Appendix A
Transportation Methodology and Assumptions Report

Transportation Methods and Assumptions Report
Sound Transit East Link Project

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Transportation Methods and Assumptions Report

1.0 Introduction

This transportation methodology and assumptions report updates the methods and assumptions for analyzing the local, corridor and region wide transportation impacts associated with Sound Transit's East Link project for the Final Environmental Impact Statement (FEIS). As part of the Draft EIS, a transportation methodology and assumptions report was prepared and reviewed by the affected federal, state and local agencies. This report is included in the Appendix H1 of the East Link Draft EIS; December 2008.

An Interchange Justification Report (IJR), required by FHWA, will be prepared in parallel to the EIS analysis focusing on the I-90 corridor and using the same analysis methodology described in this report. The analysis of local transportation impacts will identify and evaluate the impacts of the light rail alternatives on the following:

- Year of opening and design year traffic service levels at key intersections affected by light rail alternatives;
- Year of opening and design year traffic analysis along I-90;
- Short-term impacts to vehicular, bicycle and pedestrian traffic resulting from construction activities;
- Parking near stations and at park-and-ride lots along the light rail alignments;
- Property access and local traffic flow changes caused by street closures and/or rail alignment;
- Safety;
- Freight movement within the corridor including trucking and freight rail;
- Bicycle and pedestrian circulation; and
- Transit service and the integration of transit service plans.

2.0 Agency Guidelines and Regulations

Relevant laws and regulations that govern or influence the local and region-wide transportation impact analysis include the following:

- Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users. (SAFETEA-LU, Public Law 109-59)
- CFR 23 Part 450 (implementing United States Code [USC] 23 Section 111; requiring the U.S. Secretary of Transportation to approve access revisions to the Interstate System)
- Washington State Growth Management Act RCW 36,70A.070; and
- King County and Cities of Seattle, Mercer Island, Bellevue and Redmond's Comprehensive and/or Transportation Plans and Concurrency Management Systems and applicable city and development codes require the preparation of a transportation impact study and consideration of mitigation strategies for development generating peak-hour traffic delays above a specified threshold.

In addition to the laws and regulations identified above, analysis of local transportation impacts will be guided by the policy direction established in the numerous plans or policy documents adopted within the East Link corridor. These include, but are not limited to:

- Sound Transit Long-Range Plan; adopted July 7, 2005
- WSDOT Transportation Plan 2007-2026 (WSDOT November, 2006)
- WSDOT Design Manual
- WSDOT Development Service Manual. M.3007.00
- Puget Sound Regional Council (PSRC)'s Destination 2030 Plan

- Comprehensive and/or Transportation Plans for the Cities of Seattle, Mercer Island, Bellevue, Redmond and King County
- 6-Year Capital Improvement Program for the Cities of Seattle, Mercer Island, Bellevue, Redmond and King County.

3.0 Transportation Analysis Methodology

The analysis of transportation impacts will be based on a full-length East Link system from the International District/Chinatown Station in Seattle to downtown Redmond and shorter length systems with interim termini at the Ashwood/Hospital (or Hospital) Station and all proposed stations east of Overlake Hospital prior to downtown Redmond (124th Ave NE, 130th Ave NE, Overlake Village, Overlake Transit Center, SE Redmond, and Redmond Town Center stations). The analysis described in the subsequent sections of this report is focused on three areas:

a) Regional transportation impact analysis (including data such as project-wide ridership and daily vehicle miles and hours of travel)

b) Corridor and operational transportation impact analysis includes a comparison of screenline transportation impacts (such as ridership, volume to capacity, and mode split) and an operational and safety analysis of the local streets, freeway system and intermodal network(s).

c) Construction impact analysis includes an analysis of the arterials and an operational assessment of I-90 when the center reversible roadway is closed for construction of light rail.

The various transportation networks and modes will be analyzed strategically to assess the overall transportation conditions. Analysis of various transportation modes is generally categorized by three assessment levels which are supported by various measures listed in Table 1. These measures will vary among the transportation modes being analyzed. The purpose of categorizing assessment levels is to determine the appropriate data/information used in analyzing the transportation impacts.

3.1 Transportation Analysis Years

Based on the project's schedule and available traffic forecasting data, the transportation analysis will focus on four distinct periods:

- 2007: Existing
- 2020: Year of Opening. This year has been identified as an appropriate year to provide a conservative opening year analysis.
- 2030: Design Year. This year has been identified as the design year for analysis as it is consistent with the future planning horizon used by PSRC and local agencies. This design year has been agreed to by the local agencies and FTA, WSDOT and FHWA.
- A 2020 construction period assessment.

3.2 Regional Transportation Analysis

While the Puget Sound Regional Council (PSRC), Sound Transit (ST) and the Bellevue-Kirkland-Redmond (BKR) demand forecast models will be used to produce forecasts for the transportation operational-level impact analysis (refer to Section 6.2) output only from the PSRC travel demand and ST ridership models will be used as the data source for the regional-level analysis. Daily project-wide boardings, vehicle miles and hours of travel for the project study area will be provided to gauge the impact of light rail on the region:

- Project-wide daily boardings – Daily ridership throughout the entire East Link study area
- Vehicle Miles of Travel (VMT) - Trip table matrices will be multiplied by trip distance to determine the number of total vehicle miles on the highway system.
- Vehicle Hours of Travel (VHT) - Matrices of vehicle trips and travel time per trip will be used to quantify vehicle hours traveled (VHT).

TABLE 1
East Link Transportation Assessment/Measures

Assessment Level	Analysis Type	Measure/Assessment
Regional Level	Ridership	- Project-wide daily boardings
	VMT/VHT	- VMT/VHT
Corridor Level	Screenline Analysis	- Transit ridership
		- Volumes/Capacity (V/C ratios)
		- Mode share
Operational Level	Intersection Analysis	- LOS and associated vehicle delay
		- Vehicle queue length
		- accident rates
	Freeway Analysis	- LOS/density
		- Person and vehicle carrying throughput
		- Travel Times (GP, HOV, transit [bus and light rail] and trucks)
		- Access modifications
	Ridership	- Station ridership
	Freeway Safety	- Predictive assessment with reversible center roadway conversion
	Alignment Safety	- Predictive assessment of at-grade or elevated alignments within or adjacent to surface streets
	Transit LOS	- Service frequency, hours of service, passenger loads, reliability, travel times and transfer rates
	Non-Motorized	- Station area pedestrian LOS
		- Sidewalk, trail and bike inventory, access and circulation
	Parking	- On-street supply/demand - Direct alternative impacts

Information from the PSRC travel demand model will be used to generate both the No-Build and Build condition VMT/VHT data. Included in the Build condition travel demand modeling will be the Sound Transit Board's preferred light rail alternative to reflect its mode share. This preferred light rail alternative reflects the alignment generally following A1-B3-C4A-D2A-E2. Sound Transit uses an incremental model to isolate outside influences (i.e. population growth, highway congestion, parking costs) and transit service influences on transit ridership. For a summary of Sound Transit's ridership model, see Attachment 3. The change between the No-Build and Build condition VMT/VHT data will be created through a post-processing exercise related to the number of new transit riders and average trip length (derived from the Sound Transit model) with the East Link project. Furthermore VMT/VHT for the East Link alternatives that forecast the highest and lowest project-wide daily ridership will be bracketed to document the potential range of VMT/VHT change with the East Link project.

3.3 Corridor and Operational Transportation Analysis

The corridor analysis will focus on two sets of analyses:

1. A screenline analysis to provide a snapshot of vehicle and person information
2. A local street and freeway traffic analysis

This analysis will provide detailed information on ridership and traffic operations along the light rail alternatives and operations surrounding the proposed stations.

Screenline Analysis

The analysis of transportation impacts in various segments of the corridor will involve comparing ridership forecasts and projected traffic volumes on the highway and local street system at selected screenlines between the No-Build and the Build alternative. A map and table will be used to present Daily and PM peak-hour vehicle trips at the six identified screenline locations. Refer to Attachment 2 for a graphic representation of these screenlines. The screenlines are:

1. City of Seattle Screenline: A north-south screenline south of South Jackson Street that extends between and includes Alaskan Way and 5th Avenue South and also includes the Downtown Seattle Transit Tunnel);
2. Lake Washington (including SR 520 and I-90): An east-west screenline between the I-90 Mount Baker Tunnel and Mercer Island and north to include SR 520 floating bridge;
3. Interstate-90: An east-west screenline between Bellevue Way and I-405 Interchanges;
4. South Bellevue: A north-south screenline that extends between and includes Bellevue Way, 118th Avenue SE and I-405;
5. 140th Avenue: An east-west screenline that extends between and includes SR 520 and NE 8th Street in the City of Bellevue; and
6. Grasslawn: A north-south screenline that includes 140th Avenue NE and extends to Marymoor Park (City of Redmond #6 screenline in the Redmond Transportation Master Plan)

These screenlines provide a snapshot of ridership, traffic operations and traffic shifts/modal splits along the corridor. Information from the PSRC and Sound Transit forecasting models that will be presented for each screenline includes:

- Volume-to-capacity (V/C) ratio
- Mode share

Local Street System and Freeway Transportation Analysis

The methodology proposed for the local street and freeway analysis is intended to be applied as consistently as possible throughout the corridor. The local street system focuses on intersection level of service operations and safety analysis while the freeway analysis will include measures such as vehicle density, travel time, person and vehicle-throughput and safety. Impacts to parking, non-motorized facilities, transit and freight movement will also be addressed. The methodologies proposed to analyze the local street system and freeway impacts are described in detail following this section.

3.4 Construction Analysis

A qualitative assessment will be performed of short-term construction impacts for all alternatives on local traffic circulation. A quantitative traffic assessment will be performed for the Sound Transit Board's preferred alternative (see Section 4.0) and alternatives with longer-term construction impacts to roadway capacity; such as tunnel alternatives with cut-and-cover construction in downtown Bellevue. The methodologies to be used for this analysis are discussed more fully in Section 7.8. Along I-90, a quantitative operational analysis of the construction period will be performed and is further discussed in Section 7.10. This analysis will assess the I-90 outer roadway operations with the closure of the inside roadway for light rail construction.

4.0 Alternative Definitions

Within the EIS, the No-Build and light rail (Build) alternatives will be evaluated to document the change in transportation conditions and operations within the affected study area. Table 2 provides a summary of the alternatives that will be analyzed for the EIS. While only one No-Build alternative will be analyzed for the majority of the study area; along I-90 two No-Build alternatives will be analyzed. This is to reflect an I-90 No-Build condition with and without Stage 3 of the I-90 Two Way Transit and HOV Operations Project (commonly known as Alternative R-8A).

For the Build alternative, full-length and interim termini station alternatives will be analyzed. The full-length Build alternative assumes light rail is provided between Seattle to downtown Redmond. The Build analysis will also evaluate interim termini at the proposed Ashwood/Hospital Station and all station locations east to downtown Redmond. The interim termini analysis will focus on the local traffic impacts near interim termini stations with a substantial change in ridership. The construction period, while identified to occur between 2013 and 2020/2021, will be analyzed based on a conservative 2020 horizon year.

TABLE 2
Alternative Conditions

Alternatives	Horizon Years		Comments
	2020	2030	
No-Build[a]	X	X	Includes the projects listed in Table 3 and Attachment 1
Build – Seattle to downtown Redmond Alternative	X	X	
Build – Seattle to Interim Station Termini	X	X	Interim station termini are located between Overlake Hospital Station and downtown Redmond including 124th, 130th, Overlake Village, Overlake Transit Center, SE Redmond, and Redmond Town Center stations)
Construction	X		Assumes I-90 R-8A Stages 1 through 3 are constructed.

[a]Two separate 2020 and 2030 No-Build forecasts and operational analysis will be performed along I-90 with and without Stage 3 of the I-90 Two-Way Transit and HOV Operations project.

4.1 No-Build Alternative

The No-Build alternative includes a variety of projects, funding packages and proposals in the Central Puget Sound Region. The projects primarily consist of funded or committed actions by the State, regional and local agencies combined with other projects that are considered to be reasonably foreseeable by the year of opening (2020) or design year (2030). Separate No-Build project lists are prepared for the 2020 and 2030 conditions. Attachment 1 provides the list of assumed regional and local projects as part of the No-Build alternative. The following sections define the basic components of the regional and local roadway and transit projects within the No-Build alternative. Table 3 summarizes the appropriate time horizon for each of these components.

Roadway

The roadway component of the No Build Alternative includes projects funded through the 2003 Transportation Nickel Package, 2005 Transportation Partnership Account (TPA) package, American Recovery and Reinvestment Act (ARRA) and selected projects included in the PSRC's Destination 2030 plan. Within King County these funding packages include major regional projects such as the Alaska Way Viaduct and Seawall Replacement Project, SR 520 Bridge Replacement (refer to Attachment 6 for SR 520 tolling assumptions) and HOV Project and I-405 Corridor Program.

A component of the No-Build alternative is the I-90 Two Way Transit and HOV Operations Project. This joint Sound Transit/WSDOT project would add HOV lanes to the I-90 outer roadway between Seattle and Bellevue. This project also includes new I-90 HOV on and off-ramps on Mercer Island and improving the I-90 HOV access at the Bellevue Way interchange. Two separate 2020 and 2030 No-Build forecasts and operational analysis will be performed along I-90 that would either include or not include Stage 3 of the I-90 Two-Way Transit and HOV Operations Project. Stage 3 is the construction of new HOV lanes on the outer roadway between Mercer Island and Seattle. The two No-Build conditions are proposed due to the uncertainty of when Stage 3 would be constructed as it has not been determined whether Stage 3 will operate for some period of time in conjunction with vehicular traffic in the reversible center roadway, or if the reversible center roadway would close for light rail construction immediately after completion of Stage 3.

In addition to the programs and packages discussed above are roadway projects listed in the State and local agency comprehensive plan lists. For the most part, the 2020 local agency lists only include adopted CIP projects (6-year funding programs), while the 2030 list includes unfunded projects that are part of the agencies'

Transportation Plans which cover a 15-20 year time frame. The exceptions are the City of Redmond's 2022 Transportation Facilities Plan and City of Bellevue's 2009-2020 Transportation Facilities Plan. These projects have been included as part of the 2020 list given the close proximity of the two horizon years.

Table 3 indicates the 2020 No-Build list would only include projects that are considered to be fully funded within the 2020 time-frame. The 2030 No-Build list expands the list to include the State, Regional, and Local projects that are anticipated to be funded within the 2030 timeframe. Finally, some projects are included that are part of the PSRC's Destination 2030 program. These projects may not be currently fully funded but have been reviewed through an environmental process and would likely influence the travel patterns and operations along the study corridors.

TABLE 3
No-Build Alternative Components

Projects/Programs	Horizon Years		Comments
	2020	2030	
Roadway			
Nickel Package	X	X	Approved 2003
Transportation Partnership Account	X	X	Approved 2005
I-90 Two Way Transit and HOV Project	X	X	Stage 1 through 3 and also without Stage 3
Local Agencies			
Capital Improvement Programs/Transportation Facilities Plans	X	X	Typically 6-year (or near term) funding commitments
Comprehensive/Transportation Plans	X	X	Typically 15 to 20-year list of funded and unfunded projects. Funded projects included as part of CIP/TFP lists.
Puget Sound Regional Council			
Destination 2030		X	Selected projects included (refer to Attachment 1)
Transit			
Sound Transit			
Sound Move Program	X	X	Approved 1996
ST2 Program	X[a]	X	Approved November 2008.
King County Metro			
6-year Service Implementation Plans	X	X	
Transit Service Integration Plan	X	X	Prepared for East Link project
Transit Now Plan	X	X	Approved 2006

[a] Not all projects identified in these programs are expected to be built by 2020. Refer to Attachment 1 for the project list by horizon year.

Transit

The transit No-Build component follows similar guidelines to those used to select the roadway projects. The main component for future transit service is the approved Sound Transit 2 program (also known as ST2) and the joint effort by King County Metro and Sound Transit to develop a Transit Service Integration Plan for both 2020 and 2030 No-Build conditions. The draft plans provide a snapshot of how bus service would look without the project. The transit integration plan identified future transit routes and included changes to current bus headways and operating hours to attempt to meet future demand. Included as part of the No-Build integration plans will be the currently adopted transit service plans by Sound Transit and King County Metro. This will include the completion of the Sound Move program and King County's 'Transit Now' plan, an initiative to expand Metro Transit service approved by King County voters in the general election in November 2006. Only a portion of the

transit components of the ST2 program will be included in the 2020 No-Build integration plan since some of the ST2 projects will not be fully implemented until after 2020. An exception will be the East Link project of ST2 program. This project will be analyzed as the Build alternative. The Transit Integration Plan will be reflected in Sound Transit's transit ridership model to forecast bus and rail riders in both 2020 and 2030 No-Build conditions.

4.2 Build Alternative: East Link Light Rail Alternatives

The Build alternative consists of the light rail alternatives identified by Sound Transit for study in the East Link EIS including the Sound Transit Board's preferred alternative. Refer to Chapter 2 of the EIS for a description of the light rail alternatives. For the Build alternative, full-length and interim terminus station alternatives will be analyzed. The full-length Build alternative assumes light rail is provided from Seattle to downtown Redmond. The Build alternative will also evaluate interim termini which are located at the proposed Ashwood/Hospital (or Hospital) Station and other stations east prior to downtown Redmond (124th, 130th, Overlake Village, Overlake Transit Center, SE Redmond, and Redmond Town Center stations). The interim station terminus alternatives assume the East Link light rail connections in Seattle remain unchanged.

All the projects, programs and packages listed in Table 3 and Attachment 1 as part of the No-Build alternative are also assumed in the Build alternative. A light rail operations plan for the East Link project is being prepared and assumes up to 7 minute peak and 10 minute off-peak headways by year 2030. In addition to the light rail alternatives, King County Metro and Sound Transit will develop a 2020 and 2030 Transit Service Integration Plan to reflect potential changes in transit service for each East Link alternative. The plan identified future transit routes and included changes to current bus headways. Although the service plans would not be finalized until close to system operation, the draft plans provide a snapshot of how bus service would look with the project. The Transit Integration Plan will be reflected in Sound Transit's transit ridership model to forecast bus and rail riders in both 2020 and 2030 No-Build and Build conditions.

5.0 Definition of Study Area

A list of intersections has been identified for analysis. These intersections are those potentially impacted by the light rail alternatives. Intersections directly impacted, such as a change in the channelization or signal control, will be analyzed. Additionally intersections that are indirectly affected, such as a significant change in volume, will be analyzed. Refer to Section 5.1 for the screening procedures. These locations also include intersections surrounding park-and-ride lots and station areas. This list reflects public and/or agency comments received during the EIS process.

5.1 Intersection Screening Procedures

Screening procedures were applied in the DEIS to improve the efficiency of the traffic impact analysis to minimize the number of analysis iterations on a previously analyzed intersection. This procedure will be conducted again for the FEIS. The existing conditions at all study area intersections identified in Section 5.2 will be evaluated using traffic data collected at the outset of the project. Additionally, the 2020 and 2030 PM peak-hour analysis for the No-Build alternative will be developed for the same set of study area intersections. For the Build alternative, a screening process will be applied to each of the study area intersections, using threshold values, to pinpoint conditions that could result in a change in the level of service at the intersection. Additional intersections or revision of the study area will be reviewed once future 2020 and 2030 forecasts have been developed. At that time, it will be determined where changes in volume demand and patterns occur within the Build alternative to warrant a change in the study area limits. If impacts to intersection operations occur at the limits of the identified study area, the study area could be potentially expand. No further analysis beyond the No-Build conditions will be conducted at study area intersections where changes in traffic volumes or other conditions in the Build alternatives are expected to be below the threshold values identified in Table 4. The methodology is to conduct the Build alternative intersection analysis for only the worst-case traffic impact condition. Any light rail alignment that has direct (physical) geometry impacts to an intersection will also be analyzed.

