WSDOT

U. S. Department of Transportation
Federal Highway Administration

July 2018

I-405, Tukwila to I-90 Vicinity Express Toll Lanes Project (MP 0.0 to 11.9) and Downtown Bellevue Vicinity Express Toll Lanes Project (MP 11.9 to 14.6)

Attachment A: Transportation Discipline Report

Note to readers:

This version of the Transportation Discipline Report contains changes to the project description and maps for the Tukwila to I-90 Vicinity portion of the I-405 Express Toll Lanes Projects.

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SUMMARY

The Washington State Department of Transportation (WSDOT) is proposing to construct the I-405, Tukwila to I-90 Vicinity Express Toll Lanes Project (MP 0.0 to 11.9) (Tukwila to I-90 Project) and the I-405, Downtown Bellevue Vicinity Express Toll Lanes Project (MP 11.9 to 14.6) (Downtown Bellevue Project) to improve traffic operations and safety performance on Interstate 405 (I-405) between Tukwila and Bellevue. This discipline report assesses these projects' operational and construction effects on transportation. This report evaluates conditions if the Projects were not constructed (No Build Alternative) and conditions with the Projects (Build Alternative).

What is our study approach?

The project team analyzed the transportation and traffic effects of both the Tukwila to I-90 Project and the Downtown Bellevue Project together. Collectively, these projects are called the I-405 Express Toll Lanes Project or the Projects. This report discusses traffic effects of the Projects cumulatively and includes a discussion of individual project effects. The analysis determined effects on freeway operations and local street intersections.

What are the existing conditions?

Traffic on I-405 in the study area is congested due to high regional traffic demands in both directions, many hours of the day. Congestion is present in both general purpose (GP) lanes and high-occupancy vehicle (HOV) lanes, with high volumes and low operating speeds. Transit vehicles that use the HOV lanes have reduced reliability due to congestion.

What would happen if the Projects are not built?

If the Projects are not built, the growth in regional traffic demand would further degrade traffic operations in the study area. This would be especially noticeable in bottleneck areas, where traffic would continue to worsen with longer queues and more hours of congestion. Drivers unable to access the freeway due to congestion would seek alternate routes, including adjacent local roadways for regional trips, which

would add more congestion on these limited-capacity facilities. Transit reliability would continue to degrade, and travel times would increase.

What would be the Projects' effects?

The Projects would add freeway capacity, improve travel time reliability, increase travel speed, and benefit operations on I-405. The Projects would link existing tolled systems to create one 40-mile toll lane system between Auburn on State Route 167 (SR 167) and Lynnwood on I-405 that would give transit and carpool users a more reliable trip throughout the region. The projects would improve safety performance in the study area by reducing congestion-related crashes.

What measures would WSDOT use to avoid or minimize the Projects' effects?

Existing capacity would be maintained during construction activities to the extent possible. Lane or roadway closures would be minimized and scheduled for when there is the least effect on traffic in the study area, such as overnight and weekend time periods.

WSDOT would coordinate with the local agencies and other projects to prepare a Traffic Management Plan prior to making any changes that might affect traffic flow or implement lane closures. Local agencies, the public, school districts, emergency service providers, and transit agencies would be informed of the changes in advance through the media, the Projects' website, and an email listserv. Pedestrian and bicycle circulation would be maintained as much as possible during construction. For any road, bicycle lane, and/or sidewalk closure, clearly marked detours would be provided.

Would there be any unavoidable adverse effects?

We do not foresee these projects causing any substantial, unavoidable adverse effects on transportation.

SECTION 1 INTRODUCTION

This transportation discipline report was prepared in support of the *I-405, Tukwila to I-90 Vicinity Express Toll Lanes Project (MP 0.0 to 11.9) Environmental Assessment (EA)* and the *I-405, Downtown Bellevue Vicinity Express Toll Lanes Project (MP 11.9 to 14.6) EA*.

Both projects propose to make several roadway, structural, drainage, and transit and operational improvements to the Interstate 405 (I-405) corridor. Because the Projects are anticipated to be built at the same time and are located next to each other, the Washington State Department of Transportation (WSDOT) has decided to evaluate possible effects on transportation in a single technical analysis because effects would be similar and occur in a contiguous area.

Both projects are part of a comprehensive strategy identified in the 2002 *I-405 Corridor Program Final Environmental Impact Statement* and subsequent Federal Highway Administration (FHWA) *Record of Decision* to reduce traffic congestion and improve mobility along the state's second-busiest highway. The Projects are needed because travelers on I-405 face one of the most congested routes in the state, particularly during peak travel times.

Design Year and Opening Year

We analyzed traffic conditions in 2016 to represent existing conditions, as well as conditions in an opening year of 2025 and a design year of 2045 without the Projects (No Build) and with the Projects (Build). The design year is consistent with the federal requirements for environmental documentation because it is 20 or more years past the start of construction. They represent current existing conditions, as well as the expected construction and funding timeline for the opening year.

Why do we analyze existing conditions?

We analyze existing conditions for several reasons. The existing conditions analysis allows us to identify issues and deficiencies within the existing transportation study area. In addition, we use existing data to "calibrate" our models so that we have confidence that they are correctly predicting future conditions.

SECTION 2 PROJECT DESCRIPTION

Section 2 provides a description of both projects evaluated in this report: the *I-405, Tukwila to I-90 Vicinity Express Toll Lanes Project* (Tukwila to I-90 Project) and the *I-405, Downtown Bellevue Vicinity Express Toll Lanes Project* (Downtown Bellevue Project). The Tukwila to I-90 Project is described first and the Downtown Bellevue Project follows.

What improvements are proposed with the I-405, Tukwila to I-90 Vicinity Express Toll Lanes Project?

Exhibit 2-1 describes in detail the improvements proposed with the Project. Exhibit 2-2, sheets 1 through 8, show the proposed improvements on a series of maps. In general, the Project proposes to add one lane to I-405 in each direction for about 9 miles beginning on I-405 near SR 167 and continuing approximately 1 mile north of I-90. The Project would also add a general purpose (GP) (auxiliary) lane to southbound I-405 between MP 6.7 (north of N 30th Street) and 7.1 (south of NE 44th Street) and MP 9.4 (north of 112th Avenue SE) to 10.5 (north of Coal Creek Parkway). The existing high-occupancy vehicle (HOV) lane on I-405 and the additional lane would be operated as a two-lane express toll lane system. Additional details describing the express toll lanes are provided in the next question, "How would the express toll lanes work?"

Exhibit 2-1. Improvements Proposed with the I-405, Tukwila to I-90 Vicinity Express Toll Lanes Project

Project Element	I-405, Tukwila to I-90 Vicinity Express Toll Lanes Project
I-405/I-5 Interchange Exhibit 2-2, Sheet 1	– Extend the southbound left lane at the I-5 interchange west for approximately 500 feet to provide additional merge distance.
I-405 Lanes and Shoulders from SR 167 to north of I-90 Exhibit 2-2, Sheets 2 through 8	– Create a dual express toll system from MP 2.9 (northeast of the I-405/SR 167 interchange) and MP 11.9 (north of the I-405/I-90 interchange) by adding one new lane in each direction and converting the existing HOV lane to an express toll lane. – Convert the existing HOV lane to a single express toll lane from MP 2.4 (at the I-405/SR 167 interchange) to MP 2.9 on northbound I-405 and from MP 1.6 (in Renton over Springbrook Creek) to MP 2.9 on southbound I-405. – Add an additional GP (auxiliary) lane on southbound I-405 between MP 6.7 (north of 30th Street) and MP 7.1 (south of NE 44th Street) and MP 9.4 (north of 112th Avenue SE) to MP 10.5 (north of Coal Creek Parkway). – Bring I-405 up to current freeway standards where feasible.
I-405 Tolling from SR 167 to north of I-90 Exhibit 2-2, Sheets 2 through 8	– Construct tolling gantries to collect the tolls for the express toll lane system (see description in the row above).
Cedar Avenue Exhibit 2-2, Sheet 4	– Reconstruct the bridge over I-405 to widen southbound I-405.
Renton Avenue Exhibit 2-2, Sheet 4	– Reconstruct the bridge over I-405 to widen southbound I-405.
Cedar River Bridge Exhibit 2-2, Sheet 4	– Widen the southbound I-405 bridge over the Cedar River.
Sunset Boulevard N Interchange Area Exhibit 2-2, Sheet 4	– Widen the I-405 northbound and southbound bridges over Sunset Boulevard N.
NE Park Drive Interchange Area Exhibit 2-2, Sheet 5	– Widen the I-405 southbound bridge over NE Park Drive.
N 30th Street Interchange Area Exhibit 2-2, Sheet 5	– Replace the local road overpass abutment slopes with retaining walls on both sides of I-405 and lower the southbound I-405 roadway by approximately one foot.
NE 44th Street Interchange Area Exhibit 2-2, Sheet 6	– Replace the northbound and southbound I-405 bridges over May Creek with two new single span bridges and provide habitat improvements. – Replace the NE 44th Street bridge over I-405. Construct new direct access ramps and two inline transit stations (one in each direction) in the I-405 median. Transit stations would include station platforms, signage, artwork, lighting, fare machines (ORCA), and site furnishings such as shelters, lean rails, benches, bollards, bicycle parking, and trash receptacles. – Realign and reconstruct the northbound access to I-405 from a loop ramp to a new on-ramp from Lake Washington Boulevard NE. – Build four roundabouts along local arterials. – Construct an at-grade park-and-ride lot at Lake Washington Boulevard N and N 43rd Street with a minimum of 200 parking stalls and a roundabout (improvements would be built, but may be built by Sound Transit or others).

Exhibit 2-1. Improvements Proposed with the I-405, Tukwila to I-90 Vicinity Express Toll Lanes Project

Project Element	I-405, Tukwila to I-90 Vicinity Express Toll Lanes Project
112th Avenue SE Interchange Area Exhibit 2-2, Sheet 7	– Replace the 112th Avenue SE bridge over I-405. – Construct new direct access ramps, two inline transit stations (one in each direction) in the I-405 median. Transit stations would include station platforms, signage, artwork, lighting, fare machines (ORCA), and site furnishings such as shelters, lean rails, benches, bollards, bicycle parking, and trash receptacles. – Construct a roundabout on 112th Avenue SE. – Reconfigure the Newport Hills Park-and-Ride.
Coal Creek Parkway Interchange Area Exhibit 2-2, Sheet 7	– Construct a new southbound I-405 bridge on a new alignment. Convert the existing southbound I-405 bridge to northbound express toll lanes. – Convert the four local road intersections on Coal Creek Parkway SE to roundabouts.
I-405/I-90 Interchange Area Exhibit 2-2, Sheet 8	– Reconfigure the I-405 southbound to I-90 eastbound ramp from one to two lanes. – Realign the I-405 northbound to I-90 eastbound ramp. As part of this work, construct two new bridges over the eastbound I-90 ramp to Factoria Boulevard and over Factoria Boulevard.
Fish Passage Exhibit 2-2, Sheet 6	– Construct four fish passage crossings for unnamed tributary (UNT) 08.LW.0283 (formerly Gypsy Creek). – Construct a fish passage crossing under I-405 mainline for Stream UNT 08.LW.7.7A.[a] – Construct a fish passage crossing under I-405 mainline for Stream UNT 08.LW.7.8.[a]
Lake Washington Trail Exhibit 2-2, Sheets 6 and 7	– Realign and reconstruct the existing trail west of its current location to reside in the King County's Eastside Rail Corridor property between Ripley Lane in Renton (MP 7.7) and Coal Creek Parkway in Bellevue (MP 10.2). As part of this work, widen a portion of the King County's Eastside Rail Corridor Regional Trail.
Noise Walls Exhibit 2-2, Sheets 4, 6, 7 and 8	– Construct 4 new noise walls. – Relocate 2 existing noise walls.
Stormwater Management Exhibit 2-2, Sheets 1 through 8	– Add 46.92 acres of new PGIS and 5.7 acres of non-PGIS. – Provide enhanced treatment for 100% of new impervious surfaces. – Retrofit 51 percent (111.5 acres) of existing untreated PGIS and continue to treat stormwater from the 21.27 acres of PGIS that currently receives treatment. – Treat a total of 179.69 acres of PGIS.
Construction Duration	– 5 years of construction is expected from 2019 through 2024. – The direct access ramps and associated transit improvements at 112th Avenue SE, reconfiguring the Newport Hills Park-and-Ride lot, and building four roundabouts on Coal Creek Parkway SE may be constructed after 2024, depending on when allocated funds for these elements become available.

GP = general purpose; HOV = high-occupancy vehicle; MP = milepost PGIS = pollutant generating impervious surfaces
[a] For these culverts, a restrictor plate will be put in place to prevent flooding until a downstream barrier is removed, at which time the restrictor plate will be removed.

Exhibit 2-2. I-405, Tukwila to I-90 Vicinity Express Toll Lanes Project Improvements | Sheet 1 of 8

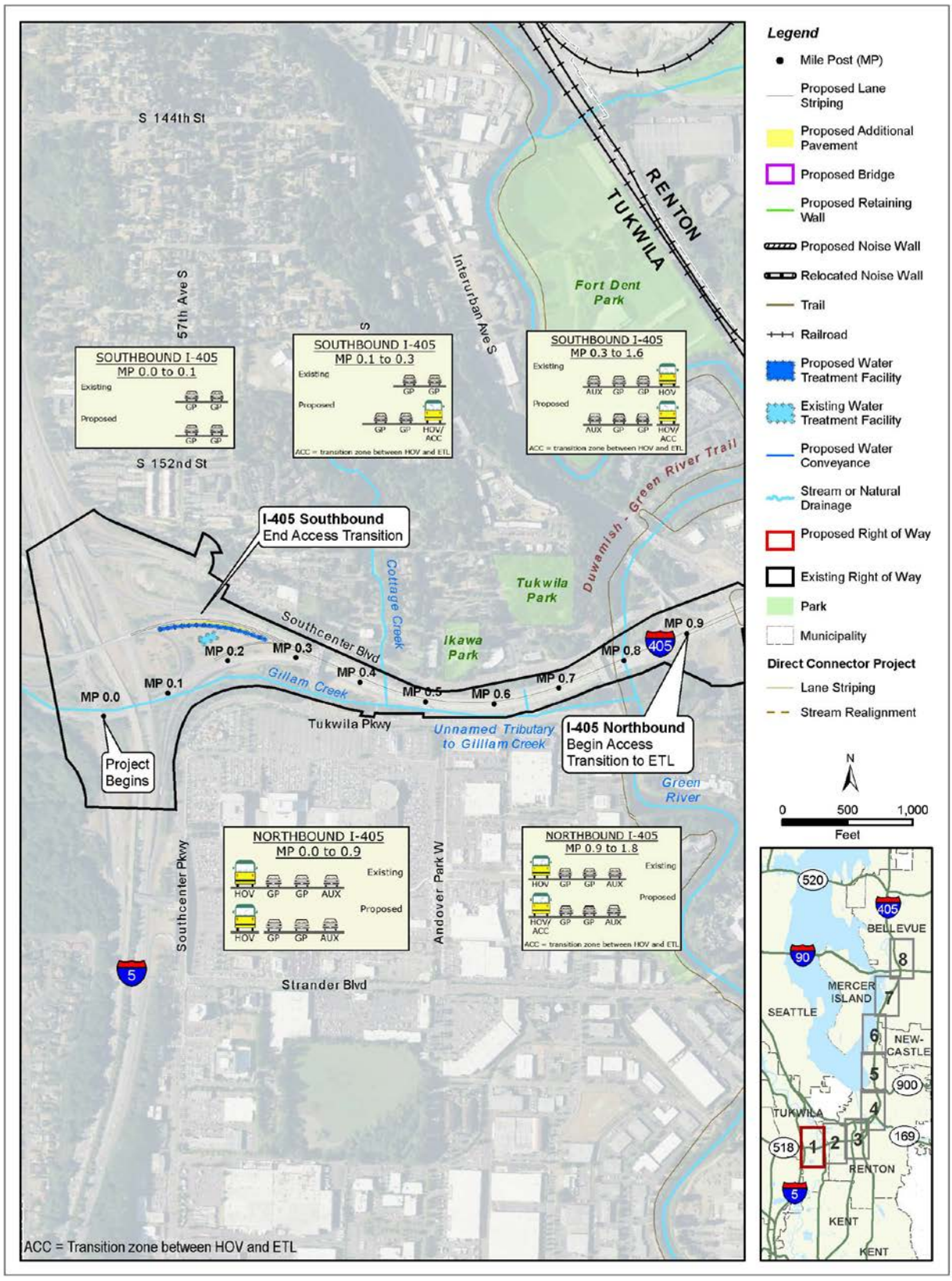


Exhibit 2-2. I-405, Tukwila to I-90 Vicinity Express Toll Lanes Project Improvements | Sheet 2 of 8

