar to an intersection-wide v/c ratio. It describes the extra capacity available at an intersection to handle incidents and fluctuations in traffic. Intersection Capacity Utilization is rated on a level of service scale as shown in Table 3.

Table 3
Intersection Capacity Utilization Criteria

ICU	Level of Service
≤ 60%	A
>60% to 70%	B
>70% to 80%	C
>80% to 90%	D
>90% to 100%	E
>100% to 110%	F
>110% to 120%	G
>120%	H

Source: Synchro 5.0

The network of signalized and unsignalized intersection was modeled using SimTraffic modeling software. SimTraffic is used to analyze complex situations such as:

- Closely spaced intersections with blocking problems
- Closely spaced intersections with lane changes
- The effects of signals on nearby unsignalized intersections and driveways

- The operation of intersections under heavy congestion

The SimTraffic software was used to estimate queue lengths, speeds and travel times.

Design Hour Determination

A screening level analysis was used to determine the traffic demand peak hour for the intersections within the vicinity of the Magnolia Bridge. The analysis summarized the impact of heavy vehicles (trucks and buses) in the traffic stream on weekdays and weekends during the morning, mid-day, and afternoon peak hours. The seven-day, 24-hour counts in the October 31 through November 6, 2002 period were compared with the 11-hour (7 AM to 6 PM) truck counts on a weekday (Thursday) and Saturday from the video survey. Each truck passing through a signalized intersection is the equivalent of two passenger cars in the use of capacity.

The screening level analysis determined the weekday AM peak hour and PM peak hour to be the critical demand peaks for both general and heavy vehicle traffic. Future traffic conditions were analyzed during both the weekday AM and PM peak hours (8 to 9 AM and 5 to 6 PM). These traffic analyses determined intersection approach lane configurations and vehicle queue lengths.

Safety

Rankings of high-accident locations were obtained from the City of Seattle and consulted to determine the presence of any intersections of concern with respect to safety. Separate listings were provided for signalized and unsignalized intersections, covering the year 2002. Signalized intersections with ten or more collisions and unsignalized intersections with five or more collisions were reported.

Transit Service

Impacts on transit operations were determined by reviewing existing use of the Magnolia Bridge (by King County Metro Routes 19, 24, and 33) and 15th/Elliott Avenue West (by routes 15 and 18), and estimating potential route or schedule changes.

Emergency Vehicle Service

Relative impacts on emergency service vehicle access were evaluated, taking into account police, fire, and medical services. Impacts were evaluated based on directness of travel and expected response time.

Studies and Coordination

Studies

Immunex Headquarters Project Draft Environmental Impact Statement, produced by the Port of Seattle in June 1995, describes the future plans of a major employer in the study area and the associated traffic impacts.

West Galer Street Flyover New Off-ramp to Elliott Avenue West, a technical memo produced by CH2M HILL, provides details about a project planned to address those impacts.

West Galer Street Closure Study, produced by K2 & Associates in July 2002, describes the impacts associated with the closure of the at-grade crossing of the Burlington Northern Santa Fe railroad at West Galer Street.

Seattle Monorail Project Green Line Draft Environmental Impact Statement, produced by Parametrix in August 2003, provides information about the impacts of a major infrastructure project planned for the Magnolia Bridge Replacement Project study area.

Data Sources

Vehicle volume summaries, provided by Seattle Department of Transportation, were obtained for intersections along Elliott Avenue West and 15th Avenue West. Additional turning movement counts for many intersections in the study area were obtained from *Magnolia District Turning Movement Report* and *Magnolia District Turning Movement Report, Phase 2*, produced by O'Bunco Engineering. Truck volume and turning movement counts were obtained from *Truck Count & Classification Study, Port of Seattle*, a series of video surveys produced by ATD Northwest. Arterial traffic volumes were obtained from tube counts, provided by Seattle Department of Transportation. Signal timing data and engineering sketches, showing lane configurations and geometric dimensions of intersections in the study area, were obtained from Seattle Department of Transportation.

Major Assumptions

Traffic

The 21st Avenue West surface street between Smith Cove and Thorndyke Avenue West will be in place for all of the alternatives including the No Build Alternative. This will be an extension of the existing 21st Avenue West to the south through Port of Seattle property. The location of this route will be determined by the North Bay master planning process being conducted by the Port of Seattle.

The western ramps on the existing Magnolia Bridge structure, that provide access to Smith Cove Park and Elliott Bay Marina, will be connected to the 21st Avenue West surface street so that traffic movements for the No Build Alternative at this intersection would operate the same as Alternative A – Ramps.

The Galer Flyover will be modified by the addition of a ramp from the eastbound flyover to southbound Elliott Avenue West. This ramp will be in place for all of the

alternatives including the No Build Alternative. The construction of this ramp is not a currently scheduled. Its timing will depend on the rate of traffic growth from the Amgen site and surrounding area and the quality of operation of the existing intersection of the Galer Flyover with Elliott Avenue West.

All alternatives would include the signalization of two currently unsignalized intersections: Alaskan Way West/Galer Flyover and Thorndyke Avenue West/21st Avenue West.

Transit

The Green Line Monorail will be built and operational through Interbay by year 2010. The Seattle Monorail Project Final Staff Recommendation (January 2004) places a dual-beam monorail alignment on the west side of 16th and 15th Avenue West and along the center of Elliott Avenue West with switches to allow trains to transfer in and out of an Operations Center located west of 15th Avenue West and north of West Armory Way. The Dravus Station will be located between 15th and 16th Avenues West, mid-block between West Barrett Street and West Dravus Street. A future station site, not proposed for construction in the initial phase, will be on the west side of 15th Avenue West near West Blaine Street.

Sound Transit commuter rail service between Seattle and Everett began operation on BNSF tracks through Interbay in December 2003. No commuter rail station is planned for the Interbay area.

Pedestrians and Bicycles

The Elliott Bay Trail, a multi-use trail connecting downtown Seattle with Magnolia, will remain operational in the same location with existing access points.

Affected Environment

Traffic Operations

Origins and Destinations

Travel patterns on the Magnolia Bridge were examined for three locations within the study area during the PM peak period (the time of heaviest travel through the study area):

- Magnolia Bridge
- Elliott Avenue West (south of West Galer Street)
- Ballard Bridge

The travel patterns were derived from a combination of existing traffic counts and the City of Seattle travel forecasting model.

Magnolia Bridge

During the PM peak period, 90 percent of existing traffic traveling westbound on the Magnolia Bridge originates from locations south of the bridge. About 40 percent of existing traffic is traveling from downtown Seattle, and 27 percent from Queen Anne/South Lake Union. Ten percent of westbound bridge traffic originates from locations north of the Magnolia Bridge.

For traffic traveling eastbound on the Magnolia Bridge during the PM peak period, 75 percent of the traffic is destined for downtown Seattle and areas south of the bridge, while 25 percent of the eastbound traffic is destined to the north of the bridge.

Elliott Avenue

Travel on Elliott Avenue West south of West Galer Street is heavily oriented to and from downtown Seattle, Queen Anne, South Lake Union and points south of downtown along the Alaskan Way Viaduct. To the north, approximately 35 percent of the Elliott Avenue West traffic uses the Magnolia Bridge to access various Magnolia destinations, while 65 percent of traffic continues north along 15th Avenue West. Around 25 percent of the total traffic continues north across the Ballard Bridge.

The Ballard Bridge

Travel across the Ballard Bridge serves several neighborhoods to the north of the bridge in Ballard and surrounding areas as well. Approximately 20 percent of the northbound bridge traffic continues through Ballard into north Seattle. The remaining 80 percent stays in Ballard. For southbound traffic, around 40 percent of the trips access Magnolia, the Port of Seattle, Fisherman's Terminal, the railroad yards, and other local business. These trips are primarily across the West Emerson Street and West Dravus Street bridges. Less than 5 percent of the trips use the Magnolia Bridge. Queen Anne attracts almost 35 percent of the Ballard Bridge traffic, while around 25 percent continues south toward downtown Seattle and South Lake Union.

Traffic Conditions

Street Network

The 15th/Elliott Avenue West roadway serves as the primary north and south arterial connecting the neighborhoods of Queen Anne, Ballard and Loyal Heights to downtown Seattle. This route is classified by the City of Seattle as a principal arterial. Thorndyke Avenue West/20th Avenue West/Gilman Avenue West is a minor arterial running along the east edge of the Magnolia district between West Galer Street and West Government Way. It serves as the primary collector for traffic to and from Magnolia to the west.

In 2000, the City completed the installation of a series of pedestrian and traffic safety improvements on 15th Avenue West. These improvements included:

- Adding or upgrading pedestrian signals at West Gilman Drive, West Wheeler Street, and West Armory Way.
- Coordinating pedestrian signals with traffic light timing along 15th Avenue West to improve traffic flow and reduce pedestrian/vehicle conflicts.
- Repairing and adding sidewalks and installing wheelchair ramps at pedestrian crossings.
- Installing a traffic island with street lighting at the 15th Avenue West/West Ruffner Street intersection to prevent left-turns and U-turns.
- Replacing street lamps to provide brighter, more even lighting.

Magnolia Bridge, West Dravus Street, and West Emerson Place/Street run east-west between these two arterial routes and connect the Magnolia neighborhood and the Interbay area to 15th Avenue West and Elliott Avenue West. The west end of Magnolia Bridge connects to Thorndyke Avenue West via West Galer Street. The east end of Magnolia Bridge connects to 15th Avenue West at the West Garfield Street intersection. The Galer Flyover intersection with Elliott Avenue West serves the westbound ramp over 15th Avenue West to the Magnolia Bridge

West Dravus Street connects directly with 20th Avenue West at the west end of the railroad crossing bridge and continues west onto the East Hill of Magnolia. East of the 15th Avenue West interchange, West Dravus Street continues east, uphill into the Queen Anne neighborhood. West Dravus Street is classified as a principal arterial between 15th Avenue West and 20th Avenue West, and as a minor arterial west of 20th Avenue West and east of 15th Avenue West.

West Emerson Place/Street is a principal arterial connecting Gilman Avenue West with 15th Avenue West and providing a bridge crossing of the BNSF railroad. East of 15th Avenue West, the principal arterial route continues east as West Nickerson Street and provides connections with the Queen Anne neighborhood via 3rd Avenue West and other north-south streets. West Nickerson Street also connects to the Fremont Bridge and Westlake Avenue North on the east side of Queen Anne Hill.

There are no other principal arterials in the Magnolia street network. In addition to Thorndyke Avenue West/20th Avenue West/Gilman Avenue West, other Magnolia minor arterials include:

- Magnolia Bridge/West Galer Street/Magnolia Boulevard West/Clise Place West/West Lynn Street between 15th Avenue West and 34th Avenue West;

- 34th Avenue West/West Government Way between West Lynn Street and Gilman venue West; and
- West Emerson Street between 34th Avenue West and Perkins Lane West.

There are several routes classified as collector arterials in Magnolia. These include:

- 28th Avenue West/West Tilden Street/30th Avenue West between West Galer Street and West Government Way;
- 22nd Avenue West between Thorndyke Avenue West and Gilman Avenue West;
- West Blaine Street/Condon Way West between Thorndyke Avenue West and West McGraw Street;
- West McGraw Street/Montavista Place West between 28th Avenue West and Magnolia Boulevard West;
- West Howe Street/Magnolia Boulevard West between Clise Place West and West Emerson Street; and
- West Hayes Street between Thorndyke Avenue West and 28th Avenue West.

Existing Volumes

Study Area

The Annual Average Weekday Traffic (AAWDT) volumes are shown on Figure 12. Thirty percent of the AAWDT crossing the three east-west connections between Magnolia and 15th Avenue West/Elliott Avenue West uses the Magnolia Bridge. The remaining 70 percent is split evenly between the West Dravus Street and West Emerson Place/Street crossings.

Traffic flow along east-west arterial roadways— Magnolia Bridge/West Galer Street, West Dravus Street and West Emerson Place/Street— is heavier in the eastbound direction during the AM peak period and in the westbound direction during the PM peak period as a result of the commuting pattern between the Magnolia residential district and employment centers accessed by the 15th/Elliott Avenue West corridor. On 15th/Elliott Avenue West, traffic is heavier in the southbound direction toward downtown Seattle during the AM peak period and in the northbound direction during the PM peak period. AM (8 to 9 AM) and PM (5 to 6 PM) peak hour volumes in the primary study area are shown on Figure 13 and Figure 14, respectively.

Many streets in the Magnolia neighborhood provide access for residents to the Magnolia Bridge corridor. North-south arterials such as 28th Avenue West, 32nd Avenue West, and 34th Avenue West serve as commuter routes during the AM and PM peak hours and carry between 4,000 and 6,000 vehicles per day. An additional north-south arterial on Magnolia's East Hill is 22nd Avenue West beginning at Thorndyke Avenue West on the south, crossing West Dravus Street and ending at West Emerson Avenue on the north. It carries about 2,000 vehicles per day.

East-west arterials that connect between 28th Avenue West and the north-south arterial composed of Thorndyke Avenue West/20th Avenue West/Gilman Avenue West are:

- West Galer Street at the south end of Thorndyke Avenue West
- West Blaine Street located 0.25 mile north of West Galer Street
- West Dravus Street located 0.80 mile north of West Blaine Street

- West Emerson Street located 0.80 mile north of West Dravus Street

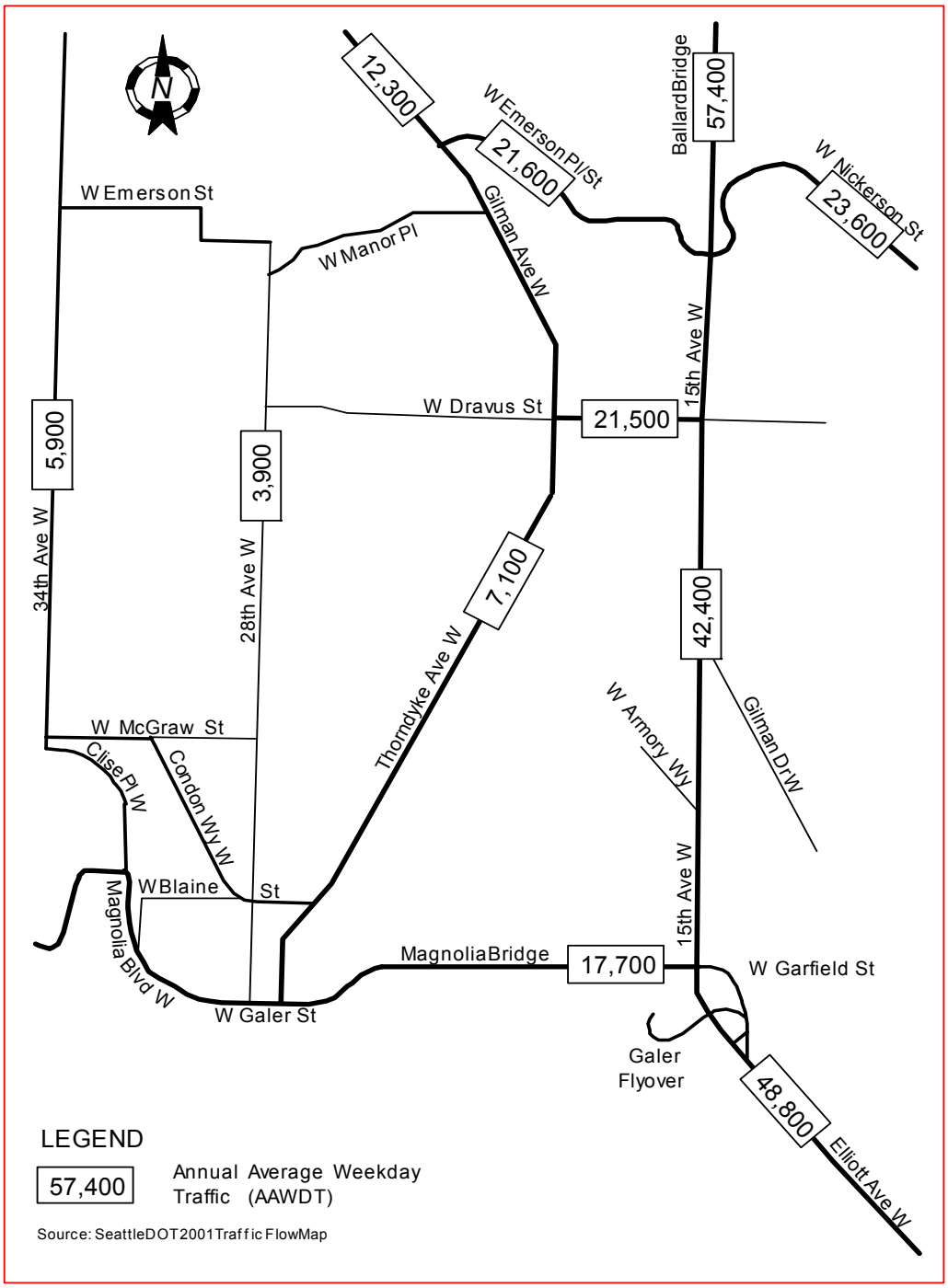


Figure 12
Annual Average Weekday Traffic

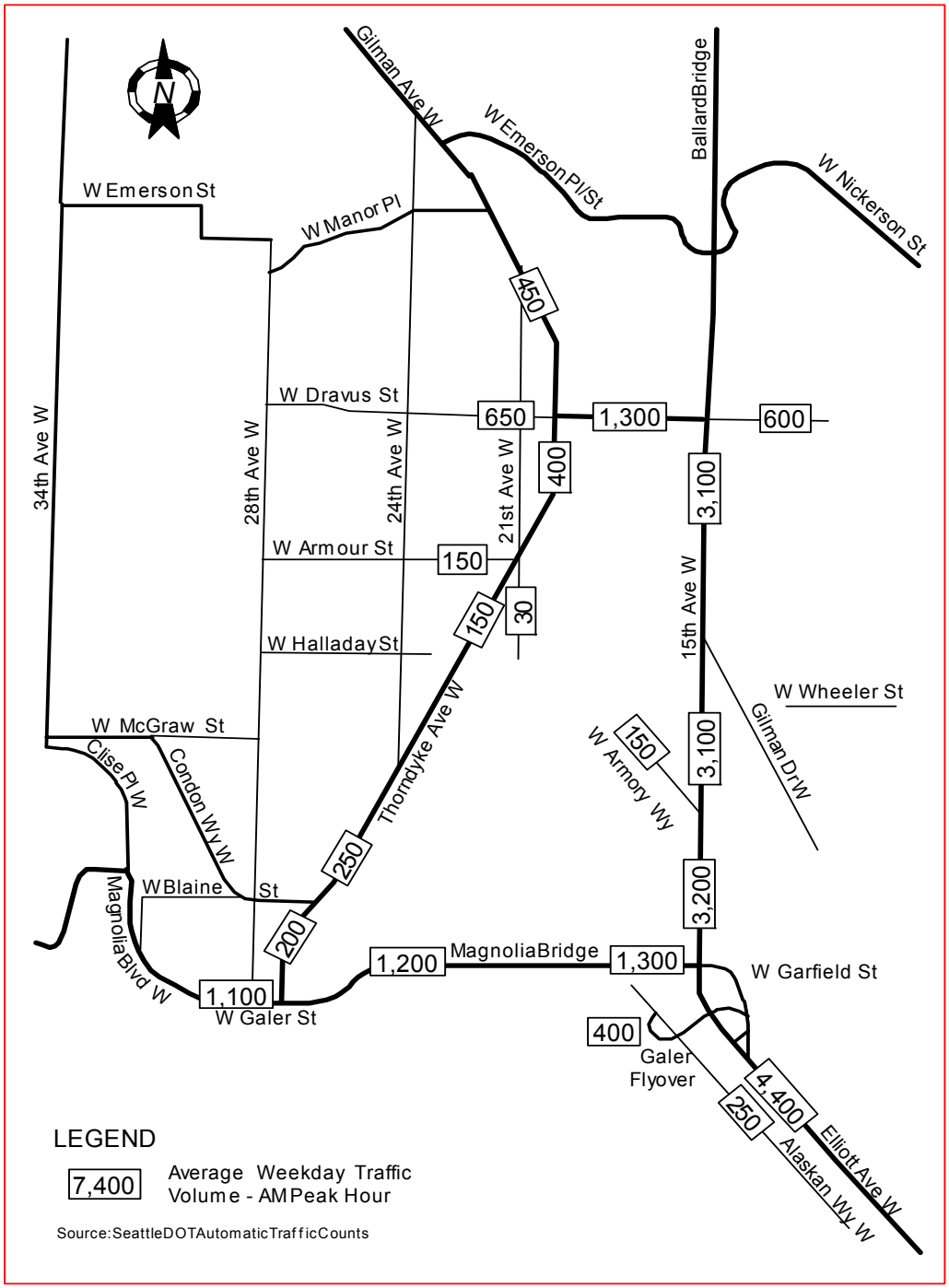


Figure 13
Existing Traffic Volumes – AM Peak Hour

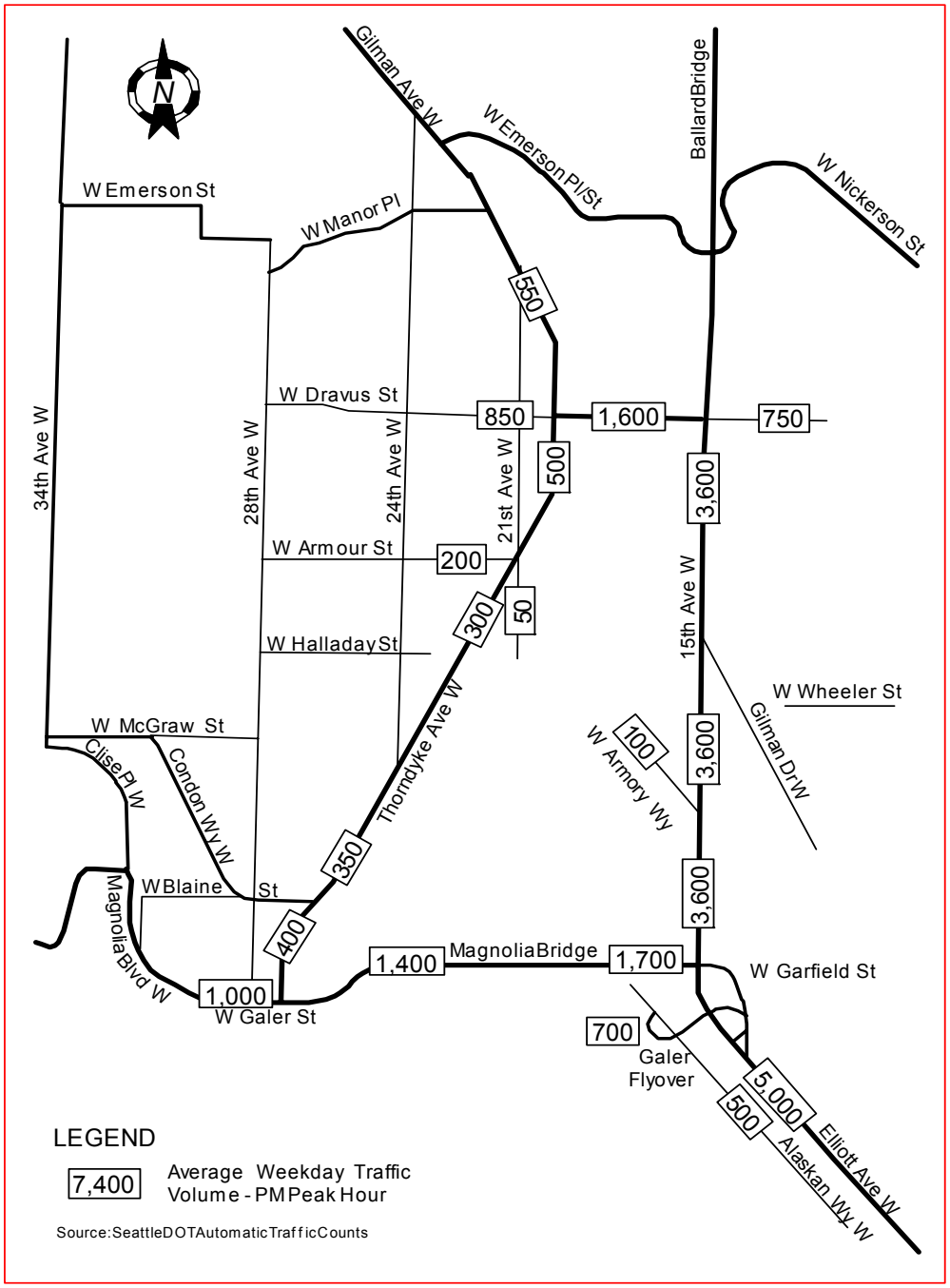


Figure 14
Existing Traffic Volumes – PM Peak Hour

Local streets provide routes for residents to access Thorndyke Avenue West for connections to either the Magnolia Bridge or West Dravus Street. Commonly used east-west streets include West Plymouth Street, West Boston Street, and West Armour Street. North-south local streets include 21st and 24th Avenues West. The traffic analysis shows that these local streets primarily serve Magnolia residents and attract limited 'cut-through' traffic. The narrow widths, steep grades and discontinuity of the east-west streets serve to discourage cut-through movements. Each of these local streets carries about 1,300 vehicles per day

Terminal 91 Traffic

Average weekday traffic (AWDT) volumes into and out from Terminal 91 were counted at two locations in October and November, 2002: the Main Gate at the mid-bridge center-lane ramps and the East Gate at the north end of Pier 90 at Alaskan Way West. The total AWDT is approximately 3,450 vehicles for both gates. About 41 percent of the AWDT consists of heavy vehicles. The heavy vehicle volume includes school buses that are about 14 percent of the total AWDT.

Table 4
Terminal 91 – Average Weekday Traffic (2002)

	Number of Vehicles		
	In	**Out**	**Total**
Main Gate	400	350	750
East Gate	1,350	1,350	2,700
Total Volume	1,750	1,700	3,450

Source: Port of Seattle traffic counts, October/November 2002

Heavy vehicles are not allowed to use the Main Gate ramps from the Magnolia Bridge and must access Terminal 91 from the East Gate via Alaskan Way West. Traffic using the East Gate is about 78 percent of the total AWDT at the two gates. In the past, traffic using the East Gate also used the at-grade railroad crossing and intersection at West Galer Street and Elliott Avenue West. In March of 2003, this intersection was closed, and all East Gate traffic must now use the Galer Flyover between Alaskan Way West and Elliott Avenue West.

The AWDT at the Main Gate is 750 vehicles, about 4 percent of the total AAWDT on the Magnolia Bridge.

AWDT at the East Gate is 2,700 vehicles, split evenly between vehicles entering and leaving. The AWDT using the East Gate comprises about 3 percent of the total AAWDT on 15th/Elliott Avenue West

Peak traffic hours for Terminal 91 activity occur during mid-day hours on the Magnolia Bridge and 15th/Elliott Avenue West. Terminal 91 traffic builds in the morning after the peak hour and remains relatively constant from 10 AM until 3:30 PM, with the peak between 2 and 3 PM. In the morning, traffic is heavier in the inbound direction. In the afternoon, traffic is heavier in the outbound direction.

Existing Intersection Operations

Design Hour Determination

An analysis of the intersections in the vicinity of the Magnolia Bridge was conducted to determine the peak traffic hours. The analysis considered the total traffic entering each intersection and the percent of vehicles that were buses and trucks. The volumes of heavy vehicles were converted to passenger car equivalent units (PCU) assuming each heavy vehicle is equivalent to two passenger cars (2 PCUs) in its effect on intersection operation. The average weekday and weekend volumes are shown in Table 5 and Table 6.

The traffic count data indicate that the AM peak hour for the total traffic flow is from 8 to 9 AM. The PM peak hour for the total traffic is from 5 to 6 PM. The peak flow for trucks and buses occurs mid-day from 1 to 2 PM, while the peak flow for

trucks only occurs from 12 to 1 PM. During these mid-day periods, however, the equivalent volume (PCU) remains below those during the morning and afternoon peak hours.

Table 5
Traffic Volumes[1] Entering Intersections,
Average Weekday Analysis

Intersection	AM Peak Hour (8-9 AM)	Midday Peak Hour (1-2 PM)	PM Peak Hour (5-6 PM)
Elliott Ave W & Galer Flyover	4,300	3,700	4,900
15th Ave W & Garfield Off-ramp	4,900	3,700	4,500
Galer Flyover and Magnolia Bridge	1,200	1,300	2,100

Note: [1]Volumes given in equivalent passenger car units (PCUs)
Source: HNTB, 2003

Weekday Analysis

On weekdays, heavy vehicles comprise about 7 percent of the total traffic volume on 15th/Elliott Avenue West at the Magnolia Bridge during the mid-day hour. During the AM and PM peak hours, heavy vehicles averaged about 5 percent or less of the total traffic volume.

The analysis indicates that the Elliott Avenue West/Galer Flyover intersection processes over 4,900 passenger car units (PCUs) during the weekday PM peak hour. During the AM peak hour, 4,300 PCUs enter the intersection and 3,700 PCUs enter during the mid-day peak hour.

The signalized intersection at 15th Avenue West/West Garfield Street off-ramp processes the most passenger car units during the weekday AM peak hour with 4,900 PCUs entering the intersection. The entering PCUs during the weekday mid-day and PM peak hours are 3,700 and 4,500, respectively.

The unsignalized intersection at the Galer Flyover and Magnolia Bridge westbound on-ramp experiences peak volumes of about 2,100 PCUs during the weekday PM peak period.

Table 6
Traffic Volumes[1] Entering Intersections,
Average Weekend Analysis

Intersection	AM Peak Hour (8-9 AM)	Midday Peak Hour (1-2 PM)	PM Peak Hour (5-6 PM)
Elliott Ave W & Galer Flyover	1,500	3,300	3,200
15th Ave W & Garfield Off-ramp	1,700	3,400	3,400
Galer Flyover and Magnolia Bridge	400	1,000	1,000

Note: [1]Volumes given in equivalent passenger car units (PCUs)
Source: HNTB, 2003

Weekend Analysis

Heavy vehicle (truck) volumes during the weekend are relatively consistent throughout the day while the total traffic volumes peak during both the mid-day and PM peak hours.

The peak flow entering the Elliott Avenue West/Galer Flyover intersection on weekends occurs during the mid-day hour with about 3,300 PCUs. Weekend AM and PM peak hour PCUs entering the intersection are 1,500 and 3,200, respectively.

The flow into the 15th Avenue West/West Garfield Street off-ramp intersection peaks during the mid-day and PM peak hours with flows of 3,400 PCUs. The weekend flow rate for the AM peak hour is 1,700 PCUs.