TABLE 4
Intersection Analysis Screening Process

Parameter	Threshold Value	Description
Critical Volumes	5%	Forecasts indicate that a critical volume comparison between a Build and No-Build alternative would exceed the threshold value.
Change in Intersection Geometry	Changes in the physical geometry of the intersection.	Changes in intersection geometry resulting from the project.
Change in Intersection Control	Traffic Signal Installation	The addition of a traffic control device such as a signal would affect the capacity for some traffic movements, and could change the overall level of service.
Crosswalk Lengths Across Major Streets	Increased crossing distance	Side street green time would be extended and pedestrian clearances would be longer.
Intersection Level of Service	If the intersection operates with a delay value within 10 percent of the agency's LOS threshold.	Locations meeting the threshold criterion with the No-Build Alternative would likely require further analysis. For example: if an intersection operates at LOS E/75 seconds in No-Build and the LOS threshold is LOS E (80 seconds) the intersection is then included in the Build analysis.

City of Seattle (11)

- Rainier Avenue South & South Dearborn Street
- Rainier Avenue South & South Massachusetts Street
- Rainier Avenue South & 23rd Avenue South
- Rainier Avenue South & I-90 EB Off-Ramp
- Dearborn Street & I-5 Southbound Ramp
- Dearborn Street & I-5 Northbound Ramp
- I-90 & 4th Avenue South
- South Royal Brougham Way & 4th Avenue South
- Airport Way South & 4th Avenue South
- I-90 HOV Access & South Dearborn Street
- SR 519 & I-90 EB On-Ramp

City of Mercer Island (17)

- West Mercer Way & I-90 Ramps
- West Mercer Way & 24th Avenue SE
- 80th Avenue SE & SE 27th Street
- 80th Avenue SE & I-90 EB Express Lanes Ramp
- 80th Avenue SE & North Mercer Way
- 77th Avenue SE & Sunset Highway
- 77th Avenue SE & I-90 WB Express Lanes Ramp
- 77th Avenue SE & I-90 EB Off-Ramp
- 77th Avenue SE & North Mercer Way
- 77th Avenue SE & 27th Street
- 76th Avenue SE/North Mercer Way & I-90 WB On-Ramp
- 76th Avenue SE & 24th Avenue SE
- Island Crest Way & I-90 EB On-Ramp
- Island Crest Way & I-90 WB Off-Ramp
- East Mercer Way & I-90 EB Off-Ramp
- East Mercer Way & I-90 EB On-Ramp
- East Mercer Way & I-90 WB Ramps

Freeway System

For the EIS, I-90 between the SR 519/I-90 terminus and the Interstate 5 ramps to and from the east and the I-405 ramps to and from the west will be analyzed. This analysis will include the I-90 mainline and merge/diverge areas between the study area endpoints. The analysis will also include:

- The I-90 reversible center roadway;
- The ramps to and from the express lanes located at Rainier Avenue, Mercer Island and Bellevue Way;
- The D2 roadway between Airport Way/5th Avenue and Rainer Avenue; and
- The I-90 collector-distributor system between the Bellevue Way and I-405 interchanges.

I-405 and I-5 mainline and merge/diverge areas will not be analyzed since there are no direct modifications or impacts expected with the project.

5.2 Segment B

Within Segment B, 19 intersections are identified for analysis as they either are along the proposed alternatives or expected to experience a change in operating conditions through either change in intersection control, geometry or traffic volume; such as near a station. Five intersections within Bellevue's Mobility Management Area #7 will be analyzed. Refer to Attachment 2 for a map of these intersections.

City of Bellevue (19)

- 112th Avenue SE & Bellevue Way SE (MMA #7)
- 112th Avenue SE & SE 8th Street (MMA #7)
- 118th Avenue SE & SE 8th Street (MMA #7)
- 1-405 NB Ramps & SE 8th Street (MMA #7)
- I-405 SB Ramps & SE 8th Street (MMA #7)
- Bellevue Way SE & SE 30th Street
- Bellevue Way SE & South Bellevue P&R
- 114th Avenue SE & SE 6th Street
- SE 8th Street & 114th Avenue SE (Bellefield Business Park)
- Bellevue Way SE & 108th Avenue SE
- Bellevue Way SE & SE 16th Street
- Bellevue Way SE & 104th Avenue SE
- Bellevue Way SE & SE 10th Street
- 112th Avenue SE & SE 15th Street
- 118th Avenue SE & 118th Station Entrance (only for Alternative B7)
- 118th Avenue SE/Coal Creek Parkway SE & I-405 SB Ramps
- Coal Creek Parkway SE & I-405 NB Ramps
- 119th Avenue SE & Coal Creek Parkway SE
- Bellevue Way SE & North driveway of South Bellevue Park-and-Ride
- Bellevue Way SE & South driveway of South Bellevue Park-and-Ride

5.3 Segment C

Within Segment C, 40 intersections are identified for analysis as they either are along the proposed alternatives or expected to experience a change in operating conditions through either change in intersection control, geometry or traffic volume; such as near a station. Nine of the thirteen intersections within Bellevue's Mobility Management Area #3, two of the five intersections within Bellevue's Mobility Management Area #4 and one of the fifteen intersections within Bellevue's Mobility management Area #12 will be analyzed. Refer to Attachment 2 for a map of these intersections.

City of Bellevue (40)

- Bellevue Way SE & SE Wolverine Way
- Bellevue Way & Main Street (MMA #3)
- Bellevue Way NE & NE 2nd Street
- 112th Avenue NE & NE 12th Street (MMA #3)

- 112th Avenue NE & NE 10th Street
- 112th Avenue NE & NE 8th Street/I-405 SB Ramp (MMA #3)
- 112th Avenue NE & NE 6th Street
- 112th Avenue NE & NE 4th Street (MMA #3)
- 112th Avenue NE & NE 2nd Street
- 112th Avenue & Main Street (MMA #3)
- 112th Avenue SE & SE 6th Street
- 110th Avenue NE & NE 12th Street
- 110th Avenue NE & NE 10th Street
- 110th Avenue NE & NE 8th Street
- 110th Avenue NE & NE 6th Street
- 110th Avenue NE & NE 4th Street
- 110th Avenue NE & NE 2nd Street
- 110th Avenue & Main Street
- 108th Avenue NE & NE 12th Street (MMA #3)
- 108th Avenue NE & NE 10th Street
- 108th Avenue NE & NE 8th Street (MMA #3)
- 108th Avenue NE & NE 6th Street
- 108th Avenue NE & NE 4th Street (MMA #3)
- 108th Avenue NE & NE 2nd Street
- 108th Avenue & Main Street (MMA #3)
- 106th Avenue NE & NE 12th Street
- 106th Avenue NE & NE 10th Street
- 106th Avenue NE & NE 8th Street
- 106th Avenue NE & NE 6th Street
- 106th Avenue NE & NE 4th Street
- 106th Avenue NE & NE 2nd Street
- 106th Avenue NE & Main Street
- NE 4th Street & I-405 SB Ramp
- NE 4th Street & I-405 NB Ramp
- NE 10th Street & I-405 NB Ramp (future interchange ramp)
- 116th Avenue NE & NE 12th Street (MMA #12)
- 116th Avenue NE & NE 10th Street (future signal)
- 116th Avenue NE & NE 8th Street (MMA #4)
- 116th Avenue NE & NE 4th Street (MMA #4)
- 116th Avenue NE & Felix Terry Swistak Drive (signal north of the NE 10th Street overcrossing)

5.4 Segment D

Within Segment D, 30 intersections in the Cities of Bellevue and Redmond are identified for analysis as they either are along the proposed alignments or expected to experience a change in operating conditions through either change in intersection control, geometry or traffic volume; such as near a station. Six of the fifteen intersections within the City of Bellevue's Mobility Management Area #12 will be analyzed. Some intersections in this segment are also within the City of Redmond's jurisdiction and therefore they would be classified within Redmond's Transportation Management District (TMD) #5 – Overlake area. The access locations to the proposed maintenance bases within Segment D will also be analyzed. These locations are not included in the list below as they have not been identified. Refer to Attachment 2 for a map of these intersections.

City of Bellevue (16)

- 120th Avenue NE & NE 16th Street (future road extension)
- 120th Avenue NE & NE 12th Street (MMA #12)
- 124th Avenue NE & Northup Way (MMA #12)
- 124th Avenue NE & NE 16th Street (future road extension)
- 124th Avenue NE & Bel-Red Road (MMA #12)

- 130th Avenue NE & Bel-Red Road (MMA #12)
- 130th Avenue NE & NE 16th Street (future road extension)
- 130th Avenue NE & 130th Station P&R Entrance
- 130th Avenue NE & NE 20th Street (MMA #12)
- 132nd Avenue NE & Bel-Red Road
- 132nd Avenue NE & NE 16th Street
- 132nd Avenue NE & NE 20th Street
- 136th Avenue NE & NE 16th Street
- 136th Avenue NE & NE 20th Street
- 140th Avenue NE & NE 20th Street (MMA #12)
- NE 20th Street & Mall Entrance

City of Redmond (14)

- 148th Avenue NE & SR 520 WB Ramps
- 148th Avenue NE & SR 520 EB Ramps
- NE 24th Street & 148th Avenue NE
- NE 24th Street & 151st Avenue NE
- NE 24th Street & 152nd Avenue NE
- NE 24th Street & Bel-Red Road
- NE 40th Street & 148th Avenue NE
- NE 40th Street & SR 520 WB Ramps
- NE 40th Street & SR 520 EB Ramps
- NE 40th Street & 156th Avenue NE
- Overlake P&R Entrance & 156th Avenue NE
- NE 36th Street & 156th Avenue NE
- NE 31st Street & 156th Avenue NE
- 148th Avenue NE & NE 20th Street

5.5 Segment E

Within Segment E, 26 intersections are identified for analysis as they either are along the proposed alignments or expected to experience a change in operating conditions through either change in intersection control, geometry or traffic volume; such as near a station. Intersections in this segment are within the City of Redmond's jurisdiction and therefore they are classified within Redmond's Transportation Management Districts (TMD) #1 – Downtown Redmond and #7 – SE Redmond area. The access locations to the proposed maintenance bases within Segment E will also be analyzed. These locations are not included in the list below as they have not been identified. Refer to Attachment 2 for a map of these intersections.

City of Redmond (26)

- Leary Way NE & West Lake Sammamish Parkway NE
- Leary Way NE & 159th Place NE
- Leary Way NE & Bear Creek Parkway
- Leary Way NE & NE 76th Street
- Redmond Way at 161st Avenue NE
- NE 83rd Street at 161st Avenue NE
- 164th Avenue NE & SR 202
- 164th Avenue NE& NE 76th Street
- 166th Avenue NE & SR 202
- 166th Avenue NE & NE 76th Street
- NE 76th Street & Bear Creek Parkway
- SR 202 & SR 520 WB Ramps
- SR 202 & SR 520 EB Ramps
- SR 202 & NE 70th Street
- NE 70th Street & 176th Avenue NE

- Cleveland Street & 161st Avenue NE (Future Intersection)
- NE 85th Street & 161st Avenue NE
- 164th Avenue NE and NE Cleveland Street
- 164th Avenue NE & NE 80th Street
- 164th Avenue NE & NE 85th Street
- 166th Avenue NE & Cleveland Street
- 166th Avenue NE & 80th Street
- 178th Place NE & NE Union Hill Road
- Avondale Road NE & NE Union Hill Road
- East Lake Sammamish Parkway NE & NE 65th Street
- SR 202 & East Lake Sammamish Parkway NE (180th Avenue NE)

6.0 Assessment Methods

The intent of the intersection analyses is to identify the potential local traffic operational impacts and to identify potential improvements to mitigate any identified impacts. The *Highway Capacity Manual* (HCM) methodologies will be followed for analysis of the surface streets and the I-90 freeway system. The intersection analysis will be limited to PM peak-hour conditions as the PM peak hour is typically the "worst case" for surface street operations in urbanized areas. A review of traffic volumes on key high volume arterials determined the PM peak hour captures the highest volume condition and therefore no AM peak-hour traffic analysis is conducted on the local street system, except at five intersections near the Overlake Transit Center due to the nature of the land uses surrounding the transit center. Along the I-90 corridor AM peak-hour analysis will also be conducted along the freeway and in Mercer Island and Seattle. The methodology that will be used to conduct the AM peak hour traffic analysis will be similar to the methodology used to conduct the PM peak hour traffic analysis.

For the analysis along I-90, the reported intersection results will be for one hour of analysis, but the reported freeway analysis will be created based on a 2.5 hour duration to better simulate peak period conditions.

6.1 Data Collection

A variety of data was collected and assembled to analyze the local and freeway system for the DEIS. A majority of the data collected for the DEIS will continue to be utilized for the FEIS analysis. It is noted below where the data supporting the DEIS analysis will be reviewed or where new information is planned to be collected for the FEIS.

- Existing peak-hour turning movement counts at the intersections identified in Section 5.2. These counts will be collected from the local and state agencies (Cities of Seattle, Mercer Island, Bellevue and Redmond and WSDOT). For I-90, volume data from WSDOT's loop counters will be used to generate existing mainline and ramp volumes. New counts will be taken for a two-hour period during the PM peak hour, if 2005-2007 turning movement counts are not available from the listed agencies above. The new counts will include autos, trucks classified by light, medium and heavy types, buses, pedestrians, and bicyclists. All peak-hour turning movement counts and I-90 mainline and ramp volumes will be factored to a common base analysis year (2007) based on available historical data trends.
  - FEIS data collection: PM peak hour turning movement counts will only be collected for any new intersections analyzed in the FEIS and for intersections that have been improved by others (local, regional, state agencies) since the DEIS analysis.
- Physical characteristics of the existing street system including functional use, lane geometry, traffic signal timing and phasing patterns, and other parameters necessary to conduct traffic operations analysis (such as the proximity of bus stops, speed limits, presence of on-street parking, etc.). Where available, this data will be obtained from the local agencies (such as paint line sketches developed by the City of Seattle). This data will be field checked as appropriate.
  - FEIS data collection: Physical characteristics will only be collected for any new intersections analyzed in the FEIS and for intersections that have been improved by others (local, regional, state agencies) since the DEIS analysis. Otherwise the physical characteristics collected as part of the DEIS will be utilized for the FEIS analysis.

- On- and off-street public parking supply and peak weekday parking utilization survey data will be collected within a 0.25-mile walking distance radius of each station as well as documenting any on- and off-street parking potentially removed by East Link alternatives. In general, data will be obtained from the local agencies, and augmented by field visits where appropriate. Private parking will not be collected and only described qualitatively with supplementary information, as available, by the cities, Chamber of Commerce or Downtown Association groups.
  - FEIS data collection: On- and off-street public parking supply and utilization survey data collected as part of the DEIS will be utilized for the FEIS analysis.
- Park and Ride supply and demand will be collected at either proposed stations or locations within a 0.25-mile walking distance radius of each station. Park and Ride information and utilization rates will be gathered from existing information from King County Metro. If unavailable, data will be facilitated by field visits.
  - FEIS data collection: Park and Ride supply and demand data collected as part of the DEIS will be utilized for the FEIS analysis.
- Short duration (15 to 30 minute) driveway counts for locations where access into and out of driveways would be affected will be collected. This includes locations were driveways would be removed/consolidated, movements would be restricted or where the light rail alignment would interact with the driveway operations.
  - FEIS data collection: Driveway counts that were already collected for alternatives in Segments B, D and E in the DEIS will be utilized for the FEIS analysis. Driveway count data will be collected in Segment C for alternatives that modify driveway access.
- Pedestrian volumes will be collected in areas with high pedestrian activity, such as the I-90 multi-use trail across Mercer Island, and where existing counts have been conducted by local jurisdictions. This data collection effort will be limited to the pedestrian volume data collected for each of the intersections identified in Section 5.2. If pedestrian and bicycle volume data is available from the agencies for major non-motorized facilities near proposed station areas, such as the Sammamish River Trail in Redmond, this will be also included.
  - FEIS data collection: Pedestrian volume data collected as part of the DEIS will be utilized for the FEIS analysis. Pedestrian volume information will be collected at new intersections analyzed in the FEIS as part of the peak hour turning movement counts (refer to the first bullet of this section).
- Existing transit route information along the proposed light rail alternatives will be obtained from local transit agencies and compiled. This will include information on selected routes that serve the East Link corridor. The bus route information that will be collected includes service areas, hours of service (including schedule/frequency), reliability and passenger load. Passenger load information will be collected at the six screenline locations. Transit reliability information will be collected at selected transit centers and park-and-ride facilities in the study area.
  - FEIS data collection: Existing transit route information used for the DEIS analysis will be utilized for the FEIS analysis.
- Accident data for the most recent three-year period will be obtained for the study area intersections (signalized and unsignalized) and I-90 between I-5 and I-405. Accident data for roadways (between intersections) will be collected only where there are at-grade or elevated light rail alternatives running within or immediately adjacent to a roadway. Accident data will not be collected if the light rail alignment would not directly affect a roadway or access to it such as along SR 520 in the Bel-Red area.
  - FEIS data collection: Accident data collected as part of the DEIS will be utilized for the FEIS analysis.
- Existing and planned pedestrian and bicycle facilities within an approximate 0.5-mile radius of each station area (1.0 mile for bicycle facilities) will be inventoried by either field visits or available information from agencies (such as GIS). This will include identification of school walk routes and any barriers to pedestrian or bicycle travel within each station area. The general sidewalk condition will be assessed qualitatively immediately surrounding station areas.

  - FEIS data collection: Existing and planned pedestrian and bicycle facilities documented in the DEIS will be reviewed and updated, if needed, for the FEIS analysis

- Existing truck corridors/routes and any truck weight or height restrictions will be identified.
  - FEIS data collection: Existing truck corridors/routes information collected as part of the DEIS will be reviewed and updated, if needed, for the FEIS analysis.
- Local, regional and State agency *Six-Year Transportation Improvement Plans/Capital Improvement Programs or Transportation Facilities Plans* among other planned improvements in close proximity to a light rail alternative will be reviewed and summarized. This will include identification of all "committed" improvements assumed for the No-Build Alternative.
  - FEIS data collection: Local, regional, and state TIP/CIP and long-range plans collected as part of the DEIS will be reviewed and updated, if needed, for the FEIS analysis.
- Vehicle occupancy data along I-90 will be collected by lane type (general purpose, HOV, reversible center roadway) for use in I-90 person throughput calculations. Vehicle occupancy data will be obtained from WSDOT for the most recent year available.
  - FEIS data collection: I-90 vehicle occupancy data collected as part of the DEIS will be reviewed and updated, if needed, for the FEIS analysis.

6.2 Travel Demand Forecasting

The study area comprises the jurisdictions of Seattle, Mercer Island, Bellevue and Redmond. As a result, the analysis will require the integration of model output from three different models. Figure 1 shows the overall process of the travel demand methodology. The analysis will utilize two regional models: (1) Sound Transit's (ST) model which provides future transit ridership estimates, and (2) Puget Sound Regional Council (PSRC) model (Version 1.0b) to provide future year modal demand information. The methodology for forecasting transit ridership with ST ridership model is discussed in Attachment 3. Subsequently, the local traffic impact analyses in Bellevue and Redmond will be developed using the Bellevue-Kirkland-Redmond (BKR) model with its higher network resolution within the study area. The PSRC model will be used to develop the regional traffic analysis measures, screenline information, travel demands across I-90 for use in the freeway analysis and for forecasting intersection volumes on Mercer Island and Seattle. The assumptions in the latest PSRC model regarding capacities, parking costs, tolling, etc. will be assumed for this project unless otherwise noted throughout this document.