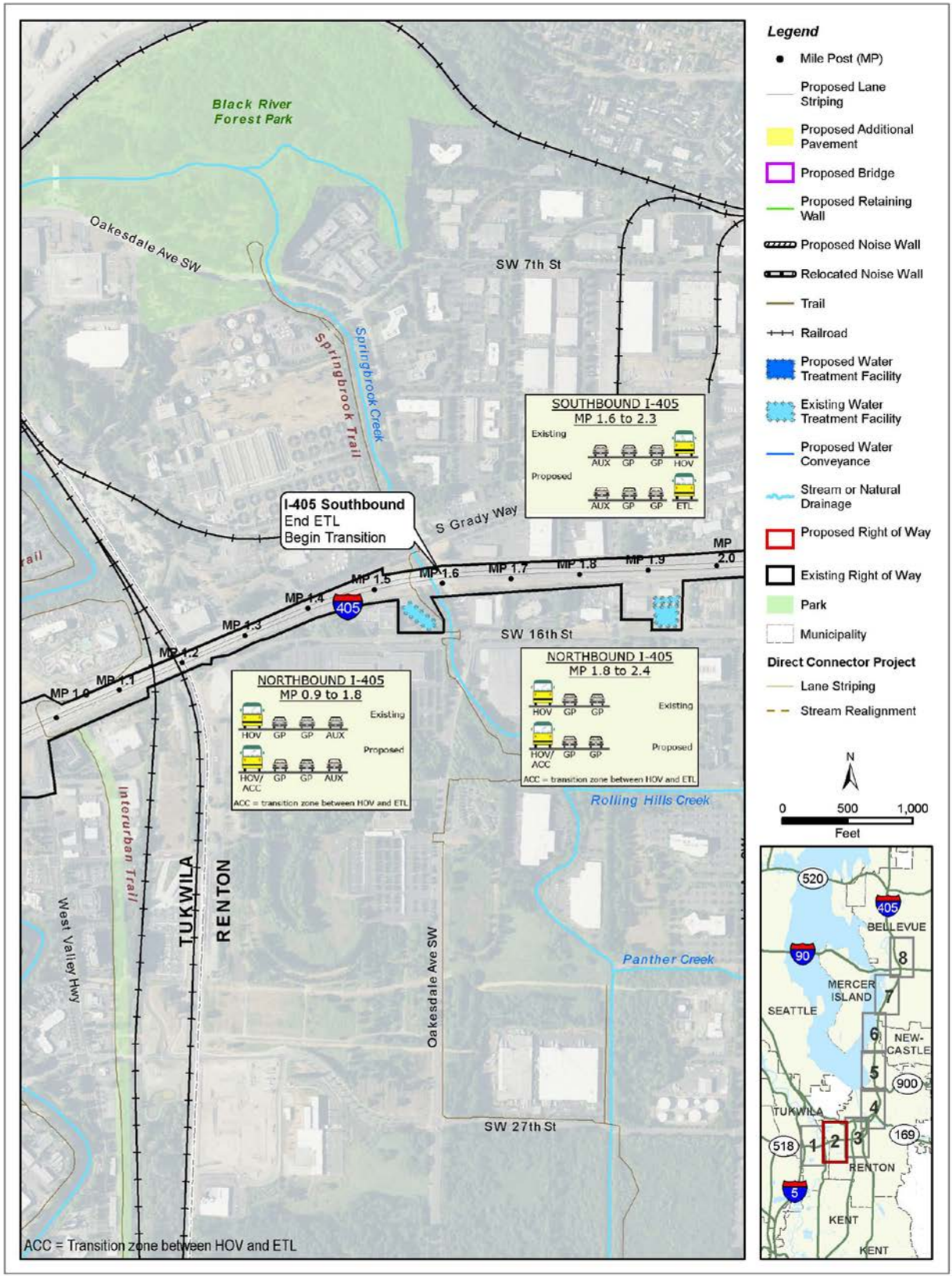


Exhibit 2-2. I-405, Tukwila to I-90 Vicinity Express Toll Lanes Project Improvements | Sheet 3 of 8

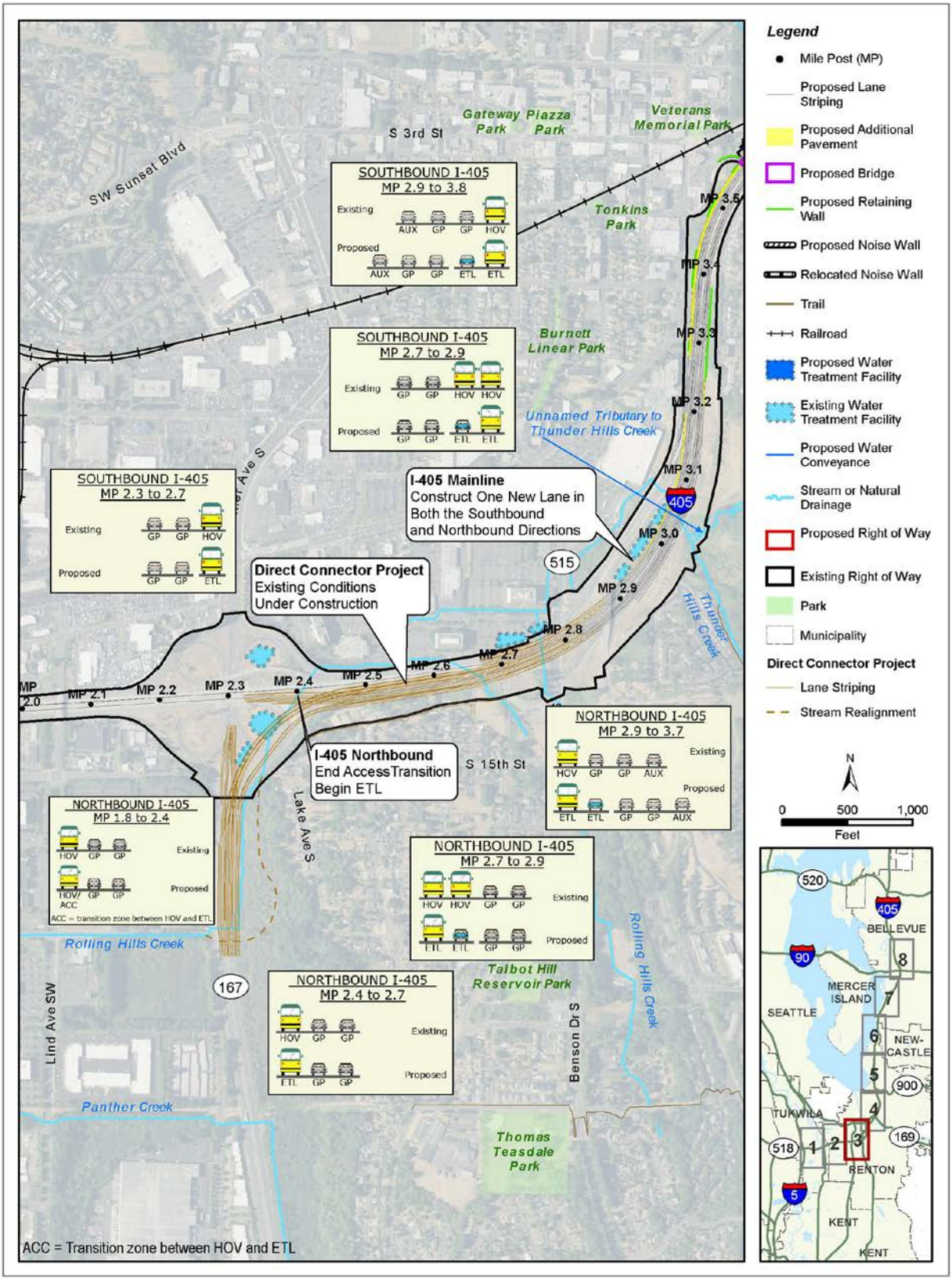


Exhibit 2-2. I-405, Tukwila to I-90 Vicinity Express Toll Lanes Project Improvements | Sheet 4 of 8

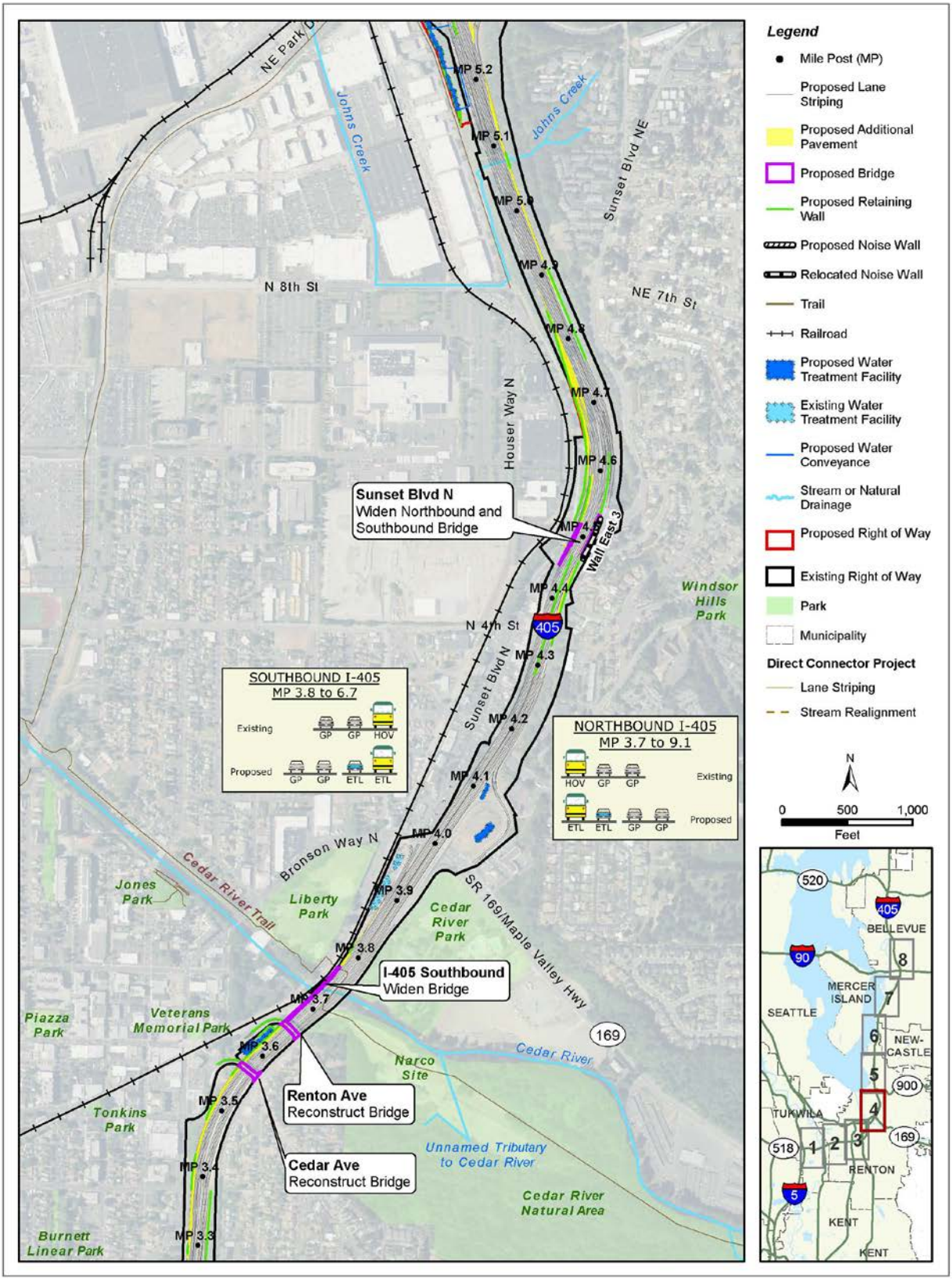


Exhibit 2-2. I-405, Tukwila to I-90 Vicinity Express Toll Lanes Project Improvements | Sheet 5 of 8

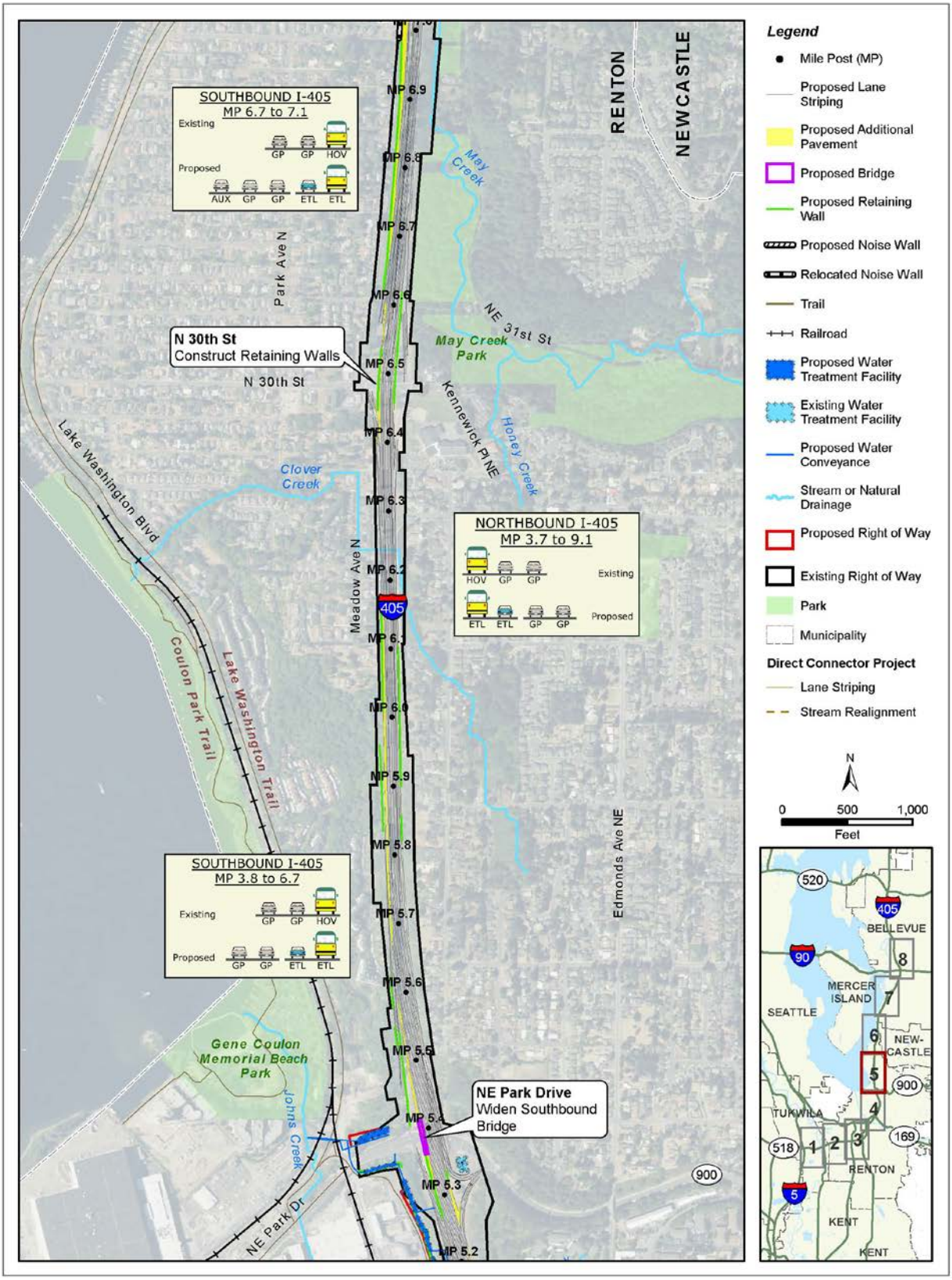


Exhibit 2-2. I-405, Tukwila to I-90 Vicinity Express Toll Lanes Project Improvements | Sheet 6 of 8