The weekend peak at the unsignalized Galer Flyover/Magnolia Bridge intersection occurs during both the mid-day and PM peak hours.

Peak Traffic Hours

The analysis concluded that the weekday AM peak hour and PM peak hour are the critical demand peaks for both general and heavy vehicle traffic. For weekend conditions, traffic flows including heavy vehicles are heaviest during the mid-day peak hour, but at levels well below those observed on weekdays. Future traffic conditions were analyzed during both of the weekday AM and PM peak hours (8 to 9 AM and 5 to 6 PM). The alignment design (approach lane requirements) for each alternative is based on the hour that has the highest volume, and review of traffic queuing for all approach lanes.

Intersection Analyses

The street network for the Magnolia district includes all arterial roadways and intersections in the primary study area. Intersection operation analyses were conducted for the eight signalized and seven unsignalized intersections within the study area shown in Table 7. The existing traffic operating conditions along 15th/Elliott Avenue West were assessed by analyzing the intersections at the Galer Flyover, West Galer Street, West Garfield Street and the ramp terminals at West Dravus Street.

Table 7
Existing Intersection Operations

	AM Peak Hour			PM Peak Hour		
Signalized Intersections	**LOS[1] (Delay)[2]**	**ICU[3] (%)**	**V/C[4] (max.)**	**LOS[1] (Delay)[2]**	**ICU[3] (%)**	**V/C[4] (max.)**
15th Ave W SB Ramps & W Dravus St	B (14.0)	68.9	1.00	B (18.4)	56.7	1.00
15th Ave W NB Ramps & W Dravus St	A (9.2)	60.5	0.73	B (15.6)	60.5	0.77
15th Ave W & Gilman Dr W	A (8.7)	75.8	0.70	B (16.5)	82.5	0.76
15th Ave W & W Armory Way	A (4.5)	66.9	0.60	A (6.1)	68.3	0.61
15th Ave W & W Garfield St	A (1.9)	68.5	0.61	A (3.7)	65.5	0.72
Elliott Ave W & W Galer St	A (0.3)	70.9	0.66	A (1.5)	55.4	0.49
Elliott Ave W & Galer Flyover	A (3.6)	78.0	0.73	D (38.9)	92.4	1.09
20th Ave W & W Dravus St	A (8.9)	58.8	0.55	B (13.7)	72.6	0.75
Unsignalized Intersections	**LOS[1] (Delay)[2]**	**Worst Approach**		**LOS[1] (Delay)[2]**	**Worst Approach**	
Gilman Ave W & W Emerson Pl	C (19.7)	-		F (70.8)	Westbound	
Thorndyke Ave W & 21st Ave W	A (9.9)	-		B (11.3)	-	
Thorndyke Ave W & W Blaine St	B (11.4)	-		B (12.3)	-	
Thorndyke Ave W & W Galer St	D (28.2)	-		E (49.6)	Southbound	
32nd Ave W & Clise Pl W	B (11.3)	-		B (10.6)	-	
Magnolia Blvd. & W Howe St	C (15.6)	-		C (17.5)	-	
Alaskan Way W & Galer Flyover	A (8.9)	-		B (13.6)	-	

Notes: [1] Level of service.
[2] Delay is in seconds per vehicle.
[3] Intersection Capacity Utilization.
[4] Volume to capacity ratio.
Source: HNTB, 2003

All of the signalized intersections currently operate at LOS B or better in the AM peak hour. The intersection of Elliott Avenue West and the Galer Flyover operates at LOS D during the PM peak hour due to the high volume of northbound through traffic. The other intersections operate at LOS B or better in the PM peak hour.

Traffic conditions along the Thorndyke Avenue West/20th Avenue West/Gilman Avenue West roadway were analyzed at the West Emerson Place, 21st Avenue West, West Blaine Street, and West Galer Street intersections. These unsignalized intersections operate at LOS C or better with the exceptions of the intersections of Gilman Avenue West/West Emerson Place and Thorndyke Avenue West/West Galer Street. Gilman Avenue West at West Emerson Place operates at LOS F during the PM peak hour due to westbound traffic in excess of 700 vehicles. Thorndyke

Avenue West at West Galer Street operates at LOS D in the AM peak and LOS E in the PM peak due to high traffic volumes at the stop-controlled, southbound approach.

Transit Facilities

Transit Summary

The Magnolia Bridge links the Magnolia neighborhood with Elliott Avenue West, a major roadway (classified as a principal arterial) into downtown Seattle. Six transit routes travel along Elliott Avenue West. Three routes carry passengers to the downtown area from the Ballard neighborhood to the north and three routes serve the Magnolia neighborhood. A Magnolia route that bypasses the Magnolia Bridge links Magnolia with the University of Washington. These routes are summarized in Table 8 and Table 9, and shown on Figure 15.

Table 8
Transit Service to Magnolia Area – Weekday

Bus Route #	Route Direction	Weekday			
		Daily Trips	Approx Time Range*	Peak Headway	Off-Peak Headway
19 Peak Period Only	Downtown	4	6:43 AM to 8:12 AM	30	n/a
	Magnolia	6	4:00 PM to 6:09 PM	45-60	n/a
24	Downtown	36	5:20 AM to 12:33 AM	15-30	30
	Magnolia	36	5:32 AM to 12:50 AM	30-15	30
31	University of Washington	26	6:03 AM to 6:34 PM	30	30
	Magnolia	28	6:23 AM to 6:53 PM	30	30
33	Downtown	25	5:25 AM to 9:37 PM	20	45
	Discovery Park	28	6:03 AM to 10:15 PM	20-25	45
15	Downtown	52	5:17 AM to 12:46 AM	20	20
	Ballard and Blue Ridge	53	4:48 AM to 1:49 AM	20	20
18	Downtown	52	4:53 AM to 1:48 AM	20	20
	Ballard and N. Beach	51	6:08 AM to 1:25 AM	20	20
81 Night Owl	Downtown	2	2:56 AM & 4:11 AM	n/a	70
	Ballard and Loyal Heights		2:30 AM & 3:45 AM		75

Note: *Nearest bus stop on schedule; first and last hour of service may have greater headway than noted.
Source: Metro On-line Schedule, September 2002.

Magnolia Area Service

Two Magnolia bus routes, #24 and #33, provide continuous service in the area with weekday and weekend service. Both routes travel throughout the Magnolia neighborhood and have 15-30 minute headways from about 5:30 AM to after midnight. Route #19 is peak-period-only service from West Emerson Street/Magnolia Boulevard West along West Viewmont Way, across the Magnolia Bridge, onto Elliott Avenue West and into downtown Seattle. A fourth bus route, #31, provides a connection to the University of Washington weekdays and Saturdays from 6 AM to about 7 PM. This route travels along Thorndyke Avenue West/20th Avenue West/Gilman Avenue West to the West Emerson Place access point.

Table 9
Transit Service to Magnolia Area – Weekend

		Saturday			Sunday		
Bus Route	**Route Direction**	**Daily Trips**	**Approx Time Range***	**Headway**	**Daily Trips**	**Approx Time Range***	**Headway**
19 Peak Period Only	Downtown	n/a	n/a	n/a	n/a	n/a	n/a
	Magnolia						
24	Downtown	37	5:55 AM 12:32 AM	30	37	5:55 AM 12:34 AM	30
	Magnolia	37	6:20 AM 12:50 AM	30	37	6:34 AM 12:54 AM	30
31	University of Washington	25	6:05 AM to 6:45 PM	30	n/a	n/a	n/a
	Magnolia	26	6:21 AM to 6:15 PM	30			
33	Downtown	22	5:49 AM to 8:56 PM	45	22	5:51 AM to 8:57 PM	45
	Discovery Park	22	6:16AM to 10:00 PM	45	22	6:15 AM to 10:00 PM	45
15	Downtown	50	6:02 AM to 12:54 AM	20	33	6:14 AM to 12:50 AM	30
	Ballard and Blue Ridge	49	7:05 AM to 1:49 AM	20	37	7:05 AM to 1:49 AM	30
18	Downtown	49	6:03 AM to 1:50 AM	20	38	6:28 AM to 1:49 AM	30
	Ballard and N. Beach	49	6:50 AM to 1:24 AM	20	37	6:50 AM to 1:24 AM	30
81 Night Owl	Downtown	2	2:56 AM & 4:11 AM	70	2	2:56 AM & 4:11 AM	70
	Ballard and Loyal Heights		2:30 AM & 3:45 AM	75		2:30 AM & 3:45 AM	75

Note: * Nearest bus stop on schedule; first and last hour of service may have greater headway than noted.
Source: Metro On-line Schedule, September 2002.

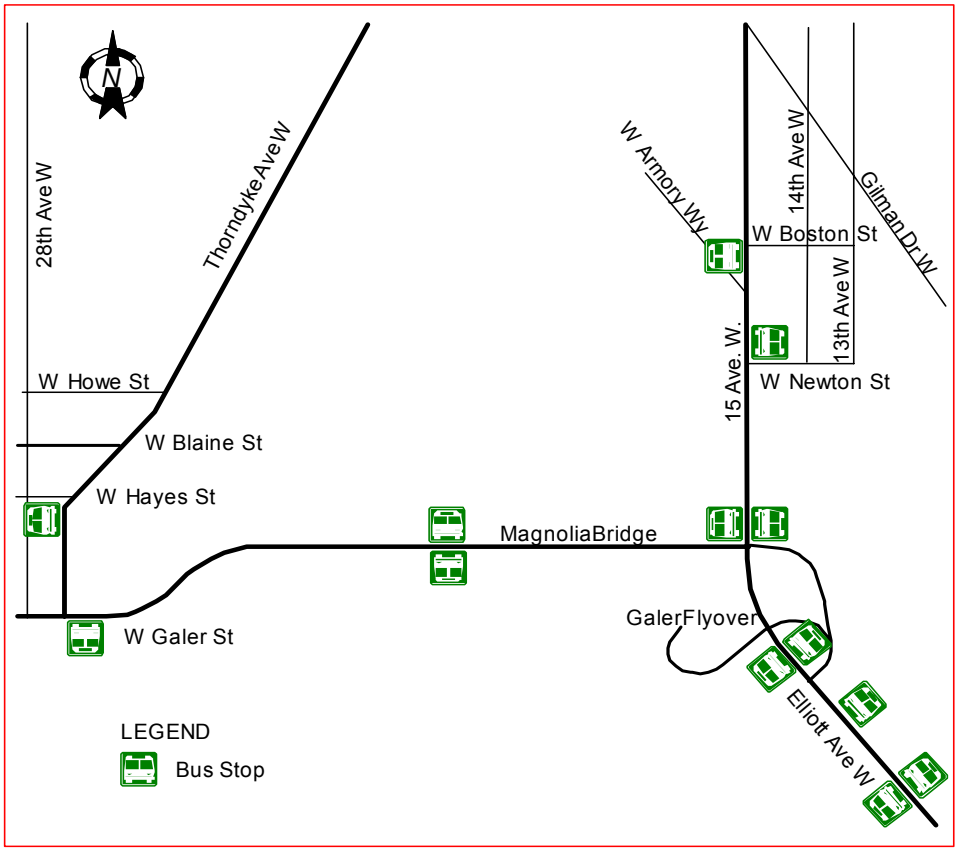
Figure 15
Bus Routes

Elliott Avenue Service

Transit service along Elliott Avenue West includes the three routes from Magnolia, #19, #24, and #33, joining with routes #15, #18, and #81. The #18 and #15 buses have 20 minute headways, but alternate with each other, giving essentially 10 minute headways on Elliott Avenue West from downtown Seattle to Ballard and north on both weekdays and weekends. Route 81 is a night owl service with only two early morning routes.

Elliott Avenue West has no transit-only lane, but the City of Seattle is implementing transit signal priority technology along 15th Avenue West with plans to extend the technology along Elliott Avenue West.

There are 13 bus stops near the Magnolia Bridge as shown on Figure 16. Two of these stops are on the Magnolia Bridge and serve Terminal 91 businesses. The Magnolia Bridge connection with Elliott Avenue West is a transfer point offering connections to the Magnolia bus routes.



Source: Mirai Associates, 2003

Figure 16
Bus Stops

Transit Ridership

Bus routes serving the study area carry over 11,000 passengers each day, as shown in Table 10. The three routes serving Magnolia contribute around 28 percent of the daily total ridership along the corridor.

Table 10
Transit Ridership Along 15th/Elliott Avenue West

Bus Route	Destination	Service	Daily Passengers
19	West Magnolia	Peak Period Only	230
24	Central Magnolia	All day	1,900
33	East Magnolia	All Day	1,140
15	Blue Ridge, Ballard	All Day	4,250
18	North Beach, Ballard	All Day	4,040
	TOTAL		11,560

Notes: *Does not include Route 81, which is a night-owl service
Source: King County Metro, Fall 2002

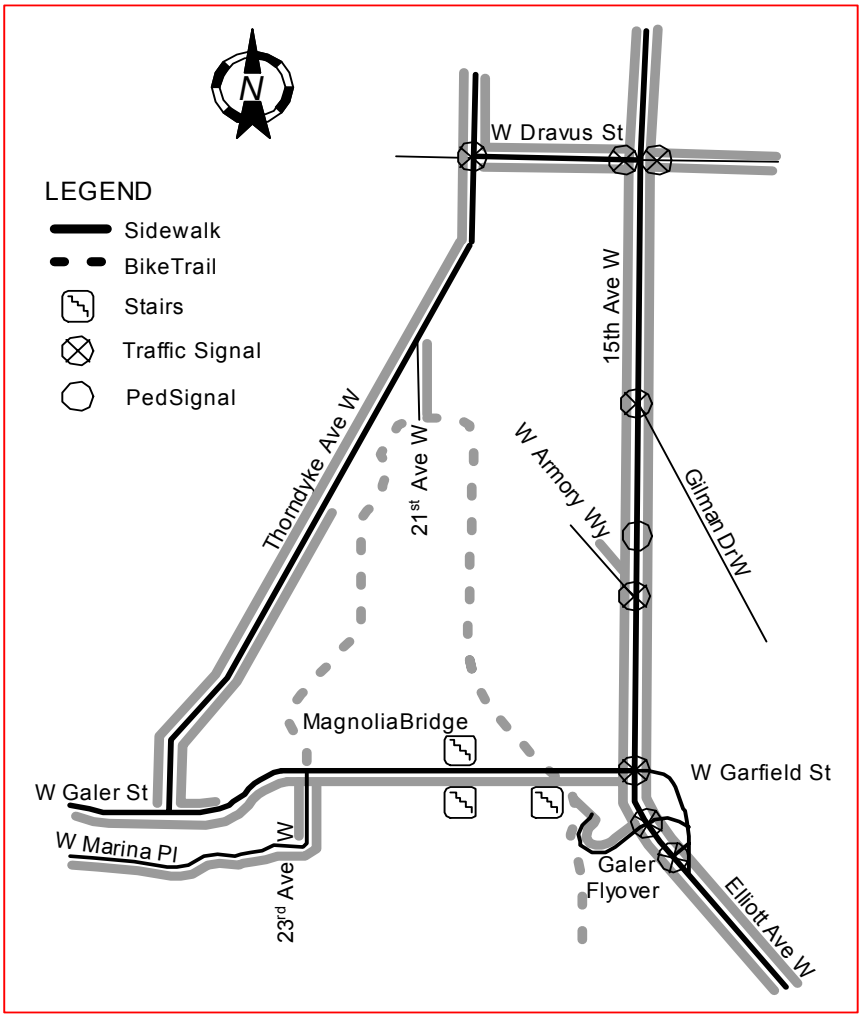
Pedestrian and Bicycle Facilities

Pedestrian and bicycle facilities near the Magnolia Bridge are influenced by the unique geographic location. Magnolia, because of its geography, is similar to an island. It is located on a peninsula west of Queen Anne Hill, south of the Ballard Locks, and a short distance from downtown Seattle. The east bluff of Magnolia rises steeply from Interbay. Magnolia is accessible by three bridges which cross over the Interbay area (including industrial/port properties and railroad through tracks and yards). All vehicles, pedestrians, and bicyclists must use one of these three bridges to access Magnolia from the major north-south arterial, 15th Avenue West/Elliott Avenue West, along the east side of the Interbay area. Figure 17 and Figure 18 show the pedestrian and bicycle routes located within the study area.

Pedestrian Facilities

The Magnolia Bridge has pedestrian facilities connecting the Magnolia neighborhood to 15th Avenue West/Elliott Avenue West. Figure 17 shows the roadways with sidewalks and the multi-use trail located within the study area. The south side of the existing bridge contains a five-foot wide sidewalk along the length of the structure that connects to the ramps to Elliott Avenue West. The north side contains a short section of discontinuous sidewalk in the midpoint area near the ramps leading to the marina and Smith Cove.

There are two stairways for pedestrians on the south side of the bridge. One stairway is located at the mid-point of the bridge (near the north end of Pier 91). The stairway leads to a pedestrian under crossing that connects to the stairs located directly opposite on the north side of the bridge. Bus stops on the Magnolia Bridge are located near these stairways. The other stairway is along the eastern end of the bridge immediately east of the BNSF tracks. The walkway at the bottom of the stairs crosses to the north side of the bridge structure and continues east to 15th Avenue West along the north side of the structure. This stairway also provides access to businesses south of the bridge structure along Alaskan Way West and 16th Avenue West. A new pedestrian bridge over the BNSF tracks at West Prospect Street is under construction as a link to Amgen's new development in the area.



Source: Mirai Associates, 2003

Figure 17
Pedestrian Routes

Table 11 shows the pedestrian street crossing volumes at nine key study area intersections. The counts are the four highest consecutive 15-minute volumes during the AM and PM. Note that the peak hours for pedestrian traffic may be different for each intersection and are not necessarily the same peak hours used for vehicular traffic.

The Elliott Bay multi-use trail connects Magnolia with downtown Seattle. The trail passes under the Magnolia Bridge west of the BNSF railroad tracks, but there are no direct connections to the bridge. More details about the trail are presented in the following section on bicycle facilities and are shown on Figure 18. Several parks surround the Magnolia area. All are popular destinations for local residents, bicyclists, and tourists. Magnolia Park overlooks Puget Sound, and is located along the west side of Magnolia. Smith Cove Park and the Elliott Bay Marina are located to the south. Discovery Park, on Magnolia's northwest side, encompasses 534 acres, has seven miles of trails, and is Seattle's largest park. Adjacent to Discovery Park is the West Point Lighthouse with walking trails descending to the beach and the lighthouse.

Table 11
Existing Pedestrian Peak Hour Volumes

Intersection	AM Pedestrian Peak Hour*	PM Pedestrian Peak Hour*
15th Ave W & W Dravus St, SB Ramps	37	55
15th Ave W & W Dravus St, NB Ramps	29	41
15th Ave W & W Armory Way	27	31
15th Ave W & W Garfield St	23	23
Elliott Ave W & W Galer St	41	28
20th Ave W & Dravus St.	81	72
Thorndyke Ave W & 21st Ave W	11	7
Thorndyke Ave W and W Blaine St	25	33
Thorndyke Ave W and W Galer St	19	10

Note: *Pedestrian volumes represent highest hourly AM or PM count for each intersection.
Source: Magnolia District Turning Movement Report, O'Bunco Engineering, November 2002
Magnolia District Turning Movement Report, Phase 2, O'Bunco Engineering, March 2003
Magnolia District Turning Movement Report, Phase 3, O'Bunco Engineering, May 2003
Vehicle Volume Summaries, Seattle DOT, August 2000 to January 2001

Bicycle Facilities

The Seattle *Bicycling Guide Map* shows Magnolia Boulevard as a commonly used bike route linking Discovery Park to the south with Magnolia Park and Thorndyke Avenue West. From Thorndyke Avenue West, cyclists can connect to a major multi-use trail, the Elliott Bay Trail. The northern area of Magnolia also accesses the Elliott Bay Trail at 20th and 21st Avenues West, near their intersections with Thorndyke Avenue West, and at the north end of the North Bay/Terminal 91 property. The Elliott Bay Trail is a multi-use trail connecting downtown Seattle with Magnolia through Myrtle Edwards Park. This trail is a major north-south trail used by commuter bicyclists not only from Magnolia, but also from neighborhoods to the north via the Ballard Bridge and West Dravus Street. The trail connects Smith Cove Park, under the bluffs east of 23rd Avenue West and downtown Seattle. The trail starts in Myrtle Edwards Park and runs north, separate from but paralleling Elliott Avenue West. The trail then passes under the Magnolia Bridge west of the BNSF tracks and continues north along the east side of Terminal 91 to an area near West Smith Street and 20th and 21st Avenues West. Here the trail loops south to Smith Cove Park on the west side of Terminal 91 at the base of Magnolia Bluff. As previously mentioned, many trial users access the trail at 20th and 21st Avenues West.

Bicyclists have been observed using the Magnolia Bridge in both directions, although there are no separate bike lanes. They have been observed traveling in the traffic lane. There is no information on how many bicyclists use the bridge. Bicyclists frequently access the Elliott Bay Trail via Thorndyke Avenue West to 20th/21st Avenues West. However, experienced bicyclists from the southern part of Magnolia use the Magnolia Bridge. There is no direct connection between the east side of the Magnolia Bridge and the Elliott Bay Trail. Once bicyclists cross the bridge, they must either travel with motor vehicles on Elliott Avenue West or find a way back to the Elliott Bay Trail using local east-west streets. The 6.5 percent grade makes it difficult for many occasional bicyclists to use the Magnolia Bridge, particularly in the westbound, uphill direction.

Figure 18
Bicycle Routes

The City of Seattle conducted field surveys of bicycle traffic volumes during the morning peak period on the Elliott Bay Trail in 1992, 1995, and 2000. The surveys were taken from 6:30 to 9:30 AM at the south end of Myrtle Edwards Park.

However, the following trends are expected to be similar further north in the Interbay area.

- During the eight years, peak period bicycle users increased by 68 percent, from 92 in 1992, to 126 in 1995, to 155 in 2000.
- In the 2000 survey, travel directions were recorded for the first time; there were 123 southbound (downtown Seattle bound) and 33 northbound bicyclists. A heavy proportion (80 percent) of peak period users were traveling to and from downtown Seattle.

Freight and Goods

Truck Routes

In the City of Seattle, every arterial street is designated as a truck street to serve local truck traffic; however, only those arterials designated as major truck streets in the Comprehensive Plan are meant to serve both local and non-local truck traffic. Within the study area, 15th/Elliott Avenue West is designated as a major truck street The City's *Freight Mobility Strategic Action Plan* (November 2002) identifies Elliott Avenue West and 15th Avenue West as an "Oversized" route to accommodate wider and taller shipments on a permit basis. This corridor is a key truck link connecting the industrial areas in Ballard, Interbay, and Terminal 91 with the Port of Seattle and downtown Seattle.

The 15th/Elliott Avenue West corridor is designated by the WSDOT as a T-2 classification, carrying 4 to 10 million tons of freight annually.

Four main truck access points provide connections to this route within the study area: West Dravus Street, West Armory Way, the Magnolia Bridge, and the Galer Flyover. Trucks accessing the Terminal 91 East Gate and the Terminal 36 grain elevators west of the rail lines use the Galer Flyover. The Magnolia Bridge ramps to the Terminal 91 Main Gate are automobile only—trucks are not allowed. The Interbay area east of the rail lines, west of 15th Avenue West and south of West Wheeler Street is accessed primarily by West Armory Way. Trucks destined to and from Magnolia use West Dravus Street or the Magnolia Bridge.

A surface intersection at West Galer Street previously allowed truck access from Terminal 91 to Elliott Avenue West. The Galer Flyover was constructed to provide a separated rail crossing and the surface intersection was closed in March 2003.

Truck Volumes

Previous studies of truck freight within the City of Seattle have demonstrated that most truck activity occurs during the daytime hours between 9 AM and 4 PM. Generally truck volumes decline between the hours of 4 to 7 PM and represent a small fraction of afternoon peak commuter traffic.

Truck volumes were analyzed by videotaping traffic movements through intersections in the vicinity of the Magnolia Bridge and Galer Flyover access points to 15th/Elliott Avenue West. From the video, counts of truck movements were obtained for 10-hour periods from 7 AM to 5 PM on a typical weekday and Saturday in late October 2002. Trucks are defined as heavy duty vehicles and semi trucks, and do not include buses. These observations were made while the West Galer Street at-grade railroad crossing was still open. In the past, this crossing attracted a

substantial amount of local truck traffic. This grade crossing was closed in March 2003, and truck volumes on the Galer Flyover are expected to increase.

The distribution of trucks throughout the day differs from other vehicles. Typically, the peak hour for trucks was observed to occur during mid-day hours, as compared with the AM and PM peak hours for the total traffic volumes.

Weekday Conditions

Mid-day Peak Hour (Peak period for trucks)

The mid-day peak hour (12 to 1 PM) truck traffic is shown on Figure 19. Trucks represent approximately 7 percent of the 15th Avenue West noon traffic volumes, 8 percent of the Elliott Avenue West noon traffic volumes, and 3 percent of the Magnolia Bridge noon traffic volumes.

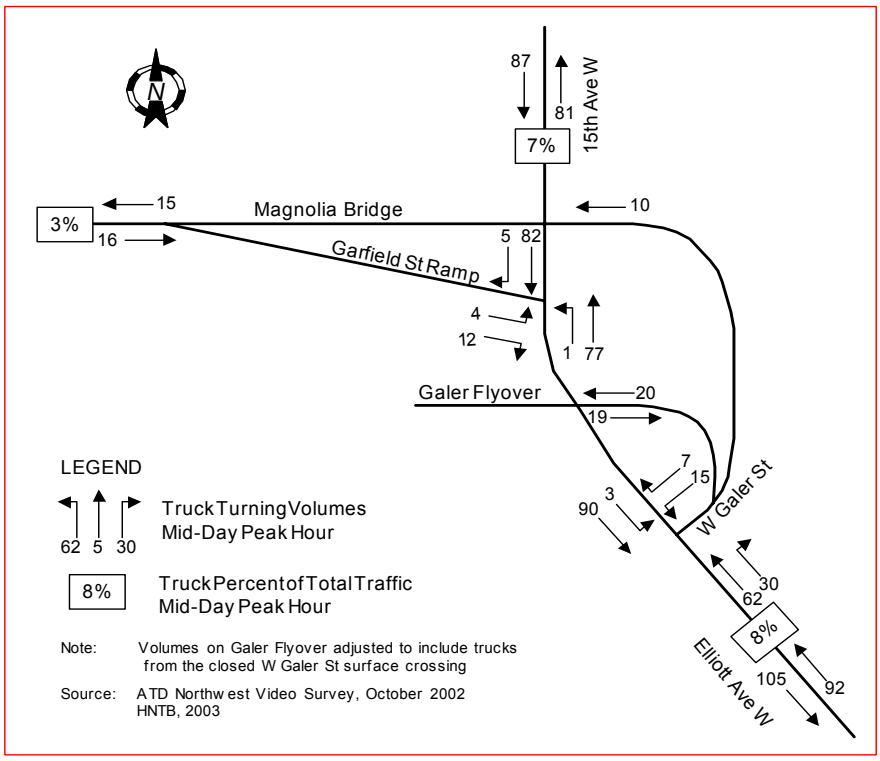


Figure 19
Existing Truck Volumes – Mid-Day Peak Hour

AM Peak Hour

During the 8 to 9 AM peak hour, trucks along 15th/Elliott Avenue West represent around 4 percent of the total traffic. Truck usage is similar in both directions along the corridor, although the percent of truck traffic is higher northbound, since the total northbound traffic volumes are lower during this hour.

The intersections of 15th/Elliott Avenue West with West Galer Street and the Magnolia Bridge, exhibit peak traffic conditions between the hours of 7 to 9 AM, depending on the route in question. Truck volumes tended to peak closer to 9 AM. Recognizing these variations, about 5 percent of the AM peak hour traffic using the

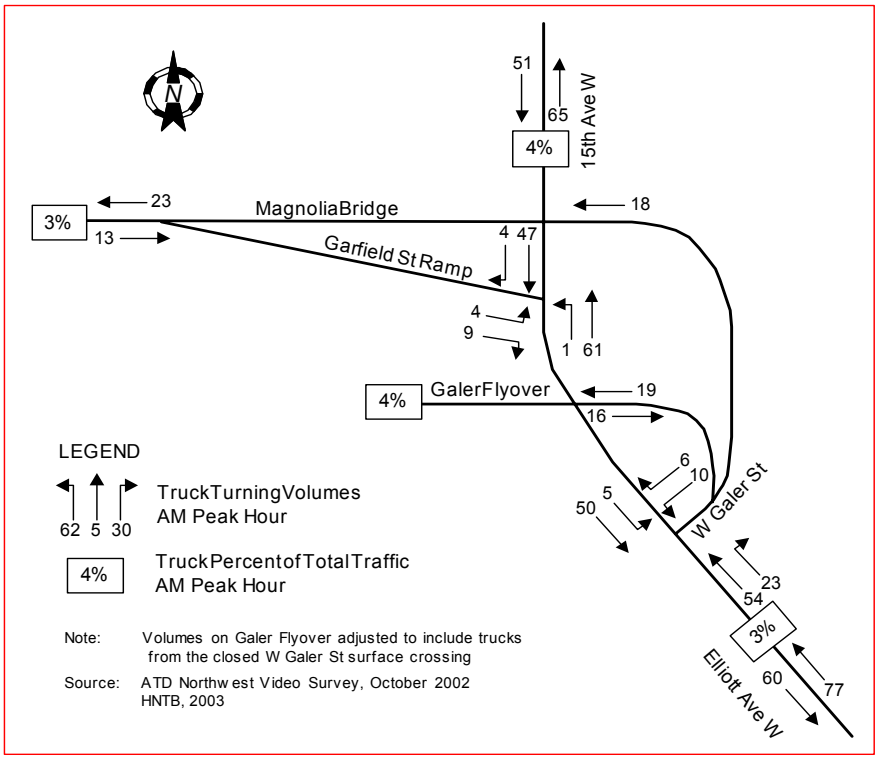


Figure 20
Existing Truck Volumes – AM Peak Hour

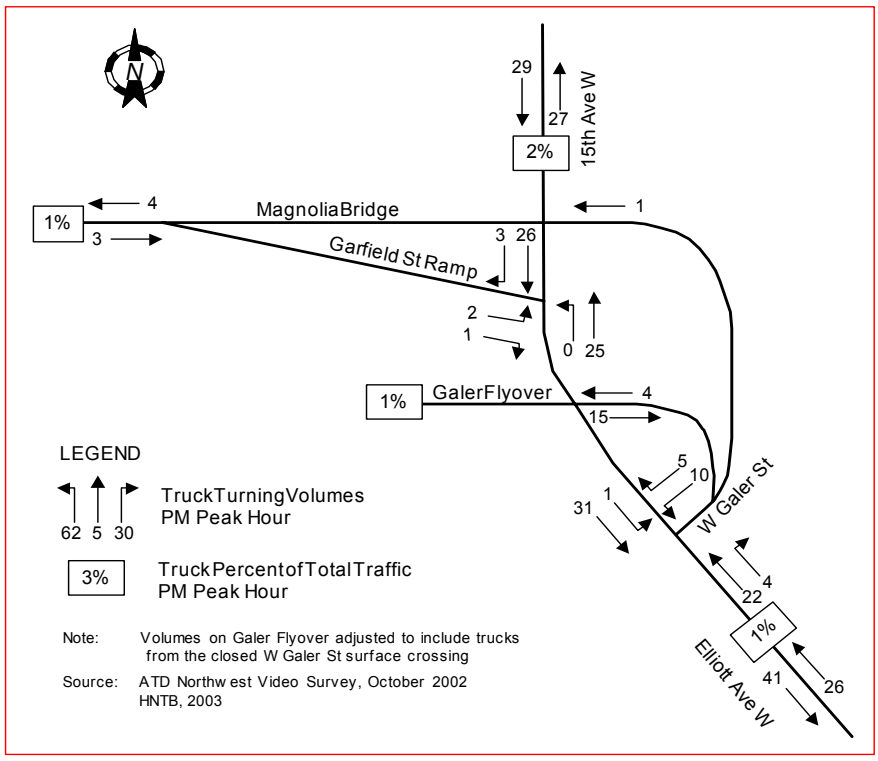


Figure 21
Existing Truck Volumes – PM Peak Hour

bridge ramp from northbound Elliott Avenue West to the westbound Magnolia Bridge is truck traffic. After this traffic merges with the on-ramp traffic from 15th Avenue West, the overall truck volume on the Magnolia Bridge is about 3 percent. The percentage of truck traffic on the Galer Flyover is similar, with an overall demand of 4 percent (5 percent westbound and 3 percent eastbound). Figure 20 shows a schematic breakdown of the AM peak hour truck volumes.