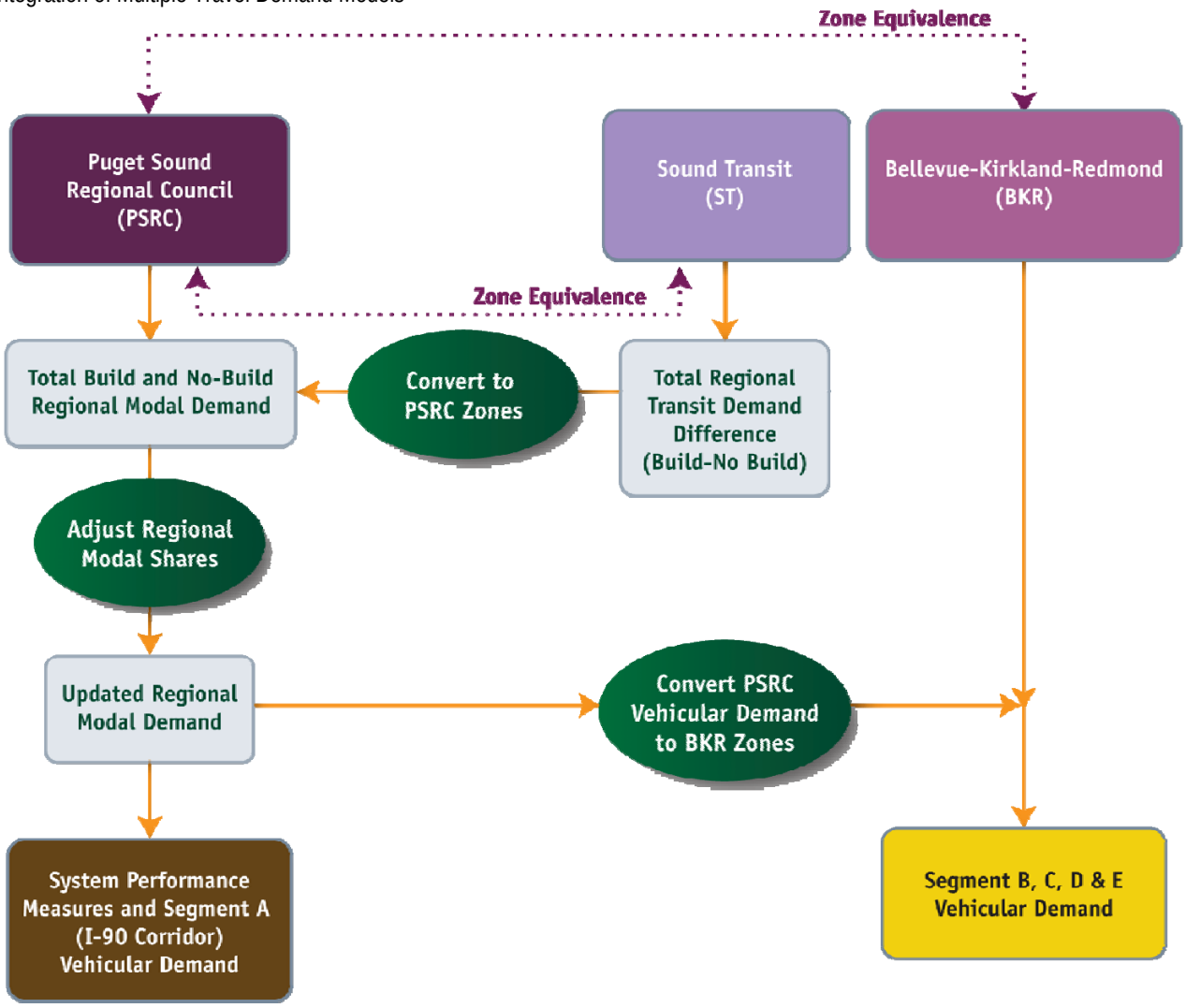
Base Year Model

The model's base year will be 2005. The year 2005 land use estimates developed by the PSRC are based on the most recent verified housing and employment data available. Zonal equivalencies will be established for the model structures; Sound Transit to PSRC and PSRC to BKR.

The next step will be to check the consistency in network definition and attributes found in the models. The BKR model contains the highest resolution of network detail. For regional comparisons, we will run the PSRC model using the enhanced network developed for the I-405 corridor program. This network provides a higher network resolution within the study area than the standard PSRC networks. While the BKR model will generally be used for trip assignments in the local areas, to ensure a high-level consistency between the PSRC and BKR models, quantitative performance measures will be compared between both models to ensure a level of consistency between the PSRC and BKR demand models. Potential measures will include cross lake vehicular demand, mode choice and person trip distribution.

The base year link auto volumes from the BKR model will be validated using 2005-2007 counts in the study area for PM peak hour or period. The PSRC estimated auto link demand will be validated for the Seattle, I-90 and Mercer Island study area. Along I-90 and within Mercer Island and Seattle areas, the PSRC model will be used to forecast mainline and ramp volumes and intersection turn movement volumes.

FIGURE 1
Integration of Multiple Travel Demand Models



Future Year No-Build Forecasts

Future year analysis will be performed for the years 2020 and 2030 based on the PSRC's current population and land uses forecasts, which will incorporate reasonable proposed adjustments given the comprehensive plan changes that have been adopted by Bellevue and Redmond (see attachment 5). The PSRC's available 2020 and 2030 networks include light rail to the Eastside and other highway and transit enhancements that will not be part of the No-Build alternative. The higher resolution I-405 and I-90 regional networks (from the I-405 Study and I-90 HOV Two-Way Transit and HOV study) will be used in the PSRC model to develop the regional and screenline performance measures (described in Section 3.2 and 3.3) as they are consistent with the assumed No-Build facility improvements. Both the BKR and PSRC model networks will be modified to reflect the agreed upon No-Build network assumptions.

Each model will be run for each future year to develop demand estimates and performance measures. The PSRC-based 2020 and 2030 No-Build models outputs will serve as the basis to perform the modeling scenarios described earlier. Peak period vehicular assignments will be run using the PSRC and BKR models to generate vehicle information for the No-Build alternative intersection and freeway analysis.

Two separate 2020 and 2030 No-Build demand forecasts will be performed along I-90 that would reflect with and without Stage 3 of the I-90 Two-Way Transit and HOV Operations project (also known as Alternative R-8A). Stage 3 is the construction of new HOV lanes on the outer roadway between Mercer Island and Seattle.

Future Year Build Alternatives Forecasts

Two methods will be used to forecast the Build condition future vehicular demand based on the sub areas. Method 1 focuses on the impacts of station area demand in the South Bellevue (Segment B), Bel-Red (Segment D) and Redmond (Segment E) areas. Method 2 will be applied to regional and corridor-level assessments, I-90 mainline and ramps, Seattle, Mercer Island (all Segment A), and downtown Bellevue intersections (Segment C).

Method 1: Station Area Volumes

2020 and 2030 transit station trip generation information will be developed from Sound Transit's transit ridership model and will be assigned to various modes of travel based on the Portland *Banfield LRT Station Mode of Access Survey*, or updated information as available. The *Banfield* methodology was a mode of access and egress survey of Portland light rail riders. This survey characterizes the different modes people choose to use to access and egress the stations; such as walk, drive alone, drive with others, drop off, transit transfer or other. This information is presented by each station type; which is based on what station facilities are provided and the surrounding land uses.

The vehicle and pedestrian trips associated with the light rail station ridership forecasts for the alternative that generates the highest ridership at this specific station will be assigned to the pedestrian and vehicular networks around the station using a spreadsheet or simple trip assignment approach based on existing and/or forecasted travel patterns. The auto traffic volumes associated with the station will be added to the future 2020 and 2030 No-Build auto forecasts from the PSRC/BKR models to produce the Build alternative forecasts surrounding that specific station area. This approach yields a conservative forecast for the Build alternative as it does not reflect the shift to transit as people replace their vehicle trip and use light rail.

The same methodology will also be used for generating volumes at each interim terminus station. The traffic forecasts and subsequent traffic analysis (Section 7.1) of the interim station alternatives will only be for the local station impacts surrounding that terminus location. Similar to the full-length Build alternative analysis, the vehicle and pedestrian trips associated with the interim terminus station will only be analyzed for the highest ridership alternative at that specific interim terminus station.

Method 2: Regional and Corridor-Level Assessments, I-90 Corridor and Downtown Bellevue Volumes

The second method used to generate Build alternative forecasts is derived from the travel demand models as shown in Figure 1. The steps to produce the Build forecasts using this approach are as follows:

1. The No-Build vehicle table estimates from the PSRC model will be modified to reflect Build vehicle tables by applying the change in transit ridership between No-Build and Build conditions. The transit trip differences are developed through Sound Transit's transit ridership model (refer to Figure 1). To reflect East Link's transit demand, the Sound Transit model includes the preferred East Link alternative and bus service modifications, developed by King County and Sound Transit. The bus service modifications are further described in Section 4.0. In addition, Sound Transit will further study the ridership changes resulting from joint or exclusive use of the I-90 D2 roadway based on the bus and light rail travel times along I-90.
2. The PSRC vehicle trip tables will then be modified accordingly, based on the change in transit demand, to forecast auto volumes for the Build condition,
3. The vehicle trip tables will then be converted into the BKR zone system and assigned within the BKR model. The vehicle trip tables developed for the BKR model will be consistent with the vehicle demand distribution found in the future year BKR model and consistent with regional estimates.

As indicated in the bottom of Figure 1, model output from Method 2's Build alternative forecasts will consist of:

a. Using the PSRC model to estimate regional and screenline changes in mode shares and traffic volumes,
b. Using the PSRC model to develop changes in the I-90 vehicular demand at the freeway mainline and ramps with the project. These volume adjustments will be post-processed to produce AM and PM three-hour peak period trip tables for I-90 mainline, ramp and ramp terminals. The vehicle demand forecasting for the construction and Build alternative conditions along I-90 include the full construction of I-90 Alternative R-8A (Stage 1 through 3). Along the I-90 corridor, VISSIM origin/destination matrices will be developed for the analysis in Section 7.3.

c. For downtown Bellevue, the changes in the vehicular demand tables will be forecasted using the PSRC model. These changes in vehicular demand will be assigned through the BKR model to forecast intersection and street segment volumes within downtown Bellevue. These forecasts will be post-processed to produce Build traffic volumes at the downtown Bellevue study area intersections listed in Section 5.2.

Future Year Construction Analysis Forecasts

For the construction analysis performed for this project, an additional PSRC travel demand forecast will be performed to generate vehicle demand on I-90 during light rail construction. This condition assumes no general/public vehicle access to and from the reversible center roadway system as it is closed during construction. As part of this condition is it assumed that all three stages of the I-90 Alternative R-8A project are constructed and operating.

Construction analysis of local street operations will be performed for the Sound Transit Board's preferred alternative that would substantially reduce the number of roadway lanes during construction as well as alternatives with construction conditions that have the potential for substantial construction-related traffic impacts; such as cut-and-cover construction within downtown Bellevue as further described in Section 7.11. Travel demand forecasts will be performed to understand trip diversion and changes in demand on the affected roadway due to construction conditions.

Post-Processing

Standard methodologies from NCHRP 255 will be used to post-process the intersection and link volumes. The difference in the count and the base model volumes will be used along with the growth between the base and the future year model runs. These procedures will be carried out in a spreadsheet model and applied to all of the intersection turning movements and freeway segment volumes. For I-90 area, post-processing at intersections will be done for both AM and PM peak. For all other areas, it will be done for PM only.

6.3 Intersection and Freeway Level-Of-Service (LOS) Standards

As part of each agency's comprehensive planning efforts, agency transportation goals and LOS standards are developed. While each agency accepts different levels of congestion; a delay-based intersection LOS analysis has been preliminary accepted by each agency. Delay is expressed in terms of average delay per vehicle, in seconds, experienced due to the intersection operations. LOS definitions for signalized and unsignalized intersections and the freeway mainline, merge/diverge, and weave areas are included in Attachment 4. Overall, if the intersection operations are better than the agency's LOS standard in the Build alternative that intersection is considered to meet the agency's standard and does not require any mitigation. Potential mitigation will be evaluated to improve intersection operations to the agency's LOS standard when:

- Intersection operations in the Build condition are worse than the LOS standard when the intersection operations meet the LOS standard in the No-Build condition, or
- Intersection operations in the No Build condition are worse than the LOS standard and the Build condition exacerbates that situation. In this situation, the Build condition is only obligated to bring the operating conditions back to the No-Build condition.

Further definition of this approach and the LOS standard(s) for each agency is noted below:

Washington State Department of Transportation

To assess intersection operations, the operating threshold is LOS E. For freeway operations, the operating threshold in urban areas is LOS D.

City of Seattle

The City of Seattle's goal is to maintain intersection operations at LOS D or better.

City of Mercer Island

To assess intersection operations, the operating threshold is LOS C.

City of Bellevue

The City of Bellevue defines its LOS standard through fourteen sub areas; called Mobility Management Areas (MMA). The sub areas that overlap the East Link corridors are listed with their LOS standards in Table 5. All study intersections within each MMA will be individually compared to that MMA's LOS standard listed in Table 5.

TABLE 5
City of Bellevue LOS Standard

MMA No.	MMA	LOS Standard
3	Downtown	LOS E
4	Bel-Red Northup	LOS D
7	South Bellevue	LOS D
12	Overlake	LOS E

City of Redmond

The City of Redmond has yet to formally adopt revised LOS standards. Based on conversations with City staff, a two-tiered methodology is proposed that will examine overall intersection and individual lane group LOS. An overall intersection and lane group LOS standard of LOS E will be used as the LOS standard. Between the No-Build and Build alternatives, intersections that operate better then LOS E and do not degrade to conditions worse than LOS E in the Build alternative are considered to meet standards as long as no lane group LOS degrades to LOS F conditions. For example, an intersection that degrades from LOS C to D and no lane groups' LOS operates at LOS F, the intersection will not be considered for any improvements other than signal timing adjustments. Although if a lane group degrades from LOS D to LOS F, improvements will be considered to improve that specific LOS. If an intersection or lane group already operates at LOS F in the No-Build alternative, the Build alternative will maintain a similar operating condition where the delay does not significantly degrade.

7.0 Surface Street and Freeway Traffic Analysis

As noted in previous sections, the locations selected for surface street impact analysis are those determined to have the greatest potential for being impacted by light rail. Refer to Section 5.0 for the preliminary intersection and freeway study area. Key parameters will be considered in the determination of impacts to the surface street system; such as reductions in street capacity, changes in vehicular delay and traffic queue lengths at intersections or grade crossings.

7.1 Signalized and Unsignalized Intersection Analysis

Synchro, version 7, software will be used to determine levels of service at signalized and unsignalized intersections. Determining if an intersection meets the agency LOS standards will be based on the conditions at each individual intersection and not by a sub area weighted average. The HCM report from *Synchro* software will be used to summarize average intersection delay, LOS, and critical queue lengths. The level of service at signalized intersections will be defined in terms of average intersection delay. Likewise, the level of service at an unsignalized intersection is also defined in terms of delay, but only for the approach that is stop-controlled, typically the minor-street. For unsignalized intersections that are stop-controlled on each approach, the average intersection delay is reported. LOS definitions for signalized and unsignalized intersections are contained in Attachment 4.

Where actual values are not available assumed existing and future intersection parameters/values for the intersection analysis are developed and listed in Table 6. These include assumptions with respect to saturation flow rates, geometry, traffic, and signalization conditions.

7.2 Surface Street Microsimulation Analysis

The *VISSIM* software, version 5.1-08, will be used to assess the downtown Bellevue street system within the study area of Bellevue Way, I-405 ramps, Main Street and NE 12th Street. This VISSIM analysis will be conducted for the 2030 PM peak hour No-Build and Build conditions. The Build condition VISSIM analysis will be conducted for the C4A Alternative. This future year analysis will be based upon the existing calibrated network already completed as a prior effort.

Transportation data (i.e. future transportation projects, vehicle and pedestrian counts, signal timings, transit routes, driveway access and volumes) that is described in this document will be used for this analysis as well as applicable intersection parameters described in Table 6 of Section 7.1. Identified roadway and/or driveway access modifications as part of the C4A alternative will be included in the VISSIM analysis. This analysis will be based on the light rail operating plan documented in the FEIS. This plan includes the identification of planned train lengths and headway. Different signal priorities may be analyzed to gauge various levels of disturbances to the street system.

Transportation data that will be used to assess the street and light rail operations will be intersection level of service and vehicle delay, vehicle throughput, vehicle travel times along key corridors, key vehicle queue lengths and the light rail travel time. Other transportation data may be presented depending on the criteria developed for the decision-making process with stakeholders.

TABLE 6
Synchro Parameters/Assumptions

Arterial Intersection Parameters	Condition		
	Existing	**2020 - Year of Opening**	**2030 - Design Year**
Peak-Hour Factor	From count and by each approach, default provided 0.90	If existing PHF is between 0.70 and 0.85 use 0.90 If existing PHF is > 0.85 ≤ 0.95 use 0.95 If existing PHF is > 0.95 use existing PHF. If existing PHF < 0.70 then increase factor by 0.10	0.95 for all intersections except where existing PHF is greater than 0.95 or less than 0.70. Use existing PHF in the cases were the PHF is greater than 0.95. If existing PHF < 0.70 then increase factor by 0.20
Conflicting Bikes and Pedestrian per Hour	From traffic count, otherwise assume 10 peds/bikes in both AM and PM periods. In Downtown Bellevue assume 50 peds/bikes per approach.	Same as existing in No-Build. For the Build condition, add the number of pedestrians based on the station ridership and Banfield mode of access survey.	Same as existing in No-Build except for Downtown Bellevue; assume 100 peds in both AM and PM periods per approach unless currently higher. If so keep same as existing count. For the Build condition, add the number of pedestrians based on the station ridership and Banfield mode of access survey.
Pedestrian Crossing Time	From agency signal phasing sheets or existing Synchro model.	Same as existing for intersections with no geometric changes. Where intersection geometry is modified a minimum of 5 second walking time. Flashing don't walk based on MUTCD (2003 Edition, Section 4E.10)	Same as existing for intersections with no geometric changes. Where intersection geometry is modified a minimum of 5 second walking time. Flashing don't walk based on MUTCD (2003 Edition, Section 4E.10)
Area Type	"Other" for all areas except Downtown Bellevue which will use CBD.	Same as existing	Same as existing
Ideal Saturation Flow (for all mvmts)	1900	1900	1900
Lane Utilization	Default software assumptions unless data/engineering	Default software assumptions unless data/engineering judgment suggests	Default software assumptions unless data/engineering judgment

TABLE 6
Synchro Parameters/Assumptions

Arterial Intersection Parameters	Condition		
	Existing	2020 - Year of Opening	2030 - Design Year
	judgment suggests otherwise	otherwise	suggests otherwise
Lane Width	From field sheets, agency in-house Synchro files or paint line drawings (i.e. SDOT)	Same as existing, unless improvements proposed then use agency standards/plans.	Same as existing, unless improvements proposed then use agency standards/plans.
Percent Heavy Vehicles	From count, otherwise 2%	From count, otherwise 2%	From count, otherwise 2%
Percent Grade[a]	From as-builts, agency in-house Synchro file or field sheets	Same as existing	Same as existing
Parking Maneuvers per Hour	Based on parking regulations. For less than 15 min. parking, assume 4 maneuvers per hour; otherwise assume 1 maneuver per hour, unless data/information gathered or provided from agencies suggest otherwise.	Same as existing. For new parking, assume existing assumptions for maneuvers based on parking durations.	Same as existing. For new parking, assume existing assumptions for maneuvers based on parking durations.
Bus Blockages	Headway information provided by transit agencies	Use future service assumptions developed by Metro and ST as part of the Transit Service Integration Plan.	Use future service assumptions developed by Metro and ST as part of the Transit Service Integration Plan.
Intersection signal phasing and coordination	From agency signal phasing sheets or their existing analysis files.	Same as existing For timing adjustments: Left-turns, if permissive in existing, will be examined for a protected phase based on LOS, access/geometry, safety and agency guidance For Build: any left-turn conflict with at-grade light rail will include a separate lane and have protected phasing. Left-turns will be restricted (or protected with a gate or similar treatment) at unsignalized intersections. For elevated light rail, mid-block left turns will be restricted.	Same as existing For timing adjustments: Left-turns, if permissive in existing, will be examined for a protected phase based on LOS, access/geometry, safety and agency guidance For Build: any left-turn conflict with at-grade light rail will include a separate lane and have protected phasing. Left-turns will be restricted (or protected with a gate or similar treatment) at unsignalized intersections. For elevated light rail, mid-block left turns will be restricted.
Light Rail Signal Phasing	N/A	Train operations are assumed to occur during the parallel through movement signal phase. If this phase is not available then a new signal phase will be coded only for light rail movement. In some instances the train may remove an intersection from being coordinated. In these conditions, the intersection may operate uncoordinated. Crossing times will be based on assumed speed, acceleration and deceleration rates of a light rail train.	same as 2020 conditions
Intersection signal timing optimization limits	N/A	Between 60 to 120 seconds for all areas except for downtown Bellevue and Redmond. Assume 60 up to 150 seconds for downtown Bellevue & Redmond signals (some in Bellevue may reach up to 180 sec.).	Same as 2020 assumptions
Minimum Green Phase time	From agency signal phasing sheets or existing Synchro	Same as existing if intersection remains unchanged.	Same as existing if intersection remains unchanged.