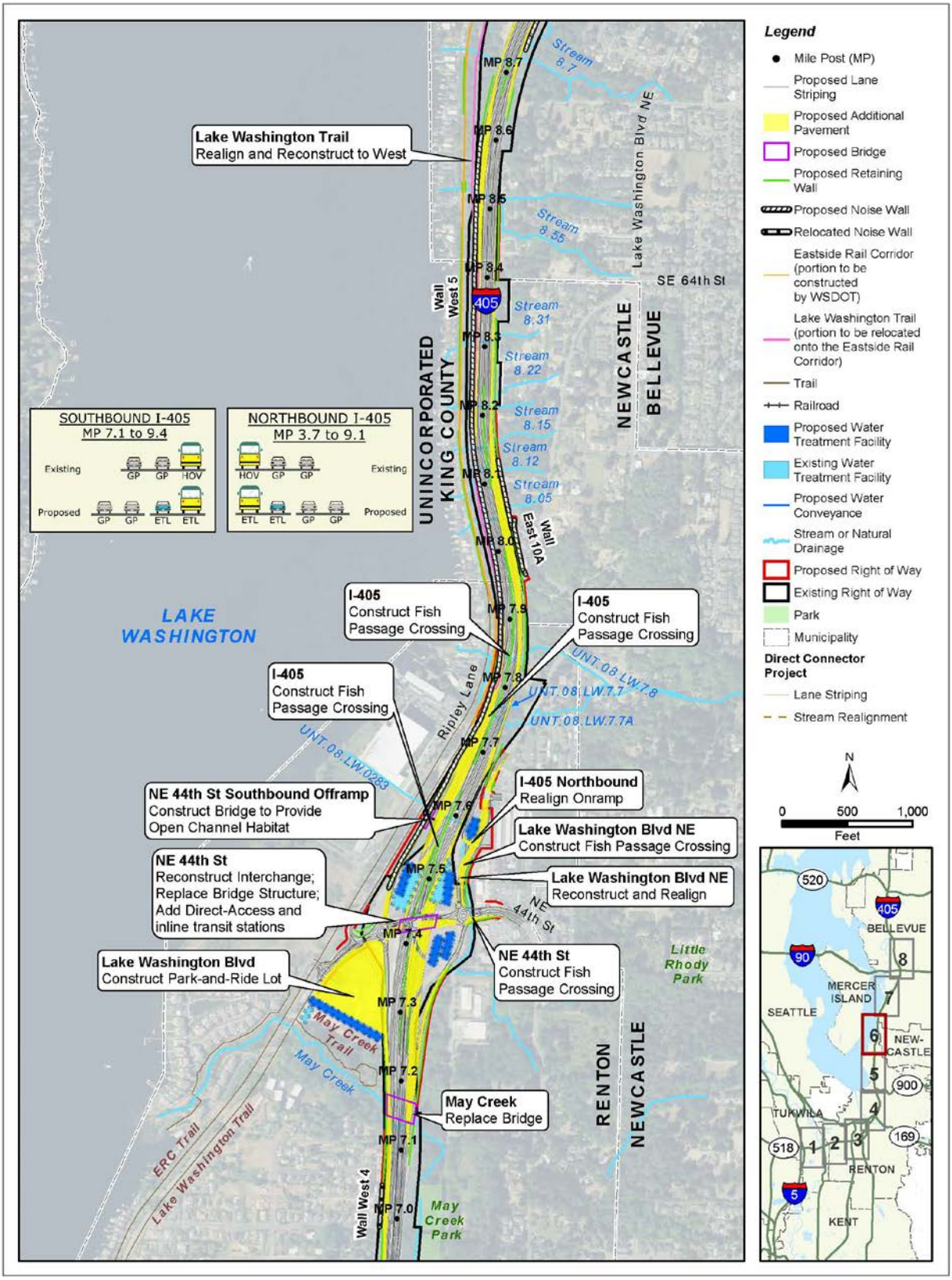
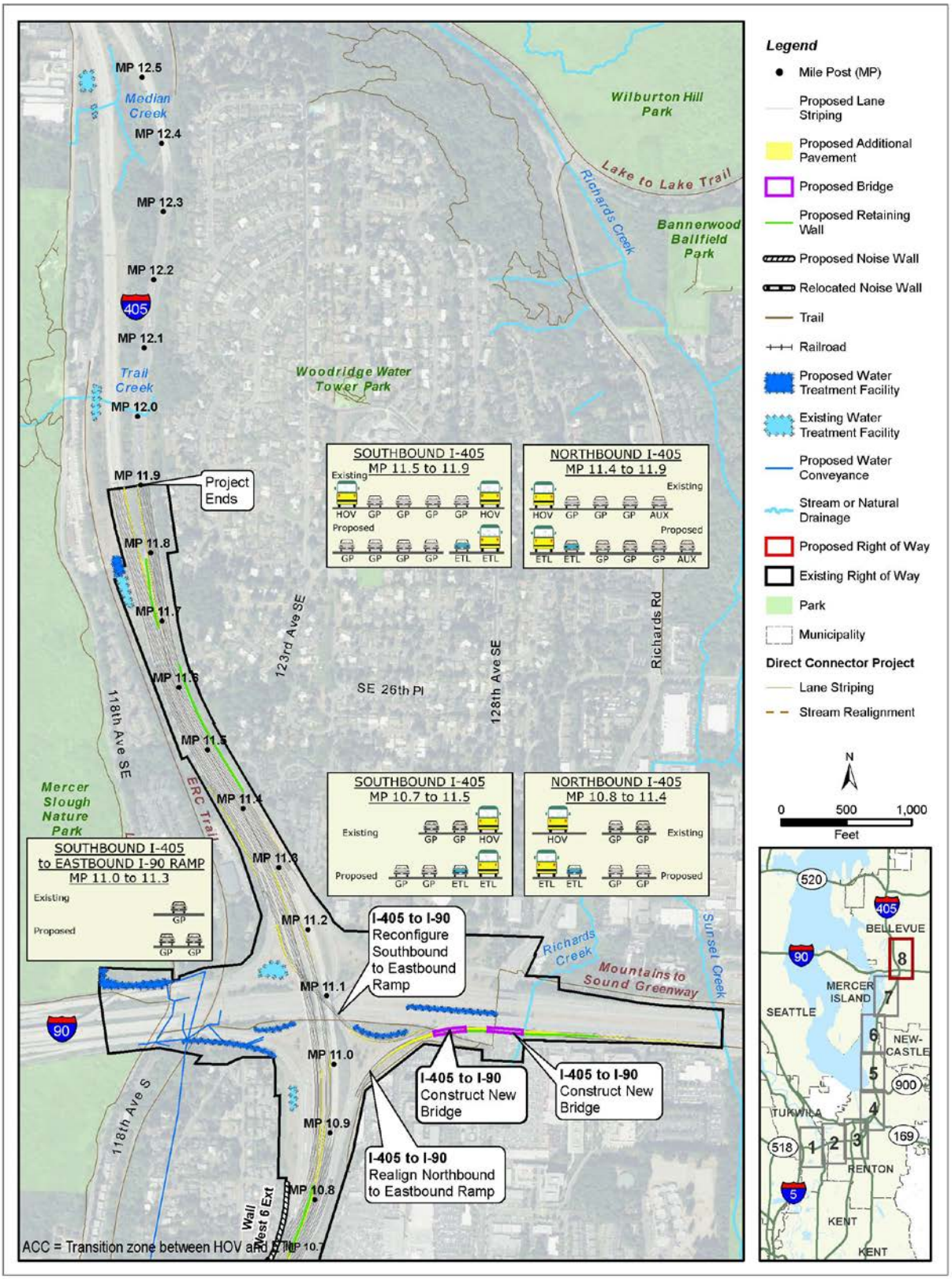


Exhibit 2-2. I-405, Tukwila to I-90 Vicinity Express Toll Lanes Project Improvements | Sheet 7 of 8

Exhibit 2-2. I-405, Tukwila to I-90 Vicinity Express Toll Lanes Project Improvements | Sheet 8 of 8

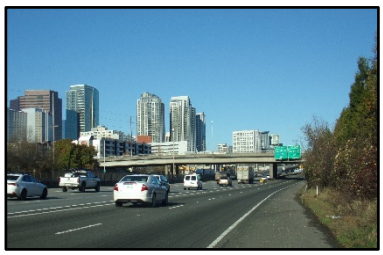


What improvements are proposed with the I-405, Downtown Bellevue Vicinity Express Toll Lanes Project?

The Downtown Bellevue Project would extend along I-405 approximately 2.7 miles from just north of the I-90 interchange (milepost [MP] 11.9) to north of the NE 6th Street interchange (MP 14.6). The Project proposes the following improvements by mile posts, as shown in Exhibit 2-3, sheets 1 and 2:

- **Northbound I-405, I-90 to NE 6th Street (MP 11.9 to 13.7) –** Develop approximately 1.6 miles of new lane in the northbound direction by widening or restriping I-405 from MP 11.9 to 13.5. In this same section of I-405, convert the existing HOV lane to an express toll lane. The new lane coupled with the existing HOV lane would create a dual express toll lane. Between MP 13.5 and 13.7, convert the existing HOV lane to an express toll lane. The express toll lane would connect to the existing express toll lanes from downtown Bellevue to Lynnwood. Westward expansion of I-405 is proposed south of SE 8th Street, and eastward expansion is proposed north of SE 8th Street.
- **Southbound I-405, I-90 to NE 6th Street (MP 11.9 to 13.7) –** From MP 11.9 to 12.5, reconfigure the existing outside HOV lane to the inner roadway and convert both of the existing HOV lanes to express toll lanes. From MP 12.5 to 13.5, develop a new lane by widening or restriping. This new lane coupled with the existing HOV lane would result in a dual express toll lane south of NE 4th Street. Between MP 13.5 and 13.7, convert the existing HOV lane to an express toll lane. The express toll lane would connect to the existing express toll lanes from downtown Bellevue to Lynnwood. Where new pavement is needed, eastward expansion is proposed.
- **I-405 Eastside Rail Corridor Overpass (MP 12.4) –** Build a new northbound I-405 bridge structure adjacent to the existing I-405 structure over the Eastside Rail Corridor Regional Trail. The new structure would carry the two express toll lanes and the general purpose (GP) lanes would remain on the existing structure.

- **Eastside Rail Corridor Regional Trail (MP 12.09 to 12.49) –** Construct a new bridge for nonmotorized travel over southbound I-405 near MP 12.15. Build a section of nonmotorized trail to connect with the Eastside Rail Corridor Regional Trail.
- **SE 8th Street Interchange (MP 12.78) –** Widen the northbound I-405 overpass over SE 8th Street.
- **Main Street Overpass (MP 13.31) –** Reconstruct the Main Street bridge (photo on right) over I-405.
- **Northbound I-405 to SR 520 Ramp (MP 14.6) –** Widen the existing northbound off-ramp to SR 520 from two lanes to three lanes for approximately 600 feet beginning where the NE 10th Street on-ramp merges onto the I-405 ramp.
- **Stormwater –** Build new flow control and runoff treatment facilities.
- **Other Improvements –** Provide pavement markings, drainage improvements, permanent signing, illumination, intelligent transportation systems, barriers, and tolling gantries.
- **Context Sensitive Solutions –** Incorporate Context Sensitive Solutions (CSS) to enhance mobility, safety, the natural and built environment, and aesthetics throughout the project corridor.
- **Property Acquisitions –** Acquire portions of five commercial and public properties to accommodate the Project.
- **Minimization Measures –** Implement avoidance and minimization measures or compensate for unavoidable effects on the environment, as described in Chapter 6, Measures to Avoid or Minimize Effects.



Existing Main Street Overpass

What are Context Sensitive Solutions?

The *Context Sensitive Solutions (CSS)* process is a model for transportation project development that has received much discussion and broad acceptance. Its essence is that a proposed transportation project must be planned not only for its physical aspects and road serving specific transportation objectives, but also for its effects on the aesthetic, social, economic, and natural environment, as well as the needs, constraints, and opportunities in a larger community setting.

Exhibit 2-3. I-405, Downtown Bellevue Vicinity Express Toll Lanes Project Improvements | Sheet 1 of 2