PM Peak Hour

In the afternoon, the peak traffic volumes in the vicinity of the Magnolia Bridge occur somewhere between the hours of 3 and 6 PM depending on the route. Truck volumes peak earlier, from 3 to 4 PM and then continue to decline for the remainder of the day. Similar to the AM peak hour, the majority of trucks used 15th/Elliott Avenue West as the main route through this area, although trucks amounted to only 1 to 2 percent of the total design PM peak hour traffic (5 to 6 PM). On this route, truck traffic totaled approximately 70 vehicles per hour south of the Galer Flyover. The truck traffic on the Magnolia Bridge approaches to Elliott Avenue West was relatively small when compared with the morning truck traffic. Only one percent of the peak hour traffic on this route represents trucks. Truck percentages on the Galer Flyover ramps were also small during the PM peak hour. Figure 21 provides a schematic breakdown of the PM peak hour truck volumes.

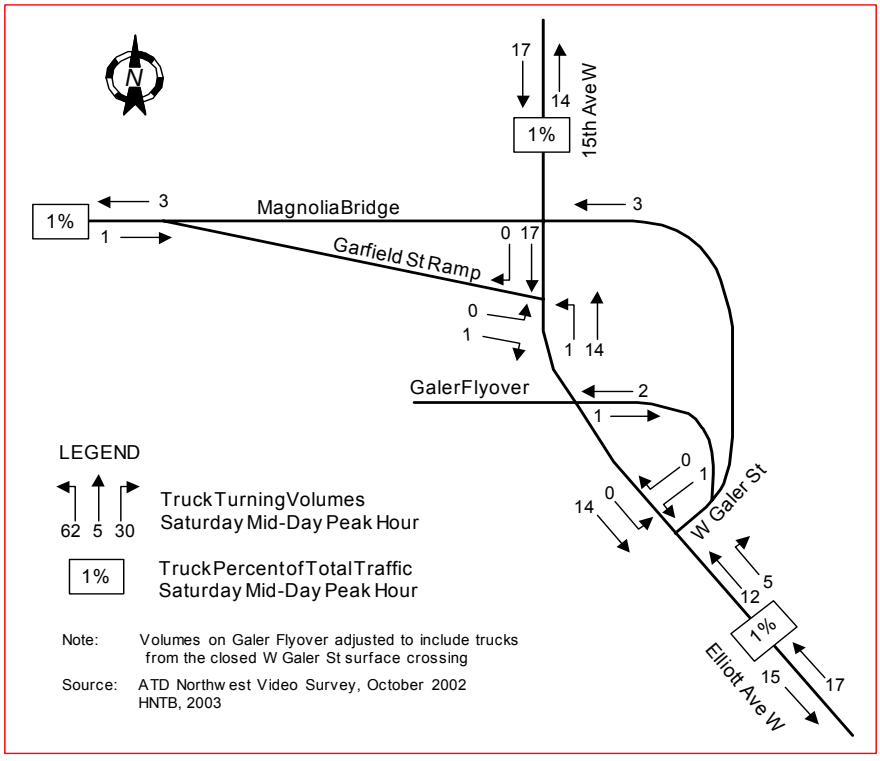


Figure 22
Existing Truck Volumes – Saturday Mid-Day Peak Hour

Saturday Conditions

On Saturdays, the heaviest truck traffic was surveyed on the 15th/Elliott Avenue West corridor, as shown in Figure 22. Overall, the Saturday truck traffic is not nearly as heavy as the average weekday. For example, the Saturday peak hour for

truck traffic on 15th Avenue West yielded 43 trucks, while during the same period on Thursday, the truck traffic was approximately four times that amount. Overall, the weekend truck traffic represents approximately one percent of the total hourly traffic measured during the noon hour. In addition, the truck volumes remain relatively constant between the hours of 6 AM and 5 PM. These movements were examined during the development of the design hour and were analyzed in greater detail in the evaluation of the build alternatives.

Terminal 91 Truck Traffic

Trucks currently access the Terminal 91 property via the East Gate at the north end of Pier 90. The trucks using the East Gate include a fleet of school buses that are based at the north end of the Terminal 91 property.

Traffic through the East Gate was counted and classified in October and November 2002 (Table 12). Over 900 trucks per day access Terminal 91 through this gate comprising about 53 percent of the total average weekday traffic (AWDT). Truck volumes through the East Gate are highest during off-peak hours between 10:30 AM and 5 PM while total traffic volumes peak between 2 and 3:30 PM. During the maximum truck activity hours, truck volumes range between 80 and 95 vehicles per hour. Truck activity through the East Gate is lowest from 8 to 10 AM during the AM peak hour.

Table 12
Terminal 91 East Gate Traffic

Time of Day	Total Traffic	Trucks & Buses	Trucks Only	Buses Only	Single Unit Trucks	Heavy Trucks
Weekday	2,700	1,420	930	490	740	190
AM Peak Hour (8-9 AM)	120	70	50	20	40	10
PM Peak Hour (5-6 PM)	220	130	50	80	40	10
Peak Activity Hours						
7-8 AM	230	145	55	90	50	5
10-11 AM	240	165	75	90	60	15
2-3 PM	250	155	80	75	60	20

Source: Port of Seattle, automatic traffic counts, October/November 2002

School buses currently comprise another 18 percent of the East Gate AWDT. The north portion of Terminal 91 is used by a school bus operator. Most of the bus activity occurs during off-peak hours. The traffic counts show buses leaving between 7 and 8 AM and returning between 10 and 11 AM. In the afternoon, buses leave between 2 and 3 PM and return during the PM peak hour between 5 and 6 PM.

Railroads

The Burlington Northern-Santa Fe Railway (BNSF) owns and operates a double track mainline, the Balmer Yard, and spur tracks serving Terminal 91, the Terminal 86 grain terminal, and other industrial properties. BNSF also operates the Interbay Yard, a locomotive servicing facility, located north of West Dravus Street and south of West Emerson Place. The Union Pacific Railroad has an operating agreement with BNSF to operate unit grain trains. The BNSF mainline continues south through

Seattle to the Columbia River, north to Canada, and to the east via Stevens Pass and Everett.

Table 13 shows actual 2001 and estimated 2010 daily trains using data provided by BNSF in 2001 for the West Galer Street Closure Study. After opening of the Galer Flyover connecting Elliott Avenue West and Alaskan Way West in late 2001, the at-grade crossing of the BNSF mainline tracks by West Galer Street was closed.

Table 13
Daily Train Crossings on BNSF Mainline at West Galer Street, Existing and Forecast

Train Type	Existing 2001	2010
Thru Intermodal	8	14
Seattle Intermodal		
BNSF	10	17
Union Pacific	3	5
Thru Freight	12	21
Local Freight	14	24
Local Balmer Yard	10	17
Amtrak Trains	6	8
Commuter Trains	0	12
Total Trains	63	118

Source: West Galer Closure Study, K2 & Associates, July 2002, Table 3

Rail activity along the mainline tracks through Interbay occurs 24 hours per day, seven days per week. The Amtrak passenger trains operate on fixed schedules. Freight trains have both fixed schedules and varying arrival and departures based on customer demand and mainline capacity constraints.

Spur tracks between the Terminal 91 buildings and the tank farm serve the current businesses in these buildings with deliveries approximately twice per week.

Emergency Vehicles

Emergency service access within the existing transportation network was reviewed for police, fire, and medical aid.

Seattle Fire Department

The Seattle Fire Department equipment and personnel providing emergency response are stationed at the locations shown in Table 14. The emergency response routes are identified in Figure 23.

The distance from each Seattle Fire Department Station that provides emergency services to several locations in the Magnolia study area is shown in Table 15.

Table 14
Emergency Response Facilities

Facility	Location	Service	Project Service Area
Station 8	110 Lee St (Queen Anne)	Engine 8	Third-in: Terminal 91; Fourth-in: Smith Cove, Dravus & 20th, Magnolia
		Ladder 8	First-in: Terminal 91, Magnolia; Second-in: Smith Cove, Dravus & 20th
Station 18	1521 NW Market St (Ballard)	Medic 18	First-in: Magnolia, Terminal 91, Smith Cove, Dravus & 20th
		Engine 18	Third-in: Magnolia, Smith Cove, Dravus & 20th
		Ladder 8	First-in: Smith Cove, Dravus & 20th; Second-in: Terminal 91, Magnolia
		Battalion 4	First-in: Terminal 91, Smith Cove, Magnolia, Dravus & 20th
Station 20	3205 13th Avenue W (Queen Anne)	Engine 20	First-in: Terminal 91, Smith Cove, Dravus & 20th Second-in: Magnolia
Station 41	2416 34th Avenue W (Magnolia)	Engine 41	First-in: Magnolia; Second-in: Terminal 91, Smith Cove, Dravus & 20th
Harbor View (HVM)	325 9th Avenue (Seattle)	Medic 1 & Medic 10	Second-in: Terminal 91, Smith Cove, Magnolia, Dravus & 20th

Notes: Engine – Engine Company, Pump truck with related equipment and personnel.
Ladder – Ladder Company, Ladder truck with related equipment and personnel.
Medic – Medic Unit, Medic vehicle and two Paramedics.
Aid – Aid Unit, Aid vehicle and two Emergency Medical Technicians.
First-in – Primary responsibility for providing emergency response.
Second-in – Provide backup and supplemental support as indicated when required.
Source: Mirai Associates, 2003

Seattle Police Department

The Seattle Police Department provides services to the Magnolia area through the West Precinct. The precinct headquarters, located at 810 Virginia Street, covers the geographic area between Spokane Street to the south, Interstate 5 to the east, the Ship Canal to the north and Elliott Bay on the west.

The Queen 1 and Queen 2 precinct districts of the Queen Sector provide police services to Magnolia. They cover all of the Magnolia and Interbay geographic area. Queen 1 and Queen 2 are separated north-south, approximately, by West Dravus Street and bordered on the east by 15th Avenue West.

Table 15
Emergency Response Distances (Miles)

Location	Station 8	Station 18	Station 20	Station 41	HVM
W Dravus St/20th Ave W	3.0	2.0	0.7	1.5	5.3
Terminal 91	1.9	3.0	1.7	2.1	3.9
Smith Cove	2.4	3.2	1.8	1.6	4.4
Magnolia Village	4.4	3.4	2.1	-	5.3

Source: Mirai Associates

Source: Mirai Associates

Figure 23
Emergency Vehicle Routes

The Magnolia Bridge, Galer Flyover, West Dravus Street and West Emerson Street provide access for police services to residents within the Queen 1 and Queen 2 precinct districts. These routes also provide access for additional needed backup police services for incident response beyond what is assigned to the Queen 1 and Queen 2 districts.

Safety

No intersections within the Magnolia Bridge, 15th/Elliott Avenue West, West Dravus Street, or Thorndyke Avenue West corridors appear on Seattle's listing of high collision intersections. A high-accident location is defined as an unsignalized intersection with 10 or more accidents annually, or an unsignalized intersection with 5 or more accidents annually.

Planned and Programmed Improvements

Three major projects are under development in the vicinity of the Magnolia Bridge study area. These projects are in various stages of development, ranging from approved projects to those in the planning stages.

The major projects currently underway are the development of the Amgen property west of Elliott Avenue West and south of the Galer Flyover, the Seattle Monorail Project "Green Line," and master planning for future development of the Port of Seattle North Bay (including Terminal 91) properties.

Amgen Development

The Amgen property is west of Elliott Avenue West and south of the Galer Flyover. An environmental review of the development plans for the Amgen property indicates that a new ramp may be needed to connect the eastbound Galer Flyover to southbound Elliott Avenue West. This action will be triggered when the existing signalized intersection of the Galer Flyover and Elliott Avenue West reaches unacceptable levels of congestion and delay. The new ramp will remove large volumes of westbound to southbound left turns from the existing intersection. The new ramp will merge with free-flow southbound through traffic on Elliott Avenue West. Several movements (the eastbound right turn, southbound through and westbound right turn) will be excluded from signal control, which will improve level of service for the movements remaining under signal control. Future increases in trip generation on the Amgen site and its vicinity will also contribute to the need for a signal at the Alaskan Way West/Galer Flyover intersection.

With the new ramp, pedestrians will be restricted from crossing Elliott Avenue West at the Galer Flyover intersection and will be required to cross at the West Galer Street traffic signal. Pedestrians from Amgen's campus are connected across the railroad tracks to Elliott Avenue West by a pedestrian overpass at West Prospect Street.

Monorail Green Line

The Seattle Monorail Project Green Line will extend between Ballard and downtown Seattle. The Final Staff Recommendation (January 2004) places a dual-beam monorail alignment on the west side of 16th and 15th Avenue West and along the center of Elliott Avenue West with switches to allow trains to transfer in and out of

an Operations Center located west of 15th Avenue West and north of West Armory Way. The Dravus Station will be located between 15th and 16th Avenues West, mid-block between West Barrett Street and West Dravus Street. A future station site, not proposed for construction in the initial phase, will be on the west side of 15th Avenue West near West Blaine Street. The Elliott Avenue West center alignment will retain parking on the west side and the use of this parking lane for a third southbound traffic lane in the AM peak period.

The Draft Environmental Impact Statement has been circulated and comments have been received. A Final Environmental Impact Statement was issued in March 2004. A mitigation program for the alignments has not yet been determined.

North Bay Master Plan

The construction of the 21st Avenue West surface street is expected as a consequence of the Port of Seattle's master plan for future North Bay development. The master plan area includes the Terminal 91 area west of the railroad tracks and the Washington National Guard property east of the railroad between West Armory Way and the Magnolia Bridge. Land use alternatives under consideration for this project could increase employment and other trip generators above the forecasts (see Table 1) used for the Magnolia Bridge Replacement project. The North Bay master planning project will produce traffic studies and environmental analyses for these higher density land use scenarios that would require zoning changes. Traffic from the existing zoning build out of the North Bay properties would contribute to the need for new traffic signals at the intersections of Thorndyke Avenue West with 21st Avenue West, and Alaskan Way West with the Galer Flyover.

Impacts

No Build Alternative

Traffic Operations

Street Network

The No Build Alternative would include several planned and programmed projects in the Magnolia Bridge vicinity. At the Elliott Avenue West/Galer Flyover intersection, a new ramp would be provided connecting from the eastbound flyover structure onto southbound Elliott Avenue West. This ramp would be constructed to serve the build out of the Amgen site (1,400 parking spaces) and other development, and when needed because of poor operation of the flyover intersection with Elliott Avenue West. With this ramp, the dual left turn on the westbound (loop) approach of the Elliott Avenue West/Galer Flyover intersection would be closed. The ramp would join southbound through traffic on Elliott Avenue West in a merging maneuver, no longer under signal control. The existing signal would continue to serve southbound Elliott Avenue West left turns and northbound movements. Pedestrian crossings of Elliott Avenue West would be relocated to the surface West Galer Street intersection.

The intersection of Alaskan Way West/Galer Flyover would also be signalized in the No Build Alternative, reflecting increasing activity on the Amgen and Port sites.

The No Build Alternative would include the 21st Avenue West surface street through North Bay/Terminal 91 property, and signalization of the Thorndyke Avenue West/21st Avenue West intersection. This connection could be used by North Bay/Terminal 91 truck traffic to and from the Magnolia Bridge, using the existing ramps serving Elliott Bay Marina and Smith Cove Park.

Traffic Volume Distribution

Under the No Build Alternative, traffic patterns in the study area would remain roughly as they are today. The 15th/Elliott Avenue West arterial would serve as the major north-south route, and the Magnolia Bridge and West Dravus Street would serve as the major east-west routes. The major traffic flows in the morning peak hour would be southbound on 15th/Elliott Avenue West and eastbound on the Magnolia Bridge and West Dravus Street. The eastbound traffic would be about equally distributed between the Magnolia Bridge and West Dravus Street. The major traffic flows during the evening peak hour would be northbound on 15th/Elliott Avenue West and westbound on the Magnolia Bridge and West Dravus Street.

Traffic Growth

The annualized traffic growth rate for the Puget Sound Region is 1.5 percent per year. Growth at this rate would give a total 30-year growth in traffic of 56 percent. Traffic in the project area is projected to grow at an annualized rate ranging from 0.7 percent to 1.2 percent, less than the Puget Sound rate. The exception to this rate would be a section of Thorndyke Avenue West between West Dravus Street and 23rd Avenue West, which would grow at a rate approaching 3 percent annually.

Traffic assignments for the No Build Alternative would show similar travel patterns compared with existing conditions. Some variations, particularly along Thorndyke Avenue West, would occur due to the 21st Avenue West surface street being open between Thorndyke Avenue West and the waterfront through the Port's North Bay (Terminal 91) property.

Table 16
2030 PM Peak Hour Traffic Volumes, Existing and No Build Alternative

		Vehicles per Hour		Percent Change from Existing	
Corridor	**Location**	**Existing**	**2030**	**30-year**	**Annual**
15th/Elliott Ave W	15th Ave W, N of W Dravus St	4,800	6,900	44%	1.2%
	15th Ave W, S of W Dravus St	3,900	5,100	31%	0.9%
	15th Ave W, N of W Armory Wy	3,600	4,600	28%	0.8%
	15th Ave W, S of W Armory Wy	3,600	4,500	25%	0.8%
	Elliott Ave W, S of Galer Flyover	5,000	6,200	24%	0.7%
W Emerson St	W Emerson Pl, E of Gilman Ave W	1,100	1,500	36%	1.0%
Thorndyke Ave W – 20th Ave W – Gilman Ave W	Gilman Ave W, S of W Emerson Pl	500	600	20%	0.6%
	20th Ave W, S of W Dravus St	500	1,100	120%	2.7%
	Thorndyke Ave W, S of 22nd Ave W	300	700	133%	2.9%
	Thorndyke Ave W, N of W Blaine St	400	700	75%	1.9%
	Thorndyke Ave W, S of W Blaine St	400	500	25%	0.8%
W Dravus St	W Dravus St, W of 20th Ave W	900	900	0%	0.0%
	W Dravus St, E of 20th Ave W	1,600	2,300	44%	1.2%
W Galer St – Magnolia Bridge	W Galer St, W of Thorndyke Ave W	1,000	1,300	30%	0.9%
	Magnolia Bridge, W of 21st Ave W	1,400	1,600	14%	0.5%
	Magnolia Bridge, E of 21st Ave W	1,700	2,100	24%	0.7%
Galer Flyover	Galer Flyover, W of Alaskan Way W	7,00	1,000	43%	1.2%

Source: Mirai Associates, 2003

The growth patterns for the No Build Alternative are shown in Table 16 and Figure 24. Traffic growth patterns for the No Build and Alternatives A and D would be the same and the following characteristics apply to all three alternatives.

- The 15th/Elliott Avenue West corridor would grow between 24 percent south of the Galer Flyover to 44 percent north of West Dravus Street. The

respective annualized growth rate would range from 0.7 percent per year to 1.2 percent per year.

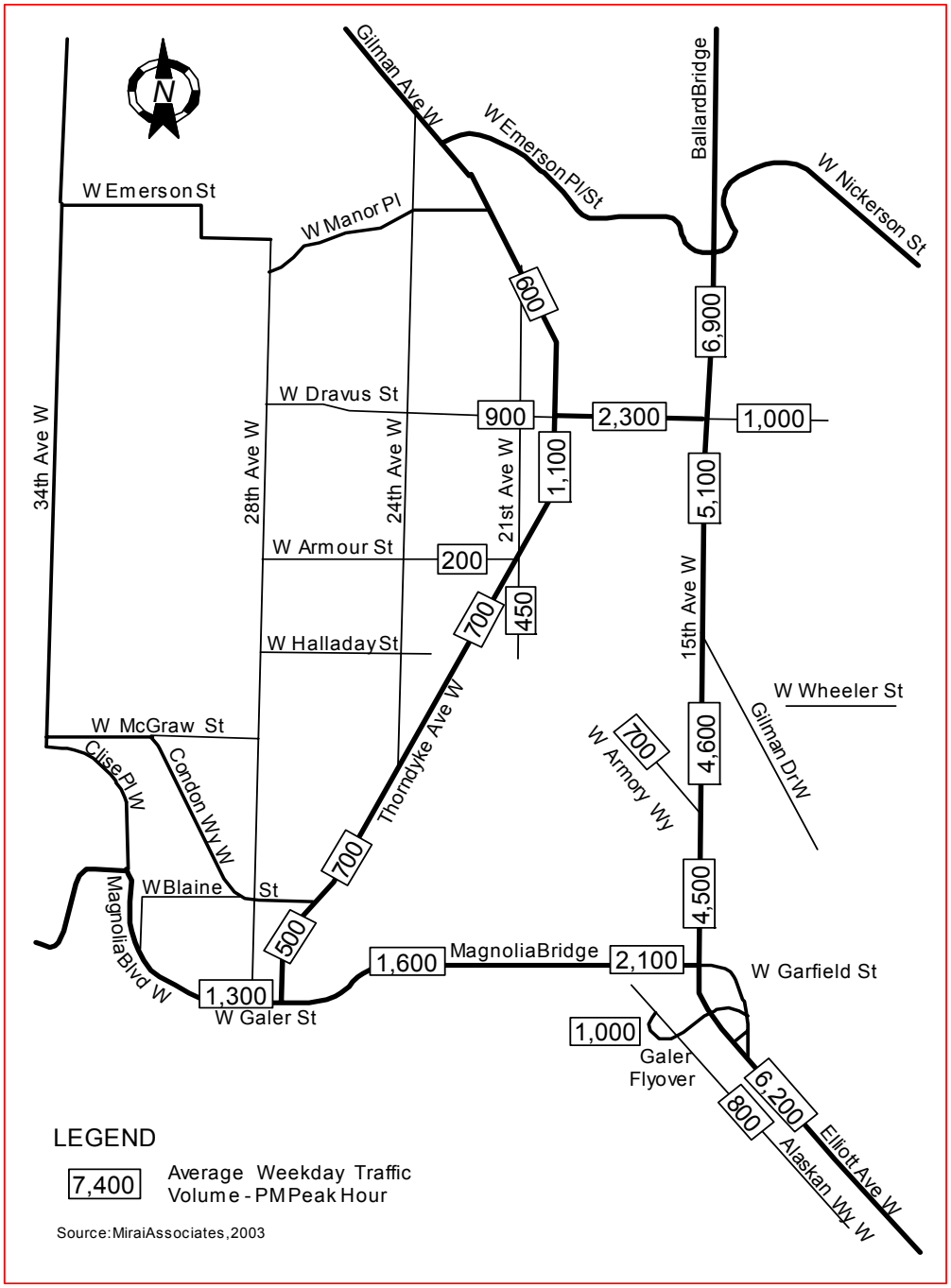


Figure 24
2030 Traffic Volumes, No Build Alternative

- The growth would vary in the Thorndyke Avenue West/20th Avenue West/Gilman Avenue West corridor. At both ends of the corridor the growth rate would be less. Near West Emerson Place in the north, growth would be 20 percent. Near West Blaine Street at the south end, the growth would be 25 percent. South of 22nd Avenue West, the growth rate on Thorndyke

Avenue West would be 133 percent. The 2030 projected two-way PM peak hour volume would be 1,100 vehicles (AWDT of about 11,000 vehicles per day) immediately south of West Dravus Street. The growth associated with North Bay under existing zoning and completion of the 21st Avenue West surface street, along with normal growth for the area, would result in this immediate area having a growth rate higher than the surrounding area.

- Traffic volumes on West Dravus Street between 20th Avenue West and 15th Avenue West would grow by 44 percent. The PM peak hour vehicles would increase from 1,600 existing to 2,300 vehicles per hour in 2030, for an annualized growth rate of 1.2 percent.
- The Magnolia Bridge corridor would have an overall 30-year growth of 14 percent to 30 percent. The two-way flow for the PM peak hour on the Magnolia Bridge would increase from 1,700 to 2,100 vehicles per hour during that time. The annualized growth rate would be 0.7 percent for this location.

Traffic volumes using the local streets in east Magnolia would increase on average by 50 percent by 2030. These streets would each carry up to 2,000 vehicles per day. This represents a growth rate of 1.5 percent annually.

Streets that would be affected by growth include: West Plymouth Street, West Boston Street, West Armour Street and 24th Avenue West. They provide access to streets and properties that are interior to the general area surrounded by Thorndyke Avenue West, West Dravus Street, 28th Avenue West, and West Blaine Street. There would continue to be a minimum of cut-through traffic because of the steep grades and narrow streets.

The extension of 21st Avenue West between Smith Cove and Thorndyke Avenue West is assumed to be constructed with either the no build or build alternatives. This connection would increase traffic along the Thorndyke Avenue West and 20th Avenue West arterial, but would not cause a significant change in traffic patterns on the local residential street system in Magnolia.

Intersection Operations

As shown in Table 17, signalized intersections would operate at LOS C or better during the AM and PM peak hours, under the No Build Alternative in 2010. With the added eastbound to southbound Elliott Avenue West ramp on the Galer Flyover, operations at the Elliott Avenue West/Galer Flyover intersection would improve to LOS A. Volume diagrams of this intersection are shown in Appendix A.

Operations for unsignalized intersections in 2010 are also shown in Table 17. During the AM peak hour, poor traffic operations would occur at the intersection of Gilman Avenue West/West Emerson Place, which would operate at LOS E in its existing, four-way stop configuration. Another location with poor operations would be the intersection of Thorndyke Avenue West/West Galer Street. The southbound approach of this intersection is stop-controlled and would operate at LOS E.

During the PM peak hour, the intersection of Gilman Avenue West/West Emerson Place West would operate at LOS F in the evening period, due to high volumes and long delays in the southbound left and westbound movements. The intersection of Thorndyke Avenue West/West Galer Street would also operate at LOS F, due to high delay for the southbound stop-controlled approach.

Table 17
2010 Intersection Operations, No Build Alternative

	AM Peak Hour			PM Peak Hour		
Signalized Intersections	**LOS[1] (Delay)[2]**	**ICU[3] (%)**	**V/C[4] (max.)**	**LOS[1] (Delay)[2]**	**ICU[3] (%)**	**V/C[4] (max.)**
15th Ave W SB Ramps & W Dravus St	B (18.9)	75.4	1.00	C (26.7)	73.3	1.00
15th Ave W NB Ramps & W Dravus St	B (12.6)	68.5	0.85	B (13.3)	75.9	0.92
15th Ave W & Gilman Dr W	B (11.9)	88.2	0.88	C (22.6)	89.1	0.97
15th Ave W & W Armory Way	A (4.5)	83.2	0.77	A (5.4)	70.0	0.72
15th Ave W & W Garfield St	A (3.0)	74.8	0.71	A (8.6)	68.7	0.74
Elliott Ave W & W Galer St	A (4.4)	87.3	0.87	A (0.4)	59.8	0.56
Elliott Ave W & Galer Flyover	A (4.1)	101.6	0.84	A (8.0)	107.8	0.96
Alaskan Way W & Galer Flyover	A (3.7)	60.3	0.53	B (12.2)	60.3	0.85
20th Ave W & W Dravus St	B (15.0)	69.8	0.85	C (21.8)	77.0	0.93
Thorndyke Ave W & 21st Ave W	C (26.0)	61.9	0.62	C (29.4)	77.6	0.83
Unsignalized Intersections	**LOS[1] (Delay)[2]**	**Worst Approach**		**LOS[1] (Delay)[2]**	**Worst Approach**	
Gilman Ave W & W Emerson Pl	E (40.8)	Southbound		F (193.1)	Westbound	
Thorndyke Ave W & W Blaine St	B (11.7)	-		B (12.5)	-	
Thorndyke Ave W & W Galer St	E (36.0)	Southbound		F (91.6)	Southbound	
32nd Ave W & Clise Pl W	B (11.8)	-		B (11.6)	-	
Magnolia Blvd. & W Howe St	C (18.3)	-		C (22.8)	-	
21st Ave W & Magnolia Bridge (north ramp)	A (7.5)	-		A (3.9)	-	
21st Ave W & Magnolia Bridge (south ramp)	A (7.7)	-		A (9.3)	-	

Notes: [1] Level of service.
[2] Delay is in seconds per vehicle.
[3] Intersection Capacity Utilization.
[4] Volume to capacity ratio.
Source: HNTB, 2003

As shown in Table 18, signalized intersections in the study area would generally operate at LOS C or better during the AM peak hour and LOS D in the PM peak hour in 2030. The West Dravus Street/20th Avenue West and West Dravus Street/15th Avenue West southbound ramps intersections would operate at LOS E in the PM peak with average delays of more than 70 seconds per vehicle. The unsignalized intersections of Gilman Avenue West/West Emerson Place and Thorndyke Avenue West/West Galer Street would operate at LOS E and F during

the 2030 AM and PM peak hours, respectively. PM peak hour delays would exceed three minutes per vehicle on the worst approaches.