TABLE 6
Synchro Parameters/Assumptions

Arterial Intersection Parameters	Condition		
	Existing	2020 - Year of Opening	2030 - Design Year
	model.	If modified in No-Build or Build condition: - If pedestrian crossing: based on pedestrian times (see Pedestrian Crossing Time). - If no pedestrian crossing: a minimum of 5 sec.	If modified in No-Build or Build condition: - If pedestrian crossing: based on pedestrian times (see Pedestrian Crossing Time). - If no pedestrian crossing: a minimum of 5 sec.
Yellow and all-red time		New signals: (Y) = 4 seconds and (R) = 1 second	New signals: (Y) = 4 seconds and (R) = 1 second
Right Turn on Red	Allow	Allow	Allow
Right Turn Overlaps	signal timing plans	Identify if used	Identify if used
50th and 95th percentile vehicle queues	Based on 25 feet per vehicle	Based on 25 feet per vehicle	Based on 25 feet per vehicle

[a]Percent grade assumed for at grade intersections only.
Delay-based LOS results will be reported from Synchro's HCM Reports

7.3 Freeway and Ramp Analysis

The *VISSIM* software, version 4.3, will be used to assess the I-90 freeway operations for the mainline/merge and diverge freeway areas as well as the ramp terminals between I-5 and I-405. Refer to Section 6.0 for the proposed I-90 analysis periods and Section 5.2 for a description of the freeway study area. The extent of the study area will create a comprehensive connected system to better simulate travel patterns and fluctuations. Control devices; such as ramp meters on the on-ramps will also be included in the *VISSIM* network to portray operating conditions onto and from I-90. If joint transit/rail operation on the I-90 D2 roadway is carried into the EIS analysis, this operating plan will be reflected in *VISSIM* network.

The network coding within *VISSIM* software will be built from the *WSDOT I-90 Center Roadway Study* or found on as-built plan sheets or aerial photos. For any design changes as part of the Build alternative, they will be coded based upon the preliminary engineering drawings made available from the engineering team. Table 7 identifies some of *VISSIM's* additional inputs and assumptions that will be incorporated into the analysis. While the ramp terminals and ramp control devices will be coded into *VISSIM*, the intersection results (including ramp terminals) will be from the analysis conducted with the *Synchro* software as this software program is more effective in testing and optimizing traffic signals on an arterial network.

TABLE 7
VISSIM Freeway Parameter Methods/Assumptions

Freeway Parameter	Existing	2020 Year of Opening	2030 Design Year
Deceleration Lane Length	From as-builts or aerial	Same as existing or from design plans	Same as existing or from design plans
Acceleration Lane Length	From as-builts or aerial	Same as existing or from design plans	Same as existing or from design plans
Grade	From as-builts, if not assume 0%	Same as existing	Same as existing
Superelevation	Assume 0%	Same as existing	Same as existing

TABLE 7
VISSIM Freeway Parameter Methods/Assumptions

Freeway Parameter	Existing	2020 Year of Opening	2030 Design Year
Pavement Type	Assume dry concrete	Assume dry concrete	Assume dry concrete
Desired Free-Flow Speed	70 mph	Same as existing	Same as existing
Car Following Sensitivity Factor[a]	Variable	Same as existing	Same as existing
Truck %	From traffic data	Same as existing	Same as existing
I-90 Carpool/HOV Person Designation	2+ with access for Mercer Island residents in the I-90 reversible center roadway	No-Build based on PSRC's assumption; for Build include Mercer Island residents[b]	No-Build based on PSRC's assumption; for Build include Mercer Island residents[b]
Carpool / HOV %	From field data	From demand modeling information	From demand modeling information
Origin-Destination Patterns	From WSDOT I-90 Study; if not, from calibrated 2005 PSRC demand model	From demand modeling information	From demand modeling information
Lane Distribution (for entering links)	Assume even distribution over all entering lanes	Assume even distribution over all entering lanes	Assume even distribution over all entering lanes
Vehicle Type Specifications	Assume default vehicle type specifications	Same as existing	Same as existing
Warning Sign Distance (for on-ramps) [b]	From as-builts, variable depending on freeway conditions and geometry	Same as existing	Same as existing
Warning Sign Distance (for off-ramps)[b]	From as-builts, variable depending on freeway conditions and geometry	Same as existing	Same as existing
Ramp Metering	Will be coded as fixed-timed	Will be coded as fixed-timed	Will be coded as fixed-timed
VISSIM Output *(pcphpl - per car; per hour; per lane)*	Segment density (in terms of pcphpl) and corridor travel time	Segment density (in terms of pcphpl) and corridor travel time	Segment density (in terms of pcphpl) and corridor travel time
Number of Simulations	Up to 5 simulations	Same as existing	Same as existing

[a]CFSF and Warning Sign Distances are key inputs and will be used as a calibration technique to match field conditions.
[b]Per the December 22nd, 2006 WSDOT letter to the City of Mercer Island.

Detailed vehicle data along I-90 will be post-processed and presented to identify four mobility measures for the I-90 freeway corridor. These measures described below will be used to identify the potential benefits and impacts of the light rail alternative on I-90. These four mobility measures are:

1. ***Number of access locations.*** The number of access points to and from I-90 will be identified. This will include any access changes or conversions with the Build alternative.

2. ***AM and PM Level of Service (LOS).*** The Highway Capacity Manual defines the freeway LOS in terms of density to quantify the operating conditions on a freeway facility. Density, and its corresponding LOS, for each mainline, merge/diverge and weaving segment will be provided. Density is measured by the number of passenger cars, per hour, per lane (pcphpl). Attachment 3 provides LOS definitions for freeway segments.

3. ***AM and PM Peak Hour Travel Time.*** Eastbound and Westbound No-Build travel times for the outer roadway general purpose (GP) and HOV (including transit) lanes along with the reversible center roadway express lanes on I-90 will be provided for four vehicle classes (GP, HOV, Trucks & Transit) between four locations; I-5, 77th Avenue SE/Island Crest Way, Bellevue Way and I-405.

   For the Build alternative, the No-Build alternative center lane travel times will be replaced with the travel time for light-rail between Seattle and the Mercer Island station. The GP and HOV travel times for the outer

roadway will also be provided for four vehicle classes (GP, HOV, Trucks & Transit) for the Build alternative. Table 8 provides a list of the travel times and their corresponding endpoints.

4. ***AM and PM Peak Hour Person and Vehicle-Throughput.*** Person and vehicle throughput will be determined at the two screenlines locations on I-90 (Section 3.3):

   a. west of Mercer Island on the mid-span of the floating bridge, and
   b. between the Bellevue Way and I-405 Interchanges.

   Throughput is a function of the operating condition; therefore vehicle data from *VISSIM* will be post-processed with the latest PSRC occupancy survey data to generate SOV and HOV person-throughput. Transit ridership data from the Sound Transit model will be included as a component of the No-Build and Build alternative person-throughput.

   Person and vehicle-throughput statistics will be provided for a range of light rail alternatives through post-processing transit ridership and service information. This assumes GP and HOV vehicles along I-90 will remain constant between the light rail alternatives as unserved demand in the peak period will replace any mode shift to transit.

TABLE 8
I-90 Travel Time Endpoints

Mode/Facility	No-Build Alternative	Build Alternative
Outer Roadway GP and HOV lanes	1. I-5 to Bellevue Way (EB) 2. I-5 to I-405 (WB) 3. I-405 to I-5 (EB) 4. Bellevue Way to I-5 (EB) 5. I-5 to Island Crest Way (EB) 6. Island Crest Way to I-5 (WB)	1. I-5 to Bellevue Way (EB) 2. I-5 to I-405 (EB) 3. I-405 to I-5 (WB) 4. Bellevue Way to I-5 (WB) 5. I-5 to Island Crest Way (EB) 6. Island Crest Way to I-5 (WB)
Reversible center roadway	7. I-5 to 77th Avenue SE (EB) 8. 77th Avenue SE to I-5 (WB)	7 & 8. Light rail between the IDS, Mercer Island and South Bellevue Stations (EB & WB)

7.4 Local Street and Freeway Safety Analysis

A safety (accident/crash) analysis will be used to assess the type, cause, and frequency of accidents currently occurring within the project limits. Accident data from the latest three years will be completed and summarized to identify any current safety deficiencies. Unique accident patterns (e.g. high frequency of a specific pattern) will be noted. The accident data will be collected for the directly affected local intersections, roadways and I-90 mainline and ramps. Only where the light rail alternatives are proposed to be either at-grade in semi-exclusive right-of-way or elevated within or immediately adjacent to the road right-of-way will an intersection and roadway safety analysis be conducted. Along the local streets, a qualitative discussion of how the project may affect accident type and frequency will be provided.

Along I-90, a predictive assessment of how accidents may change in the future related to volume/congestion level changes will be developed using current hourly corridor data. By relating various accident quantities to congestion levels, future accident rates or quantities can be applied to future volume predictions for both Build and No-Build alternatives. Current accident patterns/rates determined in the DEIS suggest a similar accident history when the safety analysis was conducted for the *I-90 Two-Way Transit and HOV Operations EIS and IJR.* Therefore, the future predictive analysis for that project will be used as the baseline condition for the I-90 outer roadways. This includes the crash reduction measures proposed in these studies and approved by WSDOT. The benefit of converting the reversible center roadway to light rail will also be accounted for in the safety analysis. No accident analysis or safety conclusions for alternatives proposed to operate outside the roadway right-of-way

(exclusive right-of-way) will be conducted. An example of this type of alignment is the light rail alternative that is proposed adjacent to the SR 520 corridor.

7.5 Light Rail Stations/Park-and-Ride

Using the analysis methodology described in previous sections, key access points to the light rail stations and park-and-ride lots will be analyzed to determine the traffic impacts associated with each light rail alternative. The current and/or proposed South Bellevue, 118th, 130th, Overlake Village and SE Redmond Park and Rides and Bellevue, Mercer Island, Overlake and Redmond Transit Centers are located at or nearby potential light rail alternatives; therefore, the evaluation of traffic impacts due to the East Link alignments will be based on the projected net change in park-and-ride demand for all transit users in each station's vicinity due to the introduction of light rail service or any expansions in park-and-ride capacity. Other issues to be addressed in the assessment of park-and-ride lot and other transit station impacts will include drop-off needs, pedestrian and bicycle circulation and access, and a qualitative evaluation of the potential for spillover parking within adjacent commercial or residential neighborhoods (hide-and-ride as described in Section 7.6).

Characteristics and locations of proposed transit stations and park-and-ride lots will be provided as part of the definition of each light rail alternative. Light rail ridership data at each station, consisting of average weekday park-and-ride, bus transfer, and walking/bicycle patron volumes, will be obtained from the ridership forecasting described in Section 6.2. Park-and-ride trip generation and peaking characteristics for each type of access mode, including both parked vehicles and passenger pick-up/drop-off trips, will be estimated based on information provided in the *Banfield LRT Station Mode of Access Survey* (Tri-Met 1996) for stations in the Portland area that have similar characteristics to proposed Link stations. Parking trip generation will also be sensitive to the project and location-specific characteristics that affect each park-and-ride such as driveway locations.

Traffic impacts at light rail stations will be evaluated using *HCM* methodologies at adjacent key intersections and at the proposed station or parking lot driveway intersections as discussed in Section 7.1. To provide a conservative evaluation of potential traffic impacts, park-and-ride lots will be assumed to be operating at full capacity with all light rail alternatives. Beyond the vehicle trip generation and subsequent intersection traffic analysis associated with the development of light rail stations and park-and-ride lots, a qualitative assessment will be conducted to assess the likelihood of or potential for other traffic impacts associated with these facilities. These impacts could include:

- Discussion of the potential for off-site and/or commuter parking in the vicinity of each station on local streets or in privately-owned parking lots (this differs from the quantitative impact of physical parking loss or reconfiguration discussed in Section 7.5);
- Estimation of the potential for residential neighborhood traffic intrusion; and
- Identification of existing or potential future barriers to bicycle and pedestrian circulation in the vicinity of light rail stations or caused by light rail trackway development.

Table 9 summarizes the criteria used to assess non-quantifiable station-area traffic impacts as described above. These criteria include definitions for the determination of impact magnitude. Variations in transit station ridership forecasts associated with interim terminus alternatives and station deferrals may also be considered in the assessment of station area traffic impacts.

7.6 Parking

Parking supply and costs vary throughout the corridor; large supplies of free private parking are available in both Bellevue and Redmond areas. Many private parking garages are also located in the Bellevue downtown area. Demand for parking spaces also varies depending upon location throughout the corridor, with relatively high demand in downtown Bellevue, more moderate demand in Bellevue-Redmond and Overlake areas and relatively low demand in other locations; such as South Bellevue. Analysis of the impacts of light rail on existing on and off-street public parking will focus on the loss or reconfiguration of this parking due to light rail station and trackway development.

TABLE 9
Criteria for Evaluation of Station-Area Traffic Impacts

Impact	Factors Considered	Impact Assessment
Potential for Off-site Station Area Parking Impacts (Hide-and-Ride)	• Availability of unrestricted parking within a reasonable walking distance. • Convenient access between parking areas and the station. • Compatible land uses. • Perception of security. • Proximity to other light rail station with available parking.	• Low – Station surrounded by restricted parking, inconvenient station access, land uses incompatible, security questionable. • Moderate - Parking both restricted and unrestricted, land uses compatible with all day parking, reasonably secure. • High - parking generally unrestricted and convenient access to station. Station may be an access point to large travel shed.
Potential for Residential Neighborhood Traffic Intrusion	• Existence of through street connections • Character of surrounding land use (is it residential?). • Existence of or lack of traffic calming devices. • Spatial relationship of access routes to residential area.	• Close correlation with potential for off-site parking impacts.
Pedestrian/ Bicycle Traffic	• Existing facilities available and/or proposed through local agency plans. • Volume of traffic on adjacent roadways. • Topography and/or gradient differences.	• Qualitative assessment related directly to provision or lack of facilities and/or presence of existing or potential physical barriers.

[a] Restricted parking not available to light rail riders will include on-street parking with meters, residential parking zone (RPZ) signs, or time limit signs, and private off-street parking not available for general public use.

Inventory of Parking Supply and Utilization

The analysis of each light rail alternative's impact to the number of on- and off-street parking spaces will be documented. Refer to Section 6.1 for the parking data collection parameters. At station areas, parking inventory and utilization surveys will be conducted within a 0.25-mile radius of each station. Within this area, an inventory of existing on and off-street public parking spaces will be developed. Inventory data will be stratified by type of parking (i.e., time limited parking, free parking, loading zone, etc.) and location (i.e., block face or other distinguishing feature). Where available, data from the local agencies will be used to initiate the inventories near the station locations. Where data is not available from the local agencies, data will be collected through field surveys. Analysis will focus on locations that may be specifically impacted by the light rail alignments including both available parking and internal site circulation. Data will include a space occupancy count by block face taken once during mid-morning or mid-afternoon hours on a weekday. This time period represents typical conditions for parking demand. Private off-street parking utilization data will not be collected as part of this project and, only if available by the local agencies or civic groups, will the private parking supply and utilization be documented.

Assessment of Parking Impacts

The assessment of public parking impacts will be based on review of the inventory of parking supply and demand coupled with an evaluation of the conceptual drawings for each light rail alternative. The conceptual drawings will assist in identifying specific locations where changes would be made to the existing parking supply. Comparison between existing demand and the supply remaining after construction of each light rail alternative will form the basis for identification of parking loss associated with the project. The loss of existing public parking spaces will be stratified by both location and type. Private off-street parking will only be analyzed qualitatively since quantitative private parking data will not be collected.

7.7 Non-Motorized Facilities/Modes

A qualitative assessment of the light rail alignments on existing and future proposed pedestrian and bicycle facilities will be performed. Specific issues to be discussed include the following:

- Pedestrian access and circulation in the vicinity of the proposed station, in relationship to the forecasted ridership.
- Identification of non-motorized facilities present at stations.
- Identification of direct (physical) effects on pedestrian and bicycle facilities along each light rail alignment.
- Barriers created to non-motorized (pedestrian and bicycle) traffic movement.
- Intersection crossing issues associated with station layout and connections to major pedestrian routes and destinations.
- Missing sidewalk sections for arterial classified streets within a half-mile radius of the proposed light rail stations.
- Impacts to recommended school walk routes.
- Existing regional bike paths, routes and deficiencies within a 1.0-mile radius of the proposed light rail stations with a general qualification of how major multi-use trails/paths are used (i.e. by commuters or recreational use).

A pedestrian LOS analysis will also be conducted for sidewalks at intersections within one block or 300 ft of each proposed station entrance for both the No-Build and Build conditions to document an impacts created to the pedestrian environment. The *Transit Capacity and Quality of Service Manual* (TCQSM) and *Highway Capacity Manual* (HCM) methodology for determining sidewalk LOS will be used for this analysis. Additional factors such as station layout, adjacent land uses, connections to nearby pedestrian routes and destinations, and potential queue locations will be considered and qualitatively discussed as part of the sidewalk analysis.

7.8 Property Access/Local Circulation

Beyond the analysis of intersection level of service and delay impacts, a qualitative assessment will be made of traffic impacts on local circulation. This assessment will include such factors as:

- Effect of potential street closures on localized traffic movement,
- Potential for neighborhood traffic intrusion associated with either light rail stations or trackway,
- Loss of left-turn access to and from driveways for at-grade and elevated light rail alternatives,
- Changes in property access,
- Other factors.

7.9 Freight

A qualitative assessment will be made of the light rail alignments' impact on freight movements. This assessment will focus on truck movement, truck routing impacts and impacts to the BNSF freight rail corridor. The freight assessment will focus on potential impacts to major truck routes (including I-90) and the BNSF rail corridor, truck service areas, access to major industrial areas, and modifications of truck access to local businesses. Along I-90 a quantitative assessment of truck operations will be documented. This will include the number of trucks able to cross Lake Washington in the 2020 and 2030 AM and PM peak periods for the No-Build and Build conditions and the truck travel time associated with each condition. For a further description of this information refer to Section 7.3.

7.10 Transit

To ensure transit is appropriately evaluated the level of service analysis documented in Transit Cooperative Research Program, Report 100, 2nd Edition *The Transit Capacity and Quality of Service Manual* (TCQSM) will be used as a guideline for measuring and comparing transit in the Existing, No-Build, and Build conditions. The transit LOS measures will be evaluated for each of the East Link project service areas, project screenline locations

and at the stations. The transit service integration plan will provide the necessary information to analyze the future No-Build and Build conditions. The measures to be considered include:

- Service Frequency – Transit schedules and headways will be reviewed at the regional transit centers and park-and-ride locations to determine the number of times an hour a user has access to the transit mode. Special attention will be focused on transit routes that would serve comparable destinations as light rail.
- Hours of Service – Also known as "service span," is simply the number of hours during the day when transit service is provided along a route, a segment of a route, or between two locations.
- Passenger Loads – Reflect the passenger's comfort level of the on-board vehicle portion of a transit trip, both in terms of being able to find a seat and overall crowding levels within the vehicle. This will be a quantitative comparison at the screenline locations between the No-Build and Build conditions.
- Reliability (On-Time Performance and Headway Adherence) – This measure would rely on actual field information from King County's Metro and Sound Transit's Automatic Vehicle Location (AVL) data for an assessment of existing conditions at transit centers and park-and-ride lots. Observations will be made at selected potential station locations to assess the reliability of existing bus routes. Future No-Build and light rail alternatives would be assessed in a qualitative fashion.
- Travel Time– Will be compared for No-Build and Build conditions. Average door-to-door travel times determined based on Sound Transit's forecasting model will be compared for the alternatives being considered.
- Transfers - Will be compared for No-Build and Build conditions. Average number of transit boardings per transit trip will be reported.