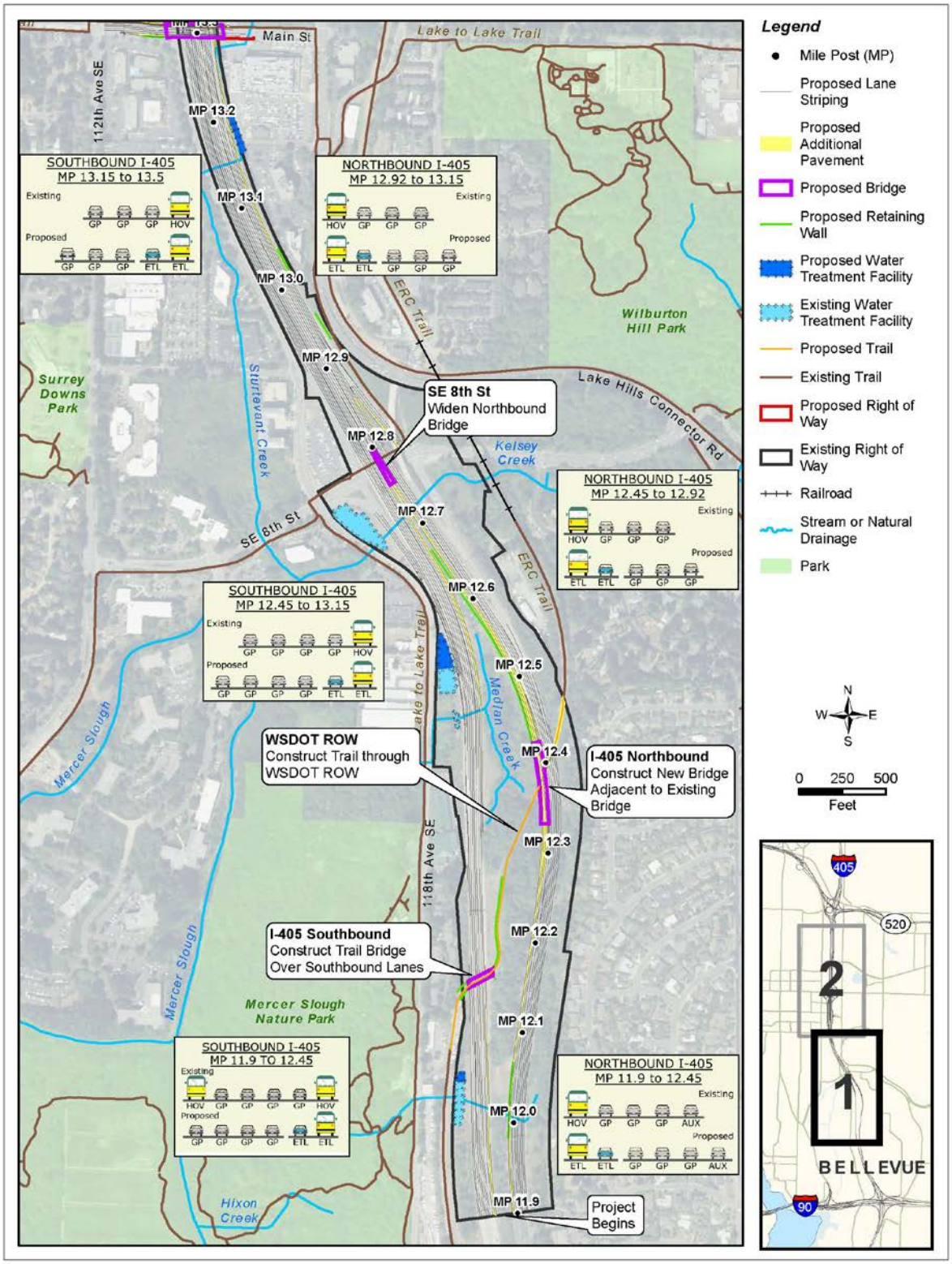
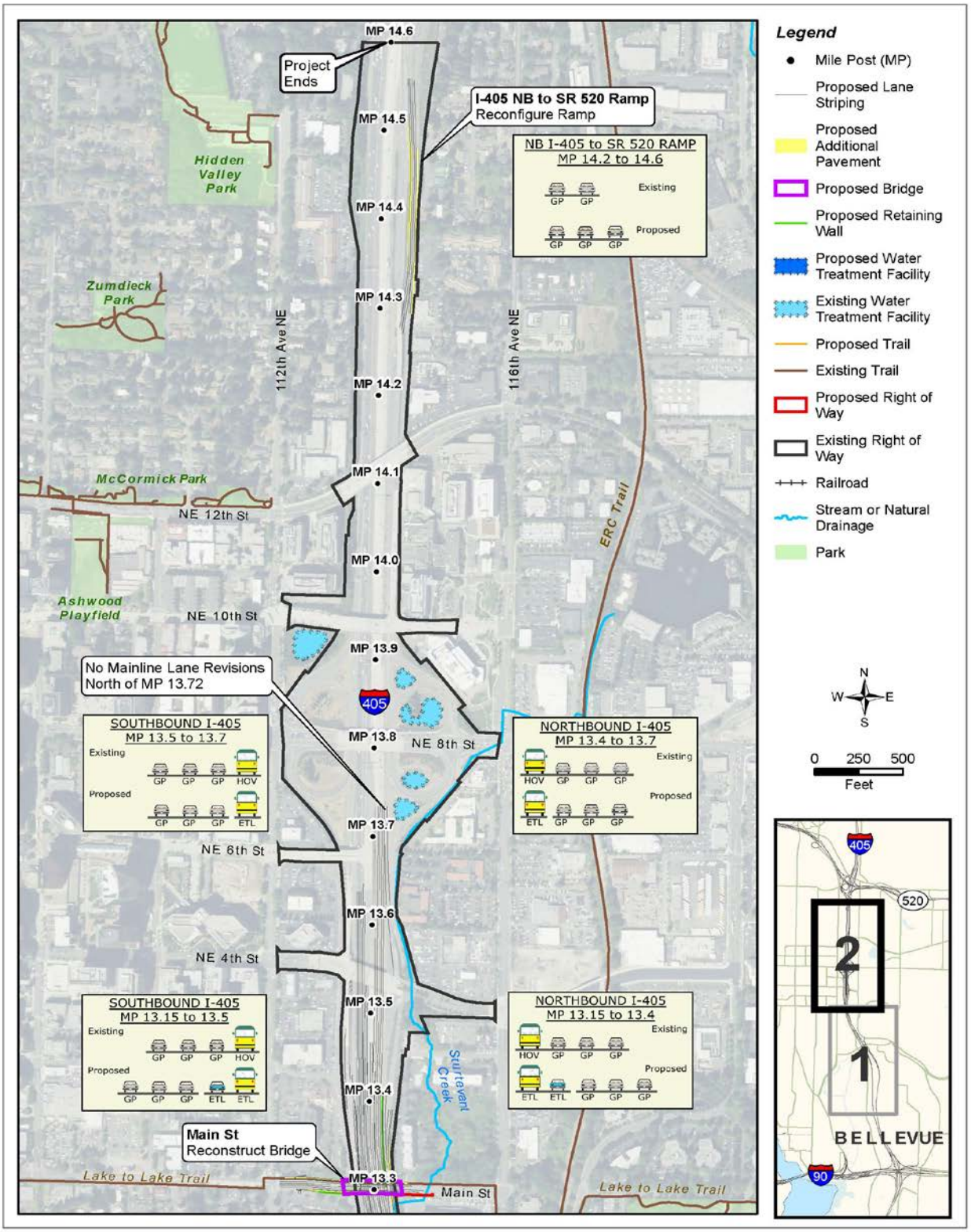


Exhibit 2-3. I-405, Downtown Bellevue Vicinity Express Toll Lanes Project Improvements | Sheet 2 of 2



How would the express toll lanes work?

At this time, the Washington State Transportation Commission (WSTC) has not established operational hours, user exemptions, occupancy requirements, and operating parameters for the express toll lanes proposed with the Project. The WSTC would set operational requirements for the express toll lanes prior to opening day. For this analysis, we assumed the requirements for the current I-405, Bellevue to Lynnwood express toll lane system would be used for this project. These assumptions, listed below, represent the most recent operating guidance from the WSTC for express toll lanes:

- **Limited Access** – The system would have designated entry and exit points, with a buffer between the express toll lanes and the GP lanes. These access points would vary in length, depending on the location.
- **Dynamic and Destination Pricing** – The I-405 express toll lane system would use both dynamic and destination pricing to determine a driver's toll at the time they enter the express toll lane. With *dynamic pricing*, toll rates vary based on congestion within the corridor to maintain performance. Electronic signs would be used to communicate the current toll rate for drivers. Toll rates are updated every few minutes, but the driver's price is set when they enter the system. With *destination pricing*, the toll is based on the driver's destination. Toll signs would show up to three toll rates for different toll zones, or destinations. Drivers would pay the rate they see upon entering the express toll lanes to reach their destination, even if they see a different toll rate for their destination further down the road. When both of these pricing approaches are used together, it means that the toll that drivers pay is based both on the congestion in the corridor and the distance they are traveling.
- **Operating Hours and *Good To Go!* Passes** – The express toll lane system is expected to operate from 5 a.m. to 7 p.m. on weekdays, with the system toll-free and open to all at other hours and on major holidays. Transit, HOVs, and motorcycles would need to have a *Good To Go!* pass to use the express toll lanes for free during operating hours. Eligible HOV users would be

How does dynamic pricing work?

Electronic monitors along the roadway measure real-time information on speed, congestion, and number of vehicles in the express toll lanes. This information is used to determine whether tolls go up or down to optimize lane use.

As the express toll lanes become congested, toll rates increase, and as congestion decreases, toll rates decrease. The use of dynamic pricing allows the lanes to operate with high volumes, but avoid becoming congested.

When would tolls be charged to use the express toll lanes?

It is assumed the express toll lanes would operate from 5 a.m. to 7 p.m. on weekdays. At all other times and major holidays, the lanes would be free and open to all without a *Good To Go!* pass.

During operating hours:

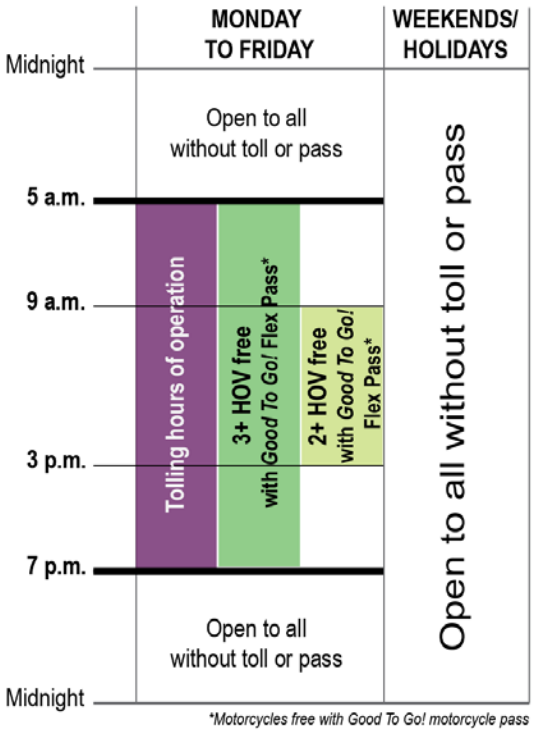
- **Single Occupancy Vehicle (SOVs)** would pay a toll to use the lanes.
- **Transit, High Occupancy Vehicle (HOV) 3+, and Motorcycles** would travel for free with a *Good To Go!* pass.
- **HOV 2+** would travel for free from 9 a.m. to 3 p.m. with a *Good To Go!* pass. From 5 a.m. to 9 a.m. and 3 p.m. to 7 p.m. HOV2+ would pay a toll to use the express toll lanes with or without a *Good To Go!* pass.
- **Large vehicles** over 10,000 pounds gross vehicle weight would not be able to use the express toll lanes at any time.

required to set the *Good To Go!* pass to the HOV mode to avoid charges. Single-occupant vehicles (SOVs) could choose to pay a toll to use the express toll lanes during operating hours with or without a *Good To Go!* pass.

- **Occupancy Requirement**s – During the peak periods (weekdays from 5 a.m. to 9 a.m. and 3 p.m. to 7 p.m.), transit vehicles and carpools with three or more persons (HOV 3+) would be able to use the lanes for free with a *Good To Go!* pass. From 9 a.m. to 3 p.m., the system would be open toll-free to those with two or more passengers (HOV2+) with a *Good To Go!* pass. Motorcycles ride toll-free in the express toll lanes with a *Good To Go!* pass. During non-operating hours, SOVs will not be permitted to enter the express toll lanes from ramps where access is provided directly from local streets. SOV access would only be permitted from freeway GP entry and exit points.
- **Vehicle Weight** – Vehicles over 10,000 pounds gross vehicle weight will be prohibited, which is consistent with HOV lane restrictions throughout Washington.
- **Electronic Tolling** – Payments would be made via electronic tolling with a *Good To Go!* pass. For drivers who choose not to use a *Good To Go!* Pass, WSDOT offers optional photo billing (pay by mail) for an extra fee.

What is a *Good to Go!* Account?

A Good To Go! account is the cheapest and easiest way to pay tolls in Washington. With an account, your tolls will be paid automatically without having to stop at a toll booth or worry about bills in the mail. For more information please go to: http://www.wsdot.wa.gov/GoodToGo/default.htm



What is the construction schedule?

Both projects are anticipated be built at the same time. Construction is expected to last up to 5 years beginning in 2019 and ending in 2024.

SECTION 3 STUDY APPROACH

The project team performed a combined analysis of transportation effects for the I-405, Tukwila to I-90 Project and the Downtown Bellevue Project. Section 5, Project Effects, presents the results of the analysis. This section presents the analysis approach.

Analysis Methodology

WSDOT used several tools to conduct the transportation analysis. Models included EMME, a regional travel demand model; VISSIM, a freeway operations simulation model (WSDOT 2014; FHWA 2004); Synchro, an intersection operations model (WSDOT 2017); and SIDRA, a roundabout operations model (WSDOT 2015).

Traffic analyses are necessary to enable FHWA approval of interstate system access modifications and to provide traffic data for air and noise analyses for project-level environmental documentation. These tools were also used to provide the traffic operations basis for the project design.

Analysis Data

The project team compiled data on the following information in the study area:

- Volume, speed, and congestion data for GP lanes, HOV lanes, express toll lanes, high-occupancy toll (HOT) lanes, on-ramps, and off-ramps. These data come from permanent loop detectors embedded in the roadway that collect continuous data. On freeways, loops are typically spaced every 0.5 mile.
- Truck data from several permanent data recorders in the study area.
- Information about where motorists are coming from and going to, commonly referred to as origin-destination data.
- Volume and origin-destination patterns within existing express toll and HOT lanes from tolled transactions.

We obtained local street, peak-period, turning movement traffic volumes from the cities of Bellevue and Renton and supplemented these data with traffic volume counts we

What are the differences between freeway lane types?

General purpose (GP) lanes are available to all traffic.

High-occupancy vehicle (HOV) lanes are available to buses, motorcycles, vanpools, and vehicles carrying a specified number of occupants. As noted on signs, most HOV lanes require two passengers, while some require three within the study area.

High-occupancy toll (HOT) lanes and express toll lanes are available for use by HOV users without a toll and single-occupant vehicles (SOV) users who choose to pay a variable toll.

collected on July 13, 2016. We also collected other transportation data, including traffic impact studies and information regarding future transportation projects, to develop future year traffic projections.

We used WSDOT crash data from freeways and ramps in the study area for the latest 5-year period available, from 2012 to 2016.

Project and Related Corridors Forecasts

The project team used the Puget Sound Regional Council (PSRC) travel demand forecast model to develop future year traffic projections. This model predicts traffic volumes and travel patterns based on adopted land use plans and the expected transportation network within the region. We refined the PSRC model to include detailed network resolution for the I-405 and State Route 167 (SR 167) corridors, as well as portions of SR 520, I-90, and Interstate 5 (I-5). We incorporated supplemental data from other cities' travel demand models from cities located along the study area.

We refined housing, employment, and land use projections for future year modeling. We also included future network improvements such as planned roadway and transit projects, including Sound Transit 3 (ST3)-funded improvements to the corridor. We assumed some projects would be constructed by 2025, and others by 2045, based on their current completion schedule and whether they are funded. Of note, the I-405/SR 167 interchange Direct Connector Project, currently under construction, would be a key component of the future transportation network in the study area and is included in both No Build and Build forecasting and planning.

We then developed existing, opening year, and design year forecasts for No Build and Build (the projects) scenarios, assuming that both projects would be built. Appendix C, PSRC Model Renton to Bellevue Update, details the forecasting process used to update the PSRC model for existing conditions and No Build and includes a list of the assumed future year roadway projects.

The operational characteristics of the Projects are discussed in Section 5, Project Effects, for both the No Build and Build Alternatives.

Express Toll Lane Volumes

The Projects would connect the existing express toll lanes between Bellevue and Lynnwood with the HOT lane system on SR 167, using the I-405/SR 167 Direct Connector. We made further refinements to modeling forecasts, including driver willingness to pay tolls to develop forecasted volumes and revenue for the full express toll lane system. Our modeling reflects the dynamically priced express toll lane system and assumes toll rates adjusted to optimize express toll lane use and overall mobility. This includes a detailed origin and destination volume data set that was used in the freeway and local intersection analysis. Appendix D, Traffic and Revenue Forecasting, details the process used for Build Alternative forecasting, including projected express toll lane use and revenue. Additional information about how WSDOT would operate the toll lanes is provided in Section 5, Project Effects.

Freeway Analysis

The analysis team used VISSIM (Version 7.00-16), a traffic modeling software commonly used on WSDOT projects, for modeling existing and future year freeway operations. For the analysis, we used VISSIM to assign vehicles to trip paths based on travel demand patterns in the study area freeway network. We calibrated an existing conditions model to accurately represent field conditions, such as volumes and speeds, and used it as the base for evaluating future conditions.

Intersection Analysis

The quality of traffic operations at intersections is measured using a level of service (LOS) system as defined in the Transportation Research Board *Highway Capacity Manual* (HCM) (TRB 2010). LOS refers to the degree of congestion measured in average delay per vehicle. LOS A is the best operating condition, with motorists experiencing minimal delays. LOS F is the worst condition, with motorists experiencing very high delays, and at signals, often waiting through multiple signal cycles. This analysis reports the LOS results for intersection operations. Exhibit 3-1 shows the LOS and average vehicle delay criteria for signalized and unsignalized intersections.

What are signalized and unsignalized intersections?

An intersection that uses a traffic signal to control vehicles, bicyclists, and pedestrian movements is considered a signalized intersection. An intersection that uses signs such as "Stop" and "Yield" to control movements is considered unsignalized.

Exhibit 3-1. Level of Service Criteria for Signalized and Unsignalized Intersections

LOS	Signalized Average Delay per Vehicle (seconds)	Unsignalized Average Total Delay per Vehicle (seconds)	Description
A	0–10	0–10	Little or no delay
B	10–20	10–15	Short delays
C	20–35	15–25	Moderate delays
D	35–55	25–35	Long delays
E	55–80	35–50	Very long delays
F	>80	>50	Failure - extreme congestion

Source: Transportation Research Board *Highway Capacity Manual* (2010)

We used Synchro (Version 9.1.912) to calculate the unsignalized and signalized intersection delay and to develop future year signal timings. To support our analysis, we used geometric layouts, volume, and signal timing information from the City of Bellevue, the City of Renton, and WSDOT. For future year scenarios, the intersection timing parameters were maintained from the existing analysis while cycle lengths and signal timings were optimized by Synchro.