Table 18
2030 Intersection Operations, No Build Alternative

	AM Peak Hour			PM Peak Hour		
Signalized Intersections	**LOS[1] (Delay)[2]**	**ICU[3] (%)**	**V/C[4] (max.)**	**LOS[1] (Delay)[2]**	**ICU[3] (%)**	**V/C[4] (max.)**
15th Ave W SB Ramps & W Dravus St	C (20.4)	85.4	1.00	E (73.9)	86.8	1.31
15th Ave W NB Ramps & W Dravus St	B (15.6)	75.2	0.90	C (21.7)	89.8	1.11
15th Ave W & Gilman Dr W	B (16.7)	90.6	0.93	D (40.5)	101.0	1.13
15th Ave W & W Armory Way	B (13.1)	90.4	0.93	A (6.2)	79.2	0.84
15th Ave W & W Garfield St	A (5.1)	78.0	0.82	B (10.4)	70.8	0.74
Elliott Ave W & W Galer St	A (6.2)	87.3	0.87	A (0.4)	64.0	0.60
Elliott Ave W & Galer Flyover (Ramp[5] merge to 3 SB lanes)	B (15.7)	101.8	1.09	B (10.8)	109.9	1.02
Alaskan Way W & Galer Flyover	B (14.2)	84.4	0.89	C (21.9)	78.4	0.95
20th Ave W & W Dravus St	B (19.0)	76.1	0.89	E (71.4)	81.6	1.23
Thorndyke Ave W & 21st Ave W	C (27.1)	66.7	0.74	D (40.1)	81.3	0.91
Unsigalized Intersection	**LOS[1] (Delay)[2]**	**Worst Approach**		**LOS[1] (Delay)[2]**	**Worst Approach**	
Gilman Ave W & W Emerson Pl	E (43.7)	Southbound		F (207.3)	Westbound	
Thorndyke Ave W & W Blaine St	B (12.0)	-		C (16.6)	-	
Thorndyke Ave W & W Galer St	E (45.4)	Southbound		F (198.0)	Southbound	
32nd Ave W & Clise Pl W	B (11.5)	-		B (11.9)	-	
Magnolia Blvd. & W Howe St	B (12.5)	-		D (26.1)	-	
21st Ave W & Magnolia Bridge (north ramp)	A (8.3)	-		A (9.7)	-	
21st Ave W & Magnolia Bridge (south ramp)	A (8.8)	-		A (10.1)	-	

Notes: [1] Level of service.
[2] Delay is in seconds per vehicle.
[3] Intersection Capacity Utilization.
[4] Volume to capacity ratio.
[5] Planned ramp on Galer Flyover
Source: HNTB, 2003

The operation of the Alaskan Way West/Galer Flyover intersection was evaluated using SimTraffic software to determine average queue lengths on the three single-lane approaches. SimTraffic was also used to determine whether the simulated

queues were decreasing or increasing at the end of the four, 15-minute simulation intervals. Table 19 shows the results of this analysis for both 2010 and 2030.

Under the No Build Alternative in 2010, the highest traffic demands would be on the west approach, from the Galer Flyover, in the AM peak and on the south approach, from Alaskan Way West, in the PM peak. By 2030, this traffic would include the build-out of the Amgen site. The queue approaching the intersection from the south would average about 400 feet (up to 16 cars) in the PM peak hour. This queue would extend through the Alaskan Way West/West Galer Street surface intersection which serves properties along 16th Avenue West.

Table 19
Alaskan Way West/Galer Flyover Intersection Queuing, No Build Alternative

	2010 Queues (feet)		2030 Queues (feet)	
Intersection Approach	**AM**	**PM**	**AM**	**PM**
Galer Flyover, west leg	180 ↓	100 ↓	210 ↑	160 ↑
Alaskan Way W, north leg	60 ↑	60 ↑	60 ↑	50 ↓
Alaskan Way W, south leg	110 ↑	290 ↑	140 ↑	430 ↑

Notes: ↓ = queue decreasing at end of simulation period.
↑ = queue increasing at end of simulation period.
Source: HNTB, 2004

Transit Facilities

Route Modifications

As no changes would be made to the existing bridge structure with the No Build Alternative, no changes in bus routes would be expected. Changes in route schedules, such as frequency or coverage, could be made to coordinate with the Green Line Monorail service that would also travel on 15th Avenue West.

While the location and the timing of the monorail stations near the bridge are not yet determined, there would be a station on the block between 16th Avenue West and 15th Avenue West south of West Dravus Street that could increase the pedestrian traffic on West Dravus Street. The location of the future Interbay Station, not yet determined, has the potential to become an intermodal hub in the area with access from monorail, commuter rail, water transport, and bus transfer. In this location, the station could serve Amgen, Terminal 91/North Bay and Smith Cove.

Ridership

By 2010, bus transit, commuter rail, and the monorail are expected to be providing service in the corridor. Total study area transit ridership could increase by nearly 4,000 riders, an annualized rate of over 4 percent from existing. Between 2010 to 2030, ridership would grow at a 5 percent annualized rate with up to 15,000 additional riders on all modes. It would be difficult to assess the exact mode share split of these services. Certainly shifts from transit to monorail could be expected. Without a planned commuter rail station in the Interbay area, a mode shift to commuter rail would not occur.

Pedestrian and Bicycle Facilities

Pedestrian and bicycle travel would grow in proportion to the population and employment in Seattle. The No Build Alternative would not change the access for pedestrians and bicycles in the Magnolia Bridge corridor. The existing connections at the east and west ends of the bridge would be maintained. All existing staircases to/from the bridge deck would remain the same, as would the existing circulation patterns and connections. Access to the Elliott Bay Trail to downtown Seattle would remain the same. The addition of the north-south roadway corridor through the Port property will facilitate non-motorized access from Magnolia to the Elliott Bay Marina via 21st Avenue West. This road will also connect to the Elliott Bay Trail. Travel times for pedestrians and bicycles would be similar to existing conditions.

Freight and Goods

Trucks

By 2030 in the No Build Alternative, truck volumes would grow in proportion to the growth in population and employment in the area. Table 20 illustrates the expected truck volume growth on key roadway links and North Bay/Terminal 91 area. The 15th/Elliott Avenue West corridor would continue to provide the major truck access to and from Terminal 91. AM peak hour truck volumes are forecast to increase on 15th/Elliott Avenue West by almost 150 trucks per hour, many of them destined to businesses in the North Bay/Terminal 91 area. PM peak hour truck volumes on Elliott Avenue West would increase by 30 vehicles. North Bay/Terminal 91 truck volumes are expected to be 200 vehicles per hour in the AM peak hour representing a four-fold increase over current Terminal 91 truck volumes. This would be consistent with the forecast growth in employment in the North Bay/Terminal 91 area. PM peak hour port-related truck volumes would increase to 70 vehicles per hour, reflecting the fact that truck volumes peak earlier in the afternoon than the design peak hour.

Table 20
2002 & 2030 Truck Volumes, No Build Alternative

Truck Route	Trucks per Hour (both directions)*			
	AM Peak Hour		PM Peak Hour	
	2002	2030	2002	2030
Galer Flyover	30	85	20	35
Magnolia Bridge	20	95	5	30
21st Ave W (surface street)	0	20	0	15
Elliott Ave W (south of W Galer St)	90	245	70	100
North Bay/Terminal 91 Trucks (all routes)	50	200	10	70

Note: *Truck volumes do not include school buses
Source: Mirai Associates

In the No Build Alternative, the Galer Flyover would continue to serve as the major access for heavy truck traffic serving Terminal 91 activities. With the extension of 21st Avenue West to serve the North Bay area, trucks also could use the existing ramps to connect from the Magnolia Bridge to 21st Avenue West. Large trucks would be restricted from West Dravus Street due to turning constraints at the 15th Avenue West intersections.

As a result, truck volumes on the Magnolia Bridge between 15th Avenue West and the west ramps would be expected to increase during the AM peak hours from 20 currently to almost 100 trucks per hour in 2030. Similarly, truck volumes on the Galer Flyover are forecast to increase from the current 30 trucks to a high of around 85 trucks in the AM peak hour. PM peak hour truck volumes on the Magnolia Bridge and Galer Flyover would be much lower. It is assumed that the current school bus parking on the Port property would be relocated outside of this area once the North Bay property is developed.

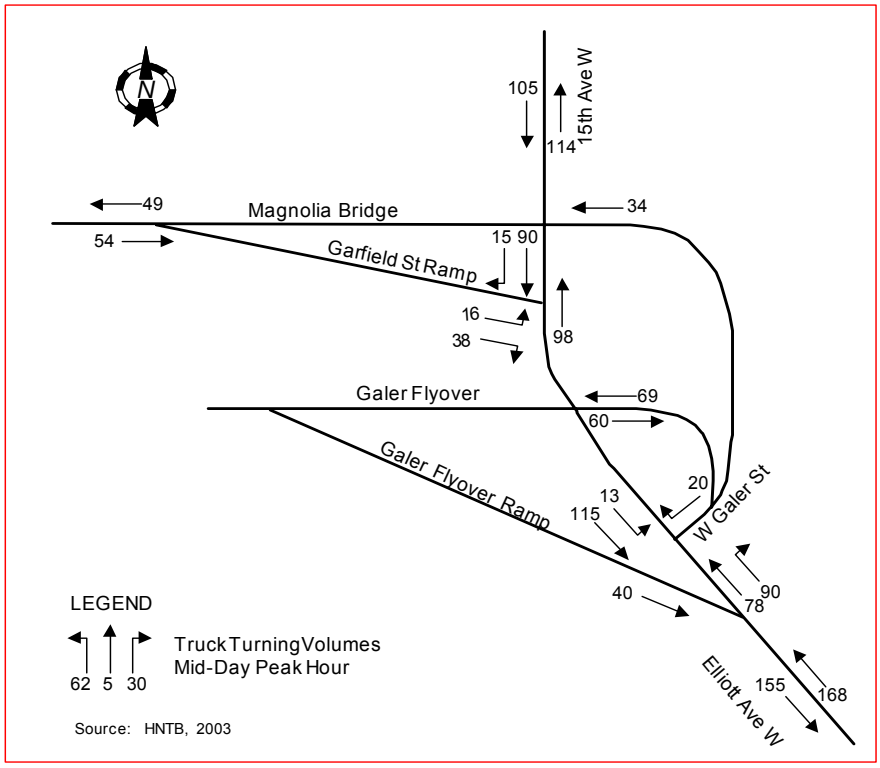


Figure 25
2030 Mid-Day Peak Hour Truck Volumes, No Build Alternative

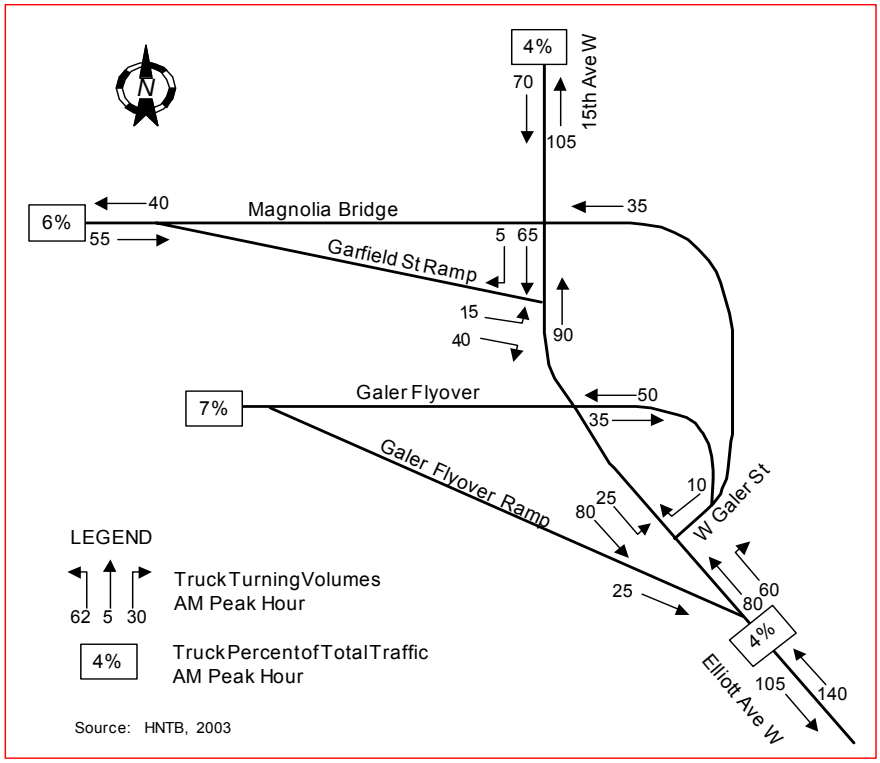


Figure 26
2030 AM Peak Hour Truck Volumes, No Build Alternative

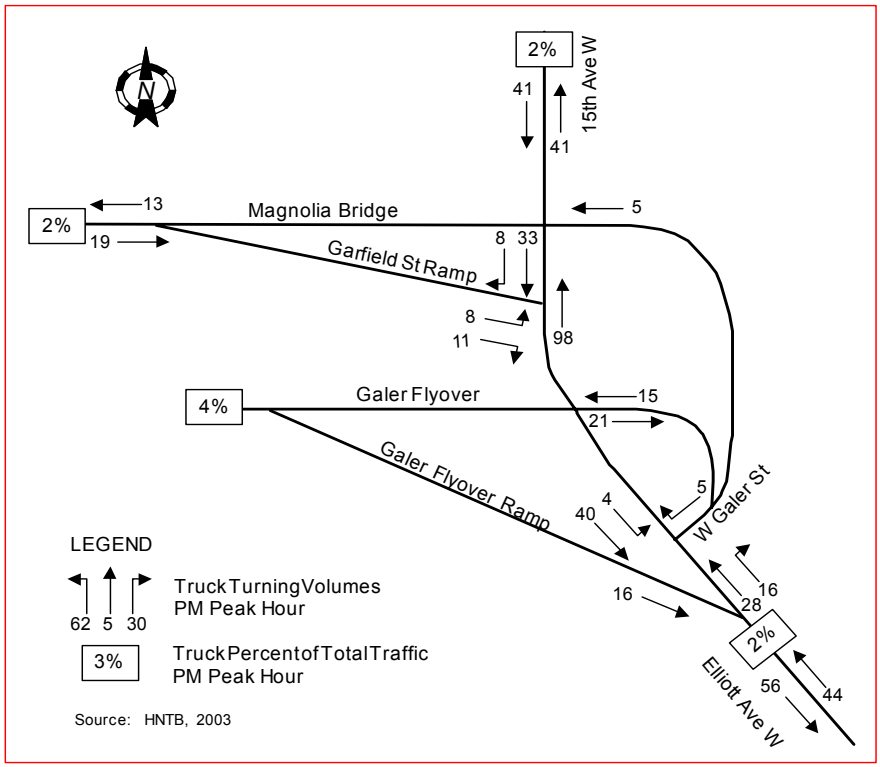


Figure 27
2030 PM Peak Hour Truck Volumes, No Build Alternative

Truck turning movements for the 2030 design year are shown graphically. Mid-day peak hour (12 to 1 PM) turning movements are shown in Figure 25, AM peak hour (8 to 9 AM) turning movements shown in Figure 26, and PM peak hour (5 to 6 PM) truck turning movements are shown in Figure 27. The midday period would continue to experience the highest truck volume, with over 300 trucks hourly on Elliott Avenue West south of the Galer Flyover. The combined effects of growth in through and local truck traffic would result in increases of 64 to 80 percent in truck volumes on Elliott Avenue West during the various time periods, compared to existing levels.

Railroads

Since the No Build Alternative would not have at-grade railroad crossings, there would be no impact to future railroad operations.

Emergency Vehicles

Under the No Build Alternative, there would be no change in the access routes other than providing access to the new 21st Avenue West surface street from the existing bridge ramps to 23rd Avenue West. Access distances would be the same as the existing conditions.

If there were an incident, such as an earthquake, that would affect the viability of the Magnolia Bridge structure, incident response would be affected. Emergency vehicles that would normally use the Magnolia Bridge would be rerouted to West Dravus Street and West Emerson Street. There would be additional congestion and additional travel distance because of the loss of the route.

Safety

Collision patterns in the study area would be expected to remain similar to existing conditions. The numbers of collisions may grow with increasing volumes of traffic and increasing levels of congestion.

Alternative A

Traffic Operations

Street Network

With Alternative A, the Magnolia Bridge would be replaced immediately south of the existing bridge, with connections on the east to 15th/Elliott Avenue West and west to West Galer Street on Magnolia Bluff similar to those today. Patterns of access would be similar to those in the No Build Alternative.

The two options under consideration for Alternative A would function differently at the junction with the 21st Avenue West surface street. Alternative A – Intersection would allow for full turning movements at the junction. Alternative A – Ramps would allow only movements to and from the east. Alternative A – Ramps would be functionally similar to the No Build Alternative, where two sets of ramps to 23rd Avenue West serve only movements to and from the east at the existing Magnolia Bridge.

Trips between the Magnolia community and the waterfront would use Thorndyke Avenue West and the 21st Avenue West surface street with Alternative A – Ramps. In Alternative A – Intersection, these trips would be served by an intersection on the proposed bridge.

Traffic Volume Distribution

Under Alternative A – Ramps, traffic patterns in the study area would be similar to the No Build Alternative.

Under Alternative A – Intersection, a slight difference in traffic volumes from the No Build Alternative and Alternative A – Ramps would be expected. This difference would be due to the direct access between Magnolia and the waterfront from the proposed bridge. Traffic in both the northbound and southbound direction of Thorndyke Avenue West would decrease. The forecasts indicate a volume of about 10 vehicles in both the AM and the PM peak hours in each direction for these trips.

An increase to 50 vehicles in the PM peak hour was assumed between Magnolia and the waterfront for a sensitivity test at the intersection of Thorndyke Avenue West/21st Avenue West. Even with this worst-case assumption, the effect of the diversion would not be significant.

Traffic Growth

Traffic growth for Alternative A would be identical to the No Build Alternative.

Intersection Operations

Intersection operations under Alternative A – Ramps would be identical to the No Build Alternative for both the AM and PM peak hours in 2010 and 2030, see Table 17 and Table 18. Signalized intersections along the 15th/Elliott Avenue West and West Dravus Street corridors would operate at LOS E or better, with the LOS E operation occurring at the West Dravus Street at 20th Avenue West and 15th Avenue West southbound ramp intersections in the 2030 PM peak hour. Table 19 shows intersection queuing conditions at the Alaskan Way West/Galer Flyover intersection for the No Build Alternative that would also be the same for either Alternative A – Ramp or Alternative A – Intersection.

Intersection operations under Alternative A – Intersection would be similar to the No Build Alternative except there would be no ramps down to the 21st Avenue West surface street. There would, however, be a signalized intersection on the proposed bridge. The projected operation of this intersection for both the AM and PM peak hours in 2010 and 2030 are shown in Table 21. Volume diagrams of this intersection are shown in Appendix A.

Table 21
2010 & 2030 Signalized Intersection Operations,
Alternative A – Intersection

21st Ave W Ramp & Magnolia Bridge	AM Peak Hour LOS[1] (Delay)[2]	AM Peak Hour ICU[3] (%)	AM Peak Hour V/C[4] (max.)	PM Peak Hour LOS[1] (Delay)[2]	PM Peak Hour ICU[3] (%)	PM Peak Hour V/C[4] (max.)
2010 (Opening Year)	A (6.7)	65.3	0.85	A (8.9)	53.4	0.73
2030 (Design Year)	B (11.2)	75.4	0.91	B (12.9)	60.3	0.79

Notes: [1]Level of service.
[2]Delay is in seconds per vehicle.
[3]Intersection Capacity Utilization.
[4]Volume to capacity ratio.
Source: HNTB, 2003

Two unsignalized intersections, also identified in the No Build Alternative, would operate at poor levels of service in the future. These locations, Gilman Avenue West/West Emerson Place and Thorndyke Avenue West/West Galer Street, would experience increasing delays on stop-controlled minor approach legs.

Transit Facilities

Route Modifications

No major changes to bus routes would be expected with Alternative A as the bridge would remain in the same location as the existing bridge with the same connections at both the east and west ends. With Alternative A, the same or equivalent bus access would be available, either by building the required bus stops on the structure, or by a Metro bus route revision through the North Bay development.

Compatibility with the Green Line monorail, waterfront street car and potential commuter rail access would remain the same as in the No Build Alternative.

Ridership

Ridership would increase in the corridor as discussed under the No Build Alternative as the conditions would remain the same.

Pedestrian and Bicycle Facilities

Alternative A would provide a ten-foot wide sidewalk, barrier-separated from the adjacent traffic lane, on the south side of the new bridge. Sixteen-foot-wide, outside traffic lanes in both directions would provide room for bicyclists.

Pedestrian and bicycle non-motorized access to Magnolia and 15th/Elliott Avenue West at either end of the bridge for Alternative A would be similar to the No Build Alternative. Stairways similar to existing would be provided at mid-bridge and near the east end of the bridge. The mid-bridge stairway location(s) to Port of Seattle property would be coordinated with the Port in order to assure the security of the Terminal 91 operation.

Alternative A – Ramps

Pedestrian and bicycle connections would be similar to the No Build Alternative. As a result, non-motorized travel times would also be similar to the No Build

Alternative. The ramps to 21st/23rd Avenue West would be to and from the east and would provide bicycle connections from 15th/Elliott Avenue West corridor to the North Bay property and the waterfront. Bicycle users to and from Magnolia would access North Bay, the waterfront, and the Elliott Bay Trail via the 21st or 20th Avenue West surface streets from Thorndyke Avenue West.

Pedestrians would have stairway access at mid-bridge to North Bay property. Terminal 91 would remain restricted to public access although there could be secured access for Terminal 91 employees. Pedestrian using the south sidewalk and bicyclists using either the south sidewalk or the eastbound travel lane would be required to cross the eastbound on-ramp. Bicyclist using the westbound travel lane would also cross the westbound off-ramp. Pedestrians and bicyclists would yield to ramp traffic before crossing the ramps.

Alternative A – Intersection

The intersection on the bridge would provide a safer design for bicycles and pedestrians on the bridge than the No Build Alternative or Alternative A – Ramps, since the intersection would be signalized and there would be no ramps to cross. The intersection design would also allow for direct pedestrian and bicycle connections from Magnolia down to the North Bay property and the waterfront. This would save time for non-motorized users that would be heading to the marina area from Magnolia or connecting to the western end of the Elliott Bay Trail. Users heading from Magnolia to downtown Seattle would need to follow the Elliott Bay Trail around the north end of the North Bay property or continue to access the trail from Elliott Avenue West and the Galer Flyover. Direct public access would still be restricted across the secured Terminal 91 property.

Freight and Goods

Trucks

Alternative A – Ramps would provide the same access for trucks as the No Build Alternative.

Alternative A – Intersection would be identical to Alternative A – Ramps in terms of truck access to Magnolia and 15th/Elliott Avenue West. The intersection design on the bridge would require trucks to turn from the bridge onto a connecting ramp at a signalized intersection. The design would also allow trucks to access the North Bay property to/from Magnolia at that intersection. Truck volumes for this movement would be expected to be low.

Truck turning movements for the 2030 design year would be the same as for the No Build Alternative. Mid-day peak hour (12 to 1 PM) turning movements are shown in Figure 25, AM peak hour (8 to 9 AM) turning movements shown in Figure 26, and PM peak hour (5 to 6 PM) truck turning movements are shown in Figure 27.

Railroads

Since Alternative A would have no at-grade railroad crossings, there would be no impact to future railroad operations.

Emergency Vehicles

Seattle Fire Department

Alternative A – Ramps would provide the same response routes that the No Build Alternative would provide. The connection from the new bridge structure to the Terminal 91 and Smith Cove would be provided by half-diamond ramps to and from the east. The ramps would connect to a new surface street that will connect 21st Avenue West to Smith Cove and Terminal 91.

Alternative A – Intersection would provide similar access to the area but would have a signalized intersection mid-span. There would be up to a 0.4 mile increase in travel distance to Smith Cove and Terminal 91 because of the length of connector street between the Magnolia Bridge intersection and the 21st Avenue West intersection.

The first-in emergency responses to Smith Cove and Terminal 91 would travel via the West Dravus Street/20st Avenue West route. The second-in responses could use the Magnolia Bridge route. The 21st Avenue West surface street would reduce the first-in response distance to Smith Cove by 0.2 mile.

Emergency response from Station 41, located within Magnolia Village, to Smith Cove and Terminal 91 would be routed through a u-turn to access the westbound ramp, under Alternative A – Ramps, or via the signalized intersection, under Alternative A – Intersection.

The response distance and the change relative to the No Build Alternative for fire and medic emergency vehicles operated by the Seattle Fire Department are shown in Table 22 and Table 23.

Table 22
Emergency Response Impacts, Alternative A – Ramps

	Distance/Change Relative to No Build Alternative (miles)				
Location	**Station 8**	**Station 18**	**Station 20**	**Station 41**	**HVM**
W Dravus St/20th Ave W	3.0/n.c.	2.0/n.c.	0.7/n.c.	1.5/n.c.	5.3/n.c.
Terminal 91	1.9/n.c.	3.0/n.c.	1.7/n.c.	2.1/n.c.	3.9/n.c.
Smith Cove	2.4/n.c.	3.0/-0.2	1.6/-0.2	1.6/n.c.	4.4/n.c.
Magnolia Village	4.4/n.c.	3.4/n.c.	2.1/n.c.	-	5.3/n.c.

Note: n.c. = no change
Source: Mirai Associates, HNTB, 2004

Table 23
Emergency Response Impacts, Alternative A – Intersection

	Distance/Change Relative to No Build Alternative (miles)				
Location	**Station 8**	**Station 18**	**Station 20**	**Station 41**	**HVM**
W Dravus St/20th Ave W	3.0/n.c.	2.0/n.c.	0.7/n.c.	1.5/n.c.	5.3/n.c.
Terminal 91	1.9/n.c.	3.0/n.c.	1.7/n.c.	2.3/**+0.2**	3.9/n.c.
Smith Cove	2.8/**+0.4**	3.0/-0.2	1.6/-0.2	1.8/**+0.2**	4.8/**+0.4**
Magnolia Village	4.4/n.c.	3.4/n.c.	2.1/n.c.	-	5.3/n.c.

Note: n.c. = no change
Source: Mirai Associates, HNTB, 2004

Seattle Police Department

The Seattle Police Department depends on patrol units assigned to the Queen 1 and Queen 2 precinct districts for first response to incidents. The response routing is based on the discretionary judgment of the patrol officers involved.

Support response would come from patrol units originating from the Queen Anne area and downtown Seattle area. Route choices would be dependant on the location of the responding units. The distance comparisons for the Magnolia Bridge routes for Alternative A would be similar to those shown in Table 22 and Table 23 for the fire department.

Safety

The number of collisions and collision rates would be similar to the No Build Alternative because traffic patterns would remain generally unchanged. Alternative A – Intersection might experience a higher collision rate than Alternative A – Ramps, because through traffic on the bridge would be interrupted with signal control. Alternative A – Ramps would create some out-of-direction travel using Thorndyke Avenue West and the 21st Avenue West surface street, but only for light volumes of local traffic (under 50 vehicles per hour).

Alternative A – Intersection would replace the existing eastbound on-ramp crossing for pedestrians on the south side of the bridge with a continuous, barrier-separated sidewalk on the south side of the new structure. This would remove an existing pedestrian/vehicle conflict location. The traffic signal at the elevated ramp intersection would include pedestrian cross walks and signal phases to allow crossing from the south sidewalk, to the ramp sidewalk, to 21st Avenue West.

Alternative A – Ramps would require pedestrians using the south sidewalk to cross on-ramp traffic. This would be similar to the existing and No Build condition.

Overall safety impacts of Alternative A would not be significant for either of its configurations at 21st Avenue West.

Alternative C

Traffic Operations

Street Network

With Alternative C, the Magnolia Bridge would be replaced with two structures connected by surface road to the north of the existing bridge. The connections on the east and west limits would be similar to those of today. The surface road between the two structures would cross the planned 21st Avenue West surface street with a signalized intersection. Traffic patterns would remain similar to the No Build Alternative and Alternative A.

Trips between the Magnolia community and waterfront would use either the new bridge in front of the bluff down to the 21st Avenue West surface street or Thorndyke Avenue West to 21st Avenue West.

Traffic Growth

Traffic growth for Alternative C would be essentially the same as the No Build Alternative and Alternative A. The added distance of the Alternative C route between Magnolia Bluff and 15th Avenue West, when compared to the No Build Alternative and Alternative A, would increase travel time by about one minute, but would not result in a significant diversion to an alternate route such as West Dravus Street.

Traffic Volume Distribution

Under Alternative C, PM peak hour traffic volumes would be reduced by about 10 vehicles in each direction on Thorndyke Avenue West due to the direct access between Magnolia and the waterfront that would be provided. Traffic patterns would be similar to Alternative A – Intersection.

Intersection Operations

Intersection operations under Alternative C would be identical to the No Build Alternative for both the AM and PM peak hours in 2010 and 2030, see Table 17 and Table 18, with the exception of the signalized intersection with the 21st Avenue West surface street. Table 19 shows intersection queuing conditions at the Alaskan Way West/Galer Flyover intersection for the No Build Alternative that would also be the same for Alternative C.

The projected operations of the intersection with the 21st Avenue West surface street for both the AM and PM peak hours in 2010 and 2030 are shown in Table 24. Volume diagrams of this intersection are shown in Appendix A.

Table 24
2010 & 2030 Signalized Intersection Operations, Alternative C

	AM Peak Hour			PM Peak Hour		
21st Ave W Surface Street & Alternative C Surface Road	**LOS[1] (Delay)[2]**	**ICU[3] (%)**	**V/C[4] (max.)**	**LOS[1] (Delay)[2]**	**ICU[3] (%)**	**V/C[4] (max.)**
2010 (Opening Year)	A (5.5)	47.9	0.56	A (6.3)	61.4	0.66
2030 (Design Year)	A (6.5)	57.0	0.60	A (7.9)	68.5	0.73

Notes: [1] Level of service.
[2] Delay is in seconds per vehicle.
[3] Intersection Capacity Utilization.
[4] Volume to capacity ratio.
Source: HNTB, 2004

Transit Facilities

Route Modifications

No major changes to bus routes would be expected with Alternative C as the bridge connections at both the east and west ends would remain the same. The travel distance for the Magnolia Bridge routes would increase by approximately 0.5 mile as the new structures would arc north with a surface road through the North Bay property. Travel time would increase about one minute compared to the No Build Alternative. This added bus travel time would be offset for North Bay transit riders if bus stops were in place on the surface road portion of the alignment. Additionally, North Bay transit riders would not need to use stairs or ramps as required for the

existing bridge or with Alternatives A and D. Metro bus routes could also use the planned surface 21st Avenue West for access through the North Bay development.