Bus and Vanshare layover needs will also be reviewed for each proposed station location. The primary source of information for the future Build alternative will be the light rail alternatives' ridership forecasting effort which is expected to provide the network design, service level inputs, and ridership and travel time outputs. Coordination with King County Metro, and possibly Community Transit will be required. The methodology for analysis of I-90 transit operations (i.e. travel time changes with the project) is provided in section 7.3.

7.11 Construction

A qualitative analysis will be conducted for all alternatives in the FEIS. A more detailed quantitative traffic analysis will be conducted for the Sound Transit Board's preferred alternative as well as alternatives with construction conditions that have the potential for substantial construction traffic impacts (such as cut-and-cover construction in downtown Bellevue). This traffic analysis will be conducted as outlined in section 7.1 and will include key intersections within the construction area that would likely either have additional traffic due to recirculation or reduced number of travel lanes due to construction closures..

Two primary sources of construction impacts to local traffic will be considered from a generally qualitative standpoint:

1. Impacts to traffic operations related to potential road, sidewalk, bicycle, or other transportation facility closures during construction; and
2. Impacts of construction-related traffic.

The primary source of quantitative construction impacts to local traffic will focus on:

1. Impacts to roadways with (or adjacent to) key long-term lane closures by performing traffic forecasts, identifying travel pattern changes and performing subsequent intersection analysis.

Overall, the assessment of construction traffic impacts will focus primarily on principal and minor arterials or on streets that could be directly affected by project construction. As the construction duration along I-90 will cause the closure of the reversible center roadway a quantitative traffic analysis will also be prepared to document and assess construction impacts incurred by the light rail construction along I-90. This process and technical analysis will be prepared similar to the information presented in Sections 6.0 and 7.2. As part of this analysis it is assumed that Stage 3 of the I-90 Two-Way Transit and HOV project (Alternative R-8A) will be constructed and operating to alleviate congestion caused by the reversible center roadway closure. The construction of Alternative R-8A will

not be included in this analysis as its construction staging and assessments are documented in the approved *I-90 Two-Way Transit and HOV Operations EIS and IJR*.

Overall the construction qualitative analysis will consider the following:

- Identification of changes in roadway capacity including potential lane closure requirements, parking restrictions, pedestrian or bicycle facility/routes impacts, alignment shifts, areas of construction activity adjacent to travel lanes, or other reductions to capacity due to transit facility and associated utility construction activity;
- Impacts to transit and emergency services;
- Impacts of construction-related activity on on-street parking supply;
- Identification of potential construction staging areas; including access and impact to roadway operations;
- Identification of potential construction access and truck routes and the impact of construction-related traffic on these routes;
- Estimation of construction truck traffic;
- Identification of areas that would require construction coordination between Sound Transit and other governmental agencies; and
- Development of measures that could mitigate traffic impacts from project construction.

The analysis will be summarized in a tabular format to identify the following:

- Impact location(s).
- Street characteristics.
- Type of construction activity including likely duration of impact (short-term versus long-term).
- Level of construction traffic (This may be characterized as high, moderate, or low). High truck traffic is associated with major fill, excavation, and concrete work such as with tunneling. Moderate truck traffic generally refers to activities not associated with major fill or excavation work. Low truck traffic occurs when none of the construction activities associated with moderate or high truck traffic occurs).
- Full or partial road closures.
- Availability of detour routes.
- Potential for detoured traffic to impact a residential neighborhood. (This is characterized as high, medium or low and is related to both potential for road closure and options for traffic detour.)
- Loss of on-street parking. (This may be characterized as "yes" for parking loss and "no" for no parking loss. Additionally, there may be some temporary loss of off-street parking due to the location and operation of construction staging.)
- The parking demand and supply data discussed in Section 7.5 will be used to determine the level of potential impact that construction worker parking could have on parking supply during construction activities.
- General comments highlighting key issues for each location related to construction traffic activity that do not fall into one of the foregoing categories.
    a. Identify capacity issues, impact on parking/access
    b. Identify construction routes/staging areas

7.12 Mitigation

Potential mitigation measures will be described to address potential transportation impacts associated with the light rail alternatives. Based on the 2020 and 2030 traffic analysis, opportunities for mitigation of long-term impacts will be identified where:

- Intersection operations in the Build condition are worse than the LOS standard when the intersection operations meets the LOS standard in the No-Build condition, or
- Intersection operations in the No Build condition are worse than the LOS standard and the Build condition exacerbates that situation.

These measures might include operational changes such as signal phasing or timing or physical modification such as added lanes. For intersections that do not meet the established LOS standards in the No-Build condition, the light rail alternatives are only obligated to bring the operating conditions back to the No-Build condition. Determining if an intersection meets the agency LOS standards will be based on the conditions at each individual intersection and not by a subarea weighted average.

Areas for potential parking mitigation will be identified by considering the potential for hide-and-ride in the neighborhoods surrounding transit stations. Areas with a high potential for this type of parking activity will be identified with potential mitigation strategies to reduce the likelihood of this activity. Potential mitigation for individual properties where impacts have been determined, such as driveway closure, will also be identified. Where impacts to transit operations are identified appropriate mitigation will be proposed.

Mitigation measures aimed at addressing the construction traffic impacts identified above will be developed and reviewed. As appropriate, this will include a review of measures proposed and/or used for the Central Link light rail construction. Mitigation measures identified to address local construction traffic impacts will also be reviewed for their relevancy in addressing regional and/or corridor level construction traffic issues.

8.0 Documentation

A Transportation Technical Report will be prepared documenting the technical analysis discussed in this report. A summary of the Transportation Technical Report will be incorporated into the FEIS's relevant sections and the Transportation Chapter.

Attachment 1
No-Build Project List

NO-BUILD TRANSPORTATION PROJECTS
(Note: Italicized projects indicate they have been completed.)

Facility	Project Detail	2020	2030	Source
King County Interstate and State Routes				
I-405	1 lane each direction from I-5 to SR 181	X	X	Nickel Package
	1 lane NB from SR 181 to SR 167	X	X	Nickel Package
	1 lane SB from SR 169 to SR 167	X	X	Nickel Package
	1 lane NB from SR 167 to SR 169	X	X	TPA
	SR 515 half-diamond interchange (Talbot Rd)	X	X	TPA
	1 GP lane NB from 112th Ave SE to SE 8th	X	X	Nickel Package
	1 GP lane and one outside HOV SB from I-90 to SE 8th	X	X	Nickel Package
	NE 10th overcrossing	X	X	TPA
	NB Braided crossing from NE 8th to SR 520	X	X	TPA
	1 lane NB from NE 70th to NE 124th	*X*	*X*	*Nickel Package*
	1 lane NB from NE 124th to NE 160th	X	X	TPA
	1 lane SB from SR 522 to SR 520	X	X	Nickel Package
	2 NB lanes Braided Crossing from NE 160th to SR 522	X	X	TPA
	NE 132nd St Interchange	X	X	TPA
	Totem Lake Freeway Station NE 128th	*X*	*X*	*Sound Transit*
	Totem Lake Transit Center	*X*	*X*	*Sound Transit*
	NB/SB SR 167 to I-405 HOV Direct Connect		X	Destination 2030
	1 lane each direction SR 169 to SR 900 (Sunset Blvd)		X	Destination 2030
	2 lanes both directions Sunset to Park Drive		X	Destination 2030
	HOV Direct Access N 8th		X	ST/Destination 2030
	3 lanes both directions from Park Dr to NE 30th		X	Destination 2030
	2 lane NB NE 30th to SE 52nd Ave SE		X	Destination 2030
	3 lanes SB from Coal Creek to NE 30th		X	Destination 2030
	3 lanes both directions from Coal Creek to I-90 (Braids for I-90 to I-405)		X	Destination 2030
I-90	Two-way Transit/HOV from Seattle to Mercer Island (Stage 1, 2, and 3)	X	X	TPA (Only Stages 1 and 2) , ST/WSDOT Stage 3.
	Eastgate Access / 142nd Ave SE	*X*	*X*	*Sound Transit*
SR 519	New ramp at South Atlantic Street and grade separated crossing over Royal South Royal Brougham Way	X	X	Nickel Package
SR 520	Widen to 8 lane including auxiliary and HOV lanes from W Lake Sammamish to SR 202	X	X	Nickel Package
	6 lane (2 GP, 1 HOV) facility Between I-405 and Mountlake Blvd (This assumes the Eastside Transit and HOV Project and the tolling strategies documented in the EIS.)	X	X	Destination 2030

NO-BUILD TRANSPORTATION PROJECTS
(Note: Italicized projects indicate they have been completed.)

Facility	Project Detail	2020	2030	Source
SR 167	1 SB lane from I-405 to SW 41st	X	X	TPA
	1 HOV lane SB from 15th NW to 15th SW	X	X	Nickel Package
	Add HOV both directions from 15th St SW to Pierce Co. Line	X	X	TPA
	Extend HOV lane from 8th St SW to 15th Street NW – HOV	X	X	Nickel Package
I-5	*1 NB lane NE 175th to NE 205th*	*X*	*X*	*Nickel Package*
	Complete HOV from Pierce Co. Line to Tukwila	*X*	*X*	*Nickel Package*
SR 509	Phase 1: 180th to I-5		X	Destination 2030
SR 900	Add 1 lane both directions from SE 78th to I-90	X	X	Nickel Package
	Add HOV lanes both directions from park-and-ride lot to I-90	X	X	Nickel Package
SR 522	Business/Transit Lane (Bothell-Kenmore areas)	X	X	Various sources
	UWBCC campus access: new interchange	X	X	Nickel Package
SR 518	*Add 1 EB GP lane from airport access to I-5*	*X*	*X*	*TPA*
SR 161	*Widen to 5 Lanes from Jovita Blvd to S 360th St*	*X*	*X*	*Nickel Package*
SR 99	Aurora Ave N Corridor Transit/HOV Lanes (N 105th to N 200th)	X	X	Nickel Package
	Replace viaduct	X	X	Destination 2030
SR 18	*1 lane both directions Maple Valley to Issaquah Hobart Rd*	*X*	*X*	*Nickel Package*
	1 lane both directions Issaquah Hobart Rd to I-90		X	Destination 2030
Snohomish County Interstate and State Routes				
I-5	*HOV lanes from SR 526 to US 2*	*X*	*X*	*Nickel Package/TPA*
	New ramp SB I-5 to WB SR 525	X	X	TPA
SR 522	4-lane widening from Snohomish River to US 2	X	X	Nickel Package
SR 9	Stages 1 and 2 from SR 522 to 176th St SE	X	X	Nickel Package
I-405	1 lane NB NE 195th to SR 527	X	X	TPA
SR 527	Additional lanes from 164th SE to 112th SE	X	X	Nickel Package
Pierce County Interstate and State Routes				
I-5	HOV lanes from S 48th (Tacoma) to King/Pierce Co. Line	X	X	Nickel Package
SR 161	Corridor improvements from 176th to 234th	X	X	Nickel Package
	Additional lanes from 36th to Jovita	X	X	Nickel Package
SR 16	*HOV Improvements from Olympic View Dr to I-5*	*X*	*X*	*Nickel Package*
	Tacoma Narrows Bridge: new bridge and approaches. Toll on bridge (EB only)	*X*	*X*	*Bond/Toll*
SR 410	Additional lanes from 214th to 234th	X	X	Nickel Package/TPA
Bellevue Arterials				
150th Ave SE	*Widen to 7 lanes from SE 36th to Newport Way; add turn lanes*	*X*	*X*	*TFP-011*

NO-BUILD TRANSPORTATION PROJECTS
(Note: Italicized projects indicate they have been completed.)

Facility	Project Detail	2020	2030	Source
Northup Way	*1 EB lane from 120th to 124th Avenues NE, intersection improvements at Northup Way and 124th*	*X*	*X*	*TFP-091, TFP-106*
Northup Way	Provide sidewalks and bike lanes on both sides and a two-way center turn lane between Bellevue Way and NE 24th Street.		X	TFP-079
110th Ave NE	Widen to 5 lanes between NE 4th and NE 8th	X	X	TFP-110
NE 10th St	*Extend from 112th Ave NE across I-405 and through the OHMC campus to connect with 116th Ave NE*	*X*	*X*	*TFP-189*
NE 8th Street/106th Avenue NE	*Add westbound lane from 106th to 108th Ave NE becoming right turn lane at 106th Ave NE.* Realign the roadway to the south to better utilize the new westbound travel lane (between 108th and 106th Avenues NE; funded in CIP) and preserve the existing large sequoia tree.	X	X	*TFP-184* TFP-219
NE 12th Street	Widen bridge across I-405 to five lanes. Provide additional turn pockets at 112th and 116th intersections	X	X	Bel-Red Corridor FEIS
NE 10th St at I-405	Add on-ramp to the north connecting to SR 520.	X	X	TFP-193
NE 2nd St	Widen the existing roadway from 3 lanes with parking and turn pockets to 5 lanes from Bellevue Way to 112th Ave NE		X	TFP-190
148th/150th Ave SE	Widen by extending the third SB lane from the ramp to WB I-90 to south of Eastgate Way at the I-90 WB off Ramp		X	TFP-154
129th Ave SE	Extend 129th Ave SE from SE 38th St to Newport Way		X	TFP-103
NE 4th Street Extension	Extend 4th Street to 120th Avenue NE will consist of 5 vehicle lanes, bike lanes, sidewalks and will require construction of a sunken roadway and bridge(s) for BNSF RR tracks and Pedestrian over crossings. 120th Avenue widened between NE 4th and NE 8th streets.	X	X	TFP-207
120th Avenue NE	Widen to five lanes with sidewalks and bike lanes. Extend/realign roadway between NE 8th and Old Bel-Red Rd.		X	TFP-208
NE 15th/16th Street (Phase I)	Construct a five lane roadway from 116th Avenue NE to 124th Avenue NE.	X	X	TFP-209
124th Avenue NE/Proposed NE 15th/16th Street Extension to Northup Way	Widen to five lanes with sidewalks. Key intersections at NE 15th/16th Street and Northup Way.		X	TFP-210
124th Avenue NE	Widen to 5 lanes with sidewalks between Bel-Red Road to planned NE 15th/16th Street Extension.		X	TFP-213
NE 15th/16th Street (Phase II)	Extend five lane roadway from 124th Avenue NE to 136th Place NE with a key intersection at 130th Avenue NE. Widen 136th Place NE five to three-lanes between NE 16th Street and NE 20th Street (reduction occurs at the intersection); add a double westbound left turn on NE 20th Street.		X	TFP-215
130th Avenue NE	Construct turn lanes, shared bike lanes, on-street parking and sidewalks between NE 16th and NE 20th Streets and widen to three lanes with shared bike lanes and sidewalks between NE 16th Street and Bel-Red Road.		X	TFP-218/TFP-039
Bel-Red Corridor Preferred Alt.	Land use changes included in the preferred alternative from the Bel-Red Corridor Project will be included in the FEIS. The land uses were approved by PSRC and the City of Bellevue.	X	X	City of Bellevue

NO-BUILD TRANSPORTATION PROJECTS
(Note: Italicized projects indicate they have been completed.)

Facility	Project Detail	2020	2030	Source
Redmond Arterials				
Novelty Hill Road	Road improvements to Union Hill Road in the vicinity of 196th Avenue NE, 196th/195th Ave NE from Union Hill Road NE to Novelty Hill Road and Novelty Hill Road at 196th Ave NE. Work includes the replacement of the Evans Creek Bridge. Redmond is a partner with King County	X	X	RED-CIP-C26
164th Avenue NE	Rechannelize street to one through lane in each direction, two-way left-turn lane and bike lanes.	X	X	RED-TIP-S34
166th Avenue NE	Rechannelize to a cross section that includes 1 though lane in each direction, a center two-way left-turn lane and bike lanes.	X	X	RED-TIP-S41
Union Hill Road	Widen Union Hill Rd from Avondale Rd to 178th Pl NE. Improvements include 2 through lanes and 1 right turn lane in each direction, left turn lanes, bike lanes, curb, gutter, sidewalks, street lights, storm drainage, underground power and utility pole relocation.	X	X	RED-TFP- 049a
Union Hill Road	Widen Union Hill Rd from 178th Pl NE to 188th Ave NE. Improvements include 2 through lanes in each direction, left turn lanes, bike lanes, curb, gutter, sidewalks, street lights, storm drainage, underground power and utility pole relocation, right-of-way and easement acquisition. Construct permanent signal at 178th Place NE/Union Hill.	X	X	RED-TFP-049b
Union Hill Road	Widen Union Hill Rd from 188th Pl NE to east City Limits. Improvements include 2 through lanes in each direction, left turn lanes, bike lanes, curb, gutter, sidewalks, street lights, storm drainage, underground power and utility pole relocation, right-of-way and easement acquisition.	X	X	RED-TFP-049c
162nd Avenue NE (Bear Creek Parkway Extension, west)	*Construct new arterial from 159th Pl NE to Leary Way. Improvements include 1 through lane in each direction, left turn lanes, curb, gutter, sidewalks, street lights, storm drainage, and right-of-way.*	*X*	*X*	*RED-TFP-050a*
Redmond Way	Widen Redmond Way from SR 520 to 187th Ave NE. Improvements include 6-7 lanes from SR 520 to East Lake Sammamish Pkwy (ELSP) and 4-5 lanes from ELSP to 187th Ave NE, bike lanes, curb, gutter, sidewalks, street lights, storm drainage, underground power.	X	X	RED-TFP-065
160th Avenue NE	Construct new 160th arterial from current terminus at approximately NE 99th St north to the intersection with Red-Wood Rd and modify existing 160th arterial from NE 90th St north to current terminus. Improvements include 1 through lane in each direction, left turn lanes, bike lanes, curb, gutter, sidewalks, street lights, storm drainage, right of way and easement acquisition.	X	X	RED-TFP-072a
NE 116th Street	Widen NE 116th St from Red-Wood Rd to Avondale Rd. Improvements include 1 through lane in each direction, left turn lanes, bike lanes, curb, gutter, sidewalks, equestrian trail, street lights, storm drainage, underground power, right-of-way and easement acquisition. Project also includes construction of roundabout at 172nd Ave NE.	X	X	RED-TFP-105
188th Avenue NE	Construct new 188th Ave NE arterial from NE 68th Street to Union Hill Rd. Improvements include 1 through lane in each direction, left turn lanes, bike lanes, curb, gutter, sidewalks, street lights, storm drainage, right-of-way and easement acquisition.	X	X	RED-CIP-C52
188th Avenue NE	Complete 188th Ave NE arterial from Redmond Way to NE 68th Street. Improvements include 1 through lane in each direction, left turn lanes, bike lanes, curb, gutter, sidewalks, street lights, storm drainage, right-of-way and easement acquisition.		X	RED-TFP-117
185th Ave NE	Construct new 185th Ave NE arterial from NE 80th St to Union Hill Rd. Improvements include 1 through lane in each direction, left turn lanes, sidewalks, street lights, storm drainage, right-of-way, easements and traffic signal at Union Hill Rd.	X	X	RED-TFP-118

NO-BUILD TRANSPORTATION PROJECTS
(Note: Italicized projects indicate they have been completed.)