We used SIDRA (Version 6.1) to analyze roundabout intersections. The roundabout analysis assumes the same LOS criteria as used for signalized intersections.

Evaluation Criteria

We identified evaluation criteria to differentiate between the No Build and Build Alternatives.

We evaluated freeway operations using vehicular volumes, travel times, person throughput, and speed as measures of effectiveness on mainline roadways. Differing facilities types were considered separately (such as GP, HOV, or express toll lane facilities). We measured speeds for a 6-hour AM and PM peak period, while the remaining measures were evaluated for a 3-hour peak period.

We evaluated local intersections in terms of vehicular volumes, LOS, average vehicle delay and queuing during the AM and PM peak hours. Safety, transit, freight, pedestrian, and bicycle operations were evaluated qualitatively.

Time Periods

The morning and evening commutes on freeways in the study area last for several hours. Our traffic models replicate the AM and PM peak commute periods, including the buildup and dissipation of congestion using a 6-hour VISSIM model (5 a.m. to 11 a.m., and 2 p.m. to 8 p.m.). Each model also has a 1-hour warm up, or "seeding" period, prior to the 6-hour evaluation period.

To capture the peak freeway operations during each commute period, we report data from a 3-hour period in both the morning (7 a.m. to 10 a.m.) and afternoon (4 p.m. to 7 p.m.). In general, the AM and PM peak identified above represents, on average, the period with the most congestion throughout the entire study area. We selected a 3-hour average because the corridor has variable peaking characteristics and using a typical 1-hour peak reporting interval would under-represent the worst traffic conditions. For example, special trip generators such as Seattle-Tacoma International Airport (Sea-Tac Airport) and Boeing shift changes have an early peak hour. Other generators, such as the Microsoft Campus in Redmond, have a peak hour during the latter part of each period.

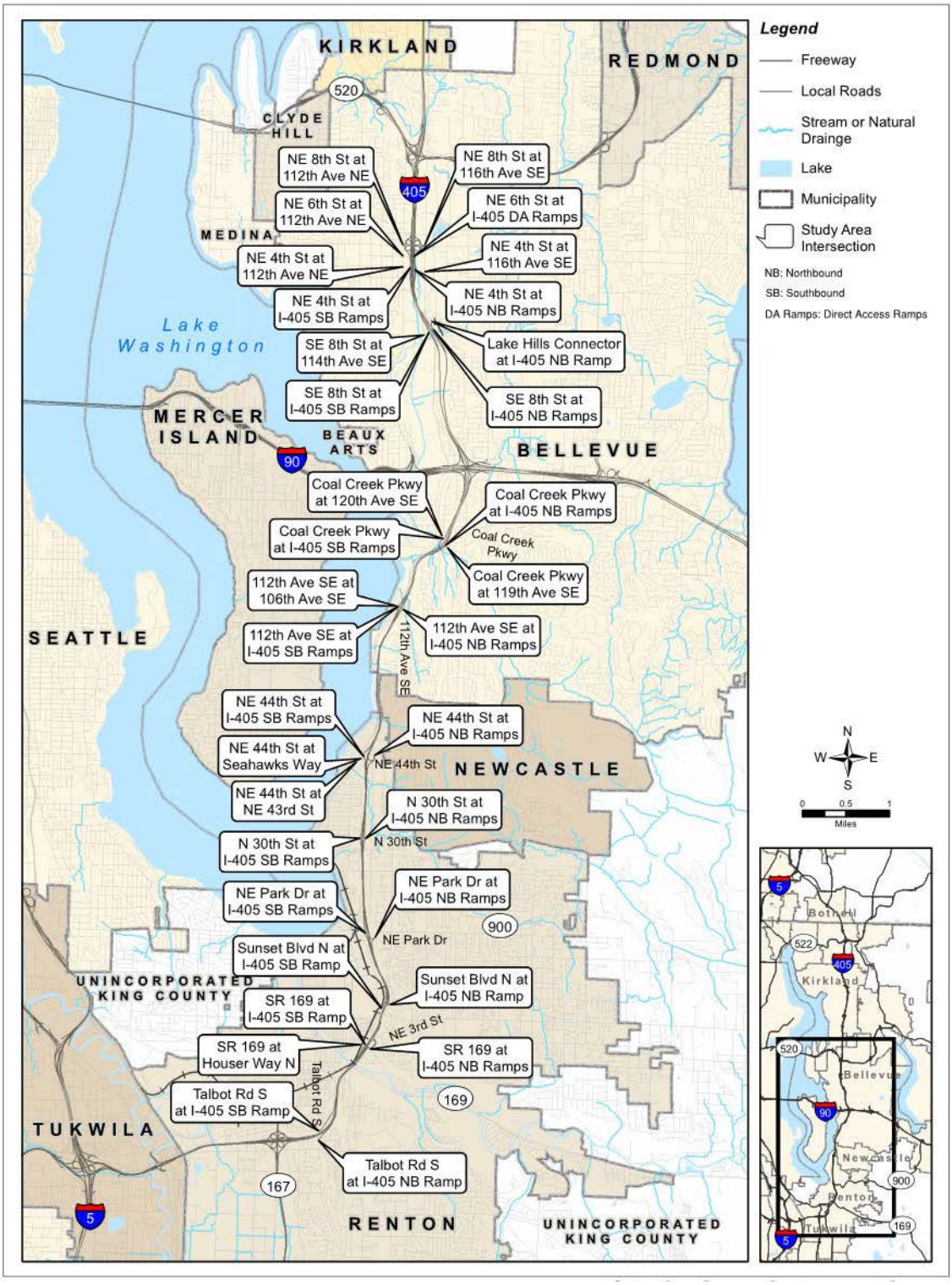
For the intersection analysis, we used the corridor peak AM 1-hour and peak PM 1-hour to represent the worst-case condition. The intersection AM peak hour is 7 to 8 a.m., and the PM peak hour is 4 to 5 p.m.

Study Area

The freeway analysis includes mainline and ramp facilities of the entirety of I-405 with adjacent portions of I-5, SR 167, I-90, and SR 520, as these facilities influence operations in the study area. We analyzed local streets and intersections in the study area from NE 8th Street to Talbot Road S. Local intersections at the ramp terminal intersections, as well as immediately adjacent intersections are included in the analysis. The local intersection analysis in this report focuses on operations at ramp terminal intersections because these would have the greatest impact from the Projects.

Exhibit 3-2 shows the local intersections in the study area.

Exhibit 3-2. Study Area Intersections



What are the previous and current plans on the I-405 corridor?

A number of ongoing studies, plans, and projects in the area have varying degrees of influence on the study area. The Projects discussed in this report align with the long-range vision of the plans presented below.

I-405 Master Plan

The I-405 Master Plan, as documented in the 2002 *I-405 Corridor Program NEPA/SEPA Final Environmental Impact Statement* (WSDOT 2002), describes a 20-year-plus vision of multimodal improvements to the freeway, transit systems, and arterials along the I-405 corridor from Tukwila to Lynnwood. This plan includes improvements over the 20-year period, such as additional freeway lanes and park-and-ride facilities and additional transit services such as bus rapid transit (BRT).

The current vision to complete the 2002 I-405 Master Plan includes two additional lanes of capacity through the corridor, but operating one of the additional lanes as part of a two-lane express toll lane system (converting the existing HOV lane to form the second express toll lane) and one additional GP lane. The Projects would move toward this vision by constructing one additional lane in each direction and converting the HOV lane to a two-lane express toll lane that would operate as part of a regional 40-mile toll lane system on SR 167 and I-405.

Tukwila to Renton Improvement Project and SR 169 to I-90 Renton to Bellevue Project

Environmental impacts of the I-405 Tukwila to Renton Improvement Project (TRIP), (I-5 to SR 169) and the I-405, SR 169 to I-90 Renton to Bellevue Project (Renton to Bellevue Project) were previously evaluated in 2006 and 2008, respectively. We have already constructed some elements of TRIP and would construct additional improvements with the Tukwila to I-90 Project.

A summary of the remaining elements of the TRIP and Renton to Bellevue Project is provided below. It is assumed that these improvements would be constructed as funds become available. Because the remaining improvements of the TRIP and the Renton to Bellevue Project were evaluated in EAs completed in 2008 and 2006, respectively, much of the analysis is complete. Updates to previous environmental

documentation would be made as needed when future construction stages are proposed.

Tukwila to Renton Improvement Project

The remaining elements of the TRIP that are not yet funded are discussed in detail in Chapter 4 of the 2008 TRIP EA (WSDOT 2008) and include the capacity improvements listed below in addition to associated improvements to modify and expand interchanges and local roadways, build noise walls, construct stormwater management facilities, and construct fish passage:

- Constructing one additional GP lane in both directions on I-405 from SR 181 through SR 167
- Constructing an auxiliary lane on northbound SR 167 from S 43rd Street to I-405
- Constructing one additional GP lane in each direction on I-405 from SR 167 through SR 169

Renton to Bellevue Project

The remaining elements of the Renton to Bellevue Project are discussed in detail in Chapter 4 of the 2006 Renton to Bellevue EA (WSDOT 2006). These improvements include constructing an additional GP lane in each direction on I-405 between Renton to Bellevue and associated improvements to interchanges, local roadways, noise walls, stormwater management facilities, and fish passage. One of the key components of this project discussed the addition of two GP lanes and a buffer separation to the existing HOV lane, while changing the HOV user requirements to 3+ carpool and transit only from the 2+ designation as it today.

Sound Transit

We assumed there would be several projects funded through Sound Transit within the Project corridor. In November 2016, voters passed an expansion of the regional mass transit system, collectively known as ST3. The ST3 package of projects includes funding for BRT along I-405 between Lynnwood and south Renton. The ST3 plan provides funding for freeway stations that would allow buses to stop in the freeway right-of-way to pick up and drop off riders. A freeway station would be built at the NE 44th Street interchange in Renton, and connections to this station would be provided by direct access ramps. A freeway station at the 112th Avenue SE interchange

is also assumed as additional funding becomes available from Sound Transit. While specific routing of Sound Transit BRT has not been determined, the analysis assumes BRT would operate in the express toll lane wherever feasible and is included in the Build condition forecasting and analysis. WSDOT would coordinate with Sound Transit and its partners (such as its consultants and contractors, and other transit agencies such as King County Metro) throughout the development and implementation of the Projects.

Local Municipalities

The Projects pass through four separate cities and King County. The cities of Tukwila, Renton, Newcastle, and Bellevue provided land use and transportation input to the regional planning process. WSDOT would coordinate with these municipalities throughout the development and implementation of the Projects.

SECTION 4 EXISTING CONDITIONS

The existing conditions analysis encompasses the transportation network in the study area as of spring 2016. This section documents the conditions in the study area, including traffic volumes, freeway and local street operations, safety performance, transit service, freight, and nonmotorized (pedestrian and bicycle) facilities.

Information for Existing Conditions

For the analysis, the project team developed models of existing conditions for both freeway and intersection operations using the data described in Section 3, Study Approach.

The project team reviewed WSDOT volume and speed data to determine typical operations under existing conditions. To develop a consistent data set in the study area, we used typical weekdays (Monday through Friday) from March 21 through May 31, 2016. We eliminated holidays and days when traffic conditions changed due to regional road closures. For the analysis, we used an average of 46 days for the existing conditions.

The analysis used a 6-hour AM and 6-hour PM VISSIM freeway model. We compiled twelve 30-minute average freeway and ramp volumes to use for the AM and PM models. We conducted an extensive review of each ramp and mainline volume to confirm that the data aligned with expected volumes, and we removed erroneous data from the dataset.

Why did we use Mondays through Fridays from March 21 through May 31 for the existing conditions analysis?

Seasonal variation in traffic patterns typically show higher volumes in summer, which has more light and less rain. Winter, which has less light and more effects from weather, typically shows lower volumes with higher congestion. Spring typically represents an average condition.

Monday through Fridays were used instead of a typical Tuesday through Thursday because there was not a noticeable difference in average traffic volumes, and a larger number of days was desirable in the analysis.

Freeway Operations

This section discusses freeway operations on I-405 in the study area.

Freeway Daily Traffic Volumes

We compiled the existing average weekday traffic volumes from available data. In our analysis, these volumes represent two-directional total volumes (for all lane types), with northbound and southbound traffic added together. On I-405 between I-5 and SR 167, traffic volumes are 174,000 vehicles per day and between SR 169 and SR 900, traffic volumes are 141,000 vehicles per day. Approaching

Why use an average instead of a single typical day?

Many factors affect traffic operations from day to day, such as weather, commute patterns, crashes, and events. An average value better accounts for this variability in congestion.

downtown Bellevue between I-90 and SE 8th Street, I-405 carries 206,000 vehicles per day, the highest daily traffic volume in the study area. Truck traffic makes up approximately 8 percent of the average weekday traffic volume, while HOV and transit vehicles with two or more persons makes up approximately 16 percent of the average weekday traffic volume.

Freeway Peak Period Traffic Volumes

Northbound I-405 north of NE 44th Street carries an average of 5,350 vehicles during the AM peak hour, with 35 percent in the HOV lane. During the PM peak hour, southbound I-405 in this section carries an average of 4,750 vehicles, with 25 percent in the HOV lane.

North of I-90, northbound I-405 carries an average of 8,300 vehicles during the AM peak hour, with 13 percent in the HOV lane. During the PM peak hour, southbound I-405 in this section carries an average of 6,400 vehicles, with 17 percent in the HOV lane.

Peak hour volumes are constrained by congestion within the corridor. Congestion affects the total volume of traffic able to access both GP and HOV facilities. Effects from congestion-related constraints are discussed in the following sections.

Freeway Travel Times

We determined freeway travel times from the VISSIM modeling efforts. We are reporting two trip pairs: from I-5 in Tukwila to I-90 and from I-90 to SR 520. The results are an average of the 3-hour AM peak and PM peak periods.

When traveling at the posted speed limit, the trip on I-405 between I-5 and I-90 should take about 11.9 minutes and the trip between I-90 and SR 520 should take about 2.7 minutes. The model considers actual field-measured vehicle speeds, so for some segments and lane types, modeled travel times can be faster than speed limit travel times. Exhibit 4-1 shows travel times for existing conditions in 2016.

Exhibit 4-1. 2016 Existing Conditions 3-Hour Peak Period Average Travel Times by Direction and Segment

I-405 Segment	Lane Type	Travel Time (minutes)	
		AM	PM
Northbound I-405: I-5 to I-90	GP	29.0	15.3
	HOV	15.4	13.2
Northbound I-405: I-90 to SR 520	GP	4.1	2.4
	HOV	3.0	2.4
Southbound I-405: SR 520 to I-90	GP	2.5	11.0
	HOV	2.5	7.6
Southbound I-405: I-90 to I-5	GP	12.7	16.8
	HOV	11.7	13.4

Congestion creates longer travel times relative to the posted speed travel time for northbound I-405 through Renton during the AM peak period for both the GP and HOV lanes.

During the PM peak period, congestion in Bellevue creates slow travel times for southbound I-405, affecting both the GP and HOV lanes.

Freeway Person Throughput

Person throughput is the number of persons moved through various freeway sections. It is measured as the number of vehicles in a particular class (SOVs, HOVs, buses, and trucks) multiplied by the average number of persons in each vehicle class.

North of NE 44th Street, I-405 carries an average of 7,850 persons northbound and 5,450 persons southbound during the AM peak hour. During the PM peak hour, this section carries an average of 6,900 persons northbound and 6,650 persons southbound.

North of I-90, I-405 carries an average of 11,750 persons northbound and 8,750 persons southbound during the AM peak hour. During the PM peak hour, this section carries an average of 9,700 persons northbound and 9,350 persons southbound.

Freeway Operations

Due to high regional traffic demands in both directions, I-405 experiences congestion in the study area many hours of the day in both the GP and HOV lanes. Key locations, or "recurring bottlenecks" create congested conditions during both the AM period and PM period.