Compatibility with the planned Seattle Monorail Project Green Line, and potential waterfront street car and commuter rail access would remain the same as in the No Build Alternative.

Ridership

Ridership would increase in the corridor as discussed under the No Build Alternative and Alternative A as the conditions would remain the same.

Pedestrian and Bicycle Facilities

The pedestrian and bicycle facilities on the new Alternative C bridges would be similar to Alternative A. A ten-foot-wide sidewalk would be provided on the south side of the new structures. Sixteen-foot wide, outside traffic lanes in both directions would provide room for bicyclists. The 0.5 mile increased length and the 6.5 percent slope on the structure in front of the bluff would increase walking time by about ten minutes compared to the No Build Alternative.

Pedestrian and bicycle non-motorized access to Magnolia and 15th/Elliott Avenue West at either end of the bridge for Alternative C would be identical to Alternative A and the No build Alternative. Since a surface road connects the two structures, no stairways similar to the existing would be provided.

Alternative C would provide a safer design for bicycles and pedestrians than the No Build Alternative since there would be no ramps to cross. The intersection with the 21st Avenue West surface street would also allow for direct pedestrian and bicycle connections from Magnolia down to the Port property and the waterfront. This would save time for non-motorized users that would be heading to the marina area from Magnolia or connecting to the western end of the Elliott Bay Trail. Users heading from Magnolia to downtown Seattle would need to follow the Elliott Bay Trail from the intersection with the 21st Avenue West surface street. Direct public access would still be restricted across the secured Terminal 91 property.

Freight and Goods

Trucks

Truck access to Magnolia and 15th/Elliott Avenue West would be identical to the No Build Alternative. However, trucks would access the Port property from the intersection with the 21st Avenue West surface street in the middle of the North Bay property. The truck volumes for this turning movement would be low.

Truck turning movements for the 2030 design year would be the same as for the No Build Alternative. Mid-day peak hour (12 to 1 PM) turning movements are shown in Figure 25, AM peak hour (8 to 9 AM) turning movements are shown in Figure 26, and PM peak hour (5 to 6 PM) truck turning movements are shown in Figure 27.

Railroads

Since Alternative C would have no at-grade railroad crossings, there would be no impact to future BNSF main track railroad operations. Industrial tracks serving the Trident and City Ice buildings in Terminal 91 would be relocated to connect to the

BNSF mainline from the south of Alternative C and avoid an at-grade crossing of Alternative C.

Emergency Vehicles

Seattle Fire Department

Alternative C would provide access similar to the No Build Alternative, but would have a signalized intersection on the surface road portion. There would be up to a 0.5 mile increase in travel distance to Smith Cove and Terminal 91 because of the length of 21st Avenue West surface street connection between the Magnolia Bridge surface road intersection and the waterfront.

Because of Alternative C's curved alignment to the north, the travel distances across the bridge would be approximately 0.5 mile longer than the No Build Alternative.

The response distance and changes in response-distances for fire and medic emergency vehicles operated by the Seattle Fire Department are shown in Table 25.

Table 25
Emergency Response Impacts, Alternative C

	Distance/Change Relative to No Build Alternative (miles)				
Location	**Station 8**	**Station 18**	**Station 20**	**Station 41**	**HVM**
W Dravus St/20th Ave W	3.0/n.c.	2.0/n.c.	0.7/n.c.	1.5/n.c.	5.3/n.c.
Terminal 91	1.9/n.c.	3.0/n.c.	1.7/n.c.	2.5/**+0.4**	3.9/n.c.
Smith Cove	2.9/**+0.5**	3.0/-0.2	1.6/-0.2	2.0/**+0.4**	4.9/**+0.5**
Magnolia Village	4.4/n.c.	3.4/n.c.	2.1/n.c.	-	5.8/**+0.5**.

Note: n.c. = no change
Source: Mirai Associates & HNTB, 2004

Seattle Police Department

The Seattle Police Department would depend on patrol units assigned to the Queen 1 and Queen 2 precinct districts for first response to incidents as in the No Build Alternative.

Support response would be the same as Alternative A. The distance comparisons for the magnolia Bridge routes for Alternative C would be similar to those shown in Table 25.

Safety

With Alternative C, all east-west traffic bridge traffic and all north-south traffic would pass through signal control at a single location. Higher volumes of traffic would be served, involving multiple conflicts, compared to Alternative A. Under these conditions, the number of collisions and collision rates could be expected to be higher than either configuration of Alternative A or D.

Overall safety impacts of Alternative C would not be significant.

Alternative D

Traffic Operations

Street Network

With Alternative D, the Magnolia Bridge would be replaced to the north of the existing bridge, with connections on the east and west limits similar to those today. Alternative D would provide access patterns similar to the No Build Alternative and Alternative A.

The two options under consideration for Alternative D would function the same as Alternative A. Alternative D – Intersection would allow for full turning movements at the junction with the 21st Avenue West surface street. Alternative D – Ramps would allow only movements to and from the east. Alternative D – Ramps would be functionally similar to the No Build Alternative.

Trips between the Magnolia community and the waterfront would use Thorndyke Avenue West and the 21st Avenue West surface street with Alternative D – Ramps. In Alternative D – Intersection, these trips would be served by an intersection on the proposed bridge.

Traffic Growth

Traffic growth for Alternative D would be identical to the No Build Alternative and Alternative A.

Traffic Volume Distribution

Under Alternative D – Ramps, traffic patterns in the study area would be similar to the No Build Alternative and Alternative A.

Under Alternative D – Intersection, traffic volumes would be different on Thorndyke Avenue West due to the direct access between Magnolia and the waterfront that would be provided. Traffic patterns would be similar to Alternative A – Intersection.

Intersection Operations

Intersection operations under Alternative D – Ramps would be identical to the No Build Alternative and Alternative A for both the AM and PM peak hours in 2010 and 2030, see Table 17 and Table 18. Table 19 shows intersection queuing conditions at the Alaskan Way West/Galer Flyover intersection for the No Build Alternative that would also be the same for Alternatives A and D.

The Alternative D – Intersection elevated intersection on the bridge at the ramp to 21st Avenue West would operate similarly to Alternative A – Intersection (see Table 21 and Appendix A).

Two unsignalized intersections, also identified in the No Build Alternative, would operate at poor levels of service in the future. These locations, Gilman Avenue West/West Emerson Place and Thorndyke Avenue West/West Galer Street, would experience increasing delays on stop-controlled minor approach legs.

Transit Facilities

Route Modifications

No change to bus routes would be expected with Alternative D as the bridge would remain in nearly the same location with the same connections at both the east and west ends. The travel distance for the Magnolia Bridge routes would increase about one-tenth mile as the new structure would arc north of the existing structure. Travel time would increase about 10 seconds if similar bus stops were in place. With Alternative D, the same or equivalent bus access would be available, either by building the required bus stops on the structure, or by a Metro bus route revision through the North Bay development.

Compatibility with the Green Line monorail, waterfront street car, and potential commuter rail access would remain the same as in the No Build Alternative.

Ridership

Ridership would increase in the corridor as discussed under the No Build Alternative and Alternative A as the conditions would remain the same.

Pedestrian and Bicycle Facilities

The pedestrian and bicycle facilities on the new Alternative D bridge would be similar to Alternative A. A ten-foot-wide sidewalk would be provided on the south side of the new bridge. Sixteen-foot-wide, outside traffic lanes in both directions would provide room for bicyclists. The one-tenth mile increased length compared to No Build or Alternative A would increase walking time by about two minutes.

Pedestrian and bicycle non-motorized access to Magnolia and 15th/Elliott Avenue West at either end of the bridge for Alternative D would be identical to Alternative A and the No Build Alternative. Stairways similar to the existing at mid-span on the north and south sides of the structure, and east of the BNSF tracks on the south side of the structure would be provided.

Alternative D – Ramps

Pedestrian and bicycle connections would be similar to the No Build Alternative. As a result, non-motorized travel times would also be similar to the No Build Alternative. The ramps to 21st/23rd Avenue West would be to and from the east and would provide bicycle connections from 15th/Elliott Avenue West corridor to the North Bay property and the waterfront. Bicycle users to and from Magnolia would access North Bay, the waterfront, and the Elliott Bay Trail via the 21st or 20th Avenue West surface streets from Thorndyke Avenue West.

Pedestrians would have stairway access at mid-bridge to North Bay property. Terminal 91 would remain restricted to public access although there could be secured access for Terminal 91 employees. Pedestrian using the south sidewalk and bicyclists using either the south sidewalk or the eastbound travel lane would be required to cross the eastbound on-ramp. Bicyclist using the westbound travel lane would also cross the westbound off-ramp. Pedestrians and bicyclists would yield to ramp traffic before crossing the ramps.

Alternative D – Intersection

The intersection design on the bridge would provide a safer design for bicycles and pedestrians on the bridge than the No Build Alternative or Alternative D – Ramps, since there would be no ramps to cross. The intersection design would also allow for direct pedestrian and bicycle connections from Magnolia down to the Port property and the waterfront. This would save time for non-motorized users that would be heading to the marina area from Magnolia or connecting to the western end of the Elliott Bay Trail. Users heading from Magnolia to downtown Seattle would need to follow the Elliott Bay Trail around the north end of the North Bay property or continue to access the trail from Elliott Avenue West. Direct public access would still be restricted across the secured Terminal 91 property.

Freight and Goods

Trucks

Alternative D – Ramps would provide the same access for trucks as the No Build Alternative.

Alternative D – Intersection would be identical to Alternative D – Ramps in terms of truck access to Magnolia and 15th/Elliott Avenue West. The intersection design on the bridge would require trucks to turn from the bridge onto a connecting ramp at a signalized intersection. The design would also allow trucks to access the North Bay property to/from Magnolia at that intersection. Truck volumes for this movement would be expected to be low.

Truck turning movements for the 2030 design year would be the same as for the No Build Alternative. Mid-day peak hour (12 to 1 PM) turning movements are shown in Figure 25, AM peak hour (8 to 9 AM) turning movements shown in Figure 26, and PM peak hour (5 to 6 PM) truck turning movements are shown in Figure 27.

Railroads

Since Alternative D would have no at-grade railroad crossings, there would be no impact to future railroad operations.

Emergency Vehicles

Seattle Fire Department

Alternative D – Ramps would provide the same response routes as the No Build Alternative. The connection to the Terminal 91 and Smith Cove would be the same as Alternative A. Half-diamond ramps on the new Magnolia Bridge structure would connect to the 21st Avenue West surface street.

Alternative D – Intersection would provide access similar to Alternative A – Intersection with a signalized intersection mid-span. There would be up to a 0.3 mile increase in travel distance to Smith Cove and Terminal 91 because of the length of connector street between the Magnolia Bridge intersection and the 21st Avenue West intersection.

Because the alignment for Alternative D curves to the north, the travel distance across the bridge would be approximately 0.1 mile longer than Alternative A and the No Build Alternative.

The response distance and changes in response-distances for fire and medic emergency vehicles operated by the Seattle Fire Department are shown in Table 26 and Table 27.

Table 26
Emergency Response Impacts, Alternative D – Ramps

	Distance/Change Relative to No Build Alternative (miles)				
Location	**Station 8**	**Station 18**	**Station 20**	**Station 41**	**HVM**
W Dravus St/20th Ave W	3.0/n.c.	2.0/n.c.	0.7/n.c.	1.5/n.c.	5.3/n.c.
Terminal 91	1.9/n.c.	3.0/n.c.	1.7/n.c.	2.4/**+0.3**	3.9/n.c.
Smith Cove	2.5/**+0.1**	3.0/-0.2	1.6/-0.2	1.9/**+0.3**	4.5/**+0.1**
Magnolia Village	4.4/n.c.	3.4/n.c.	2.1/n.c.	-	5.4/**+0.1**

Note: n.c. = no change
Source: Mirai Associates & HNTB, 2004

Table 27
Emergency Response Impacts, Alternative D – Intersection

	Distance/Change Relative to No Build Alternative (miles)				
Location	**Station 8**	**Station 18**	**Station 20**	**Station 41**	**HVM**
W Dravus St/20th Ave W	3.0/n.c.	2.0/n.c.	0.7/n.c.	1.5/n.c.	5.3/n.c.
Terminal 91	1.9/n.c.	3.0/n.c.	1.7/n.c.	2.4/**+0.3**	3.9/n.c.
Smith Cove	2.8/**+0.4**	3.0/-0.2	1.6/-0.2	1.9/**+0.3**	4.8/**+0.4**
Magnolia Village	4.4/n.c.	3.4/n.c.	2.1/n.c.	-	5.4/**+0.1**

Note: n.c. = no change
Source: Mirai Associates & HNTB, 2004

Seattle Police Department

The Seattle Police Department would depend on patrol units assigned to the Queen 1 and Queen 2 precinct districts for first response to incidents as in Alternative A and the No Build Alternative.

Support response would be the same as Alternative A. The distance comparisons for the Magnolia Bridge routes for Alternative D would be similar to those shown in Table 26 and Table 27.

Safety

The number of collisions and collision rates would be similar to the No Build Alternative. The effects of Alternative D – Intersection and Alternative D – Ramps would be the same as in Alternative A.

Overall safety impacts of Alternative D would not be significant in either of its configurations at 21st Avenue West.

Alternative H

Traffic Operations

Street Network

In Alternative H, a new bridge would be provided at the North Crossing. Eastbound traffic would be carried on a one-lane bridge above West Armory Way, with

westbound traffic on a one-lane bridge along West Wheeler Street. At a junction east of the rail yard, two-way traffic would be combined on a common structure to Thorndyke Avenue West. The signalized intersection of 15th Avenue West/West Armory Way would be configured to serve both local traffic on West Armory Way and through traffic on the eastbound bridge. At the 15th Avenue West/West Wheeler Street intersection, a tunnel connection would be provided for northbound 15th Avenue traffic destined westbound, to avoid introducing new traffic conflicts on 15th Avenue West.

At the west end of the North Crossing, the Thorndyke Avenue West/West Halladay Street intersection would be signalized, and left-turn lanes would be provided on the intersection approaches. Thorndyke Avenue West would be widened to four lanes between West Halladay Street and 21st Avenue West.

Alternative H would include a South Crossing between Alaskan Way West on the east and West Galer Street on the west. An at-grade signalized intersection would be provided at the 21st Avenue West surface street. This intersection would provide access to North Bay/Terminal 91, Elliott Bay Marina, and Smith Cove Park.

Traffic Growth

The North Crossing would cause a shift in traffic from the South Crossing and West Dravus Street to the proposed crossing as shown in Figure 28. Traffic volumes for Alternative H compared with the No Build Alternative are shown in Table 28.

On 15th Avenue West, volumes between West Dravus Street and West Wheeler Street would increase about 4 percent because of traffic accessing the North Crossing instead of West Dravus Street. Between the Gaylor Flyover and West Wheeler Street, traffic would increase about 11 percent because of the shift in traffic from the South Crossing to West Wheeler Street.

The new connection of the North Crossing with Thorndyke Avenue West would cause the following shifts in traffic on Thorndyke Avenue West.

- South of 22nd Avenue West, the two-way PM peak hour volumes would increase 47 percent from 700 to 1,000 vehicles per hour.
- At the intersection of 20th Avenue West/West Dravus Street, there would be a shift in the traffic to through movements northbound and southbound on 20th Avenue West instead of turning to and from the east on West Dravus Street.
- The traffic volumes entering and leaving the intersection of West Galer Street /Thorndyke Avenue West would be reduced 29 percent from 3,400 vehicles during PM peak hour to 2,400.

The additional crossing with Alternative H would cause traffic to switch to the North Crossing and reduce the 2030 PM peak hour trips by 22 percent on West Dravus Street, and 38 percent on the South Crossing.

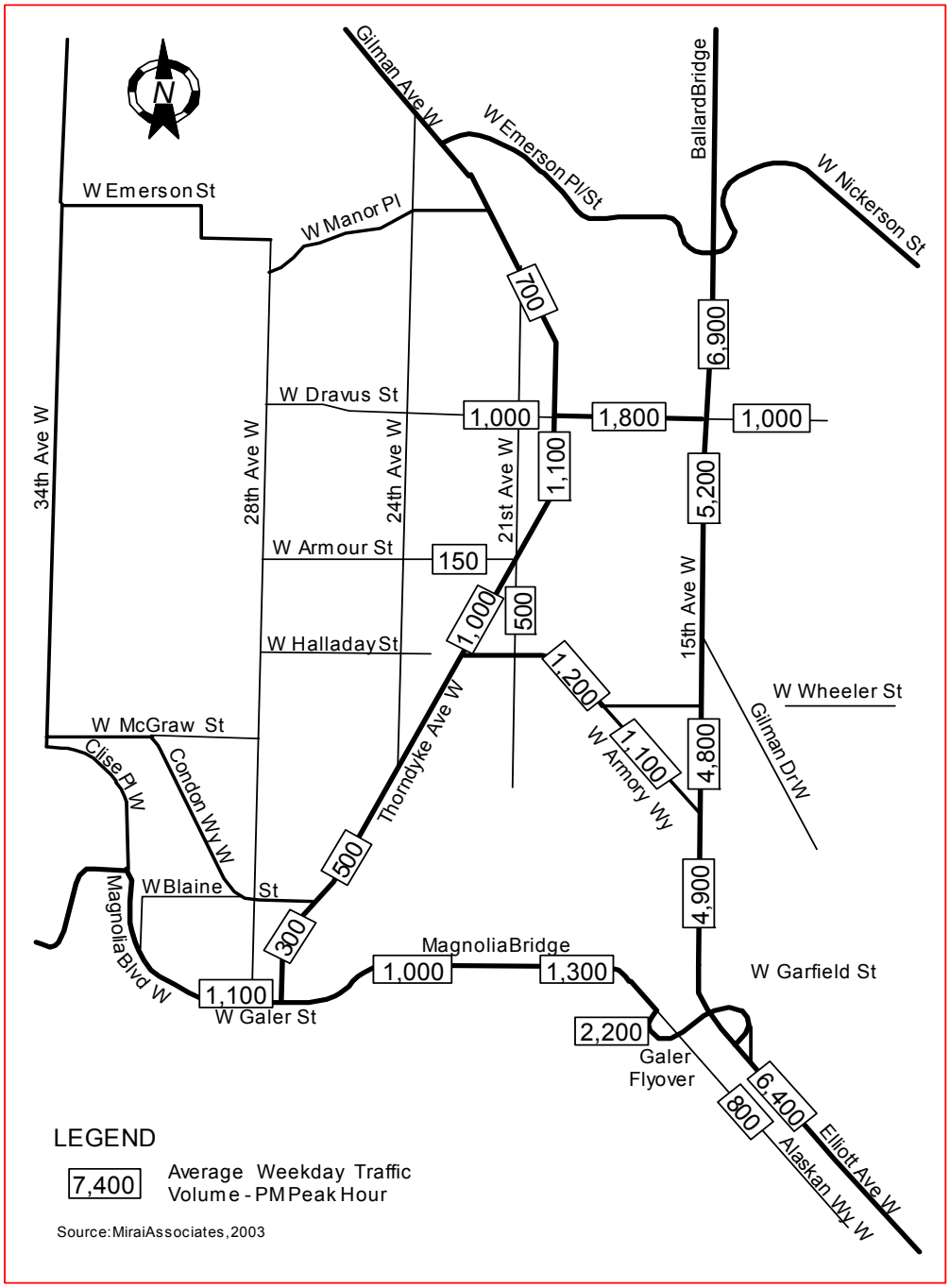


Figure 28
2030 Traffic Volumes, Alternative H

The Galer Flyover would have a 120 percent increase in traffic. This would result from a combination of the remaining Magnolia traffic with the traffic using the Galer Flyover for access to businesses on Alaskan Way West, and the traffic destined to the North Bay/Terminal 91. The volumes would increase from 1,000 to 2,200 vehicles per hour.

The PM peak hour traffic volumes on the South Crossing would be reduced 38 percent because of the new capacity created on the North Crossing. West of the 21st

Avenue West surface street, the volumes would drop from 1,600 to 1,000 vehicles, and east of the surface street, from 2,100 to 1,300 vehicles.

Table 28
2030 PM Peak Hour Traffic Volumes,
Alternative H and No Build Alternative

Corridor	Location	No Build	Alt H	% Change
15th/Elliott Ave W	15th Ave W, N of W Dravus St	6,900	6,900	0%
	15th Ave W, S of W Dravus St	5,100	5,200	2%
	15th Ave W, N of W Armory Way	4,600	4,800	4%
	15th Ave W, S of W Armory Way	4,500	4,900	9%
	Elliott Ave W, S of Galer Flyover	6,200	6,400	3%
W Emerson St	W Emerson Pl, E of Gilman Ave W	1,500	1,500	0%
Thorndyke Ave W – 20th Ave W – Gilman Ave W	Gilman Ave W, S of W Emerson Pl	600	700	17%
	20th Ave W, S of W Dravus St	1,100	1,100	0%
	Thorndyke Ave W, S of 22nd Ave W	700	1,000	43%
	Thorndyke Ave W, N of W Blaine St	700	500	-29%
	Thorndyke Ave W,S of W Blaine St	500	300	-40%
W Dravus St	W Dravus St, W of 20th Ave W	900	1,000	11%
	W Dravus St, E of 20th Ave W	2,300	1,800	-22%
W Galer St – South Crossing	W Galer St, W of Thorndyke Ave W	1,300	1,100	-15%
	Magnolia Bridge, W of 21st Ave W	1,600	1,000	-38%
	South Crossing, E of 21st Ave W	2,100	1,300	-38%
	Galer Flyover, W of Alaskan Way W	1,000	2,200	120%
North Crossing	2-Way Structure	NA	1,200	NA

Source: Mirai Associates, 2003

Traffic Volume Distribution

Under Alternative H, the 15th/Elliott Avenue West arterial would continue to serve as the major north-south route in the study area, however, Alternative H would add a fourth east-west route. The four main east-west routes through the study area would then be West Emerson Place/Street, West Dravus Street, the North Crossing, and the South Crossing. The new North Crossing would link Thorndyke Avenue West at West Halladay Street to 15th Avenue West at West Armory Street, for eastbound traffic, and at West Wheeler Street for westbound traffic.

Forecast volumes indicate that the North Crossing would serve mainly as a link for commuters traveling between Magnolia and 15th Avenue West. By comparing the 2030 forecast volumes for Alternative H with the No Build Alternative, roughly 80 percent of the volume using the North Crossing during the evening peak period would be diverted from the former Magnolia Bridge and 20 percent from West Dravus Street. About two-thirds of the volume using the North Crossing during the morning peak period would be diverted from the former Magnolia Bridge and one-third from West Dravus Street. Examination of the forecast turning movements at the intersections of Thorndyke Avenue West with West Halladay Street and 21st Avenue West, however, shows that North Bay/Terminal 91 traffic would more likely use West Dravus Street and the South Crossing in both the AM and PM peak hours.

The South Crossing would be constructed to link West Galer Street on the west with Alaskan Way West on the east. The South Crossing would be constructed just north of the existing Magnolia Bridge. A four-way, signal-controlled intersection would be provided where the South Crossing would intersect the 21st Avenue West surface street. This would allow access to North Bay/Terminal 91, Smith Cove Park, and the marina from both the east and the west.

The major traffic flows during the AM peak hour would be southbound on the 15th/Elliott Avenue West arterial, and eastbound on West Dravus Street, the North Crossing, and the South Crossing, although volumes in the westbound direction would also be heavy. The Galer Flyover also would experience heavy volumes westbound, into the Port and Amgen sites, and eastbound, from Magnolia to Elliott Avenue West.

Traffic flows during the PM peak hour would be heaviest in the northbound direction along the 15th/Elliott Avenue West arterial and westbound along West Dravus Street, the North Crossing and the South Crossing. The Galer Flyover would attract volumes near capacity in both directions of travel since it would serve outbound traffic from employers along Alaskan Way West as well as inbound traffic to Magnolia.

The proposed North Crossing between 15th Avenue West and Thorndyke Avenue West would affect traffic volumes on local streets in Magnolia. For this reason, a neighborhood traffic calming program would be provided as part of the project to keep traffic on the arterial street system. Traffic from the North Crossing would enter Thorndyke Avenue West north of 23rd Avenue West, which is about two-thirds of the distance from West Galer Street to West Dravus Street. Traffic would radiate out from the intersection of the North Crossing and Thorndyke Avenue West to streets that provide connections to the west and north.

About half of the traffic using the North Crossing would be destined to homes in the east Magnolia neighborhood (the area bounded by Thorndyke Avenue West, West Dravus Street, 28th Avenue West, and West Galer Street). This traffic would use the same local streets that would be used in the other build alternatives. Around 30 percent of the North Crossing traffic would be non-neighborhood traffic (i.e., passing through east Magnolia) to other destinations in Magnolia west of 28th Avenue West. Much of this traffic would seek to use 21st and 22nd Avenues West to reach West Armour Street or West Dravus Street. Some of this through traffic is currently occurring, but the likelihood would increase with the North Crossing. Traffic calming along selected local streets in this area would reduce the amount of through traffic.

Most local Magnolia streets to the south of the North Crossing would show either a reduction in traffic volumes or no change. Notably, peak hour volumes on 28th Avenue West could decrease by 30 to 40 percent due to traffic shifting from the Magnolia Bridge to the North Crossing. Volumes on the southern segment of Thorndyke Avenue West would decrease accordingly. Forecasts show that only around 15 percent of the North Crossing traffic would be destined to Magnolia Village and points west. Virtually all of this traffic would travel up Thorndyke Avenue West to West Blaine Street or West Galer Street. Traffic calming would be advisable along West Boston Street to keep cut-through traffic off that route.

Conversely, the South Crossing would provide the most direct route to Magnolia Village and West Magnolia. Over 80 percent of the traffic on that crossing would head west on West Galer Street.

Much of the diverted traffic would be expected to use West Armour Street or West Dravus Street, resulting in volume increases on these streets between 22nd and 28th Avenues West.

Intersection Operations

Table 29 shows the analyses of signalized and unsignalized intersections with Alternative H for the year 2010. Table 30 compares the levels of service from these analyses with the No Build Alternative.

In 2010, the intersection of 15th Avenue West/West Armory Street would operate at LOS D during the AM peak hour under Alternative H, compared to level of service A under the No Build Alternative. This effect is attributable to the shift of eastbound traffic from the existing Magnolia Bridge to the North Crossing bridge.

The intersection of Alaskan Way West/Galer Flyover would operate at LOS D during the 2010 PM peak hour compared to LOS B under the No Build Alternative. As shown in Table 32, queues from this intersection would extend an average of 500 to 700 feet on both the westbound Galer Flyover and northbound Alaskan Way West during the PM peak hour. The northbound Alaskan Way West approach would operate at LOS E with an approach delay of 75.3 seconds per vehicle. Volume diagrams of these intersections are shown in Appendix A.

Table 30 compares Alternative H 2010 intersection operation in the AM and PM peak hour with the No Build Alternative. At the unsignalized intersection of Thorndyke Avenue West/West Galer Street, traffic operations with Alternative H would improve over the No Build Alternative during the AM peak hour in 2010 as a result of traffic shift to the North Crossing accessed from Thorndyke Avenue West at West Halladay Street.

Table 31 summarizes intersection operations for the 2030 design year and Table 32 shows queue lengths at the Alaskan Way West/Galer Flyover intersection for 2010 and 2030.