Facility	Project Detail	2020	2030	Source
161st Ave NE	Construct new 161st Ave NE from Bear Creek Pkwy Extension to Redmond Way. Improvements include 1 through lane in each direction, left turn lanes, bike lanes, parking, sidewalks, street lights, storm drainage, right-of-way, easements and traffic signals at Cleveland St and Bear Creek Pkwy.	X	X	RED-TMP-001
164th Ave NE	Construct new 164th Ave NE from NE 76th St to Cleveland St. Improvements include 1 through lane in each direction, bike lanes, parking, sidewalks, street lights, storm drainage, right-of-way and easements.	X	X	RED-TMP-002
NE 36th St/NE 31st St	Construct new NE 36th St and bridge over SR 520 in the vicinity of NE 36th St and NE 31st St. Improvements include 1 through lane in each direction, left turn lanes, bike lanes, sidewalks, street lights, storm drainage, right-of-way and easements.	X	X	RED-TMP-004
172nd Ave NE	Construct new 172nd Ave NE from NE 122nd St to NE 124th St. Improvements include 1 through lane in each direction, sidewalks, street lights, traffic calming, storm drainage and easements.	X	X	RED-TMP-007
NE 85th St	Reconfigure NE 85th St from 154th Ave NE to 164th Ave NE to 1 through lane in each direction, center left turn lane, bike lanes, parallel parking and pedestrian amenities.	X	X	RED-TMP-009
164th Ave NE	Reconfigure 164th Ave NE from Redmond Way to NE 87th St to 1 through lane in each direction, center left turn lane, bike lanes and pedestrian amenities.	X	X	RED-TMP-010
Old Redmond Rd	Widen Old Redmond Road to three lanes from 132nd Ave NE to 136th Ave NE and rechannelize from 136th Ave NE to 140th Ave NE. Improvements include 1 through lane in each direction, left turn lanes, bike lanes, curb, gutter, sidewalks, street lights, storm drainage, underground power, right-of-way and easement acquisition.	X	X	RED-TMP-016
152nd Avenue NE, North	Implement a multi-modal pedestrian corridor concept on 152nd Avenue NE from NE 24th Street to NE 31st Street to create a lively and active signature street in the Overlake Village. Pending the results of the 152nd Ave NE Corridor Study, the proposed cross section for the improvements would include 1 through lane in each direction, accommodations for bus-based transit and its connections to light rail transit (LRT), left turn lanes, planted medians, bike lanes, parking, pedestrian supportive sidewalks, street lights, pedestrian amenities, storm drainage, right-of-way and easements. This corridor will also include the LRT line and an LRT station.	X	X	RED-OV-065a
Redmond Way and Cleveland Street	Convert Redmond Way from 160th Ave NE to Avondale Way to 1 through lane in each direction and center turn lane with west end having two westbound starting at 161st Ave NE and east end having two eastbound lanes starting at 168th Ave NE. Convert Cleveland St to 1 through lane in each direction. Improvements include curb extensions, widened sidewalks, pedestrian amenities, gateway treatments and realignment of street at eastern and western ends to improve traffic flow.	X	X	RED-TMP-079
Redmond Way	Widen Redmond Way bridge at Bear Creek. Improvements would include 2 through lanes in each direction, 2 eastbound left turn lanes to NE 76th St, 1 eastbound right turn lane to westbound SR 520 onramp, sidewalks, Bear Creek and E Lake Sammamish Trail connections, street lights, storm drainage, right-of-way and easements.		X	RED-TMP-013
166th Ave NE	Reconfigure 166th Ave NE from NE 85th St to NE 104th St to 1 through lane in each direction, center left turn lane and bike lanes.	X	X	RED-TMP-019
NE 83rd Street	Widen NE 83rd St from 160th Ave NE to 161st Ave NE. Improvements include widened sidewalks, increased parking, street lights, pedestrian amenities and intersection modifications.	X	X	RED-TMP-061

NO-BUILD TRANSPORTATION PROJECTS
(Note: Italicized projects indicate they have been completed.)

Facility	Project Detail	2020	2030	Source
NE 70th Street	Construct new NE 70th St from Redmond Way to 180th Ave NE. Includes 1 through lane in each direction, left-turn lanes and sidewalks.	X	X	RED-TMP-029
NE 73rd St Extension	Construct new NE 73rd St for neighborhood access and circulation from 185th Ave NE to 188th Ave NE. Improvements include 1 through lane in each direction, left turn lanes, sidewalks, street lights, traffic control, storm drainage, right-of-way and easements.	X	X	RED-TIP-C51
	Extend improvements (from RED-TIP-C51) to 192nd Ave NE		X	RED-TMP-070
NE 76th St Extension	Construct new NE 76th St from 185th Ave NE to 188th Avenue NE. Improvements include 1 through lane in each direction, left turn lanes, bike lanes, sidewalks, street lights, traffic control, storm drainage, right-of-way and easements.	X	X	RED-TIP-50
	Extend improvements (from RED-TIP-50) to 192nd Ave NE		X	RED-TMP-071
192nd Ave NE Extension	Construct new 192nd Ave NE for local access and circulation from NE 68th St to Union Hill Rd. Improvements include 1 through lane in each direction, left turn lanes, sidewalks, street lights, traffic control, storm drainage, right-of-way and easements.		X	RED-TMP-072
NE 40th Street, Transit Center SR 520 Pedestrian Crossing	Provide a new direct pedestrian connection over SR 520 between the Overlake Transit Center and the Microsoft west campus (in the vicinity of the NE 38thStreet alignment).		X	RED-OV-032
148th Avenue NE	Create third northbound through lane on 148th Ave NE from NE 22nd St to SR 520 westbound on-ramp using primarily existing right turn lanes and modify SR 520 westbound on-ramp to allow HOV access. At NE 24th St and 148th Ave NE intersection add second left turn lane on the eastbound and westbound approaches, add right turn lane on northbound approach, and extend right turn lane on westbound approach.	X	X	RED-TMP-078
Overlake Neighborhood Preferred Alt.	Land use changes included in the preferred alternative from the Overlake Neighborhood Plan will be included in the FEIS analysis. The land uses were approved by PSRC and the City of Redmond.	X	X	City of Redmond
Kirkland Arterials				
NE 120 St	Construct new 3-lane roadway with ped/bike facilities from Slater Ave to 124 Ave NE	X	X	R-21
Seattle Arterials				
Lander St	Overcrossing of BNSF railroad	X	X	Seattle
Spokane St	Addition of freeway ramps to 4th Avenue	X	X	Seattle
Alaskan Way Viaduct	New ramp connections at S Atlantic, South Royal Brougham, and King St		X	Destination 2030/Seattle
King County Arterials				
Military Road	From S 272nd to S 304th, widen to 4/5 lanes	X	X	CP-5
Issaquah Bypass	New facility		X	CP-7
Issaquah Hobart Rd	From Issaquah to SR 18, widen to 4 lanes	X	X	CP-6
Carr Road	Widen from SR 167 to Benson Road	X	X	CP-8

NO-BUILD TRANSPORTATION PROJECTS
(Note: Italicized projects indicate they have been completed.)

Facility	Project Detail	2020	2030	Source
SE 212th/SE 208th	From SR 167 to SR 515 widen to 6 lanes (transit HOV priority lanes)	X	X	CP-14
Woodinville-Duvall Rd	Widen between 171st Ave NE and Avondale Road	X	X	CP-12
Avondale Road NE	From NE 155th to NE 168th, widen to 3 lanes	X	X	CP-13
Transit Assumptions				
Central Link	2020) Northgate to Stadium: 4-minute peak and 6-minute off peak. Stadium to S 200th 8 minute peak and 12 minute off peak 2030) Lynnwood to Stadium 3.5 minute peak and 5 minute off peak. Stadium to Redondo/Star Lake (272nd) 7 minute peak and 10 minute off peak	X	X	Sound Move
ST Express	2009 SIP	X	X	Sound Move
Sounder	Everett to Seattle (4 peak period trips add Mukilteo Station), Tacoma to Seattle (9 peak period trips add S. Tacoma and Lakewood Station)	X	X	Sound Move
Street Car	Waterfront Street Car	X	X	King County Metro
	S. Lake Union street car	X	X	Seattle
	First Hill Streetcar	X	X	Sound Transit
Transit Service	Regional and local bus services operated by Sound Transit, King County Metro, Community Transit, Everett Transit and Pierce Transit. Sound Transit and King County Metro will be provide transit service integration plans for both No-Build and Build alternatives for 2020 and 2030 horizon years. The PSRC model assumes service provide by Kitsap Transit and the Washington State Ferries as well.	X	X	Agency service plans

ST2 PROJECTS BY CORRIDOR

Project ID	Mode	Project Detail	2020	2030
North Corridor				
N06	Link	University of Washington Station - Northgate (Seattle) - S 200th Street	X	X
N07a	Streetcar	Downtown Seattle - Capitol Hill via First Hill	X	X
N22	Sounder	Joint development of a Parking Garage at Mukilteo Station	X	X
N23a	Sounder	New Permanent station at Edmonds Crossing	X	X
N28	Link	Northgate - Jackson Park		X
N29	Link	Jackson Park - Shoreline		X
N30	Link	Shoreline - Mountlake Terrace		X
N31T2	Link	Mountlake Terrace - Lynnwood Transit Center (Terminal)		X
East Corridor				
E20	Express Bus	Transit Center and parking garage in Bothell	X	X
E25b	Express Bus	N 8th Street parking garage in Renton	X	X
South Corridor				
S17	Sounder	Permanent station at Tukwila	X	X
S18b	Sounder	Parking garage at Auburn Station (Alternative)	X	X
S20	Sounder	Parking garage and pedestrian bridge at Sumner Station	X	X
S21	Sounder	Parking garage and pedestrian bridge at Puyallup Station	X	X
S25	Sounder	Track and structure upgrade, Tacoma Dome Station - Reservation Junction		X
S27	Link	Sea-Tac Airport - S 200th St	X	X
S28	Link	S 200th St - Kent-Des Moines Rd via SR 99		X
S29a	Link	Kent-Des Moines Rd - S 272nd St via SR 99		X

Abbreviations:
CP Capital Improvement Plan
DT Downtown Plan
GP general purpose
NA not applicable
NB northbound
OHMC Overlake Hospital Medical Center
R Roadway
TMP Transportation Master Plan
SB southbound
SIP Service Implementation Plan
TPA Transportation Partnership Account
TFP Transportation Facilities Plan
UWBCC University of Washington Bellevue Community College

NO-BUILD INTERSECTION PROJECTS[a]
(Note: Italicized projects indicate they have been completed.)

Facility	Project Detail	2020	2030	Notes
Bellevue Intersections				
Bel-Red Road at NE 30th Street	*Will add a new traffic signal at the intersection.*	*X*	*X*	*TFP-024, I-70*
112th Avenue SE at SE 6th Street	*Will install a new traffic signal at the intersection.*	*X*	*X*	*TFP-030, I-88*
SE 16th Street/145th Place SE to 148th Avenue SE	*Construct a new westbound right-turn lane at 145th Place NE and upgrade the traffic signal at the intersection.*	*X*	*X*	*TFP-043, R-118*
116th Avenue NE at NE 12th Street	Construct a northbound right-turn lane, extend eastbound left-turn lane.	X	X	TFP-090
Northup Way/120th Avenue NE to 124th Avenue NE	Widen Northup Way/124th Avenue NE intersection to provide a northbound right-turn lane and a second eastbound left-turn lane to the SR 520 ramp.	X	X	TFP-091, TFP-106, R-133
148th Avenue NE at Bel-Red Road	Construct eastbound right and second left-turn lanes and a second westbound left-turn lane.		X	TFP-094, I-76, RED-OV-088
156th Avenue NE at Bel-Red Road	Construct a southbound right-turn lane. (Microsoft to construct)	X	X	TFP-095, TIP-53
148th Avenue NE at NE 20th Street	Construct second eastbound and westbound left turn lanes.		X	TFP-101, I-78
Bel-Red Road at NE 24th Street	Construct southbound right-turn and northbound left-turn lanes.		X	TFP-102
129th Avenue SE/SE 38th Street to Newport Way	Extend 129th Place SE north to SE 38th Street. Consider signalization and channelization improvements if warranted.		X	TFP-103
Factoria Boulevard at Newport Way	Construct back-to-back double left-turn pockets northbound at the Newport High School entrance and southbound at Newport Way.	X	X	TFP-120
148th Avenue NE at NE 36th Street	Construct a second southbound left turn lane and second westbound left turn lane.	X	X	TFP-128
Lakemont Boulevard at Village Park Drive	*Install new signal and crosswalks.*	*X*	*X*	*TFP-155, I-89*
NE 24th Street at 148th Avenue NE	Lengthen the westbound right-turn lane on NE 24th Street and provide a second westbound left-turn lane.		X	TFP-157
145th Place SE	Construct center medians and left-turn pockets where needed from SE 8th to SE 24th.	X	X	TFP-160, NIS-1
156th Avenue SE at SE Eastgate Way (I-90 westbound off-ramp)	Widen the I-90 westbound off-ramp to provide two dedicated left-turn lanes and a shared through/right-lane with a channelized right turn.	X	X	TFP-162
NE 8th Street at 148th Avenue NE	Construct 2nd eastbound and westbound left-turn lanes on NE 8th Street.	X	X	TFP-168
148th Avenue SE at Lake Hills Boulevard	*Lengthen the westbound left-turn lane from Lake Hills Blvd to 148th Avenue SE from 75 feet to approximately 250 feet and/or convert the existing through/right-turn lane to a left/through/right-turn lane.*	*X*	*X*	*TFP-188, I-90*
Lakemont Blvd (Phase 1) Cougar Mountain Way to Lewis Creek Park	Install signal and turn lanes at Cougar Mtn. Way/ Lakemont Blvd.; construct northbound left turn lane on Lakemont Blvd. at SE 62nd Street. Add sidewalk and bike lanes.		X	TFP-192
150th Avenue SE/SE 37th Street/I-90 off-ramp	Widen I-90 off-ramp 300 feet west of 150th Avenue SE and add a right-turn lane. Widen SE 37th Street 500 feet to the east of 150th Avenue SE to allow for a bypass lane on the right side of the street.	X	X	TFP-195
NE 20th Street/Bel-Red Road to 156th Avenue NE	Construct an east-to-west U-turn on NE 20th Street at 156th Avenue NE; with access management along NE 20th Street.	X	X	TFP-196,TIP-61
Bel-Red Road at NE 20th Place	Install signal, eastbound left-turn pocket, and pedestrian crossing.		X	TFP-198

NO-BUILD INTERSECTION PROJECTS[a]
(Note: Italicized projects indicate they have been completed.)

Facility	Project Detail	2020	2030	Notes
Lakemont Blvd (Phase 2)/Lewis Creek Park to 164th Ave SE	Install signal at 164th Ave SE/Lakemont Blvd; construct sidewalk and bike lane on east side; add planted medians where feasible.	X	X	TFP-205
SE 40th Lane/Factoria Boulevard	Lengthen the southbound to eastbound left turn lane and lengthen the westbound left turn lane.		X	TFP-220
NE 10th at I-405	Add on-ramp to the north connecting to SR 520.	X	X	TFP-189, TFP-193, R-149
Bellevue Way/NE 4th Street	Add a southbound right turn lane and a westbound right turn lane. Dual westbound left turn lanes.		X	TFP-222
Bellevue Way/NE 8th Street	Add southbound right turn lane.		X	TFP-223
Bellevue Way/NE 2nd Street	Add a northbound right turn lane and a second southbound left turn lanes.		X	TFP-225
NE 24th Street/156th Avenue NE	Construct an eastbound right turn lane.	X	X	TFP-239
Redmond Intersections				
124th Ave NE/Red-Wood Road	Construct eastbound through/right turn lane, a second northbound left-turn lane, and second westbound lane on the east leg of the intersection. Add sidewalk and bike lane on east leg.	X	X	RED-TIP-C41
NE 51st St/148th Ave NE	Improve traffic flow through intersection modifications and widening.	X	X	RED-TIP-C46
NE 31st St/156th Ave NE	Provide additional westbound left-turn lane.	X	X	RED-TIP-C47
NE 24th St/162nd Pl NE	Install traffic signal and add left-turn lanes on 124th Ave NE.	X	X	RED-TIP-S40
NE 90th St/151st Ave NE	Install traffic signal.	X	X	RED-TIP-S42
NE 76th St/185th Ave NE	Install traffic signal.	X	X	RED-TIP-S44
156th Avenue NE/Bel-Red Road	Add southbound right-turn lane on 156th Ave NE.	X	X	JOINT-BROTS-22.3
148th Ave NE/NE 29th Place	Add southbound through and second westbound left-turn lanes; channelize yield for westbound right-turn lane; convert eastbound right-turn lane to shared right-turn/left-turn lane.	X	X	JOINT-BROTS-28
148th Ave NE/NE 20th St	Add second eastbound left-turn and second westbound left-turn lanes.		X	JOINT-BROTS-50.1
Bel-Red Road/NE 20th Street	Add southbound right-turn lane; convert westbound lanes to provide left turn, left-turn/through and through/right-turn lanes.		X	JOINT-BROTS-52
Bel-Red Road/NE 24th Street	Add southbound right-turn and northbound left-turn lanes.		X	JOINT-BROTS-53.1
148th Avenue NE/NE 36th Street	Add second southbound left-turn lane and second westbound left-turn lane.	X	X	JOINT-BROTS-79
159th Ave NE/NE 40th St	Revise lanes to provide northbound left-turn and shared northbound left-turn/right-turn lanes.	X	X	RED-BROTS-004.1
148th Ave NE/Old Redmond Rd	Extend the northbound left-turn lane by increasing length and channelization.	X	X	RED-BROTS-005.4
150th Ave NE/NE 40th St	Add northbound right-turn lane.	X	X	RED-BROTS-008.1
W Lk Sam Pkwy NE/NE 51st St	Add southbound lane from NE 51st St to NE 50th St and then taper two southbound through lanes to one. Convert existing southbound right-turn only lane at NE 51st St to right/through lane.	X	X	RED-BROTS-011.1
W Lk Samm Pkwy NE/Bel-Red Rd	Removing exiting traffic signal. Install 2-lane roundabout at Bel-Red Road, West Lake Sammamish intersection and improve pedestrian facilities.	X	X	RED-BROTS-031/RED-TIP-C48

NO-BUILD INTERSECTION PROJECTS[a]

(Note: Italicized projects indicate they have been completed.)

Facility	Project Detail	2020	2030	Notes
140th Ave NE/Redmond Way	Add second northbound left-turn lanes.	X	X	RED-BROTS-033
140th Ave NE/Redmond Way	Add eastbound right-turn lane.	X	X	RED-BROTS-033c
Willows Rd/Redmond Way	Convert southbound lanes to provide left-turn and left-turn/through/right-turn lanes; add westbound right turn lane.	X	X	RED-BROTS-034.1
150th Ave NE/NE 51st St	Add north leg to intersection. Provide two southbound left-turn lanes.	X	X	RED-BROTS-085
NE 83rd Street at 161st Avenue NE	Install new traffic signal and make intersection improvements at NE 83rd St and 161st Ave NE.	X	X	RED-TFP-801-19
NE 51st Street at 150th Ave NE	Install new traffic signal at intersection of NE 51st St and 150th Ave NE.	X	X	RED-TFP-805-04
Redmond Way/East Lake Sammamish Parkway at 180th Avenue NE	Reconstruct intersection of Redmond Way at East Lake Sammamish Pkwy and 180th Ave NE.	X	X	RED-TFP-807-02
Redmond Way at 187th Avenue NE	Install new traffic signal at intersection of Redmond Way and 187th Ave NE.	X	X	RED-TFP-807-03
Union Hill Road at 188th Avenue NE	Reconstruct horizontal curve and install new traffic signal at intersection of Union Hill Rd and 188th Ave NE.	X	X	RED-TFP-807-05
Union Hill Road at Avondale Road	Intersection modification. Reconstruct intersection pavement and add one northbound free right-turn lane, one southbound left-turn lane, one southbound right-turn lane, one eastbound right-turn lane and one westbound left-turn lane.	X	X	RED-TFP-807-06
East Lake Sammamish Pkwy at 187th Ave NE	Install new traffic signal. Improvements include southbound left-turn lane and reconstruct grade separated trail crossing.	X	X	RED-TMP-020
Old Redmond Rd at West Lake Sammamish Way	Install new traffic signal. Improvements include modifications to better accommodate nonmotorized uses.	X	X	RED-TMP-042
148th Avenue NE/SR 520 Interchange	Modify channelization and signals, and provide wide multi-use trail that is separated from the roadway on the east side of 148th Ave NE from the westbound SR 520 ramps to the SR 520 Trail at the eastbound SR 520 ramps (148th Ave NE bridge over SR 520).	X	X	RED-TMP-081/RED-TIP-C27
Bel-Red Road and 148th Avenue NE	Work with the City of Bellevue to add eastbound and westbound left turn lanes and an eastbound right-turn lane.		X	RED-OV-088, BEL TFP-094
Redmond Way at NE 76th Street	Modify intersection. Add a southbound right turn lane on NE 76th St and add dual lefts on eastbound Redmond Way.	X	X	RED-TMP-062
Mercer Island Intersections				
27th & 77th and 27th & 78th	Install traffic signals	X	X	TIP 2009-2014 – Section B, project 3

[a] Only the Cities of Bellevue and Redmond no-build intersection projects are presented in this table. Other jurisdictions do not have intersection improvements within the project study area.