The HOV lanes experience congestion in the peak travel direction and regularly do not meet WSDOT's performance standard of maintaining a 45 mile-per-hour (mph) speed. HOV lanes are over capacity in the peak travel direction.

The capacity of HOV lanes is further reduced when the adjacent GP lanes are congested because traffic volumes are generally high, and slower GP lanes cause HOV users to drive more cautiously. The I-405 HOV lane in the study area operates with open access, and HOV drivers reduce speeds out of concern of sudden lane changes to and from the HOV lane. The HOV lane generally operates well during off-peak periods.

We analyzed freeway operations in terms of speed. Temporal speed figures were developed for GP and HOV lanes on I-405 from I-5 in Tukwila to SR 520 in Bellevue. These figures use the VISSIM model speed output, averaged across all lanes for each facility type (GP or HOV), and were summarized every 0.2 mile. To depict travel speed visually in the exhibits, it was converted into a color range corresponding to operations over time (x-axis) and location along the corridor (y-axis). Areas of congestion, which are designated with average travel speeds 45 miles per hour (mph) or lower, can be seen by the increasing presence of yellow, red, and then black coloring representing a degradation in speed. A green color scale is also used to show uncongested areas. Green represents average travel speeds at or above the posted speed limit, while other shades of green show areas with lower speeds but still considered uncongested. Using this color range, from the VISSIM analysis, Exhibit 4-2 shows the 2016 existing AM period operations by direction and lane type, and Exhibit 4-3 shows the 2016 existing PM period operations by direction and lane type.

What is a recurring bottleneck?

A recurring bottleneck is a localized constriction of traffic flow that occurs on a frequent and predictable basis, regardless of weather conditions, crashes, or events.

A bottleneck causes congestion because of too much traffic in one area. It can be exacerbated by the roadway condition, such as narrowing of the roadway or the presence of on- or off-ramps.

Generally, slower-than-posted speeds form upstream of a bottleneck, while speeds closer to posted limits occur downstream of a bottleneck.

How does open access work?

An HOV lane with open access means motorists can weave into and out of the lane at any point. This differs from a limited access lane (such as ETLs) where motorists may only access the lane at designated points.

AM Period

During the AM period in the study area, some areas experience congestion. Listed below are the locations of bottlenecks and how far congestion extends. Bottlenecks in the study area affect operations in both the GP and HOV lanes:

- A bottleneck begins on northbound I-405 at the NE 44th Street interchange, with congestion extending south through the SR 167 interchange. This congestion frequently extends onto northbound SR 167.
- A bottleneck begins on northbound I-405 at the SR 520 off-ramp, with congestion extending south to the I-90 interchange area.
- A bottleneck begins on southbound I-405 at the NE 30th interchange area, with congestion extending north through the NE 44th Street interchange.

PM Period

As with the AM period, during the PM period in the study area some areas experience congestion. Listed below are the locations of bottlenecks and how far congestion extends. Bottlenecks in the study area affect operations in both the GP and HOV lanes:

- A bottleneck begins on northbound I-405 at the Park Avenue N interchange, with congestion extending south through the I-5 interchange in Tukwila.
- A bottleneck begins on southbound I-405 at the Coal Creek Parkway interchange, with congestion extending north through the SR 520 interchange.
- A bottleneck begins on southbound I-405 at the NE 30th Street interchange, with congestion extending north through the NE 44th Street interchange.

Exhibit 4-2. I-405 Operations – 2016 Existing AM Period

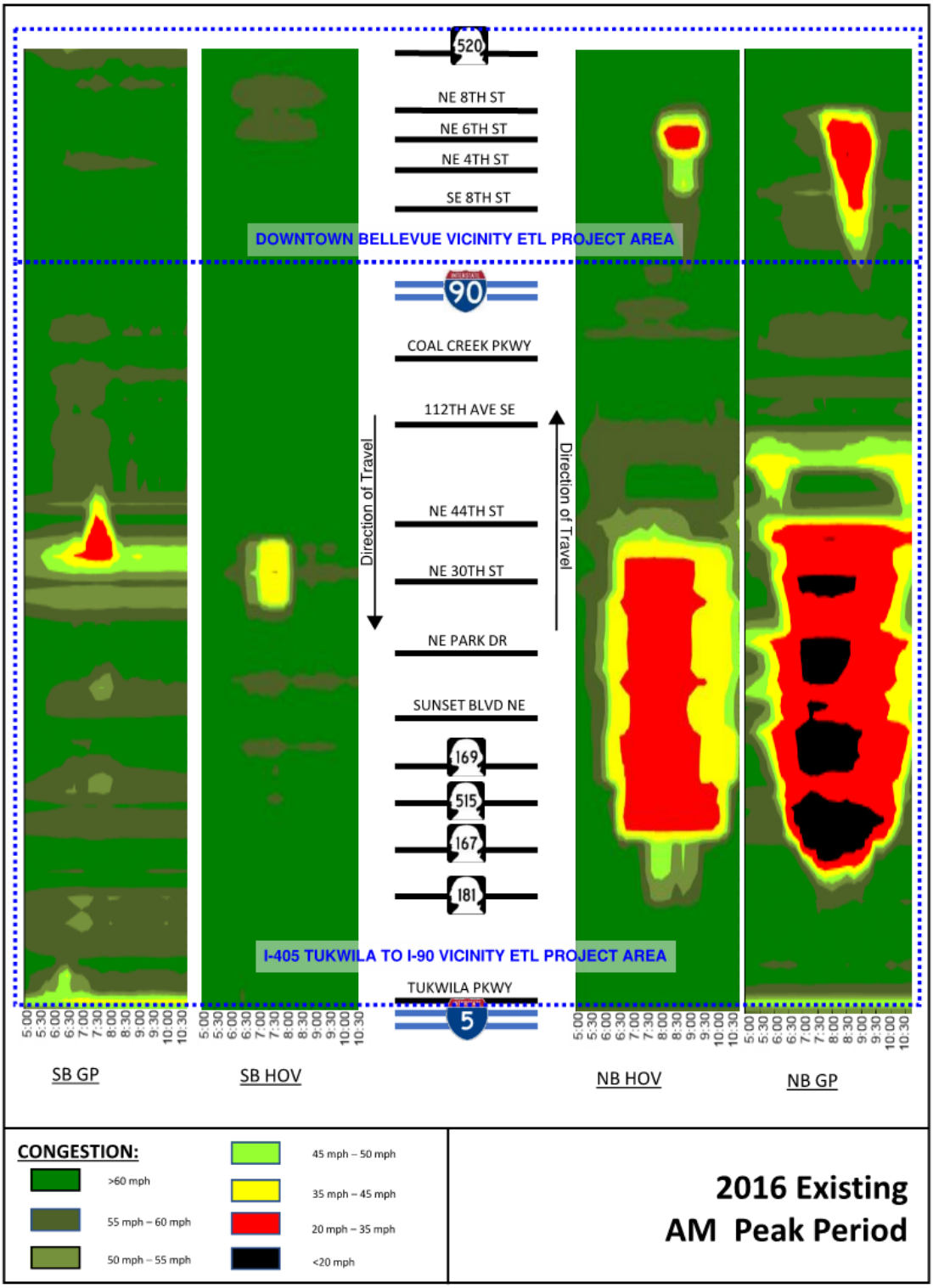
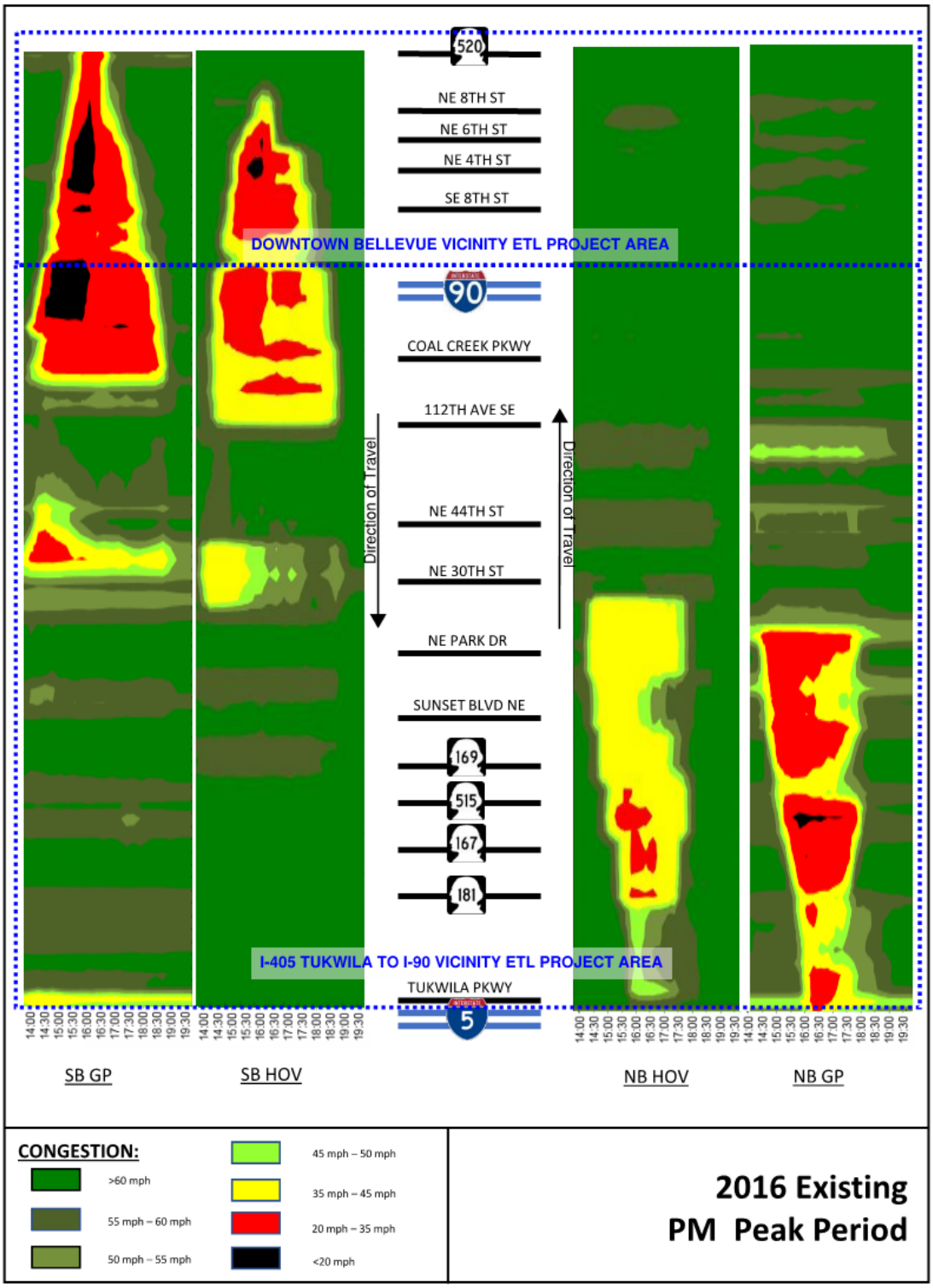


Exhibit 4-3. I-405 Operations – 2016 Existing PM Period



Local Intersection Operations

We evaluated operations at 34 intersections in the study area using Synchro to calculate the average delay experienced by vehicles, using the methodology and criteria provided in Section 3, Study Approach. Appendix E, Intersection Analysis Results, shows intersection LOS results of the Synchro analysis for each of the study area intersections.

The local intersection peak period turning movement data (as discussed in Section 3, Study Approach) were used to establish traffic volumes for existing conditions. Because the turning movement data were from a variety of sources, including single-day data collection efforts, we compared freeway ramp volumes from WSDOT with intersection ramp turning-movement volumes. Volumes between the two sources were adjusted to be consistent.

In the AM peak hour under existing conditions, four intersections operate at LOS E or worse, with an additional four intersections with at least one approach operating at LOS E or worse. The remaining intersections operate at LOS D or better for all approaches.

In the PM peak hour under existing conditions, five intersections operate at LOS E or worse, with an additional five intersections with at least one approach operating at LOS E or worse. The remaining intersections operate at LOS D or better for all approaches.

While overall intersection operations show only a few intersections at LOS E or F during the two peak periods, many specific intersection approaches operate at LOS E or F. These approaches create congested conditions for many users, with queuing that can affect adjacent intersections. Queuing from adjacent intersections may not always be reflected in LOS performance as measured using the 2010 HCM (TRB 2010) methodologies.

Existing Ramp Queuing

Whenever possible, WSDOT monitors and manages ramp terminal signals to minimize ramp queuing from affecting mainline operations.

Under existing conditions, ramp queuing at unsignalized intersections can queue back, thus, affecting operations on the mainline.

Existing Safety Performance

We collected historical freeway crash information for a 5-year period from 2012 to 2016, the most recent data available at the time of this analysis. We are reporting crash data for two areas: mainline I-405 from I-5 in Tukwila to I-90 and from I-90 to SR 520. In addition, we are reporting crash data for the entire I-405 mainline study area. The crash data provided the frequency, location, and types of crashes along the corridor. The overall number of crashes over the 5-year period in the study area is approximately 6,600 crashes, or approximately 1,320 crashes per year. Approximately 1,060 crashes per year occurred between I-5 and I-90, while approximately 260 crashes per year occurred between I-90 and SR 520.

In the northern end of the study area, the Bellevue-to-Lynnwood express toll lanes were constructed and opened to traffic in the study period, which altered lane configurations from NE 6th Street to the north in Bellevue. In this small overlapping study segment, within the 5-year dataset there were no noticeable changes in crashes because of the Bellevue to Lynnwood Project.

When we analyze crashes based on severity, we look at different crash types, including property damage only, injury, and fatal. A crash is classified as an injury or fatal based on the most severe injury level sustained in a crash. Most of the reported crashes in the study area resulted in property damage only. Approximately 30 percent of the total crashes resulted in an injury to at least one or more persons in the crash. We further analyze serious injury and fatal crashes in more detail below. Over the 5-year reporting period, four fatal crashes were reported in the Projects study area:

- In March 2012, on southbound I-405 at MP 0.59 at 1 a.m., a vehicle struck another vehicle while attempting to change lanes. Driving under the influence and exceeding a reasonable speed were reported as contributing factors of the crash. Lighting conditions were reported to be dark with street lights turned off, and the weather was reported to be clear/partly cloudy.
- In May 2013, on the northbound I-405 on-ramp from 112th Avenue SE at MP 9.69 at 11 p.m., a pedestrian was struck under dry and street-lit conditions.

- In August 2013, on southbound I-405 at MP 11.77 at 5 a.m., a vehicle struck a deer and was subsequently rear-ended under dark and wet conditions.
- In September 2013, on southbound I-405 at MP 13.33 south of the NE 6th Street direct access on-ramp at 10 p.m., a vehicle was rear-ended and struck the concrete median barrier under street-lit conditions. Driving under the influence and exceeding a reasonable speed were reported as contributing factors of the crash.

There were also 27 reported serious injury crashes on I-405 over the 5-year reporting period. Of these crashes, the following trends were observed:

- Two-thirds of the crashes (18 of 27) occurred on northbound I-405
- 30 percent occurred during the weekday evening commute
- 37 percent struck a fixed object

Approximately 48 percent of all crashes occurred during peak weekday travel times (6 a.m. to 10 a.m. and 3 p.m. to 7 p.m.), with the remaining 52 percent of crashes occurring outside of these times on weekdays and on weekends. These 4-hour peak periods see heavier congestion and higher volumes; they make up about 25 percent of the total weekly hours but account for almost half of the total crashes. During these peak hours, crash history had the following distributions:

- 74 percent rear end
- 22 percent sideswipe
- 3 percent fixed object
- 1 percent other types

Rear end and sideswipe make up most of the crashes; these crashes are typically associated with congested conditions. Of these peak period crashes, approximately 72 percent were property damage-only crashes, with 28 percent resulting in an injury. During the peak periods, the most common contributing factors were driver distraction or inattention (24 percent), exceeding a reasonable safe speed (27 percent), and following too closely (23 percent).