Table 29
2010 Intersection Operations, Alternative H

	AM Peak Hour			PM Peak Hour		
Signalized Intersections	**LOS[1] (Delay)[2]**	**ICU[3] (%)**	**V/C[4] (max.)**	**LOS[1] (Delay)[2]**	**ICU[3] (%)**	**V/C[4] (max.)**
15th Ave W SB Ramps & W Dravus St	B (16.1)	60.1	1.00	C (21.2)	70.7	1.00
15th Ave W NB Ramps & W Dravus St	B (12.5)	60.1	0.79	B (16.4)	74.2	0.88
15th Ave W & Gilman Dr W	B (10.2)	85.6	0.89	B (19.4)	86.3	0.92
15th Ave W & W Armory Way	D (49.2)	98.0	1.08	C (32.8)	82.5	1.02
15th Ave W & W Garfield St	A (3.1)	75.0	0.64	A (3.3)	74.7	0.68
Elliott Ave W & W Galer St	A (6.3)	87.3	0.86	A (4.8)	86.4	0.86
Elliott Ave W & Galer Flyover	A (1.6)	101.6	0.84	B (16.3)	107.8	0.96
Alaskan Way W & Galer Flyover	C (21.1)	120.3	1.14	D (42.4)	118.4	0.99
20th Ave W & W Dravus St	B (10.5)	61.6	0.67	B (11.8)	77.7	0.74
Thorndyke Ave W & 21st Ave W	C (25.1)	64.5	0.68	C (29.5)	80.7	0.88
Thorndyke Ave W & North Crossing (W Halladay St)	A (7.7)	57.1	0.61	A (10.0)	71.7	0.71
21st Ave W & South Crossing	A (7.4)	39.4	0.44	A (8.1)	39.4	0.46
Unsignalized Intersections	**LOS[1] (Delay)[2]**	**Worst Approach**		**LOS[1] (Delay)[2]**	**Worst Approach**	
Gilman Ave W & W Emerson Pl	D (25.9)	-		F (193.1)	Westbound	
Thorndyke Ave W & W Blaine St	B (11.1)	-		B (12.0)	-	
Thorndyke Ave W & W Galer St	B (12.0)	-		C (16.9)	-	
32nd Ave W & Clise Pl W	B (11.7)	-		B (11.6)	-	
Magnolia Blvd. & W Howe St	C (18.3)	-		D (26.1)	-	

Notes: [1] Level of service.
[2] Delay is in seconds per vehicle.
[3] Intersection Capacity Utilization.
[4] Volume to capacity ratio.
Source: HNTB, 2003

Table 30
2010 Intersection Operations, Alternative H and No Build Alternative

	AM Peak Hour LOS[1] (Delay)[2]		PM Peak Hour LOS[1] (Delay)[2]	
	No Build	**Alt H**	**No Build**	**Alt H**
Signalized Intersections				
15th Ave W SB Ramps & W Dravus St	B (18.9)	B (16.1)	C (26.7)	C (21.2)
15th Ave W NB Ramps & W Dravus St	B (12.6)	B (12.5)	B (13.3)	B (16.4)
15th Ave W & Gilman Dr W	B (11.9)	B (10.2)	C (22.6)	B (19.4)
15th Ave W & W Armory Way	A (4.5)	D (49.2)	A (5.4)	C (32.8)
15th Ave W & W Garfield St	A (3.0)	A (3.1)	A (8.6)	A (3.3)
Elliott Ave W & W Galer St	A (4.4)	A (6.3)	A (0.4)	A (4.8)
Elliott Ave W & Galer Flyover	A (4.1)	A (1.6)	A (8.0)	B (16.3)
Alaskan Way W & Galer Flyover	A (3.7)	C (21.1)	B (12.2)	D (42.4)
20th Ave W & W Dravus St	B (15.0)	B (10.5)	C (21.8)	B (11.8)
Thorndyke Ave W & 21st Ave W	C (26.0)	C (25.1)	C (29.4)	C (29.5)
Thorndyke Ave W & North Crossing (W Halladay St)	NA	A (7.7)	NA	A (10.0)
21st Ave W & South Crossing	NA	A (7.4)	NA	A (8.1)
Unsignalized Intersections				
Gilman Ave W & W Emerson Pl	E (40.8)	D (25.9)	F (193.1)	F (193.1)
Thorndyke Ave W & W Blaine St	B (11.7)	B (11.1)	B (12.5)	B (12.0)
Thorndyke Ave W & W Galer St	E (36.0)	B (12.0)	F (91.6)	C (16.9)
32nd Ave W & Clise Pl W	B (11.8)	B (11.7)	B (11.6)	B (11.6)
Magnolia Blvd. & W Howe St	C (18.3)	C (18.3)	C (22.8)	D (26.1)
21st Ave W & Magnolia Bridge (north ramp)	A (7.5)	NA	A (3.9)	NA
21st Ave W & Magnolia Bridge (south ramp)	A (7.7)	NA	A (9.3)	NA

Notes: [1]Level of service.
[2]Delay is in seconds per vehicle.
Source: HNTB, 2003

Table 31
2030 Intersection Operations, Alternative H

	AM Peak Hour			PM Peak Hour		
Signalized Intersections	**LOS[1] (Delay)[2]**	**ICU[3] (%)**	**V/C[4] (max.)**	**LOS[1] (Delay)[2]**	**ICU[3] (%)**	**V/C[4] (max.)**
15th Ave W SB Ramps & W Dravus St	B (14.3)	68.0	0.93	D (42.1)	77.7	1.22
15th Ave W NB Ramps & W Dravus St	B (13.5)	70.4	0.84	B (17.0)	84.6	0.98
15th Ave W & Gilman Dr W	B (10.4)	85.6	0.84	D (43.1)	105.5	1.20
15th Ave W & W Armory Way	F (94.1)	114.8	1.29	D (46.7)	91.6	1.11
15th Ave W & W Garfield St	A (4.1)	78.8	0.69	A (2.9)	77.0	0.71
Elliott Ave W & W Galer St	A (6.6)	87.3	0.87	A (4.8)	86.4	0.86
Elliott Ave W & Galer Flyover	A (5.5)	88.8	0.84	B (18.3)	124.6	1.10
Alaskan Way W & Galer Flyover	E (58.6)	149.2	1.60	F (113.6)	155.9	1.26
20th Ave W & W Dravus St	B (13.7)	65.5	0.81	C (20.1)	85.1	0.89
Thorndyke Ave W & 21st Ave W	C (32.5)	77.0	0.80	C (32.5)	86.1	0.95
Thorndyke Ave W & North Crossing (W Halladay St)	A (9.5)	66.4	0.72	B (10.9)	74.8	0.76
21st Ave W & South Crossing	A (7.7)	43.0	0.50	A (8.9)	49.9	0.64
Unsignalized Intersections	**LOS[1] (Delay)[2]**	**Worst Approach**		**LOS[1] (Delay)[2]**	**Worst Approach**	
Gilman Ave W & W Emerson Pl	E (43.7)	Southbound		F (203.8)	Westbound	
Thorndyke Ave W & W Blaine St	B (11.4)	-		B (13.7)	-	
Thorndyke Ave W & W Galer St	B (12.9)	-		C (19.9)	-	
32nd Ave W & Clise Pl W	B (11.4)	-		B (11.9)	-	
Magnolia Blvd. & W Howe St	B (12.5)	-		D (26.1)	-	

Notes: [1] Level of service.
[2] Delay is in seconds per vehicle.
[3] Intersection Capacity Utilization.
[4] Volume to capacity ratio.
Source: HNTB, 2003

Table 32
Alaskan Way West/Galer Flyover Intersection Queuing, Alternative H

	2010 Queues (feet)		2030 Queues (feet)	
Intersection Approach	**AM**	**PM**	**AM**	**PM**
Flyover, west leg	310 ↓	700 ↑	800 ↑	800 ↑
Alaskan Way W, north leg	220 ↓	310 ↓	420 ↓	1,150 ↑
Alaskan Way W, south leg	410 ↑	510 ↑	1,560 ↑	2,380 ↑

Notes: ↓ = queue decreasing at end of simulation period.
↑ = queue increasing at end of simulation period.
Source: HNTB, 2004

Intersection operations for Alternative H are compared with the No Build Alternative in Table 33 for the year 2030.

The intersection of 15th Avenue West/West Armory Way would operate at LOS F in the AM peak hour and LOS D in the PM peak hour under Alternative H, compared with LOS B and LOS A under the No Build Alternative, because traffic volumes would shift from the existing Magnolia Bridge onto the new West Armory Way route.

In 2030, the intersection of Alaskan Way West/ Galer Flyover would operate at LOS E in the AM peak hour compared to LOS D under the No Build Alternative, also reflecting diversion from the existing Magnolia Bridge. Queues for the Alaskan Way West south approach would average up to 1,500 feet (over 50 cars) in the AM peak hour. While the intersection would operate at LOS E, the south approach would operate at LOS F with delays averaging 3 to 4 minutes per vehicle.

The average delay at the Alaskan Way West/Galer Flyover intersection in the PM peak hour would increase by about 14 seconds per vehicle, resulting in LOS F operation for the entire intersection. Delays associated with the very long queue on the south approach would be in the range of 7 to 8 minutes. Volume diagrams of these intersections are shown in Appendix A.

Operations at the intersection of Thorndyke Avenue West/West Galer Street would improve over the No Build Alternative with the proposed North Crossing as an alternate traffic route.

Table 33
2030 Intersection Operations, Alternative H and No Build Alternative

	AM Peak Hour LOS[1] (Delay)[2]		PM Peak Hour LOS[1] (Delay)[2]	
	No Build	**Alt H**	**No Build**	**Alt H**
Signalized Intersections				
15th Ave W SB Ramps & W Dravus St	C (20.4)	B (14.3)	E (73.9)	D (42.1)
15th Ave W NB Ramps & W Dravus St	B (15.6)	B (13.5)	C (21.7)	B (17.0)
15th Ave W & Gilman Dr W	B (16.7)	B (10.4)	D (40.5)	D (43.1)
15th Ave W & W Armory Way	B (13.1)	F (94.1)	A (6.2)	D (46.7)
15th Ave W & W Garfield St	A (5.1)	A (4.1)	B (10.4)	A (2.9)
Elliott Ave W & W Galer St	A (6.2)	A (6.6)	A (0.4)	A (4.8)
Elliott Ave W & Galer Flyover	B (15.7)	A (5.5)	B (10.8)	B (18.3)
Alaskan Way W & Galer Flyover	B (14.2)	E (58.6)	C (21.9)	F (113.6)
20th Ave W & W Dravus St	B (19.0)	B (13.7)	E (71.4)	C (20.1)
Thorndyke Ave W & 21st Ave W	C (27.1)	C (32.5)	D (40.1)	C (32.5)
Thorndyke Ave W & North Crossing (W Halladay St)	NA	A (9.5)	NA	B (10.9)
21st Ave W & South Crossing	NA	A (7.7)	NA	A (8.9)
Unsignalized Intersections				
Gilman Ave W & W Emerson Pl	E (43.7)	E (43.7)	F (207.3)	F (203.8)
Thorndyke Ave W & W Blaine St	B (12.0)	B (11.4)	C (16.6)	B (13.7)
Thorndyke Ave W & W Galer St	E (45.4)	B (12.9)	F (198.0)	C (19.9)
32nd Ave W & Clise Pl W	B (11.5)	B (11.4)	B (11.9)	B (11.9)
Magnolia Blvd. & W Howe St	B (12.5)	B (12.5)	D (26.1)	D (26.1)
21st Ave W & Magnolia Bridge (north ramp)	A (8.3)	-	A (9.7)	-
21st Ave W & Magnolia Bridge (south ramp)	A (8.8)	-	A (10.1)	-

Notes: [1]Level of service.
[2]Delay is in seconds per vehicle.
Source: HNTB, 2003

Transit Facilities

Route Modifications

Alternative H would provide an additional connection between 15th Avenue West and Thorndyke Avenue West with the North Crossing. Express and/or local buses from Routes 19, 24 and 33 could be re-routed to use the North Crossing or they could travel on 21st Avenue West to the new intersection with the South Crossing. Additionally, some mix of service on the streets could be planned. Service on both crossing would result in greater transit coverage in the study area. The length of the North Crossing would increase the length of the trip by about 0.9 mile over the No Build Alternative. There would be an additional 4.1 minutes of travel westbound and 2.4 minutes eastbound. This time would include the additional delay at the two new traffic signals westbound and one eastbound (a 40-second delay/signal).

The South Crossing would be about 0.4 mile longer than the No Build Alternative, adding about two to three minutes to the travel time in 2010. This time would include two new traffic signals: one at the 21st Avenue West surface street and the other at the end of the Galer Flyover at Alaskan Way West. By 2030, the Alaskan Way West/Galer Flyover intersection would experience lengthy delays and long queues in peak traffic periods, adding several minutes to transit travel time on the South Crossing route.

Since it would be at the surface, the route could also allow new bus access to the North Bay development.

Compatibility with the Green Line monorail, waterfront street car and potential commuter rail access would remain the same as in the No Build Alternative.

Ridership

Ridership would increase in the corridor as discussed under the No Build Alternative as the conditions would remain the same.

Pedestrian and Bicycle Facilities

Alternative H would improve non-motorized access compared with the No Build Alternative. Both crossings would provide ten-foot-wide sidewalks for pedestrians. Sixteen-foot-wide outside lanes would provide room for bicyclists.

South Crossing

Pedestrian and bicycle accessibility on the Magnolia side of the South Crossing would be nearly identical to the No Build Alternative, using Thorndyke Avenue West to reach 21st Avenue West and the Elliott Bay Trail.

The design of the South Crossing would bring users down to grade at the 21st Avenue West surface street. A ten-foot-wide sidewalk would be provided on the south side of the crossing. This would facilitate direct pedestrian and bicycle connections from Magnolia to the marina and the western end of the Elliott Bay Trail. Bicyclists and pedestrians could also follow the South Crossing through the North Bay property to reach the Elliott Bay Trail along the railroad tracks or the Galer Flyover. Pedestrians and bicyclists desiring to access the 15th/Elliott Avenue West corridor would use the Galer Flyover. This crossing would provide a good non-motorized connection for the southern portion of North Bay, but would be a

longer route for other users that currently use the bridge alignment at West Garfield Street. The 0.4 mile added distance would increase walking time between the west end of the bridge and 15th Avenue West by about seven minutes.

North Crossing

Alternative H would provide an additional bridge connection between 15th Avenue West and Thorndyke Avenue West with the North Crossing. This bridge would provide a convenient pedestrian and bicycle connection for Magnolia residents that want a direct route to 15th Avenue West. A ten-foot-wide sidewalk would be provided on the north side of the crossing. Although farther to the north for residents in the southern portion of Magnolia, the directness of this bridge could be more attractive to bicycles than the more circuitous southern alignment.

At the west side of the North Crossing, Alternative H would bring users to a traffic signal at the intersection with Thorndyke Avenue West. The new signal would facilitate pedestrian crossing of the widened Thorndyke Avenue at this location. At the eastside intersection of the North Crossing with 15th Avenue West, the design would improve pedestrian and bicycle connections over the No Build Alternative.

Traffic volume increases on 22nd and 24th Avenues West would affect pedestrian crossing times and bicycling comfort along these routes.

Freight and Goods

Trucks

Alternative H would affect truck accessibility to/from 15th/Elliott Avenue West. Truck movements would affected by the increased congestion on the Galer Flyover caused by removal of the Garfield overpass.

Alternative H would provide an additional bridge connection between 15th Avenue West and Thorndyke Avenue West on the North Crossing. A minimal number of trucks would be expected to use this connection unless ramps were added at a later time to access the North Bay property.

Truck delays could be excessive on the Galer Flyover with Alternative H. During the AM and PM peak hours, operations would be near capacity, with attendant high delays and long queues.

Truck turning movements for the 2030 design year are shown graphically on Figure 29 for the mid-day, Figure 30 for the AM peak, and Figure 31 for the PM peak hours. On Elliott Avenue south of the Galer Flyover, total truck volume would be identical to the No Build condition. Mid-day peak hour (12 to 1 PM) turning movements on the Galer Flyover would increase by nearly 200 trucks per hour (fivefold) compared with the No Build Alternative. AM peak hour (8 to 9 AM) truck volumes on the flyover would increase by about 95 trucks per hour (sixfold) relative to the No Build condition. PM peak hour (5 to 6 PM) truck movements would remain low compared to other time periods.

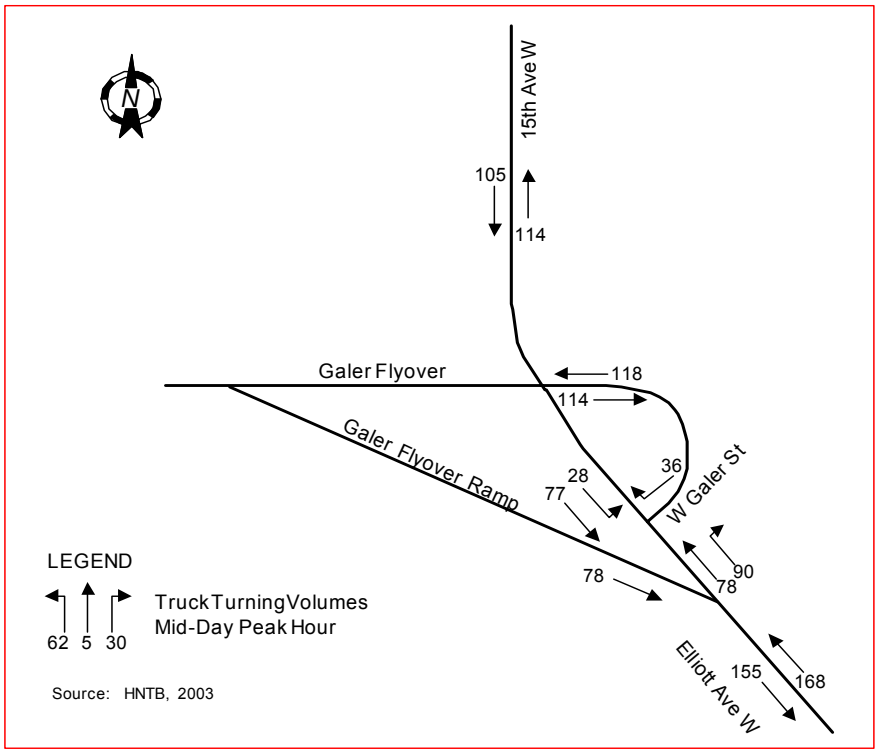


Figure 29
2030 Mid-Day Peak Hour Truck Turning Volumes, Alternative H

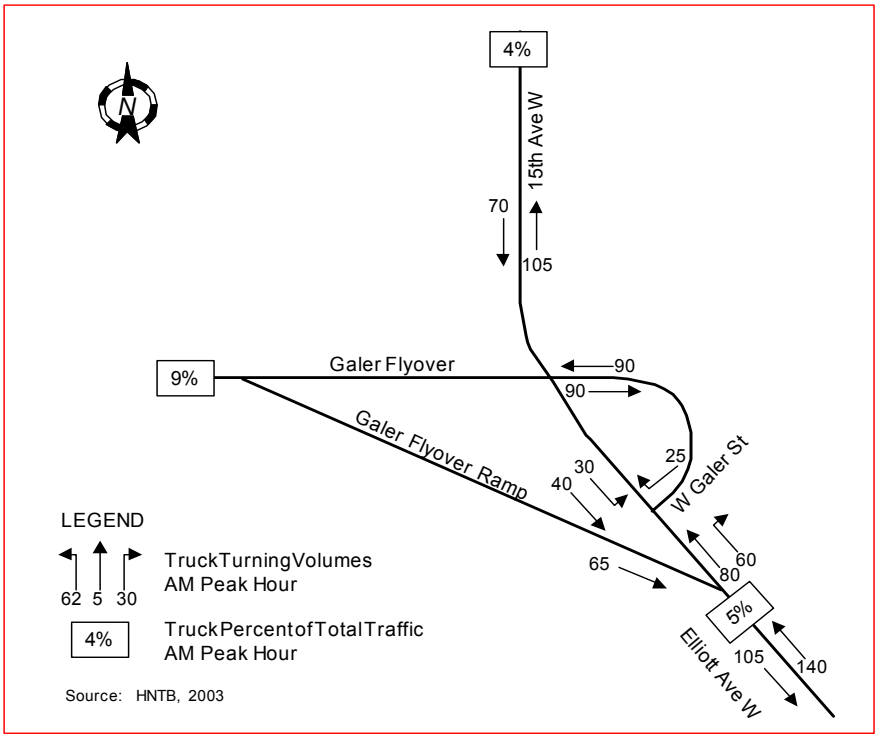


Figure 30
2030 AM Peak Hour Truck Turning Volumes, Alternative H

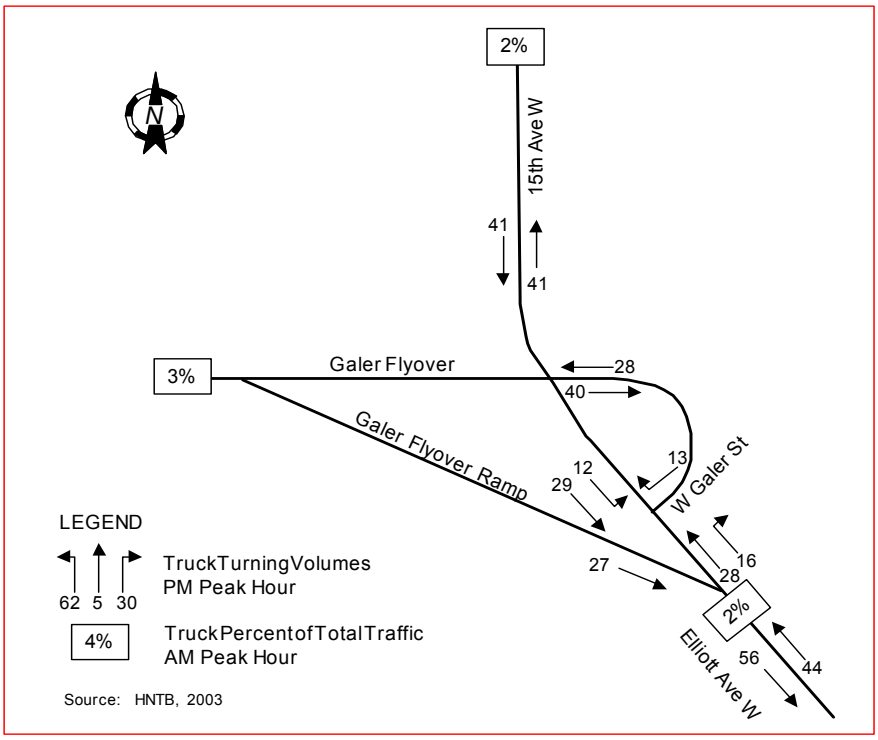


Figure 31
2030 PM Peak Hour Truck Turning Volumes, Alternative H

Railroads

The surface street portion of the South Crossing would cross the existing railroad spur tracks between the Terminal 91 buildings and the tank farm. The tank farm structures are scheduled for removal in 2004. If any remaining use required rail delivery using a remaining spur track, at-grade crossings would be installed to control automobile traffic when deliveries are made.

Emergency Vehicles

Seattle Fire Department

Alternative H would provide access to Magnolia by two routes. The South Crossing would use the existing Galer Flyover in conjunction with an at-grade roadway to a connection with the 21st Avenue West surface street and to a new bridge connect to West Galer Street on the Magnolia Bluff. The North Crossing would provide a new structure over the BNSF railroad to connect Thorndyke Avenue West at West Halladay Street with 15th Avenue West at West Wheeler Street (westbound traffic) and West Armory Way (eastbound traffic). Since the existing bridge would be removed, there would be an increase of one route to Magnolia from the 15th/Elliott Avenue West corridor.

The first-in responses to Smith Cove and Terminal 91 would travel via the West Dravus Street/20st Avenue West route. The second-in responses could use the at-grade alignment of the South Crossing and its intersection with the 21st Avenue West surface street or the new North Crossing structure.

The response distance and changes in response-distances for fire and medic emergency vehicles operated by the Seattle Fire Department are shown in Table 34.

Table 34
Emergency Response Impacts, Alternative H

	Distance/Change Relative to No Build Alternative (miles)				
Location	**Station 8**	**Station 18**	**Station 20**	**Station 41**	**HVM**
W Dravus St/20th Ave W	3.0/n.c.	2.0/n.c.	0.7/n.c.	1.5/n.c.	5.3/n.c.
Terminal 91	1.9/n.c.	3.0/n.c.	1.7/n.c.	1.4/-0.7	3.9/n.c.
Smith Cove	2.6/**+0.2**	3.0/-0.2	1.6/-0.2	1.7/**+0.1**	4.6/**+0.2**
Magnolia Village	4.4/n.c.	3.4/n.c.	2.1/n.c.	-	5.4/**+0.1**

Source: Mirai Associates

Seattle Police Department

The Seattle Police Department would depend on patrol units assigned to the Queen 1 and Queen 2 precinct districts for first response to incidents as in the No Build Alternative, and Alternatives A and D. The at-grade South Crossing of Alternative H would provide the police department with more direct access to properties along the route. Congestion and delay at the Alaskan Way West/Galer Flyover intersection during peak traffic hours could slow responses using the one-lane approaches to this intersection.

Support response would come from patrol units originating from the Queen Anne area and downtown Seattle area within the West precinct. Additional backup support also comes from the Ballard Precinct District. Route choices would be dependant on the location of the responding units. The distance comparisons would be similar to those for the fire department.

Safety

With Alternative H, traffic patterns along 15th/Elliott Avenue West, West Dravus Street, and Thorndyke Avenue West would be changed, and collision patterns could be affected. Added travel on 15th Avenue West between the North Crossing and Galer Flyover intersections could result in an increase in the number of collisions. Traffic volumes could also increase on portions of Thorndyke Avenue West. Congestion at the Alaskan Way West/Galer Flyover and 15th Avenue West/West Armory Way intersections could result in additional collisions. Diversions of traffic from West Dravus Street to the North Crossing might reduce the number of collisions in that corridor.

Safety features for pedestrians and bicyclists using the North Crossing routes would include provisions for a sidewalk and bike lanes between 15th Avenue West and Thorndyke Avenue, with a signalized intersection with crosswalks at the west end. On the South Crossing, sidewalks would be provided on both sides, with an at-grade signalized intersection and crosswalks at the 21st Avenue West intersection. These new facilities would be expected to serve additional pedestrian and bicycle travel oriented to the Amgen and North Bay sites, resulting in increased exposure for pedestrians and cyclists. Additional pedestrian crossing activity may be generated at the 15th Avenue West crosswalk at West Wheeler Street.

Bicycle travel on the South Crossing route may be difficult due to congestion, Terminal 91 truck access, and the lack of a widened lane. Conversely, Alternative H

may provide increased safety for non-motorized travel, by incorporating current design and accessibility standards on new portions of the route. Overall, there is not likely to be a discernible impact on pedestrian and bicycle safety.

Mitigation Measures

No Build Alternative

Since the No Build Alternative is offered as a base for comparison, no mitigation measures would be considered.

Future increases in trip generation from the Amgen development would contribute to the need for a signal at the Alaskan Way West/Galer Flyover intersection. This intersection is assumed to be signalized by the 2010 opening year in all alternatives and would not be part of this project.

Future increases in trip generation from the North Bay development would contribute to the need for a signal at the intersection of Thorndyke Avenue West/21st Avenue West. This intersection is assumed to be signalized by the 2010 opening year in all alternatives and would not be part of this project.

Alternative A

Traffic Operations

A peak-hour signal warrant analysis was performed for the Thorndyke Avenue West/West Galer Street intersection using the guidelines of the Manual on Uniform Traffic Control Devices (MUTCD). The analysis considered the opening year (2010) operations of the intersection under Alternative A, during the morning and evening peak hours. The warrant would be satisfied with a single-lane major approach (eastbound West Galer Street), but not for a two-lane major approach (westbound West Galer Street). The MUTCD delay warrant would not be met, therefore, no mitigation is proposed for this intersection.

Analyses of future traffic operations at the Gilman Avenue West/West Emerson Place intersection indicate that the intersection would continue to operate at LOS F with any alternative. Placing the intersection under signal control may help improve the level of service, but is not proposed as a mitigation measure for this project.

Alternative A would minimally affect traffic volumes on neighborhood streets and no mitigation would be required.

Transit Facilities

Alternative A would require no changes in transit routing or service levels and no mitigation would be required.

Pedestrian and Bicycle Facilities

Alternative A would provide similar and improved pedestrian and bicycle facilities in the study area and no mitigation would be required.

Freight and Goods

Alternative A would require no changes in truck routing and no mitigation would be required.

Emergency Vehicles

Alternative A would provide similar emergency vehicle response routes and travel times in the study area and no mitigation would be required.

Safety

Alternative A would incorporate current, applicable design standards in the facility design for the roadway and non-motorized/accessibility components. No additional mitigation would be required.

Alternative C

Traffic Operations

As discussed under Alternative A, no mitigation measures are proposed for this project.

Transit Facilities

As discussed under Alternative A, no mitigation measures are proposed for this project.

Pedestrian and Bicycle Facilities

As discussed under Alternative A, no mitigation measures are proposed for this project

Freight and Goods

Alternative C would require no changes in truck routing and no mitigation would be required.

Emergency Vehicles

As discussed under Alternative A, no mitigation measures are proposed for this project.

Safety

Alternative C would incorporate current, applicable design standards in the facility design for the roadway and non-motorized/accessibility components. No additional mitigation would be required.

Alternative D

Traffic Operations

As discussed under Alternative A, no mitigation measures are proposed for this project.

Transit Facilities

As discussed under Alternative A, no mitigation measures are proposed for this project.

Pedestrian and Bicycle Facilities

As discussed under Alternative A, no mitigation measures are proposed for this project

Freight and Goods

Alternative D would require no changes in truck routing and no mitigation would be required.

Emergency Vehicles

As discussed under Alternative A, no mitigation measures are proposed for this project.

Safety

Alternative D would incorporate current, applicable design standards in the facility design for the roadway and non-motorized/accessibility components. No additional mitigation would be required.

Alternative H

Traffic Operations

The operation of the 15th Avenue West/West Armory Way intersection would deteriorate from a 2030 LOS of B/A (No Build) to an LOS of F/D (Alternative H) in the AM/PM Peak Hour. A double right-turn configuration for the eastbound right-turn movement at the intersection of 15th Avenue West and West Armory Way would help to reduce queue lengths for the eastbound approach during the AM peak hour. This configuration would result in an improved level of service, however, it could create disadvantages for local Armory Way traffic destined north on 15th Avenue West. The level of service deterioration in the PM Peak Hour cannot be mitigated.

The operation of the Alaskan Way West/Galer Flyover intersection would deteriorate from a 2030 LOS of B/C (No Build) to an LOS of E/F (Alternative H) in the AM/PM Peak Hour. The railroad tracks to the east and Elliott Bay to the west prevent any widening that could mitigate traffic operations at this intersection.

Because the unacceptable levels of service at these two key intersections cannot be mitigated, this alternative has been eliminated from further consideration.

Construction Impacts

No Build Alternative

There would be no construction with the No Build Alternative and, therefore, no impacts or mitigation.

Alternative A

The construction period for either the ramp or intersection option for Alternative A would be 39 months, including one month for mobilization. Both access options would have a period of 17 months in which the Magnolia Bridge corridor would be closed to all traffic. During the remaining 22 months of construction, traffic would be maintained on combinations of the existing structure and completed portions of the new structure. The sequence of construction is shown in Table 35.

Table 35
Sequence of Construction, Alternative A

Stage	Duration	Demolition	Construction
1	15 mo	Eastbound on-ramp. Traffic maintained on existing bridge.	New bridge from Magnolia Bluff to Smith Cove South half of new bridge from Smith Cove to RR tracks. Begin slope stabilization of Magnolia Bluff. Alt A – Int: New ramp to surface street. Alt A – Ramp: Eastbound on-ramp.
2	17 mo	All portions of existing bridge. Close bridge to all traffic	East & West ends of new bridge. North half of new bridge from Smith Cove to RR tracks. Alt A – Int: Intersection for new ramp. Alt A – Ramp: Westbound off-ramp
3	6 mo	Remaining demolition. Traffic maintained on new bridge.	Remaining new construction..

Source: KPFF, 2004

Impacts

Traffic Operations

Closures and Diversion Routes

Access during construction is shown in Table 36.

Table 36
Access During Construction, Alternative A

Stage	Duration	Public Access To Magnolia	Public Access to Marina & North Bay	Contractor Access
1	15 mo	Existing bridge	Galer Flyover W Dravus St to 21st Ave W	Galer Flyover W Dravus St to 21st Ave W Barges to waterfront
2	17 mo	W Dravus St W Emerson St	Galer Flyover W Dravus St to 21st Ave W	Galer Flyover W Dravus St to 21st Ave W Barges to waterfront
3	6 mo	New bridge	New ramp(s)	New bridge Galer Flyover W Dravus St to 21st Ave W Barges to waterfront

Source: KPFF, 2004

During Stages 2 and 4, the bridge would be closed to all traffic. Traffic to and from Magnolia would be detoured to West Dravus Street and West Emerson Place. Traffic to and from the marina and North Bay/Terminal 91 would be detoured to the 21st Avenue West surface street and the Galer Flyover.

The detour route from the Magnolia Bluff across West Dravus Street to the intersection of Elliott Avenue West and the Galer Flyover would be approximately 1.7 miles longer than the route across the existing bridge.

Intersection Operations

During construction of Alternative A, the Magnolia Bridge would be closed to traffic for 17 months. During this closure, bridge traffic would be diverted to other routes in the study area. West Dravus Street could be expected to carry the majority of detour traffic. For planning purposes, it is estimated that up to 50 percent of traffic would shift to the Dravus corridor, 25 percent to the Emerson corridor, and 25 percent might change travel patterns by shifting travel to a different hour, or avoid the trip altogether.