Attachment 2
Alternative and Study Intersection Maps

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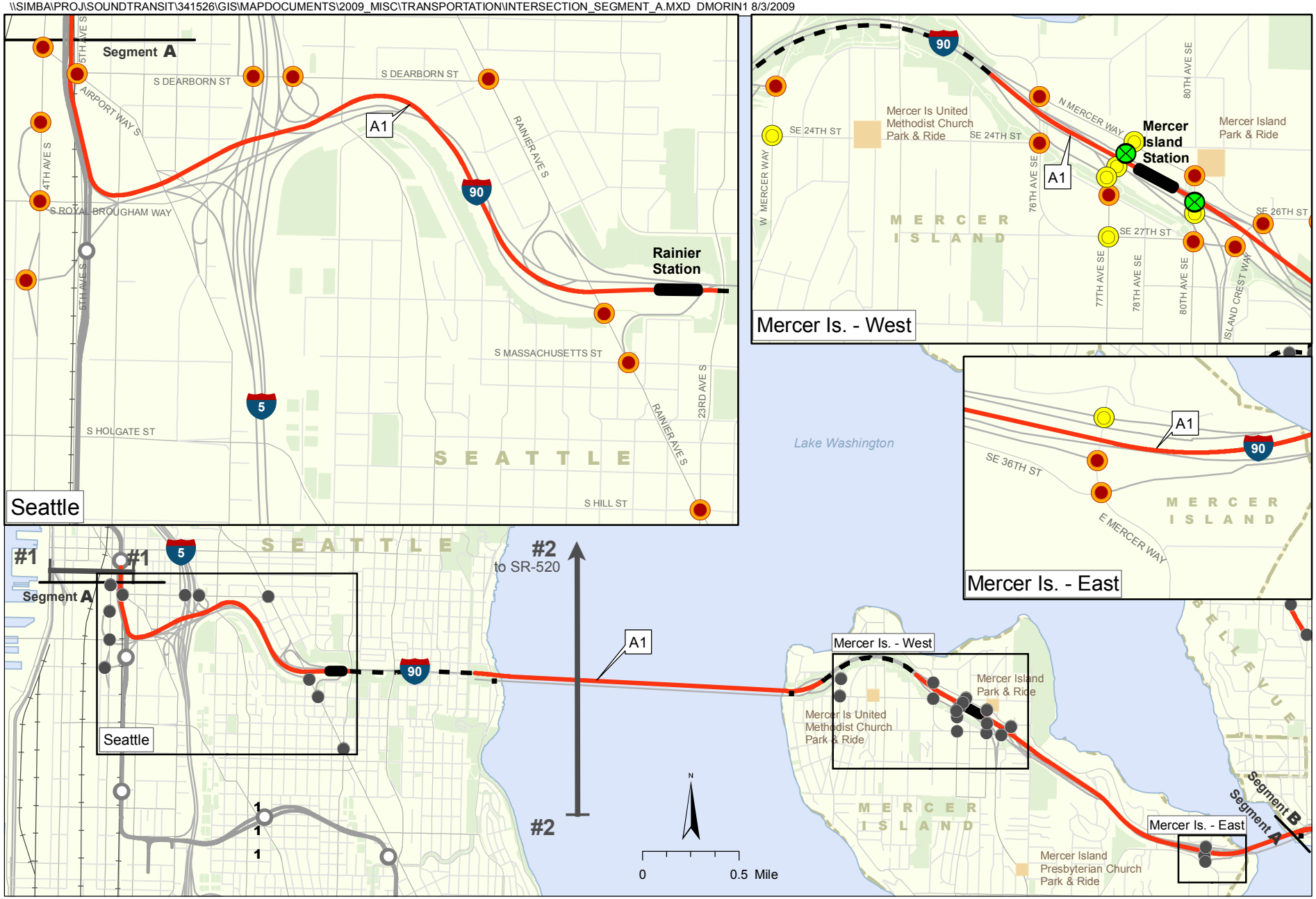


Source: Data from King County (2006) modified by CH2M HILL.

Existing Intersection Control

- Signalized
- Non-signalized

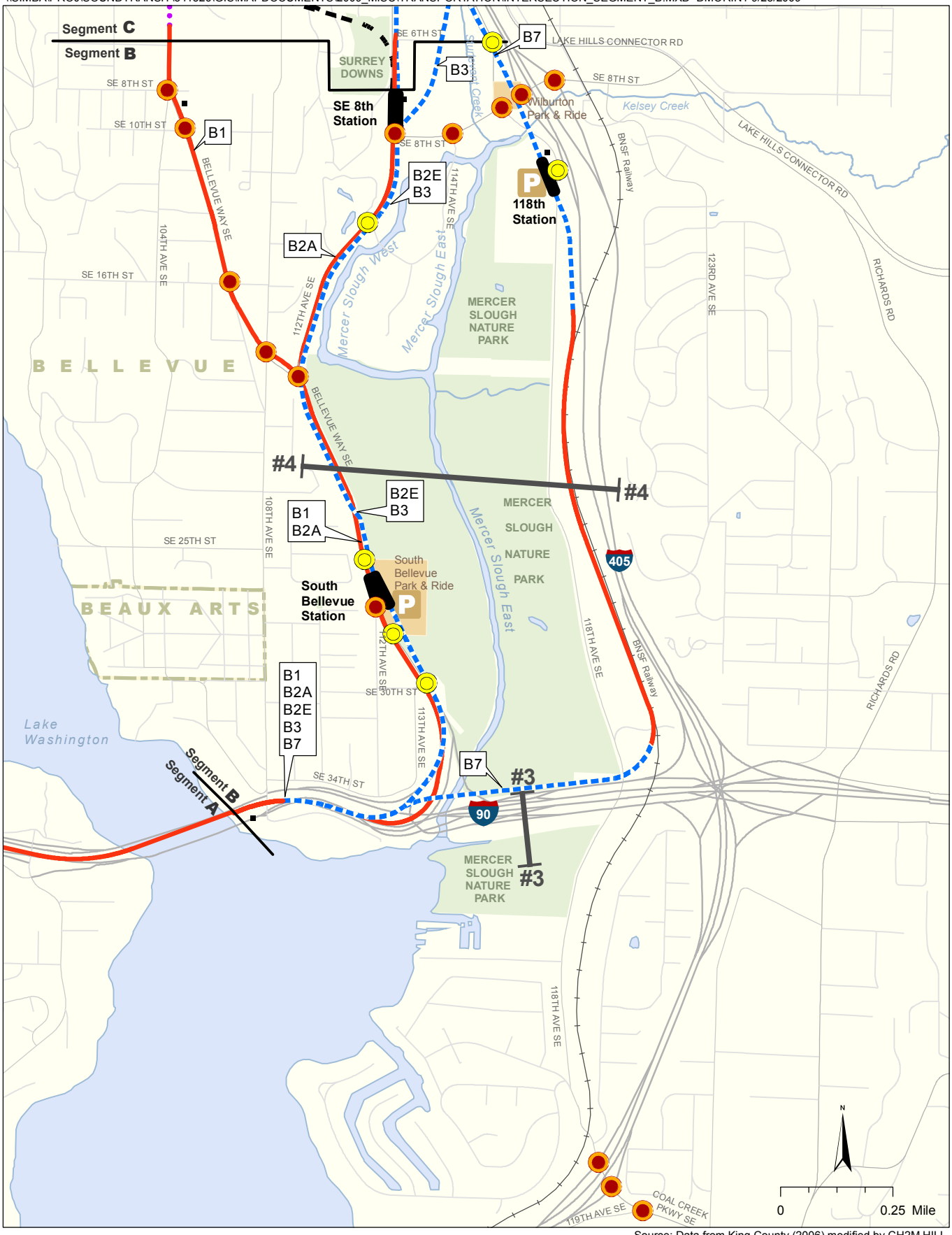
- Future Intersection
- Study Intersection
- Screenline

- At-Grade Route
- Elevated Route
- Retained-Cut Route
- Tunnel Route

- Traction Power Substation
- Proposed Station
- Central Link Alignment and Station

Segment A
Study Intersections and Screenlines
East Link Project

\\SIMBA\PROJ\SOUNDTRANSIT\341526\GIS\MAPDOCUMENTS\2009_MISC\TRANSPORTATION\INTERSECTION_SEGMENT_B.MXD DMORIN1 9/25/2009



Source: Data from King County (2006) modified by CH2M HILL.

Existing Intersection Control

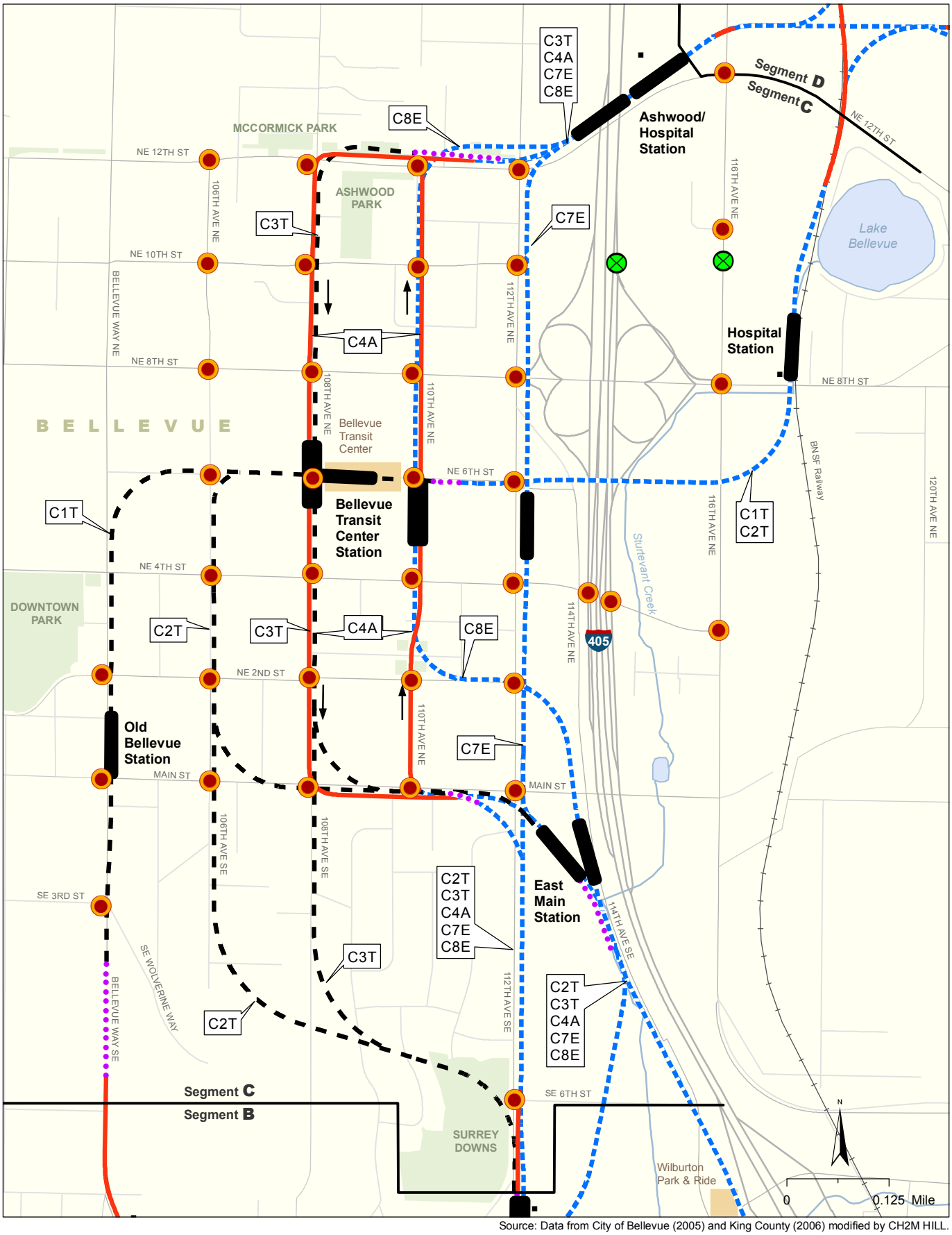
- Signalized
- Non-signalized
- Screenline

- At-Grade Route
- Elevated Route
- Retained-Cut Route
- Tunnel Route

- Traction Power Substation
- Proposed Station
- New and/or Expanded Park-and-Ride Lot

Segment B
Study Intersections and Screenlines
East Link Project

\\SIMBA\PROJ\SOUNDTRANSIT\341526\GIS\MAPFILES\FEIS\TRANSPORTATION\INTERSECTIONS\INTERSECTION_SEGMENT_C.MXD DMORIN1 8/20/2009



Source: Data from City of Bellevue (2005) and King County (2006) modified by CH2M HILL.

Existing Intersection Control

- Signalized
- Future Intersection

- At-Grade Route
- Elevated Route
- Retained-Cut Route
- Tunnel Route

- Traction Power Substation
- Proposed Station
- New and/or Expanded Park-and-Ride Lot

Segment C
Study Intersections
East Link Project

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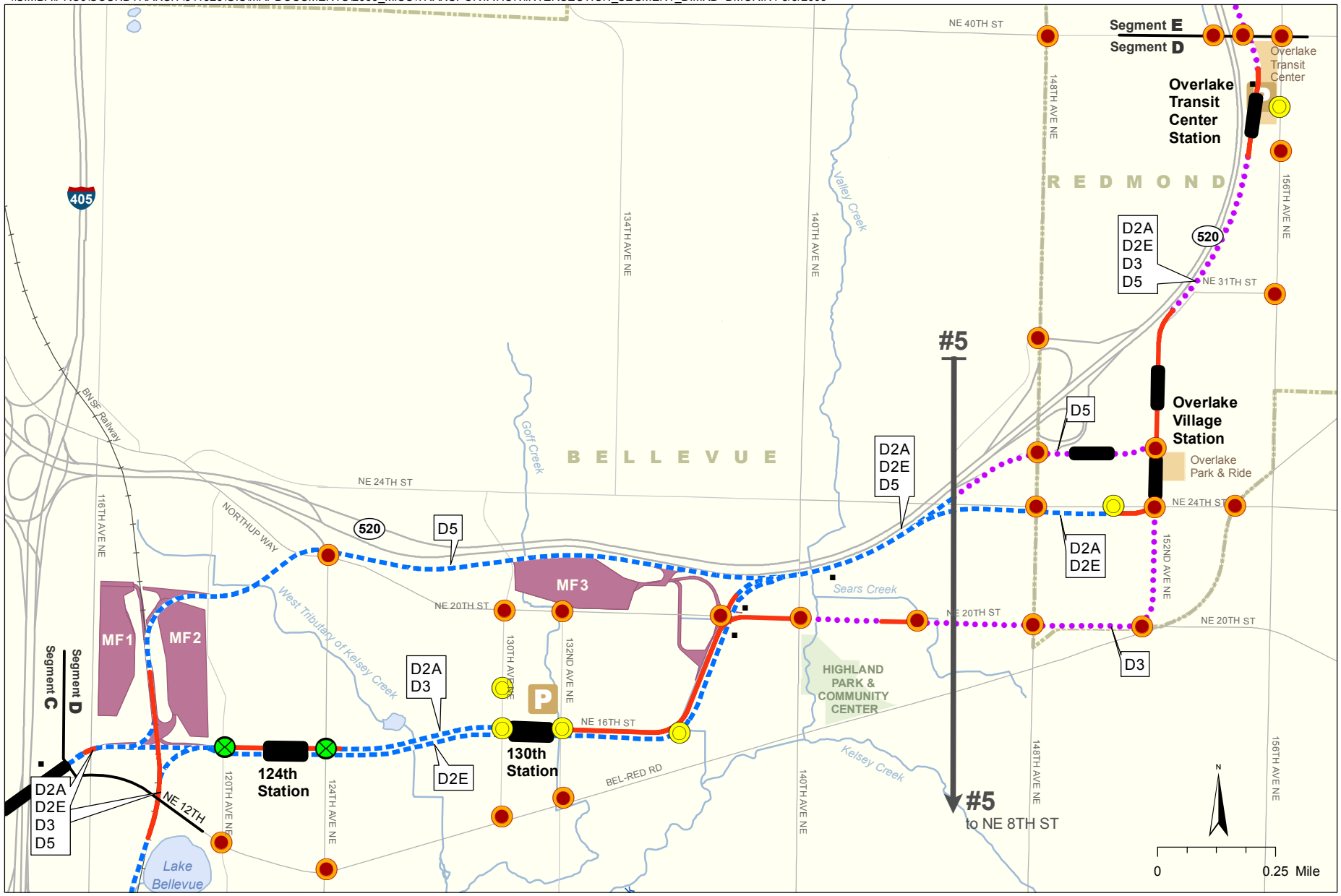

Source: Data from City of Bellevue (2005), City of Redmond (2005), and King County (2006) modified by CH2M HILL.

Existing Intersection Control

- Signalized
- Non-signalized

- Future Intersection
- Screenline
- Traction Power Substation

- At-Grade Route
- Elevated Route
- Retained-Cut Route
- Tunnel Route

- Proposed Station
- Maintenance Facility and Access Track
- New and/or Expanded Park-and-Ride Lot

Segment D
Study Intersections and Screenlines
East Link Project

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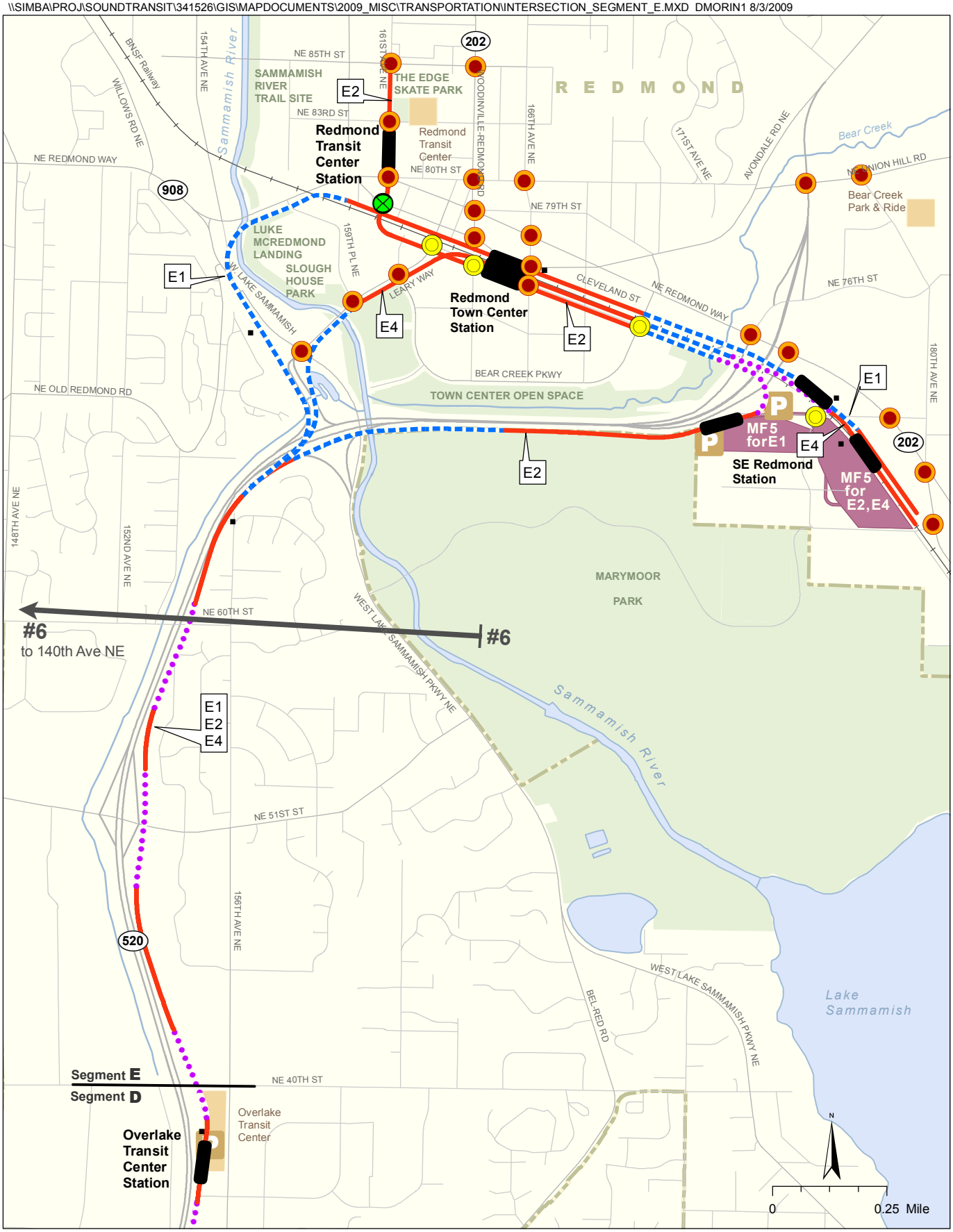


Existing Intersection Control

- Signalized
- Non-signalized
- Screenline

- Future Intersection
- At-Grade Route
- Elevated Route
- Retained-Cut Route
- Tunnel Route

- Traction Power Substation
- Proposed Station
- Maintenance Facility and Access Track
- New and/or Expanded Park-and-Ride Lot

Source: Data from City of Redmond (2005) and King County (2006) modified by CH2M HILL.