For the crashes during the off-peak periods (outside the identified weekday peak periods of 6 a.m. to 10 a.m. and 3 p.m. to 7 p.m.) the distribution of crash types was as follows:

- 64 percent rear end
- 22 percent sideswipe
- 11 percent fixed object
- 3 percent other types

Rear-end and sideswipe make up a majority of the crashes. During the off-peak periods, approximately 67 percent were property damage only crashes, with 32 percent resulting in an injury and less than 1 percent resulting in a fatality (the three crashes discussed earlier). During the off-peak periods, the most common contributing factors were exceeding a reasonable safe speed (29 percent), driver distraction or inattention (23 percent), and following too closely (21 percent). Most crashes under existing conditions are rear-end or sideswipe (91 percent), which are typically associated with congested conditions.

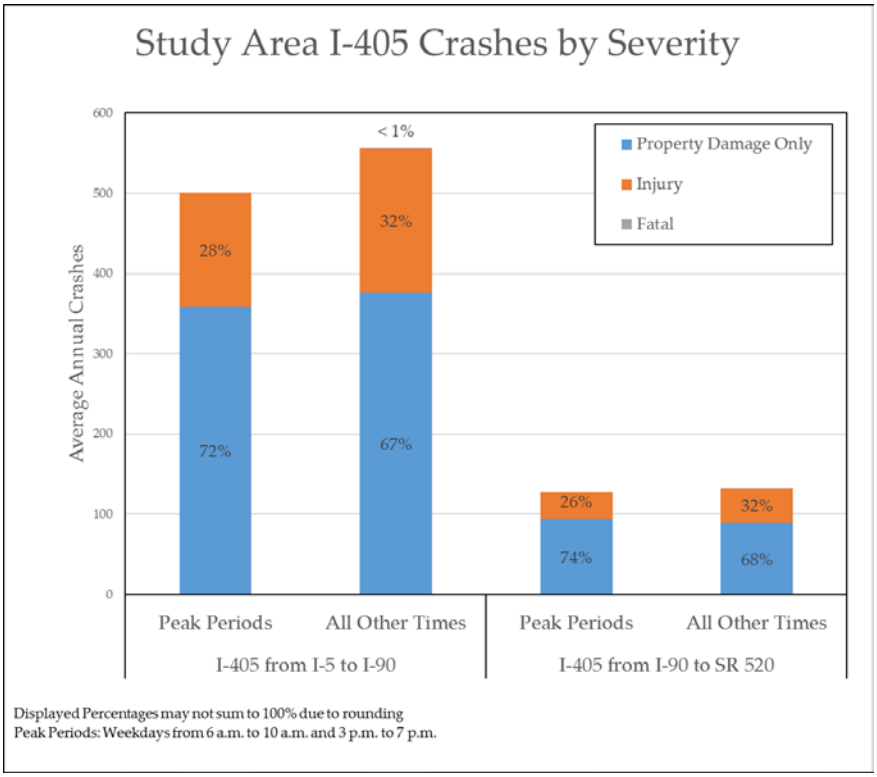
Exhibit 4-4 shows the proportion of crashes by severity and by crash type. The exhibit groups any crash that involved an injury in the "injury" category, including serious injury crashes.

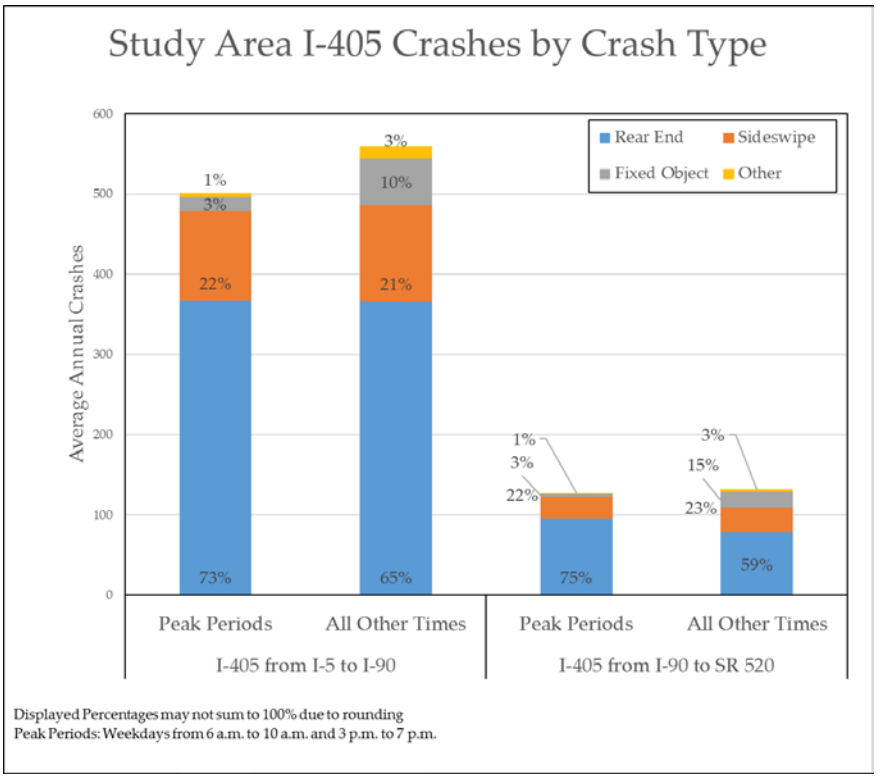
Existing Transit Network

Currently, transit service is available throughout the study area on local streets, as well as on SR 167 and I-405. King County Metro Transit (Metro) and Sound Transit provide service. All bus routes in the study area offer weekday service, and three routes also offer weekend service. We further describe existing transit service in the study area in Appendix F, Current Transit Routes.

Metro has 12 bus routes in the study area, and 8 of these routes use a portion of I-405 for their trip. Most of these routes provide local and regional service. Sound Transit has three express bus routes that use a portion of I-405. These routes provide service to major regional destinations such as Sea-Tac Airport, Overlake, and Downtown Bellevue. Where possible, transit vehicles use HOV lanes.

Exhibit 4-4. Safety Performance Analysis Results





Bus routes traveling on I-405 provide service to five main park-and-ride lots located along and near I-405 in the study area:

- Wilburton at SE 8th Street
- Newport Hills at 112th Place SE
- South Renton at S Grady Way/Shattuck Avenue S
- South Bellevue at Bellevue Way/112th Avenue SE
- Eastgate at SE Eastgate Way and 141st Avenue

Transit vehicles can use the HOV bypass lanes located at many freeway on-ramp locations in the study area. These lanes allow transit vehicles to bypass ramp meters to minimize delay. Transit vehicles also use the NE 6th Street direct access ramp that provides access directly to HOV lanes connecting into downtown Bellevue and the Bellevue Transit Center.

Transit vehicles experience delay because congestion is present throughout peak periods under existing conditions the in HOV lanes throughout the study area. This reduces transit reliability and creates more transit travel time variability. Transit agencies that use the corridor must account for this variability in their budgeting and time schedules.

Existing Freight Mobility

I-405 is a major carrier of freight traffic in east King County. Trucks make up about 8 percent of daily traffic on I-405 in the study area, with major freight origin and destinations throughout the area. The Green River Valley is a major industrial zone and I-405 is the major access corridor for freight to I-90.

Existing Nonmotorized Network

We define pedestrian and bicycle modes of travel as nonmotorized, which is a broad term to represent human-powered means of travel. While a primary function of roadways is to accommodate vehicles and transit, roadways also support nonmotorized transportation modes. Although pedestrian and bicycle travel are prohibited on freeway facilities in the study area, several nonmotorized facilities are located in and adjacent to the study area.

Two pedestrian crossings of I-405 in the study area are served by off-street paths. In Renton, the Cedar River Trail crosses under I-405 south of the SR 169 interchange. The Mountain-to-Sound Greenway, also known as the I-90 rail, connects Seattle and Mercer Island to Bellevue and runs parallel to I-90.

The Lake Washington Trail runs along the west side of I-405 between the NE 44th Street interchange and the Coal Creek Parkway interchange.

For roads that cross I-405 in the study area, sidewalks are provided on one or both sides of the road except along 112th Avenue SE, which has a wide shoulder along the north side of its interchange with I-405. Dedicated bicycle lanes are provided on some roads crossing I-405, including Benson Road and N 30th Street in Renton.

What is an off-street path?

WSDOT defines an off-street path as a facility physically separated from motorized vehicular traffic within the highway right-of-way or on an exclusive right-of-way. It is designed and built primarily for bicycles but can be used by other nonmotorized users.

SECTION 5 PROJECT EFFECTS

This section compares the Projects' effects using the evaluation criteria described in Section 3, Study Approach, for the No Build and Build (with the Projects) conditions analysis for both the opening year and design year.

The clearest way to display the differences is to show the No Build and Build Alternatives in the same graphics. Many of these figures are introduced in the No Build sections and are also referred to in later sections for the Build Alternative (with the Projects).

No Build

No Build would include the continuation of WSDOT routine maintenance in the study area, which would consist of any short-term minor construction necessary for continued operation of the existing I-405 facility. It would also include minor safety improvements as required within the Project limits.

Assumed future year roadway projects, as discussed in Section 3, Study Approach, and Appendix C, PSRC Model Renton to Bellevue Update, are included in the No Build analysis. Of note in the study area, the No Build scenario includes the I-405/SR 167 Direct Connector Project, which would provide a center-to-center (the leftmost inside lanes) connection between northbound SR 167 and northbound I-405 and between southbound I-405 and southbound SR 167. With the No Build, this Direct Connector Project would be operated as an HOV 2+ facility, matching the HOV occupancy requirements of the I-405 HOV lane and the SR 167 HOT lane.

No Build Daily Traffic Volumes

The transportation analysis defined weekday daily traffic volumes as two-directional totals (HOV and GP) with northbound and southbound freeway traffic added together. Future regional population and employment growth is anticipated in the region, so freeway traffic demand would continue to increase in the future.

In 2025 with the No Build, volumes on I-405 between I-5 and SR 167, traffic volumes are expected to be 191,000 by 2025, which is an increase of 10 percent compared to existing conditions. Between SR 169 and SR 900 on I-405, there would

be 170,000 vehicles per day, an increase of 21 percent compared to 2016 existing conditions. I-405 approaching downtown Bellevue, between I-90 and SE 8th Street, would have 255,000 vehicles per day, an increase of 24 percent over 2016 existing conditions. In 2045, daily traffic volumes would increase to 203,000 north of I-5, 179,000 north of SR 169 and 264,000 north of I-90. Congestion during the peak commute periods limits growth. Most daily traffic volume growth would occur outside the peak travel periods.

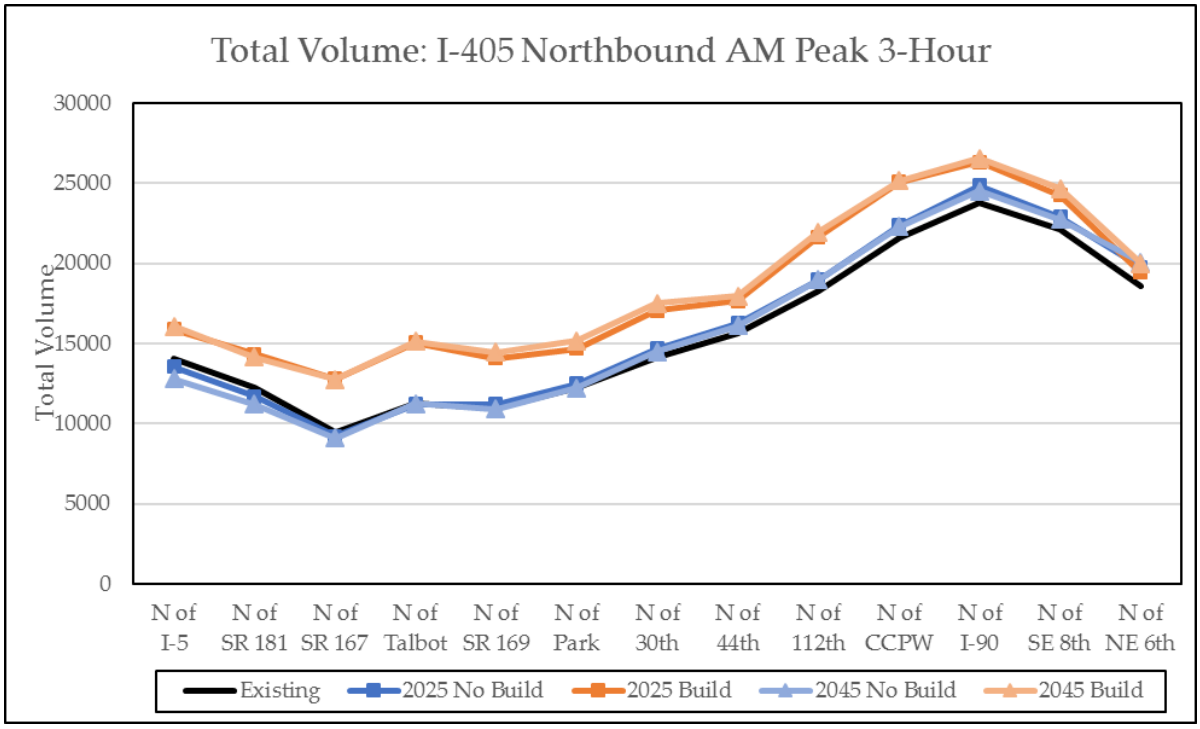
No Build Peak Period Traffic Volumes

With No Build, travel demand would increase the intensity and duration of congestion on I-405 during the AM and PM peak travel periods. Parts of the study area that are generally considered the off-peak travel direction would have higher traffic volumes and increased congestion. During peak travel periods, this increased congestion would reduce the number of vehicles able to travel through certain portions of the study area with the No Build as compared to 2016 existing conditions without any capacity changes.

We used the VISSIM model to analyze freeway operations for the 2025 and 2045 No Build. Exhibit 5-1 shows graphically the peak 3-hour, directional traffic volumes along I-405 from the model. Appendix G, 3-Hour Vehicle and Person Throughput, provides this information in tabular format.

Regional congestion limits the number of vehicles able to access I-405 with existing conditions, and this would remain true for future years with the No Build. Therefore, limited traffic volume growth would occur during the peak hour. In fact, some areas, such as southbound I-405 during the 2025 and 2045 No Build peak period in downtown Bellevue would have lower traffic volumes than existing conditions because the roadway capacity would be reduced as a result of bottlenecks in Bothell and Kirkland, which would limit the amount of traffic able to be served during the peak period.