Vehicles traveling the route across West Dravus Street would encounter eight signalized intersections where the route across the existing bridge has only one. The operation of these signalized intersections under 2010 No Build conditions is compared to their operation with the construction detour in place in Table 37.

Table 37
2010 Intersection Operations,
Construction Detour and No Build Alternative

	AM Peak Hour LOS[1] (Delay)[2]		PM Peak Hour LOS[1] (Delay)[2]	
Signalized Intersections	**No Build**	**Detour**	**No Build**	**Detour**
20th Ave W & W Dravus St	B (15.0)	E (73.8)	C (21.8)	E (68.1)
15th Ave W SB Ramps & W Dravus St	B (18.9)	B (15.3)	C (26.7)	D (38.2)
15th Ave W NB Ramps & W Dravus St	B (12.6)	D[3] (52.4)	B (13.3)	F[3] (103.3)
15th Ave W & Gilman Dr W	B (11.9)	B (18.3)	C (22.6)	D (40.4)
15th Ave W & W Armory Way	A (4.5)	B (17.9)	A (5.4)	A (2.8)
15th Ave W & W Garfield St	A (3.0)	A (2.3)	A (8.6)	A (2.3)
Elliott Ave W & W Galer St	A (4.4)	A (2.1)	A (0.4)	A (0.7)
Elliott Ave W & Galer Flyover	A (4.1)	A (3.9)	A (8.0)	D (40.4)

Notes: [1]Level of service.
[2]Delay is in seconds per vehicle.
[3] LOS without manual traffic control for northbound to westbound turning movement.
Source: HNTB, 2004

In this scenario, the intersection of West Dravus Street/15th Avenue West northbound ramps would operate at LOS D and F because a high volume of northbound traffic would be turning left onto West Dravus Street. Maximum queues of northbound PM peak-hour traffic at this intersection would be confined to the off-ramp. The West Dravus Street/20th Avenue West intersection would operate at LOS E during both the AM and PM peak hours because higher volumes of westbound traffic would be turning left onto Thorndyke Avenue West. The added detour traffic would increase the total delay through these intersections by 45 to 90 seconds per vehicle.

The additional travel time imposed by the out-of-direction detour added to the time spent at the additional signalized intersections would amount to over eight minutes for each commuting vehicle.

Parking Impacts

In this alternative, right-of-way for the new bridge would be acquired, and uses of the space beneath the new bridge would be regulated. Parking and storage functions would likely be prohibited. The existing bridge would be demolished, easements released, and the underlying property would remain in the ownership of the Port.

Transit Impacts

During the 32-month period of construction for Stages 1 and 2, bus routes would need to be detoured to West Dravus Street. Although the existing structure would be open to traffic during Stage 1, the southern eastbound on-ramp from Smith Cove and the marina to the existing bridge would be removed along with the mid-bridge stairs. The existing bus stops on the bridge surface would be removed because they would

no longer have access to the stairs that take pedestrians from the eastbound side to the westbound side. The existing bus stops on the bridge would cease to provide access to Piers 90 and 91 and North Bay/Terminal 91. Bus services would be reinstated during Stage 3.

Pedestrian and Bicycle Impacts

The impact of construction on non-motorized transportation is shown in Table 38. The following construction events would affect pedestrian and bicycle traffic.

- The 21st Avenue West surface street would be operational between Thorndyke Avenue West and the waterfront for the duration of construction of the Magnolia Bridge.
- The Elliott Bay Trail would be open to pedestrians and bicycles up to its intersection with the 21st Avenue West surface street on the east side of the Port property during all stages of construction.
- The portion of the Elliott Bay Trail from the 21st Avenue West surface street to Smith Cove Park would be closed during the entire construction period and the 21st Avenue West surface street would serve as a temporary access to this area.

Table 38
Non-motorized Impacts During Construction, Alternative A

Traffic Sequence	Duration	Effect
Existing structure open to traffic	15 months	Pedestrians and bicycle facilities on the bridge would be closed. Eastbound ramp on-ramp and sidewalk on the south side would be removed. Pedestrian and bicycle traffic to/from Smith Cove Park would have to use 21st Avenue West surface street. Access to North Bay/Terminal 91 from BNSF railroad via Elliott Bay Trail.
Total closure of bridge	17 months	Pedestrians and bicycles would have to use the Elliott Bay Trail between the BNSF railroad and North Bay/Terminal 91. Access to Smith Cove/Marina area via 21st Avenue West surface street.
Completed bridge open to traffic	6 months	New bridge available to pedestrians and bicycles. Access to Smith Cove/Marina area via 21st Avenue West surface street.

Source: Mirai Associates

Freight Impacts

The North Bay/Terminal 91property is a major terminal for the transfer and movement of freight. A priority of construction for the build alternatives would be the maintenance of clear access at all times at the following locations:

- The 21st Avenue West surface street would be open through the construction area providing access between Thorndyke Avenue West and the Smith Cove/Marina area.
- An operational route connecting Piers 90 and 91 to the south of the existing structure to the area north of the existing structure would be available at all times.
- The Galer Flyover and a connection into Terminal 91 at the East Gate on Alaskan Way West would be maintained at all times. This connection would be designed to accommodate the two-way flow of vehicles needed for

the transfer and movement of freight and goods into and out of the Port facility.

Emergency Vehicle Impacts

Seattle Fire Department

emergency response access would be maintained during the entire construction period. Table 39 shows the construction impacts for routes used by emergency access vehicles in the study area for all build alternatives.

Table 39
Emergency Access Routes During Construction, All Build Alternatives

Location	Construction Stage	Access Route Comments
Magnolia District	Stage 1	No change in routing of emergency services
	Stage 2	No changes in emergency services provided by Stations 41, 18, 20 or 8. HVM Medic Unit would use W Dravus St Instead of Magnolia Bridge.
Smith Cove Marina	Total Duration	The surface street between 21st Ave W and Smith Cove would be completed. All emergency services to the Smith Cove and Marina would use this route. The second-in services from Stations 41 and HVM Medic Unit would use W Dravus St and Thorndyke Ave W as access routes instead of the Magnolia Bridge.
Terminal 91 North Bay	Total Duration	A clear access would be maintained during construction between Terminal 91, to the south of the Magnolia Bridge, and the North Bay area to the north. Both the Galer Flyover and the 21st Ave W surface street would serve this access.
Galer Flyover	Total Duration	Access to Alaskan Way W would be maintained during construction. This in combination with the access between Terminal 91 and North Bay would provide full accessibility.

Source: Mirai Associates

Seattle Police Department

Emergency response routing would similar to that described for the Seattle Fire Department. The availability of 21st Avenue West as a route would facilitate access into the Terminal 91/North Bay area and into the Smith Cove/Marina area. The primary response would be through patrol units assigned to the Precinct Districts, Queen 1 and Queen 2. Backup response units originating south of the Magnolia Bridge would require approximately three additional minutes to access the Magnolia Village area via West Dravus Street as compared to the existing Magnolia Bridge.

Safety

During closure of the existing bridge, east-west traffic would be shifted to the West Dravus Street and West Emerson Place corridors for a period of 17 months. These detours would create an increase in congestion in these corridors similar to that experienced during the closure following the Nisqually earthquake in 2001. The increases in volume, together with additional congestion, could be expected to produce increases in the numbers of collisions in these detour corridors. These

conditions also could raise the levels of involvement of pedestrians and bicyclists using these detour corridors.

Mitigation Measures

Traffic Operations

Mitigation of the 17-month closure of the Magnolia Bridge could be accomplished with the provision of a route connecting between 21st Avenue West and Alaskan Way West at the Galer Flyover. In this way, detour traffic could connect between Thorndyke Avenue West and Elliott Avenue West. This route would require that the Port's East Gate be relocated to allow public travel across the Terminal 91/North Bay properties, or some other surface street routing be provided on the Terminal 91 perimeter outside of the secured portion of Terminal 91. With the availability of this added route, impacts on intersections along West Dravus Street could be reduced during the extended bridge closures. The low level of service at the intersection of the 15th Avenue West northbound ramps with West Dravus Street could be mitigated by utilizing officer control during weekday peak hours to provide double-left-turns for the northbound ramp movement.

Parking

Parking for construction workers could be accommodated by leasing existing paved areas on nearby properties owned by the Port, leasing of spaces at the National Guard armory, or on vacant City right-of-way along Armory Way east of the rail yards. Workers could be shuttled to specific work locations from these parking areas.

Transit Facilities

During construction, the Magnolia bus routes would need to be detoured to West Dravus Street. This would result in increased transit route distances and travel times necessitating a change in bus schedules.

The existing bus stops on the Magnolia Bridge serving North Bay would also be removed during construction. Temporary transit service to North Bay during construction could be provided using shuttle vans or buses between West Dravus Street and North Bay.

Pedestrian and Bicycle Facilities

No mitigation required.

Freight and Goods

No mitigation required.

Emergency Vehicles

No mitigation required.

Safety

Traffic control officers could be deployed during weekday peak hours in the West Dravus Street corridor during the two extended closures of the Magnolia Bridge.

Alternative C

The construction period for Alternative C would be 41 months, including one month for mobilization. The construction would have one period of 11 months that the Magnolia Bridge corridor would be closed to all traffic. During the first 27 months of construction, traffic would be maintained on the existing structure. After the 11 month closure, traffic would be moved onto the new structure. The sequence of construction is shown in Table 40.

Table 40
Sequence of Construction, Alternative C

Stage	Duration	Demolition	Construction
1	27 mo	Buildings within new right-of-way. Traffic maintained on existing bridge	New bridge segments except for west and east ends. Begin slope stabilization of Magnolia Bluff.
2	11 mo	West and east ends of existing bridge. Close bridge to all traffic	West and east ends of new bridge.
3	2 mo	Remaining portion of existing bridge Traffic maintained on new structures	Complete slope stabilization of Magnolia Bluff.

Source: KPFF, 2004

Impacts

Traffic Operations

Closures and Diversion Routes

Access during construction is shown in Table 36.

Table 41
Access During Construction, Alternative C

Stage	Duration	Public Access To Magnolia	Public Access to Marina & North Bay	Contractor Access
1	27 mo	Existing bridge	Galer Flyover W Dravus St to 21st Ave W	Galer Flyover W Dravus St to 21st Ave W Barges to waterfront
2	11 mo	W Dravus St W Emerson St	Galer Flyover W Dravus St to 21st Ave W	Galer Flyover W Dravus St to 21st Ave W Barges to waterfront
3	2 mo	New bridge	New ramp(s)	New bridge Galer Flyover W Dravus St to 21st Ave W Barges to waterfront

Source: KPFF, 2004

Intersection Operations

During construction of Alternative C, the Magnolia Bridge would remain open to traffic except for a single 11-month closure to connect the west and east ends of the new bridges. During this closure, West Dravus Street would carry the majority of detour traffic. Intersections along West Dravus Street at the 15th Avenue West ramp

terminals and at 20th Avenue West would experience LOS E and F operations. The poor intersection operations would last for a longer period compared to Alternative D, but for a shorter period compared to Alternative A.

Parking Impacts

With Alternative C, a public right-of-way would be acquired for the new bridges, and uses of the space beneath the new bridges would be regulated. Parking and storage functions would likely be prohibited. The existing bridge would be demolished, easements released, and the underlying property would remain in the ownership of the Port.

Transit Impacts

During Stage 1 of construction, the existing bridge would be open, including the existing bus stops on the bridge surface. The existing bridge would be closed during Stage 2. During these 11 months, buses would be detoured to West Dravus Street. Access to Piers 90 and 91, and North Bay/Terminal 91 could no longer be made from the bus stops on the existing bridge. Bus service would be reinstated during Stage 3.

Pedestrian and Bicycle Impacts

The impact of construction on non-motorized transportation is shown in Table 45. Construction events that would affect Alternative C would be the same as for Alternative A.

Table 42
Non-motorized Impacts During Construction, Alternative C

Traffic Sequence	Duration	Effect
Existing structure opened to traffic	27 months	Pedestrians and bicycles would have existing facilities available. Pedestrian and bicycle traffic to/from Smith Cove Park would have to use the 21st Avenue West surface street
Total closure of bridge	11 months	Pedestrians and bicycles would have to use the Elliott Bay Trail between the BNSF railroad and North Bay/Terminal 91. Access to Smith Cove/Marina area via 21st Avenue West surface street.
Completed bridge opened	2 months	New bridge available to pedestrians and bicycles. Access to Smith Cove/Marina area via 21st Avenue West surface street.

Source: Mirai Associates

Freight Impacts

Access for freight mobility would be maintained as described under Alternative A.

Emergency Vehicle Impacts

Emergency response routing during the bridge closures would be the same as for Alternative A.

Safety

Closures of the existing bridge would occur for about 11 months, during which period the West Dravus Street and West Emerson Place/Street corridors would be

used as detour routes. The combination of added traffic and increased congestion could result in additional collisions in the detour corridors during this period. Increased numbers of pedestrians and bicyclists also could be involved in collisions.

Mitigation Measures

Traffic Operations

Mitigation of the impacts of temporary closures could be mitigated with the provision of a route connecting between 21st Avenue West and Alaskan Way West at the Galer Flyover. Detour traffic could then connect between Thorndyke Avenue West and Elliott Avenue West. This route would require the East Gate area to be reconfigured to allow public travel across the Terminal 91/North Bay properties, or provision of a surface route outside of the secured portion of Terminal 91. With the availability of this route, impacts on intersections along West Dravus Street could be reduced during the bridge closures.

Parking

Parking for construction workers could be accommodated by leasing of existing paved areas on nearby properties owned by the Port, leasing of spaces at the National Guard Armory site, or on vacant City right-of-way along West Armory Way east of the BNSF tracks. Workers could be shuttled to specific work locations from these parking areas.

Transit Facilities

During 11 months of construction, the Magnolia bus route would need to be detoured to West Dravus Street. This would result in increased transit route distances and travel times necessitating a change in bus schedules. The existing bus stop on the Magnolia Bridge serving North Bay would also be removed during construction. Temporary transit service to North Bay could be provided for 11 months using shuttle vans or buses between West Dravus Street and North Bay.

Pedestrians and Bicyclists

No mitigation required.

Freight and Goods

No mitigation required.

Emergency Vehicles

No mitigation required.

Safety

Deploy traffic control officers during weekday peak hours in the West Dravus Street corridor during the 11-month closure of the Magnolia Bridge.

Alternative D

The construction period for both the ramp and intersection options for Alternative D would be 45 months, including one month for mobilization. The construction would have one period of nine months that the Magnolia Bridge corridor would be closed

to all traffic. During the first 33 months of construction, traffic would be maintained on the existing structure. After the nine month closure, traffic would be moved onto the new structure. The sequence of construction is shown in Table 43.

Table 43
Sequence of Construction, Alternative D

Stage	Duration	Demolition	Construction
1	33 mo	Buildings within new right-of-way. Traffic maintained on existing bridge	New bridge and ramps to surface street except for west and east ends. Begin slope stabilization of Magnolia bluff.
2	9 mo	West and east ends of existing bridge. Close bridge to all traffic	West and east ends of new bridge.
3	2 mo	Existing bridge Traffic maintained on new bridge	Complete slope stabilization of Magnolia bluff.

Source: KPFF, 2004

Impacts

Traffic Operations

Closures and Diversion Routes

Access during construction is shown in Table 36.

Table 44
Access During Construction, Alternative D

Stage	Duration	Public Access To Magnolia	Public Access to Marina & North Bay	Contractor Access
1	33 mo	Existing bridge	Galer Flyover W Dravus St to 21st Ave W	Galer Flyover W Dravus St to 21st Ave W Barges to waterfront
2	9 mo	W Dravus St W Emerson St	Galer Flyover W Dravus St to 21st Ave W	Galer Flyover W Dravus St to 21st Ave W Barges to waterfront
3	2 mo	New bridge	New ramp(s)	New bridge Galer Flyover W Dravus St to 21st Ave W Barges to waterfront

Source: KPFF, 2004

Intersection Operations

During construction of Alternative D, the Magnolia Bridge would remain open to traffic except for a single nine-month closure to connect the endpoints of the new bridge. During this closure, West Dravus Street would carry the majority of detour traffic. Intersections along West Dravus Street at the 15th Avenue West ramp terminals and at 20th Avenue West would experience LOS E and F operations, but for a shorter period compared to Alternative A.

Parking Impacts

With Alternative D, a public right-of-way would be acquired for the new bridge, and uses of the space beneath the new bridge would be regulated. Parking and storage functions would likely be prohibited. The existing bridge would be demolished, easements released, and the underlying property would remain in the ownership of the Port.

Transit Impacts

During Stage 1 of construction, the existing bridge would be open, including the existing bus stops on the bridge surface. The existing bridge would be closed during Stage 2. During these nine months, buses would be detoured to West Dravus Street. Access to Piers 90 and 91, and North Bay/Terminal 91 could no longer be made from the bus stops on the existing bridge. Bus service would be reinstated during Stage 3

Pedestrian and Bicycle Impacts

The impact of construction on non-motorized transportation is shown in Table 45. Construction events that would affect Alternative D would be the same as for Alternative A.

Table 45
Non-motorized Impacts During Construction, Alternative D

Traffic Sequence	Duration	Effect
Existing structure opened to traffic	33 months	Pedestrians and bicycles would have existing facilities available. Pedestrian and bicycle traffic to/from Smith Cove Park would have to use the 21st Avenue West surface street
Total closure of bridge	9 months	Pedestrians and bicycles would have to use the Elliott Bay Trail between the BNSF railroad and North Bay/Terminal 91. Access to Smith Cove/Marina area via 21st Avenue West surface street.
Completed bridge opened	2 months	New bridge available to pedestrians and bicycles. Access to Smith Cove/Marina area via 21st Avenue West surface street.

Source: Mirai Associates

Freight Impacts

Access for freight mobility would be maintained as described under Alternative A.

Emergency Vehicle Impacts

Emergency response routing during the bridge closures would be the same as for Alternative A.

Safety

Closures of the existing bridge would occur for about nine months, during which period the West Dravus Street and West Emerson Place/Street corridors would be used as detour routes. The combination of added traffic and increased congestion could result in additional collisions in the detour corridors during this period. Increased numbers of pedestrians and bicyclists also could be involved in collisions.

Mitigation Measures

Traffic Operations

Mitigation of the impacts of temporary closures could be mitigated with the provision of a route connecting between 21st Avenue West and Alaskan Way West at the Galer Flyover. Detour traffic could then connect between Thorndyke Avenue West and Elliott Avenue West. This route would require the East Gate area to be reconfigured to allow public travel across the Terminal 91/North Bay properties, or provision of a surface route outside of the secured portion of Terminal 91. With the availability of this route, impacts on intersections along West Dravus Street could be reduced during the brief bridge closures.

Parking

Parking for construction workers could be accommodated by leasing of existing paved areas on nearby properties owned by the Port, leasing of spaces at the National Guard Armory site, or on vacant City right-of-way along West Armory Way east of the BNSF tracks. Workers could be shuttled to specific work locations from these parking areas.

Transit Facilities

During nine months of construction, the Magnolia bus route would need to be detoured to West Dravus Street. This would result in increased transit route distances and travel times necessitating a change in bus schedules. The existing bus stop on the Magnolia Bridge serving North Bay would also be removed during construction. Temporary transit service to North Bay could be provided for nine months using shuttle vans or buses between West Dravus Street and North Bay.

Pedestrians and Bicyclists

No mitigation required.

Freight and Goods

No mitigation required.

Emergency Vehicles

No mitigation required.

Safety

Deploy traffic control officers during weekday peak hours in the West Dravus Street corridor during the nine-month closure of the Magnolia Bridge.

Alternative H

Alternative H has been eliminated from further analysis and would not be constructed.

Summary of Findings

Affected Environment

Street Network

There are three roadway connections from the Magnolia community of over 20,000 residents to the rest of Seattle. The Magnolia Bridge is the southernmost connection and the most direct route for much of south and west Magnolia to downtown Seattle and the regional freeway system. 15th/Elliott Avenue West serves as the primary north-south arterial connecting Queen Anne, Ballard, and Magnolia to down town Seattle. Thorndyke/20th/Gilman Avenue West runs along the east edge of the Magnolia district and services as the primary collector for traffic to and from Magnolia.

Many streets in the Magnolia neighborhood provide access for residents to the Thorndyke/20th/Gilman Avenue West collector. North-south arterials such as 28th, 32nd, and 34th Avenues West serve as primary commuter routes. Major east-west arterials include West Dravus, West Emerson, West Blaine and West Galer Streets. West Plymouth, West Boston, and West Armour Streets primarily serve as local access for Magnolia residents and attract limited cut-through traffic.

Intersection Operations

Existing intersection operations are shown in Table 46.

Table 46
Existing Intersection Operations

Signalized Intersections	AM Peak Hour LOS[1]	PM Peak Hour LOS[1]
15th Ave W SB Ramps & W Dravus St	B	B
15th Ave W NB Ramps & W Dravus St	A	B
15th Ave W & Gilman Dr W	A	B
15th Ave W & W Armory Way	A	A
15th Ave W & W Garfield St	A	A
Elliott Ave W & W Galer St	A	A
Elliott Ave W & Galer Flyover	A	D
20th Ave W & W Dravus St	A	B
Unsignalized Intersections		
Gilman Ave W & W Emerson Pl	C	F
Thorndyke Ave W & 21st Ave W	A	B
Thorndyke Ave W & W Blaine St	B	B
Thorndyke Ave W & W Galer St	D	E
32nd Ave W & Clise Pl W	B	B
Magnolia Blvd. & W Howe St	C	C
Alaskan Way W & Galer Flyover	A	B

Notes: [1]Level of service.
Source: HNTB, 2003

Transit Facilities

The Magnolia Bridge carries three of the four local transit routes serving Magnolia and downtown Seattle destinations. These three routes contribute around 28 percent of the daily total ridership in the 15th/Elliott Avenue West corridor.

Pedestrian and Bicycle Facilities

The existing bridge has a five-foot wide sidewalk on the south side, connecting between a sidewalk on West Galer Street at the west end if the bridge and 15th Avenue West at West Garfield Street at the east end of the bridge. The sidewalk is barrier-separated from the eastbound roadway between West Galer Street and the eastbound on-ramp from 23rd Avenue West. A pair of stairs that connect via a pedestrian underpass mid-span near the roadway ramps allow both eastbound and westbound bus riders to access Terminal 91. There is a bridge stairway to the south sidewalk immediately east of the BNSF mainline crossing. At the surface, this stairway connects to a walkway to the north side of the bridge and east along the base of the bridge to 15th Avenue West.

The Elliott Bay Trail is a multi-use trail connecting downtown Seattle with Magnolia through Myrtle Edwards Park, around the Port of Seattle Terminal 91 property to the north and along the base of Magnolia Bluff to Smith Cove Park and the marina via 23rd Avenue West. At the north end of Terminal 91, the trail connects to Thorndyke Avenue West and West Dravus Street via 20th and 21st Avenues West to Thorndyke Avenue West. Magnolia Boulevard is a commonly used bike route linking Discovery Park and Magnolia Park with Thorndyke Avenue West.

Emergency Vehicles

The Seattle Fire Department equipment and personnel provide emergency response from four locations: Station 41 in Magnolia, Station 18 in Ballard, and Stations 8 and 20 in Queen Anne. Medical aid is also provided from Harborview Medical Center on First Hill east of downtown Seattle. The Seattle Police Department provides services to the Magnolia area through the West Precinct that covers the geographic area between Spokane Street to the south, Interstate 5 to the east, the Ship Canal to the north and Puget Sound on the west.

Operational Impacts

Alternative H is not included in the Summary of Findings. Because unacceptable levels of service at two key intersections cannot be mitigated, this alternative has been eliminated from further consideration.

Street Network

With the No Build Alternative, traffic volumes using the local streets in east Magnolia would average an increase of 50 percent by 2030, a growth of 1.5 percent annually. Streets that would be affected include West Plymouth, West Boston, and West Armour Street and 24th Avenue West. There would continue to be minimal cut-through traffic.

Alternatives A, C, and D would be the same as the No Build Alternative.

Intersection Operations

Table 47 shows existing intersection operation based on traffic counts made primarily in 2002 and 2003. The quality of operation is described by level of service (LOS) which is based on average delay for vehicles entering the insertion in the analysis period. The morning (AM) and evening (PM) peak one-hour commuting periods were evaluated. Two of the unsignalized intersections had LOS E or F operation. The Gilman Drive West/West Emerson Place intersection had LOS F in the PM on the east, West Emerson Place, approach. Thorndyke Avenue West/West Galer Street also had LOS F in the PM on the north, Thorndyke Avenue West approach.

Table 47 summarizes study area predicted intersection operations in the AM and PM peak hours for the 2010 year of project opening and the 2030 design year. Because the Alternatives A and D ramp options would provide the same connections to the existing road system as the existing Magnolia Bridge, these build alternatives would have the same traffic flows and intersection levels of service as the No Build Alternative. Alternative A – Intersection and Alternative – D Intersection would create a new mid-bridge intersection with a new ramp to a surface street on the 21st /23rd Avenue West alignment. Alternative C would create a surface street intersection with 21st Avenue West.

In 2010, all 11 signalized and five of the seven unsignalized intersections would operate at LOS C or better. Two unsignalized intersections would operate at LOS E and LOS F, in the AM and PM peak hours, respectively. These are Thorndyke Avenue West /West Galer Street on the Thorndyke Avenue West north approach, and Gilman Avenue West/West Emerson Place with LOS E on the north approach in the AM and LOS F on the east approach in the PM.

In 2030, all 11 signalized and five of the seven unsignalized intersections would operate at LOS C or better in the AM peak hour. The Thorndyke Avenue West / West Galer Street and Gilman Avenue West/West Emerson Place unsignalized intersections would operate at LOS E on the north approaches. In the 2030 PM peak hour, the 15th Avenue West/Gilman Drive West, Thorndyke Avenue West/21st Avenue West, and Magnolia Boulevard/West Howe Street intersection would operate at LOS D. The 15th Avenue West northbound ramps/West Dravus Street and 20th Avenue West/West Dravus Street intersections would operate at LOS E, and the Thorndyke Avenue West /West Galer Street and Gilman Avenue West/West Emerson Place unsignalized intersections would operate at LOS F on the north and east approaches, respectively.

The Alaskan Way West/Galer Flyover intersection is presently unsignalized. It is assumed to be signalized by 2010 as traffic volumes increase with the build-out of the Amgen site and other area development served by Alaskan Way West. This intersection would operate at LOS B in the 2010 PM hour with queues averaging about 400 feet on the south approach. In 2030, the intersection would have LOS C operation in the PM peak with queues averaging about 400 feet.

Table 47
Intersection Operations

	Existing LOS	2010 LOS		2030 LOS	
		No Build Alt A-Ramp Alt D-Ramp	Alt A-Int Alt C Alt D-Int	No Build Alt A-Ramp Alt D-Ramp	Alt A-Int Alt C Alt D-Int
	AM/PM	AM/PM	AM/PM	AM/PM	AM/PM
Signalized Intersections					
15th Ave W SB Ramps & W Dravus St	B/B	B/C	B/C	C/E	C/E
15th Ave W NB Ramps & W Dravus St	A/B	B/B	B/B	B/C	B/C
15th Ave W & Gilman Dr W	A/B	B/C	B/C	B/D	B/D
15th Ave W & W Armory Way	A/A	A/A	A/A	B/A	B/A
15th Ave W & W Garfield St	A/A	A/A	A/A	A/B	A/B
Elliott Ave W & W Galer St	A/A	A/A	A/A	A/A	A/A
Elliott Ave W & Galer Flyover	A/D	A/A	A/A	B/B	B/B
Alaskan Way W & Galer Flyover	A/B[4]	A/B	A/B	B/C	B/C
20th Ave W & W Dravus St	A/B	B/C	B/C	B/E	B/E
Thorndyke Ave W & 21st Ave W	-	C/C	C/C	C/D	C/D
21st Ave W & Alt C Surface St	-	-	A/A[3]	-	A/A[3]
Ramp to 21st Ave W & Magnolia Bridge	-	-	A/A[2]	-	B/B[2]
Unsignalized Intersections					
Gilman Ave W & W Emerson Pl	C/F	E/F	E/F	E/F	E/F
Thorndyke Ave W & W Blaine St	B/B	B/B	B/B	B/C	B/C
Thorndyke Ave W & W Galer St	D/E	E/F	E/F	E/F	E/F
32nd Ave W & Clise Pl W	B/B	B/B	B/B	B/B	B/B
Magnolia Blvd. & W Howe St	C/C	C/C	C/C	B/D	B/D
21st Ave W & Magnolia Bridge (north ramp)	-	A/A	-	A/A	-
21st Ave W & Magnolia Bridge (south ramp)	-	A/A	-	A/A	-

Notes: [1] Level of service.
[2] For Alt A – Intersection and Alt D – Intersection only.
[3] For Alt C only.
[4] Existing LOS is for unsignalized intersection.
Source: HNTB, 2003

Transit Facilities

No Build Alternative

No changes in bus routes are expected. Bus service would be coordinated with the Green Line monorail, waterfront street car and potential commuter rail access. Transit ridership, including monorail, is forecast to grow by 4 to 5 percent annually through the study area.

Alternative A

No major changes to bus routes would be expected with Alternative A as the bridge would remain in the same location as the existing bridge with the same connections at both the east and west ends. With Alternative A, the same or equivalent bus access would be available, either by building the required bus stops on the structure, or by a Metro bus route revision through the North Bay development. Compatibility with the planned Green Line, waterfront street car and commuter rail access would remain the same as in the No Build Alternative. Ridership would be the same as the No Build Alternative.

Alternative C

Transit routes would experience an increase of approximately 0.5 mile over the No Build Alternative. Travel time would increase about one minute, but this would be offset if bus stops were in place on the surface road portion of the alignment and riders would not need to use stairs or ramps as required for the existing bridge or with Alternatives A and D. Compatibility with the planned Green Line, Waterfront Street car and Commuter rail access would remain the same as in the No Build Alternative. Ridership would be the same as the No Build Alternative.

Alternative D

Transit routes would experience an increase of approximately 0.1 mile over the No Build Alternative. Other impacts would be identical to Alternative A.

Pedestrian and Bicycle Facilities

No Build Alternative

The addition of the 21st Avenue West surface street will facilitate non-motorized access from Magnolia to the Elliott Bay Marina and Smith Cove. This would not cause a noticeable change in traffic patterns on the local street system in Magnolia.