Segment E
Study Intersections and Screenlines
East Link Project

Attachment 3
Summary of Sound Transit Ridership Forecasting Model

Summary of Sound Transit Ridership Forecasting Model

To forecast transit ridership, Sound Transit uses an incremental model that was developed in the early 1990s. The model is structured so that transit ridership results are based on observed origins and destinations of transit users, observed transit line volumes, and a realistic simulation of observed transit service characteristics. External changes in demographics, highway travel time, and costs are distinctly incorporated into the process in phases, prior to estimating the impacts of incremental changes in transit service. The Sound Transit model relies on the Puget Sound Regional Council (PSRC) model for data on external changes. For East Link analysis, Sound Transit will be using the most recent data from PSRC.

In the first stage of ridership forecasting analysis, changes in demographics are taken into consideration. In the second stage, other external changes in highway travel time (congestion) and costs (including parking costs), transit fares, and household income are taken into consideration.

Using results from the first two stages of analysis, a forecast of zone-to-zone transit trips within and to/from the RTA district boundaries is developed. In the third and final stage, incremental changes in the transit level-of-service (i.e., access, wait, and ride travel times) are taken into consideration. Finally, transit trips are assigned to the future year transit network (2020 or 2030 for East Link).

The estimated transit volumes assigned to each transit route (i.e., bus or rail) depend on the service characteristics offered on each transit route or alignment, including potential markets served and accessibility of transit stops or stations to potential riders. For example, a light rail route through a more populated area within a corridor will probably attract more passengers than an alternative route that serves a less populated area within the same corridor. The model assigns more trips to a more frequent and faster transit route than to a less frequent and slower route between two locations.

Transit service changes are incorporated into the model through an East Link transit integration planning process. For the no-build alternative analysis, Sound Transit and its partner transit agencies provide a list of expected changes for the forecast years (2020 and 2030) for the transit network. These changes include span of service, frequency, new routes and deleted routes. These changes are incorporated into the model's transit network for the no-build alternative.

For the build alternatives, Sound Transit and its partner transit agencies use a representative light rail alignment to determine the changes in transit service. Some routes are modified to serve light rail stations along the representative alignment. These changes are incorporated into the transit network for the build alternatives.

The incremental model is more effective for transit planning analysis because it:

- Uses *observed* transit travel patterns, rather than estimated
- Concentrates efforts on transit network analysis
- Separates the evaluation of population and employment changes, highway congestion and cost, and transit services through the three stages of the forecasting process
- Focuses on direct comparisons rather than complete simulations of travel behavior

Like all travel forecasting models, the Sound Transit model has some limitations. It uses average daily traffic, so does not assess the effects of special events. Also, it is not well suited for analyzing structural changes in regional land use beyond those already included in PSRC demographic forecasts, or to forecasting in outlying areas of the three-county region where there is minimal existing transit service. Finally, the model does not explicitly take into account differences in safety, comfort, or reliability of bus or rail transit service.

Attachment 4
General Intersection and Freeway Level of Service Definitions

General Intersection and Freeway Level of Service Definitions

The quality of traffic operations on roadway facilities is described in terms of level of service (LOS), a measure of operational conditions and their perception by motorists. As described in Table 1, intersection LOS ratings range from "A" to "F" based on the amount of control delay seconds per vehicle. LOS A represents the best operation and LOS F the poorest operation.

TABLE 1
Level of Service Definitions for Signalized and Unsignalized Intersections

LOS	Average Control Delay (seconds per vehicle)		Traffic Flow Characteristics
	Signalized Intersection	Unsignalized Intersection	
A	≤ 10	≤ 10	Virtually free flow; completely unimpeded.
B	> 10 and ≤ 20	> 10 and ≤ 15	Stable flow with slight delays; less freedom to maneuver.
C	> 20 and ≤ 35	> 15 and ≤ 25	Stable flow with delays; less freedom to maneuver.
D	> 35 and ≤ 55	> 25 and ≤ 35	High density but stable flow.
E	> 55 and ≤ 80	> 35 and ≤ 50	Operating conditions at or near capacity; unstable flow.
F	> 80	> 50	Forced flow; breakdown conditions.

Note: For TWSC intersections the delay and LOS for the approach with the highest delay is reported. Source: Transportation Research Board (TRB), Highway Capacity Manual (HCM), 2000.

Table 2 identifies the freeway LOS ratings. These ratings are defined by density, which is expressed in passenger cars per mile per lane (pcpmpl). Freeway densities are created for each segment of freeway analyzed. Three segment types are used in freeway analyses: mainline, merge/diverge, and weaving areas.

TABLE 2
Level of Service Definitions for Freeways

Level of Service	Basic Mainline Density	Merge/Diverge Density	Weave Density	Traffic Flow Characteristics
A	< 11	< 10	< 10	Free flows operation, vehicles are almost completely unimpeded in their ability to maneuver within the traffic stream. Unrestricted operation, smooth merging, diverging and weaving.
B	> 11 - < 18	> 10 - < 20	> 10 - < 20	Reasonably free flow, vehicles maneuver within the traffic stream is only slightly restricted. Merging, diverging and weaving maneuvers become noticeable to through drivers.
C	> 18 - < 26	> 20 - < 28	> 20 - < 28	Freedom to maneuver within the traffic stream is noticeably restricted. Both ramp and freeway vehicles begin to adjust their speeds to accomplish smooth transitions.
D	> 26 - < 35	> 28 - < 35	> 28 - < 35	Freedom to maneuver within the traffic stream is more noticeably limited, and the driver experiences reduced physical and psychological comfort level. Virtually all vehicles slow to accommodate merging, diverging and weaving.

TABLE 2
Level of Service Definitions for Freeways

Level of Service	Basic Mainline Density	Merge/Diverge Density	Weave Density	Traffic Flow Characteristics
E	> 35 - < 45	> 35	> 35 - < 43	Vehicles are closely spaced, leaving little room to maneuver within the traffic stream at speed that still exceeds 49 mph. Flow levels approach capacity, and small changes in demand or disruptions within the traffic stream can cause both ramp and freeway queues to form.
F	> 45	Demand exceeds capacity	> 43	Breakdowns in vehicular flow.

Source: TRB, 2000

Density: passenger car per mile per lane (pcpmpl)

Attachment 5
Puget Sound Regional Council Land Use Letter

Puget Sound Regional Council
PSRC

May 21, 2009

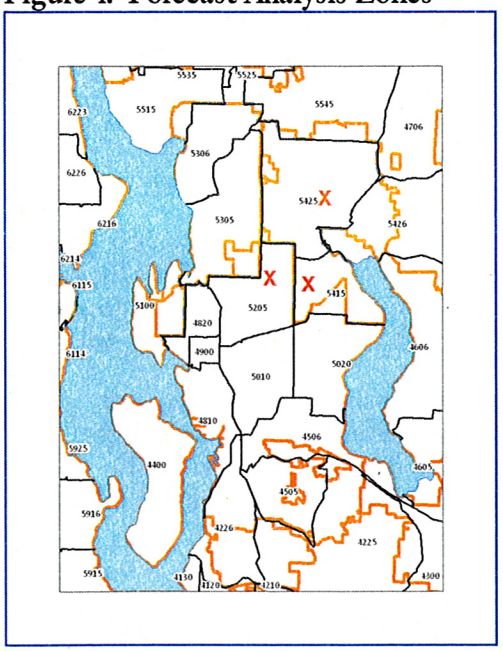
Brant Lyerla
Project Development Coordinator
Sound Transit, Link Light Rail
206.398.5404
brant.lyerla@soundtransit.org

Dear Mr. Lyerla;

Following a series of e-mails and telephone calls over the past couple of weeks, this letter reviews the suggested adjustments to the current Puget Sound Regional Council forecast data in the Sound Transit East Link Light Rail study corridor.

The Regional Council last released forecasts for the region, commonly referred to as the Small Area Forecasts, back in 2006. Staff from the City of Bellevue and City of Redmond participated in the review of those forecasts, and at the time noted that there were several planning efforts underway that could potentially result in changes to future year land use designations and development potential in several of the zones the Regional Council used for its forecasting work, called Forecast Analysis Zones (FAZs). With the completion of the Bel-Red Subarea and the Overlake Neighborhood Plan projects, staff from Bellevue and Redmond have contacted the Regional Council with information on the changes in assumptions that should be considered for the next regional forecast product, scheduled to be produced in either late 2009 or early 2010. The FAZs in question are shown in Figure 1, below:

Figure 1: Forecast Analysis Zones



For each FAZ, city staff submitted recommended changes to the forecast amount of population, households, and employment, estimated from the change in development capacity generated by the comprehensive plan updates. These are summarized in Figure 2 – adjustments from the Bel-Red Subarea study are found in the information for FAZ 5205, while the Overlake Neighborhood Study adjustments are in FAZs 5415 and 5425. Overall, the net impact on the forecasts would be an increase of 8,700 people, 5,600 households, and 5,000 jobs in the study area by 2030.

Figure 2 – Summary of proposed adjustments to FAZ-level forecasts

	Total Population				Total Households				Total Employment			
	FAZ Number:				FAZ Number:				FAZ Number:			
Year	5205	5415	5425	Subtot	5205	5415	5425	Subtot	5205	5415	5425	Subtot
Current Small Area Forecasts												
1970	4,964	5,793	8,669	19,426	1,400	1,617	1,693	4,710	5,491	1,096	2,602	9,189
1980	7,795	8,713	18,081	34,589	3,359	2,835	6,238	12,432	17,153	3,423	8,130	28,706
1990	11,181	11,578	27,093	49,852	5,100	4,458	10,468	20,026	21,838	20,959	12,315	55,112
2000	11,737	13,215	33,861	58,813	5,403	5,279	14,267	24,949	30,969	42,566	18,999	92,534
2007	11,840	13,989	35,866	61,695	5,365	5,675	14,918	25,958	31,749	55,206	28,155	115,110
2010	12,049	15,198	37,476	64,723	5,650	6,182	16,085	27,917	32,978	54,492	29,576	117,046
2020	13,830	17,219	42,560	73,609	6,691	7,232	18,875	32,798	36,079	65,521	33,709	135,309
2030	16,012	19,001	47,041	82,054	7,987	8,240	21,547	37,774	38,689	72,131	36,358	147,178
Proposed adjustments												
2020	16,728	16,279	45,054	78,061	8,489	7,660	20,883	37,032	37,749	58,726	36,588	133,062
2030	19,721	22,144	48,936	90,800	10,063	10,610	22,717	43,391	41,250	67,444	43,509	152,204
Change, from current Small Area Forecasts to Proposed Adjusted figures												
2020	2,898	(940)	2,494	4,452	1,798	428	2,008	4,234	1,670	(6,795)	2,879	(2,247)
2030	3,709	3,143	1,895	8,746	2,076	2,370	1,170	5,617	2,561	(4,687)	7,151	5,026
Average Annual Percent Changes: Trend Data and Forecasts for 2010												
70-80	4.6%	4.2%	7.6%	5.9%	9.1%	5.8%	13.9%	10.2%	12.1%	12.1%	12.1%	12.1%
80-90	3.7%	2.9%	4.1%	3.7%	4.3%	4.6%	5.3%	4.9%	2.4%	19.9%	4.2%	6.7%
90-00	0.5%	1.3%	2.3%	1.7%	0.6%	1.7%	3.1%	2.2%	3.6%	7.3%	4.4%	5.3%
00-07	0.1%	0.8%	0.8%	0.7%	-0.1%	1.0%	0.6%	0.6%	0.4%	3.8%	5.8%	3.2%
07-10	0.6%	2.8%	1.5%	1.6%	1.7%	2.9%	2.5%	2.5%	1.3%	-0.4%	1.7%	0.6%
Average Annual Percent Changes: Current Small Area Forecasts												
07-20	1.2%	1.6%	1.3%	1.4%	1.7%	1.9%	1.8%	1.8%	1.0%	1.3%	1.4%	1.3%
07-30	1.3%	1.3%	1.2%	1.2%	1.7%	1.6%	1.6%	1.6%	0.9%	1.2%	1.1%	1.1%
Average Annual Percent Changes: Forecasts with proposed adjustments												
07-20	2.7%	1.2%	1.8%	1.8%	3.6%	2.3%	2.6%	2.8%	1.3%	0.5%	2.0%	1.1%
07-30	2.2%	2.0%	1.4%	1.7%	2.8%	2.8%	1.8%	2.3%	1.1%	0.9%	1.9%	1.2%

After reviewing this information, Regional Council staff believes the proposed adjustments are reasonable given the comprehensive plan changes that have been adopted by Bellevue and Redmond. Since the updated forecasts are not scheduled to be developed until later in the year or early next, incorporating these adjustments into a sub-regional analysis is warranted, given the forecast update will use as an input the modified comp plans as well.

It should also be noted while reviewing the proposed adjustments, the estimated actual year 2007 data was compared to the 2010 forecasts for a broader list of FAZs that comprise the Bellevue-Redmond area. It is recognized that Sound Transit's need is for year 2020 and 2030 forecast results, but if at some point 2010 forecasts are required, then some additional analysis, and possibly adjustments, should be considered to the 2010 data[1].

[1] Initial indications are that the 2010 employment numbers in at least two FAZs – 4900 (Bellevue CBD) and 5305 (Kirkland – Houghland area) would likely be realized several years after 2010, unless either stronger than anticipated employment growth occurred / occurs in 2008 and 2009 - unlikely given the current economic climate.

Presented below is Figure 3, which summarizes the proposed FAZ-level adjustments by each forecast variable, for your use in developing the TAZ-level travel model inputs.

Figure 3 – FAZ-level Adjustment Summary

FAZ	MF%	LIHH	LMIHH	UMIHH	UIHH	TOTHH	HHPOP	GQI	GQN	TOTPOP	RETAIL	FIRES	MANU	WTCU	GOV/ED	TOTEMP	SF_HH	MF_HH
Current Small Area Forecasts																		
Year 2020																		
5205	63.7	1,751	1,953	1,481	1,506	6,691	13,830	0	0	13,830	5,149	22,848	1,852	5,184	1,046	36,079	2,429	4,262
5415	40.5	1,175	1,219	1,545	3,294	7,232	16,452	219	548	17,219	6,101	55,523	2,008	1,402	487	65,521	4,303	2,929
5425	56.6	2,685	4,005	5,463	6,722	18,875	41,983	267	310	42,560	4,334	20,911	3,728	2,924	1,812	33,709	8,192	10,683
Year 2030																		
5205	64.9	2,253	2,477	1,715	1,542	7,987	16,012	0	0	16,012	5,377	25,210	1,477	5,521	1,104	38,689	2,803	5,184
5415	44.9	1,412	1,431	1,788	3,609	8,240	18,133	248	620	19,001	6,614	61,561	1,586	1,735	635	72,131	4,540	3,700
5425	60.9	3,105	4,506	6,226	7,711	21,547	46,388	302	351	47,041	4,847	23,739	2,853	3,035	1,884	36,358	8,425	13,122
Proposed Adjustments																		
Year 2020																		
5205	9.9	471	525	398	404	1,798	2,898	0	0	2,898	213	2,882	(195)	(1,664)	435	1,671	(184)	1,982
5415	27.0	70	72	91	194	428	(173)	0	0	(173)	(3,955)	(271)	(1,513)	(1,056)	0	(6,795)	(1,810)	2,238
5425	4.2	286	426	581	715	2,008	3,071	0	0	3,071	3	915	1,099	862	0	2,879	(13)	2,021
Year 2030																		
5205	11.5	586	644	446	400	2,076	3,709	0	0	3,709	440	4,431	(290)	(2,471)	452	2,562	(426)	2,502
5415	30.4	406	412	514	1,038	2,370	4,011	0	0	4,011	(4,380)	3,015	(1,586)	(1,735)	0	(4,687)	(1,919)	4,289
5425	0.6	169	245	338	417	1,170	2,548	0	0	2,548	714	3,181	1,555	1,701	0	7,151	316	854
Adjusted Totals																		
Year 2020																		
5205	73.6	2,222	2,478	1,879	1,910	8,489	16,728	0	0	16,728	5,362	25,730	1,657	3,520	1,481	37,750	2,245	6,244
5415	67.5	1,245	1,291	1,636	3,488	7,660	16,279	219	548	17,046	2,146	55,252	495	346	487	58,726	2,493	5,167
5425	60.8	2,971	4,431	6,044	7,437	20,883	45,054	267	310	45,631	4,337	21,826	4,827	3,786	1,812	36,588	8,179	12,704
Year 2030																		
5205	76.4	2,839	3,121	2,161	1,942	10,063	19,721	0	0	19,721	5,817	29,641	1,187	3,050	1,556	41,251	2,377	7,686
5415	75.3	1,818	1,843	2,302	4,647	10,610	22,144	248	620	23,012	2,234	64,576	0	0	635	67,444	2,621	7,989
5425	61.5	3,274	4,751	6,564	8,128	22,717	48,936	302	351	49,589	5,561	26,920	4,408	4,736	1,884	43,509	8,741	13,976

Please feel free to follow-up if there are additional issues with information related to these proposed adjustments, or other forecast-related questions in the study area corridor, and best of luck with the remainder of the project.

Sincerely,

Mark Simonson
Principle Planner
Puget Sound Regional Council

Attachment 6
SR 520 Tolling Assumptions

Assumptions on SR 520 Tolling – August 20, 2009

For East Link FEIS - PSRC Vehicle Forecasts

The East Link DEIS used the same toll rates and method of application in the model as used in the SR 520 DEIS (August 18th, 2006). In the PSRC model (Version 1.0b) used for the East Link FEIS, as for the SR 520 Finance Plan, toll rates are entered as 2000 dollar values, then converted to a minutes penalty by a value-of-time factor developed by the PSRC. This value-of-time factor varies by income group for Home-Based Work trips, but is constant for other trip purposes.

For the East Link DEIS, the toll rates used in year 2000 dollars were as follows:

Peak periods: $3.14 per crossing for both the a.m. and p.m. peak rates. Off-peak periods: $1.65 per crossing, for each of three off-peak time periods — midday, evening, and night.

For East Link, both the traffic modeling and the transit ridership modeling assumed that vehicles with three or more people (HOV 3+) are not tolled. They also assumed that an average occupancy of 1.3 for non-carpools, reflecting the inclusion of two-person vehicles with non-carpools.

Also:

Assumed tolls on SR 520 only, assumed no tolls on I-90.

- Assumed single-point toll collection on 520 bridge only, with no tolls on any portions of the road east or west of the bridge deck.
- Assumed constant tolls within specified time periods, no dynamic variable rate tolls or congestion-dependent tolls.

For the East Link FEIS, the revised tolling rates developed as part of the 2007 SR 520 Finance Plan will be used for the vehicle forecasts from the PSRC model. Based on direction from WSDOT staff, toll rates associated with Scenario 4 (bridge toll emphasis of revenue/traffic balance) are recommended to be used for both year 2020 and 2030. The tolls are shown in Table 1.

TABLE 1
SR 520 Toll Assumptions by Time of Day ($2000)

Time of Day	Toll
AM	$2.57
Midday	$1.77
PM	$3.21
Evening	$1.64
Night	$0.77