Alternative A

A ten-foot-wide sidewalk on the south side of the bridge would improve conditions for pedestrians, as would the 16-foot-wide outside lanes for bicyclists. Trail access would be similar to the No Build Alternative.

Alternative C

A ten-foot-wide sidewalk on the south side of the alignment would improve conditions for pedestrians, as would the 16-foot-wide outside lanes for bicyclists. However, the 0.5 mile increased length and the 6.5 percent slope on the structure in front of the bluff would increase walking time by about ten minutes compared to the

No Build Alternative. Trail access would be at the intersection with 21st Avenue West.

Alternative D

Impacts would be similar to Alternative A. The one-tenth mile increased length compared to No Build or Alternative A would increase walking time by about two minutes.

Freight and Goods

No Build Alternative

Truck volumes on the Magnolia Bridge between 15th Avenue West and the west ramps would be expected to increase during the AM peak hours from 20 currently to almost 100 trucks per hour in 2030. Similarly, truck volumes on the Galer Flyover are forecast to increase from the current 30 trucks to a high of around 85 trucks in the AM peak hour.

Alternative A

Same as No Build Alternative

Alternative C

Truck volumes would be the same as the No Build Alternative, but trucks would access the Port property from the intersection with the 21st Avenue West surface street in the middle of the North Bay property.

Alternative D

Same as No Build Alternative

Emergency Vehicles

The increases in response distances with the build alternatives are shown in Table 48. None of the increases would significantly impact the response time for emergency vehicles.

Table 48
Relative Response Distances

		Distance/Change (miles) Relative to No Build Alternative				
Station	**No Build**	**Alt A-Ramp**	**Alt A-Int**	**Alt C**	**Alt D-Ramp**	**Alt D-Int**
Station 8 to Smith Cove	2.4	n.c.	2.8/**+0.4**	2.9/**+0.3**	2.5/**+0.1**	2.8/**+0.4**
Station 41 to Terminal 91	2.1	n.c.	2.3/**+0.2**	2.5/**+0.4**	2.4/**+0.3**	2.4/**+0.3**
Station 41 To Smith Cove	1.6	n.c.	1.8/**+0.2**	2.0/**+0.4**	1.9/**+0.3**	1.9/**+0.3**
Harborview to Smith Cove	4.4	n.c.	4.8/**+0.4**	4.9/**+0.5**	4.5/**+0.1**	4.8/**+0.4**
Harborview to Magnolia Village	5.3	n.c.	n.c.	5.8/**+0.5**	5.4/**+0.1**	5.4/**+0.1**

Note: n.c. = no change
Source: Mirai and Associates & HNTB, 2004

No Build Alternative

Emergency vehicle access routes would not change.

Alternative A

Alternative A-Ramps would provide the same response routes as the No Build Alternative. Alternative A-Intersection would have a 0.4 mile increase in travel distance to Smith Cove and Terminal 91 because of the connector ramp between the Magnolia Bridge intersection and the 21st Avenue West intersection.

Alternative C

The surface street intersection with 21st Avenue West would increase the travel distance to Smith Cove and Terminal 91 by 0.3 to 0.5 mile. The distance from Harbor View Medical Center to Smith Cove and Magnolia Village would also increase by 0.5 mile.

Alternative D

Alternative D would provide similar response routes to Alternative A.

Safety

No Build Alternative

Collision patterns and locations in the study area would remain similar to existing conditions. The number of collisions may grow with increasing volumes of traffic and increasing levels of congestion. Direct safety impacts would not be significant.

Alternative A

Safety impacts would be similar to those of the No Build Alternative for the Alternative A – Ramps option. Alternative A – Intersection would introduce a signal for east-west bridge traffic with additional opportunities for traffic and pedestrian/bicycle conflicts.

Alternative C

Alternative C would introduce signal control for bridge traffic and 21st Avenue cross traffic at a single location, affecting higher volumes of traffic with multiple conflict points. Differences would not be significant compared to Alternatives A and D.

Alternative D

Safety impacts would be similar to Alternative A for the Alternative D - Ramps option. Alternative D – Intersection would introduce a signal for east-west bridge traffic with additional opportunities for traffic and pedestrian/bicycle conflicts.

Construction Impacts

The anticipated construction period and staging for the Build Alternatives is shown in Table 49.

Table 49
Construction Duration (months)

Stage	Alternative A	Alternative C	Alternative D
Mobilization	1	1	1
1 – Initial construction with traffic maintained on existing bridge	15	27	33
2 – Bridge closed to traffic to complete construction	17	11	9
3 – Traffic on new structure(s) during demolition and cleanup	6	2	2
Total Construction Time	39	41	45

Source: KPFF, 2004

Traffic Operations

During the Stage 2 bridge closure, traffic would be detoured to West Dravus Street and West Emerson Place. This route would add approximately 1.7 miles to the commute between the Magnolia Bluff and the intersection of Elliott Avenue West and the Galer Flyover. Vehicles traveling this route would encounter eight signalized intersections where the route across the existing bridge has only one. The additional travel time imposed by this detour would be over eight minutes per commuting vehicle.

The operations of the eight intersections during the construction detour are compared to their operation under No Build conditions in Table 50.

Table 50
2010 Intersection Operations,
Construction Detour and No Build Alternative

	AM Peak Hour LOS[1] (Delay)[2]		PM Peak Hour LOS[1] (Delay)[2]	
Signalized Intersections	**No Build**	**Detour**	**No Build**	**Detour**
20th Ave W & W Dravus St	B (15.0)	E (73.8)	C (21.8)	E (68.1)
15th Ave W SB Ramps & W Dravus St	B (18.9)	B (15.3)	C (26.7)	D (38.2)
15th Ave W NB Ramps & W Dravus St	B (12.6)	D[3] (52.4)	B (13.3)	F[3] (103.3)
15th Ave W & Gilman Dr W	B (11.9)	B (18.3)	C (22.6)	D (40.4)
15th Ave W & W Armory Way	A (4.5)	B (17.9)	A (5.4)	A (2.8)
15th Ave W & W Garfield St	A (3.0)	A (2.3)	A (8.6)	A (2.3)
Elliott Ave W & W Galer St	A (4.4)	A (2.1)	A (0.4)	A (0.7)
Elliott Ave W & Galer Flyover	A (4.1)	A (3.9)	A (8.0)	D (40.4)

Notes: [1] Level of service.
[2] Delay is in seconds per vehicle.
[3] LOS without manual traffic control for northbound to westbound turning movement.
Source: HNTB, 2004

Parking

Parking and storage functions would be prohibited beneath the new bridge for all of the build alternatives.

Transit Facilities

Alternative A

Bus routes would need to be detoured to West Dravus Street during Stages 1 and 2 for a total of 32 months. This would add 1.6 miles to the transit routes during construction. Access to Piers 90 and 91, and North Bay/Terminal 91 could not be made from bus stops on the existing bridge.

Alternative C

During State1, buses would continue to operate on the existing bridge structure. Buses would be detoured to West Dravus Street during the 11 months of Stage 2 construction, adding 1.6 miles to the transit routes. Access to Piers 90 and 91, and North Bay/Terminal 91 could not be made from bus stops on the exiting bridge.

Alternative D

During Stage 1, buses would continue to operate on the existing bridge structure. Buses would be detoured to West Dravus Street during the nine months of Stage 2 construction, adding 1.6 miles to the transit routes. Access to Piers 90 and 91, and North Bay/Terminal 91 could not be made from bus stops on the existing bridge.

Pedestrian and Bicycle Facilities

Alternative A

The 21st Avenue West surface street would be operational between Thorndyke Avenue West and the waterfront for the duration of construction. The Elliott Bay Trail would be open to pedestrian and bicycles on the east side of the Port property up to its intersection with the 21st Avenue West surface street for all stages of construction. The portion of the Elliott Bay Trail from this intersection to Smith Cover Park would be closed during the 39 months of construction and the surface street would serve as a temporary pedestrian access to this area. Access to and from Smith Cove Park via Magnolia Bridge would be unavailable for 32 months.

Alternative C

Same as Alternative A except construction is anticipated to take 41 months. Access to and from Smith Cove Park via Magnolia Bridge would be unavailable for 11 months.

Alternative D

Same as Alternative A except construction is anticipated to take 45 months. Access to and from Smith Cove Park via Magnolia Bridge would be unavailable for 9 months.

Freight and Goods

A priority of construction for the build alternative would be to maintain access through the study area at all times.

Emergency Vehicles

Alternative A

Emergency response access would be maintained during the months of construction. The surface street between 21st Avenue West and Smith Cove Park would be completed before construction and all emergency services to the waterfront would use this route. The Galer Flyover would provide access to Pier 91. West Dravus Street and Thorndyke Avenue West would be used as access routes instead of the Magnolia Bridge for other emergency vehicles and police.

Alternative C

Same as Alternative A.

Alternative D

Same as Alternative A.

Safety

Alternative A

During closure of the existing bridge, east-west traffic would be shifted to the West Dravus Street and West Emerson Place corridors for a period of 17 months. The increases in volume, together with additional congestion, could be expected to produce increases in the numbers of collisions in these detour corridors. These conditions also could raise the levels of involvement of pedestrians and bicyclists using these detour corridors.

Alternative C

The existing bridge would be closed for 11 months. During this period, the West Dravus Street and West Emerson Place/Street corridors would be used as detour routes. The combination of added traffic and increased congestion could result in additional collisions in the detour corridors during this period. Increased numbers of pedestrians and bicyclists could also be involved in collisions.

Alternative D

Closure of the existing bridge would occur for about nine months, during which period the West Dravus Street and West Emerson Place/Street corridors would be used as detour routes. The combination of added traffic and increased congestion could result in additional collisions in the detour corridors during this period. Increased numbers of pedestrians and bicyclists also could be involved in collisions.

Secondary and Cumulative Impacts

The Magnolia Bridge replacement is one of several projects in the study area in the planning and evaluation phases of development. Planning is underway for building

new mass-transportation infrastructure and for redeveloping the large areas of underutilized land in the area. These projects will influence future transportation patterns, land use patterns, and economic potential. Related projects include the following:

- The Seattle Monorail Project is in the design phase for the Green Line, a monorail route approved by voters that will run from Ballard to West Seattle. The Green Line will include stations at West Dravus Street/16th Avenue West and West Mercer Street/Elliott Avenue West, as well as a future station near Magnolia Bridge at West Blaine Street/15th Avenue West.
- The Pro Parks Levy, approved by voters in November 2000, made over $198 million available for land acquisition and development by Seattle Parks and Recreation. Land will be acquired for over 30 new parks, and 95 park development projects are planned or underway. In the Smith Cove area, 7.3 acres of land were purchased through this levy program.
- The Port of Seattle is in the planning phase for 57 acres of land on the uplands of Piers 90 and 91, known as North Bay/Terminal 91. The Port's study also includes the possible relocation of the National Guard Armory and reuse of that property.
- Private development, including an area known as Interbay Urban Center (12.5 acres; 1,500 lineal feet along 15th Avenue West) and future phases of Amgen.
- Sound Transit's commuter rail line, known as Sounder, began operation between Everett and Seattle in December 2003. The commuter rail line uses the BNSF railroad tracks through the study area. A station is not currently proposed for the Interbay area, but a stop would be possible if future changes warrant such a stop.
- Seattle's waterfront streetcar currently runs to just north of Broad Street. There have been ongoing discussions of extending the line north to Amgen or beyond. If the streetcar line were to be extended, it could serve Interbay. Under these circumstances, the streetcar maintenance facility would need to be relocated and could be moved to the study area.

Potential for an Intermodal Hub

If the proposed transportation systems through the Interbay area were designed in concert, the concept for a future intermodal hub could develop. An intermodal hub could eliminate the need for buses from Magnolia to use 15th Avenue West. This change would reduce traffic on 15th Avenue West and benefit freight and other traffic along the corridor. The intermodal hub could provide connections between the monorail, commuter rail, water transport, buses, and pedestrian and bicycle systems. Pedestrian and bicycle routes along the water already serve Amgen and the Port's North Bay/Terminal 91 property and connect to Seattle's north waterfront, Belltown, and downtown. The Magnolia Bridge would provide access to an intermodal hub if developed.

Under the No Build Alternative, changes to the design of the bridge would not occur. The No Build Alternative would not provide an opportunity to connect to an

intermodal hub. All of the build alternatives would be designed to accommodate an intermodal hub if one were developed.

Planned Development

The location and design of the bridge structure and ramps would affect the development of currently vacant or underutilized property. The traffic operations analyses of the no build and build alternatives is based on 2010 and 2030 traffic forecasts developed for existing zoning. The Port of Seattle master planning process for North Bay is developing land use scenarios that would have higher density employments and potential residential and commercial uses that would require a Seattle Comprehensive Plan amendment and revised land use zoning.

Both the no build and build alternatives would provide two traffic lanes in each direction between access to/from North Bay and 15th Avenue West. The access to the re-development area of North Bay, west and north of Terminal 91, would use the existing ramps to and from 23rd Avenue West for the No Build Alternative, and new ramps or an intersection to a new surface street on the 21st/23rd Avenue West alignment with the build alternatives. The North Bay land use scenarios under development by the Port of Seattle could generate peak commute period traffic demand that would require modification of the build alternatives to accommodate higher traffic volumes and a greater number of trucks. The peak period traffic capacity of the 15th/Elliott Avenue West corridor could remain a constraint on North Bay development. As the Port of Seattle's land use scenarios and traffic analyses are made available, they are being considered in the Magnolia Bridge Replacement project. Increased development in North Bay may require additional vehicle access to the 15th/Elliott Avenue West corridor, apart from access available with the Magnolia Bridge Replacement alternatives.

Future re-development of properties fronting 15th Avenue West or served by local access streets directly from 15th Avenue West would not be directly affected by the no build and build alternatives.

Monorail

While the location and the timing of the monorail station near West Blaine Street has not been determined, a station will be located at south of West Dravus Street between 16th and 15th Avenues West. All transportation modes use West Dravus Street to travel between Magnolia and Queen Anne and to access 15th Avenue West. From a monorail station area planning standpoint, it is desirable to make West Dravus Street as pedestrian-friendly as possible. A new monorail stop will increase pedestrian traffic on this high-volume street. Also, more buses will be attracted to West Dravus Street for transfers to and from the monorail.

The no build and build alternatives would keep traffic patterns the same as under existing conditions and would not affect traffic volumes along West Dravus Street.

Operational Mitigation Measures

Street Network

Alternative A

No mitigation required.

Alternative C

No mitigation required.

Alternative D

No mitigation required

Intersection Operations

No mitigation required.

Transit Facilities

No mitigation required.

Pedestrian and Bicycle Facilities

No mitigation required.

Freight and Goods

No mitigation required.

Emergency Vehicles

No mitigation required.

Safety

No mitigation required.

Construction Mitigation Measures

Traffic Operations

No mitigation required.

Parking

Parking for construction workers could be accommodated by leasing existing paved areas on nearby properties owned by the Port, leasing of spaces at the National Guard armory site, or on vacant City right-of-way along Armory Way east of the rail yards. Workers could be shuttled to specific work locations from these parking areas.

Transit Facilities

Alternative A

Increased transit route distances and travel times would necessitate a change in bus schedules. The lack of a bus stop serving North Bay could be mitigated with temporary transit service using shuttle vans or buses from West Dravus Street.

Alternative C

Same as Alternative A.

Alternative D

Same as Alternative A

Pedestrian and Bicycle Facilities

No mitigation required.

Freight and Goods

No mitigation required

Emergency Vehicles

No mitigation required.

Safety

Alternative A

Traffic control measures would be required during construction of Alternative A to address congestion on the detour routes (West Dravus Street and West Emerson Place/Street). Manual peak period traffic control by officers should be considered for the 15th Avenue West NB Ramps/Dravus Street intersection during the 17 months of detours.

Alternative C

Traffic control measures would be required during construction of Alternative C to address congestion on the detour routes (West Dravus Street and West Emerson Place/Street). Manual peak period traffic control by officers should be considered for the 15th Avenue West NB Ramps/Dravus Street intersection during the 11 months of detours.

Alternative D

Traffic control measures would be required during construction of Alternative D to address congestion on the detour routes (West Dravus Street and West Emerson Place/Street). Manual peak period traffic control by officers should be considered for the 15th Avenue West NB Ramps/Dravus Street intersection during the 9 months of detours.

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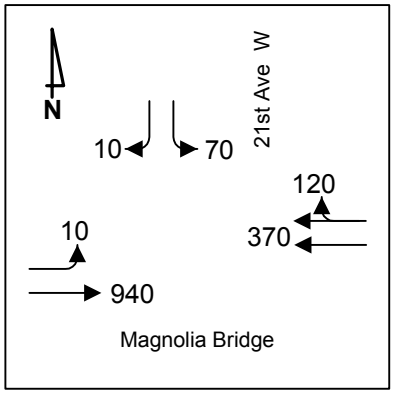
Appendix A – Traffic Volume Diagrams

The following diagrams illustrate proposed lane configuration and turning movements at selected intersections. These intersections include:

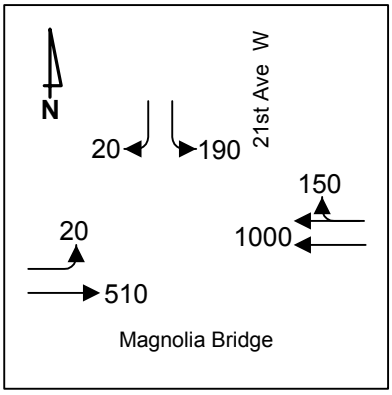
- The intersection of 21st Avenue West with the mid-span elevated intersection for Alternative A – Intersection and Alternative D – Intersection.
- The intersection of 21st Avenue West with the Alternative C surface road.
- The intersection of Elliott Avenue West with the Galer Flyover for all alternatives.
- The intersection of Alaskan Way West with the Galer Flyover for Alternative H.
- The intersection of 15th Avenue West with West Armory Way for Alternative H.

21st Avenue West & Magnolia Bridge

Alternative A – Intersection and Alternative D – Intersection



2010 AM Peak Hour



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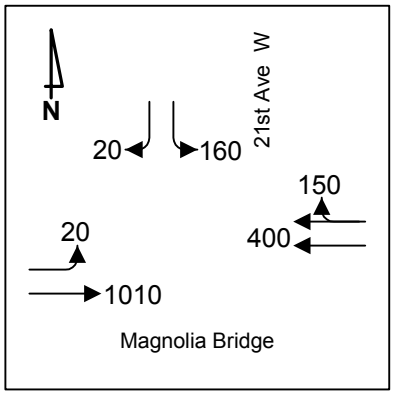
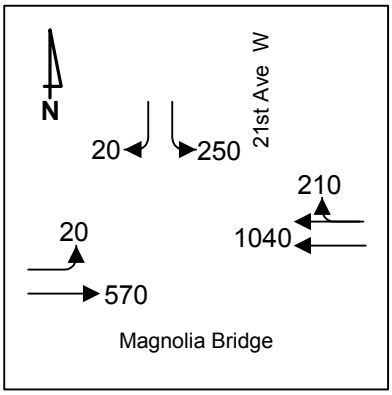


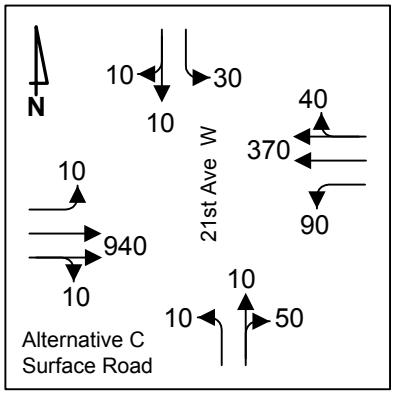
2030 AM Peak Hour



2030 PM Peak Hour

21st Avenue West & Alternative C Surface Road

Alternative C



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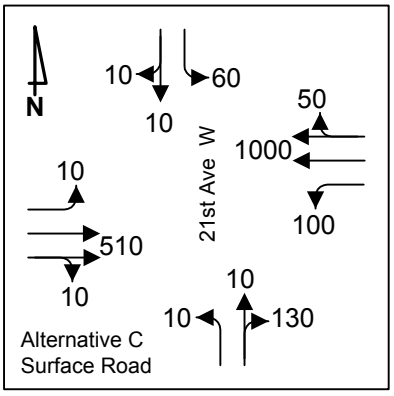

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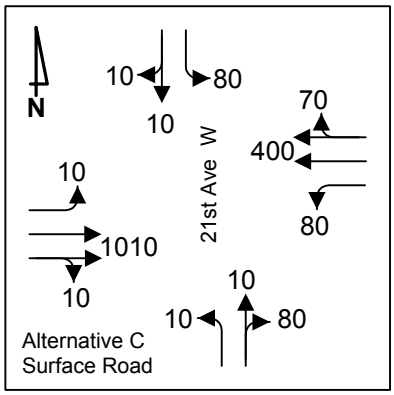

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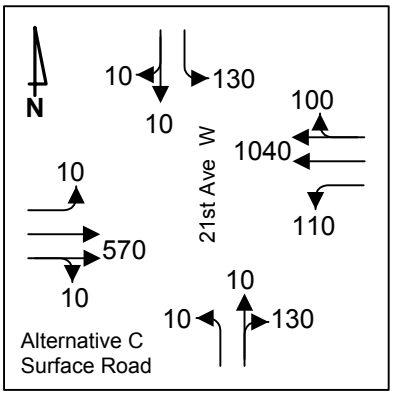
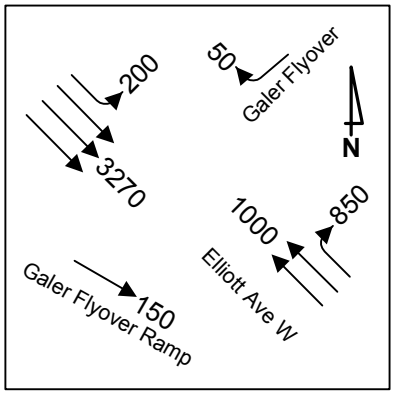


2030 PM Peak Hour

Elliott Avenue West & Galer Flyover

No Build and Alternatives A and D



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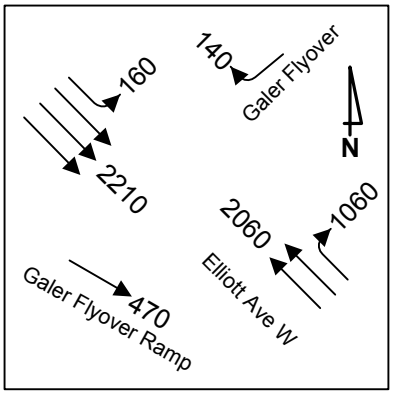

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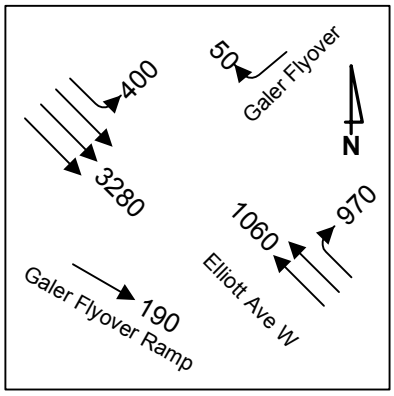
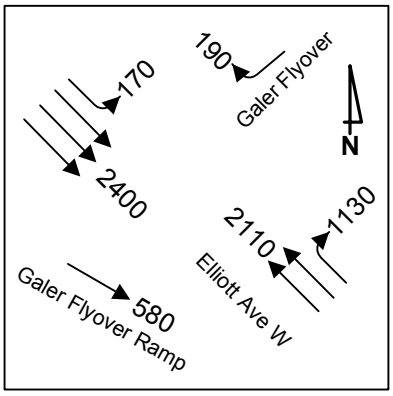


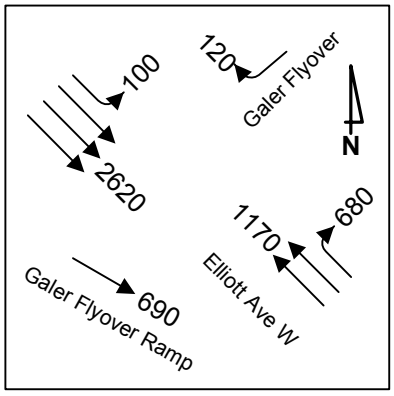
2030 AM Peak Hour



2030 PM Peak Hour

Elliott Avenue West & Galer Flyover

Alternative H



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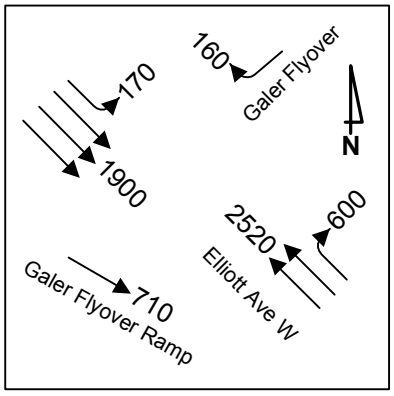

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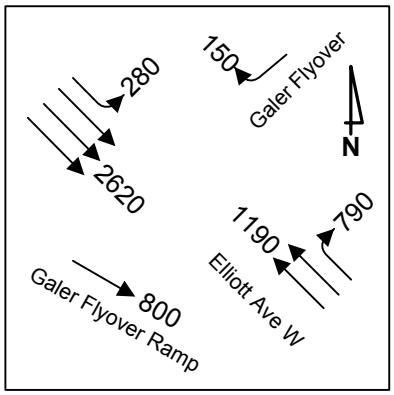
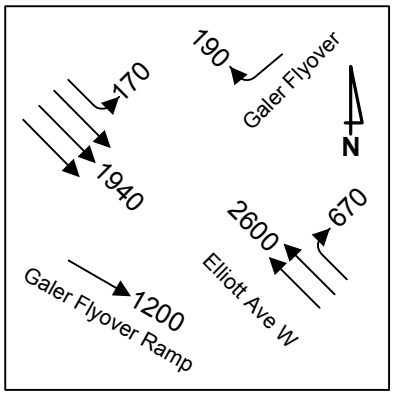


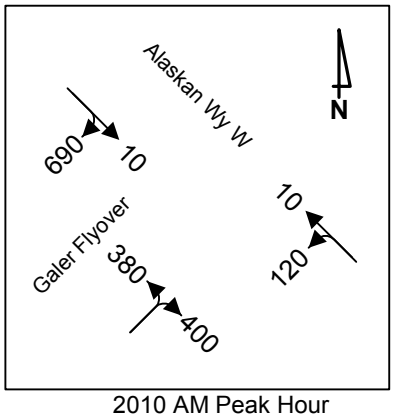
2030 AM Peak Hour



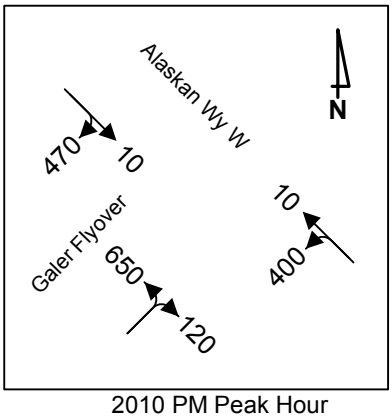
2030 PM Peak Hour

Alaskan Way West & Galer Flyover

Alternative H



2010 AM Peak Hour



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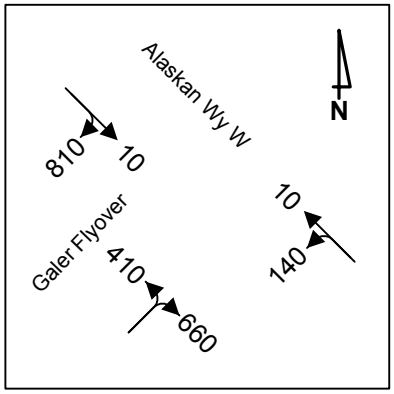
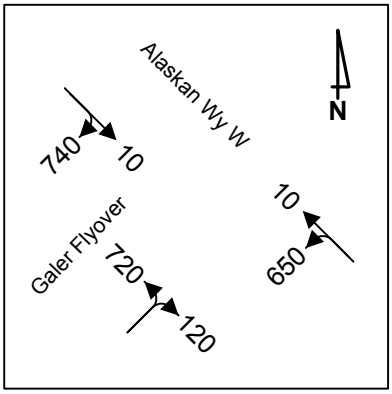


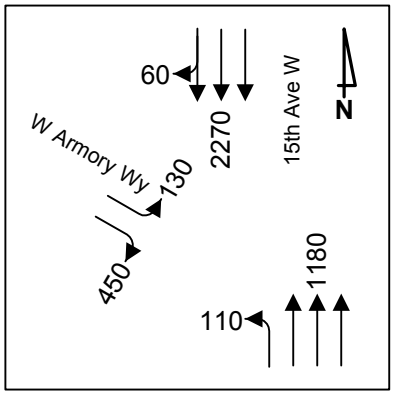
2030 AM Peak Hour



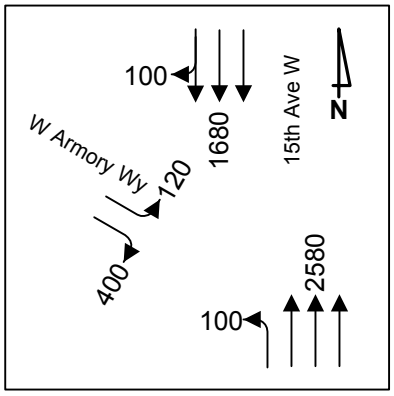
2030 PM Peak Hour

15th Avenue West & West Armory Way

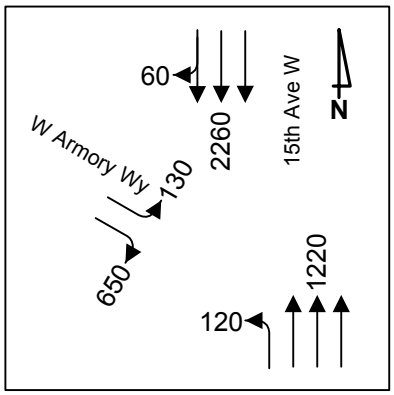
Alternative H



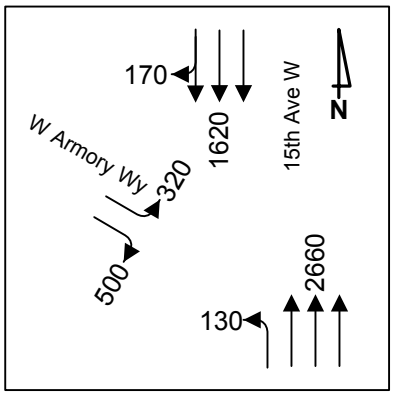
2010 AM Peak Hour



2010 PM Peak Hour



2030 AM Peak Hour



2030 PM Peak Hour