Exhibit 5-1. I-405 AM and PM Peak 3-Hour Total Volumes, Sheet 1 of 2



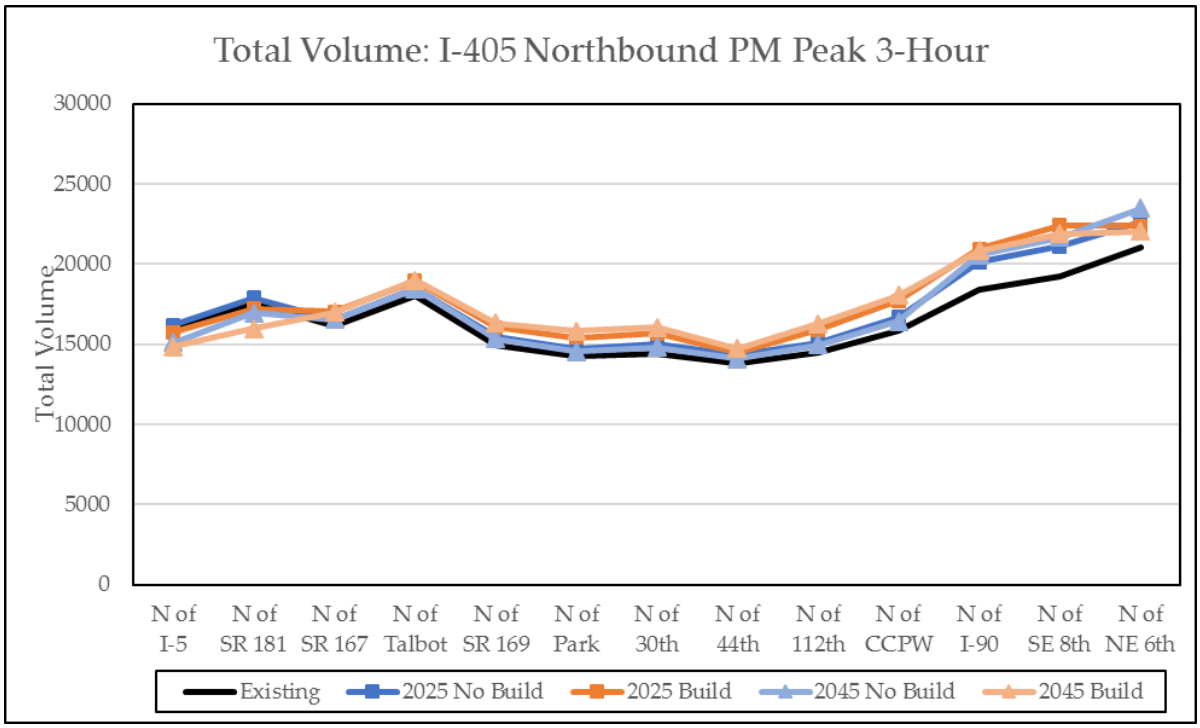
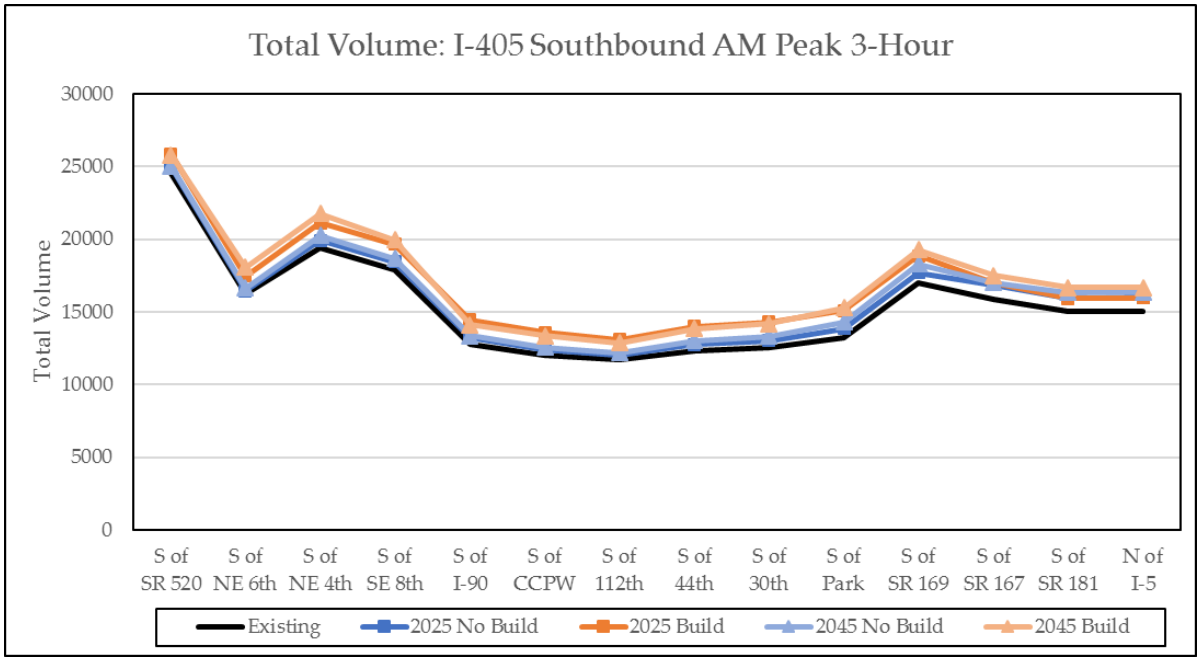
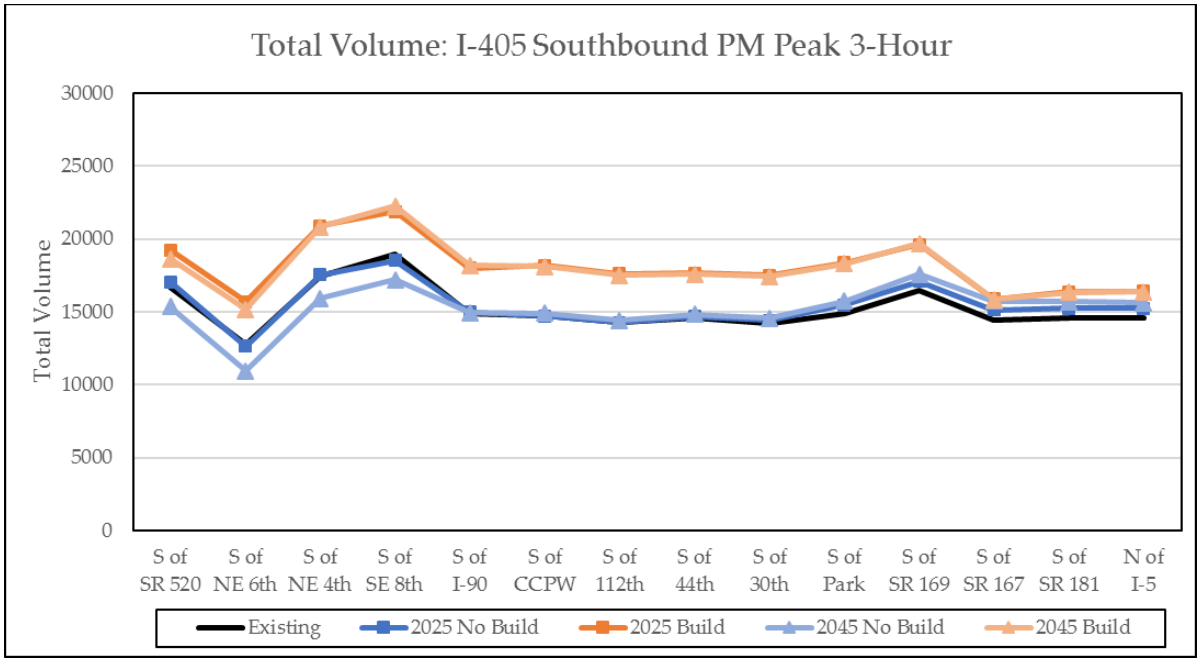


Exhibit 5-1. I-405 AM and PM Peak 3-Hour Total Volumes, Sheet 2 of 2





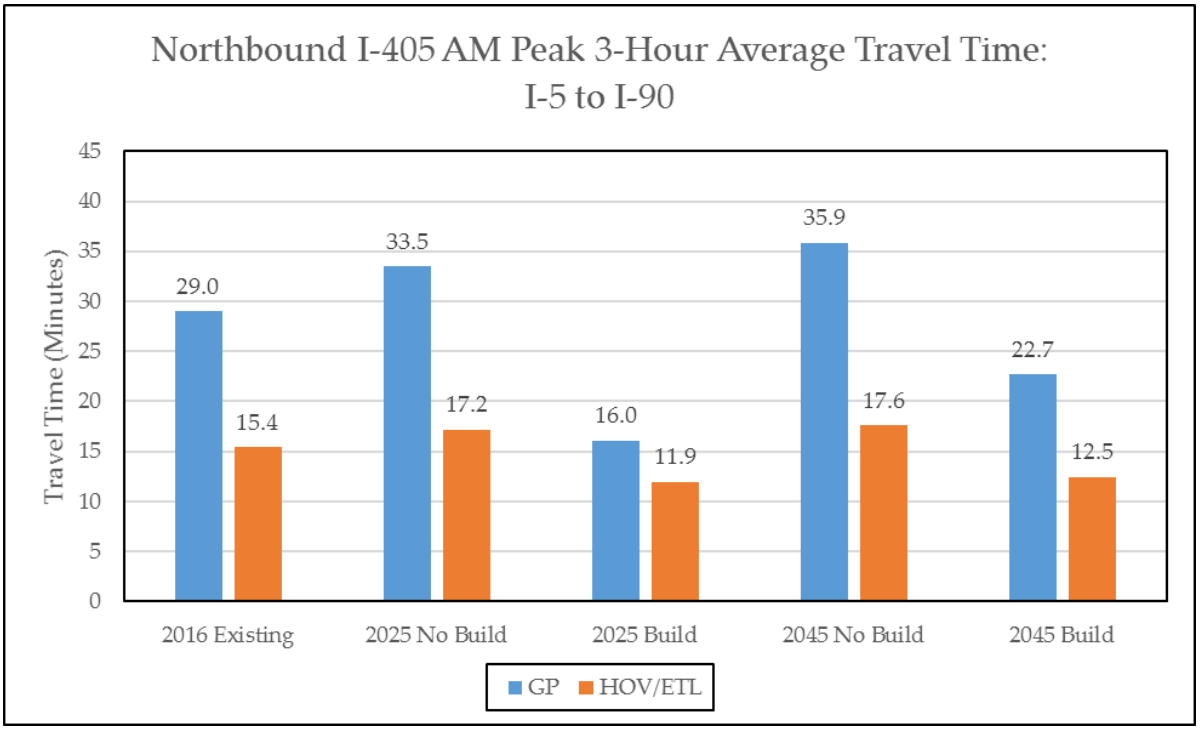
No Build Freeway Travel Times

Freeway travel times from the VISSIM modeling efforts were collected for two trip pairs, from I-5 in Tukwila to I-90 and from I-90 to SR 520. Exhibit 5-2 shows the reported average 3-hour travel times for existing, 2025, and 2045 No Build and Build for GP and HOV/express toll lane trips.

When traveling at the posted speed limit (60 mph), the trip between I-5 and I-90 should take about 11.9 minutes and the trip between I-90 and SR 520 should take about 2.7 minutes.

During the AM period, northbound I-405 experiences heavy congestion in Renton, which would continue to worsen in the future without the Projects. During the PM period, southbound I-405 experiences high congestion through downtown Bellevue into the Coal Creek Parkway interchange area and at points farther south in Renton, which would continue to worsen in the future. Vehicle travel times in both segments would increase for GP and HOV with the 2025 and 2045 No Build.

Exhibit 5-2. I-405 AM and PM Peak 3-Hour Average Travel Times, Sheet 1 of 4



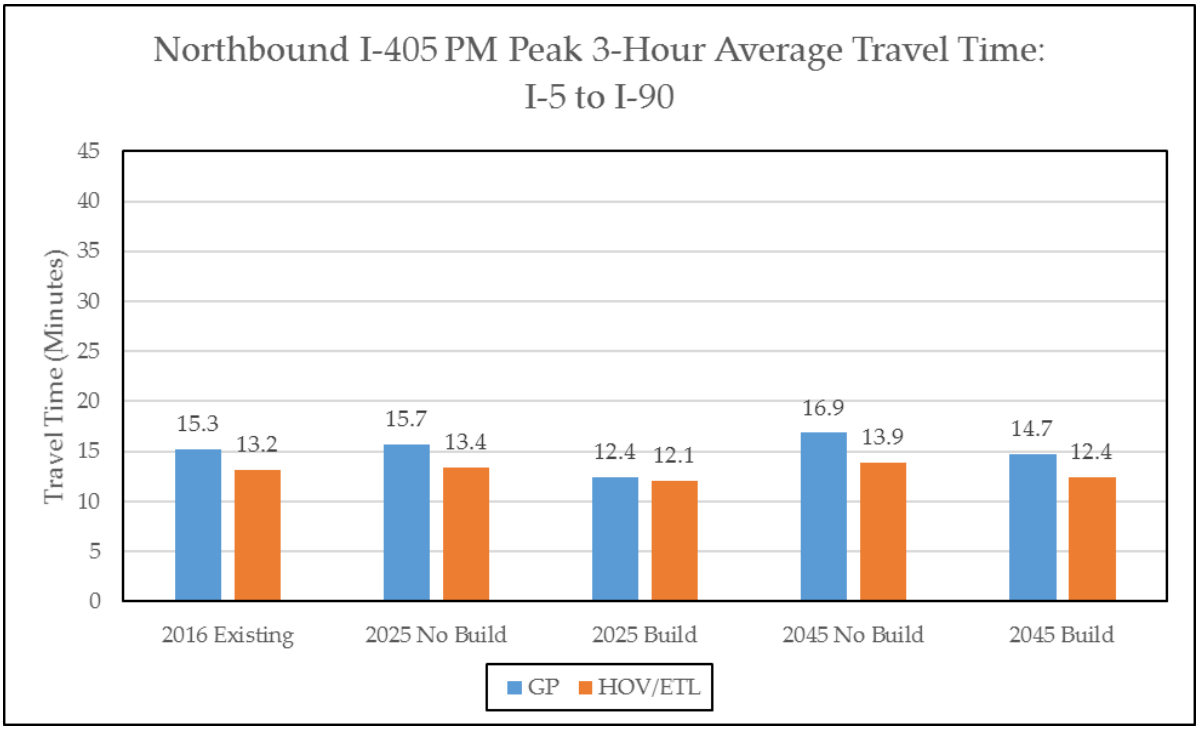
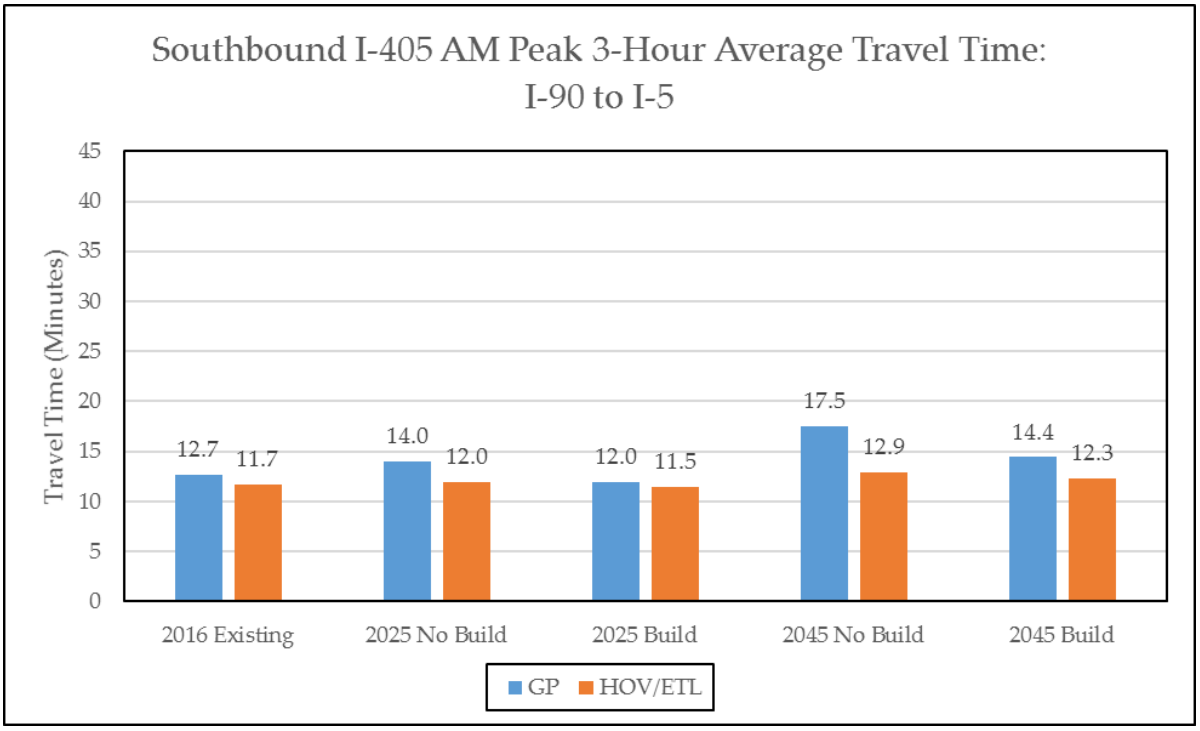


Exhibit 5-2. I-405 AM and PM Peak 3-Hour Average Travel Times, Sheet 2 of 4



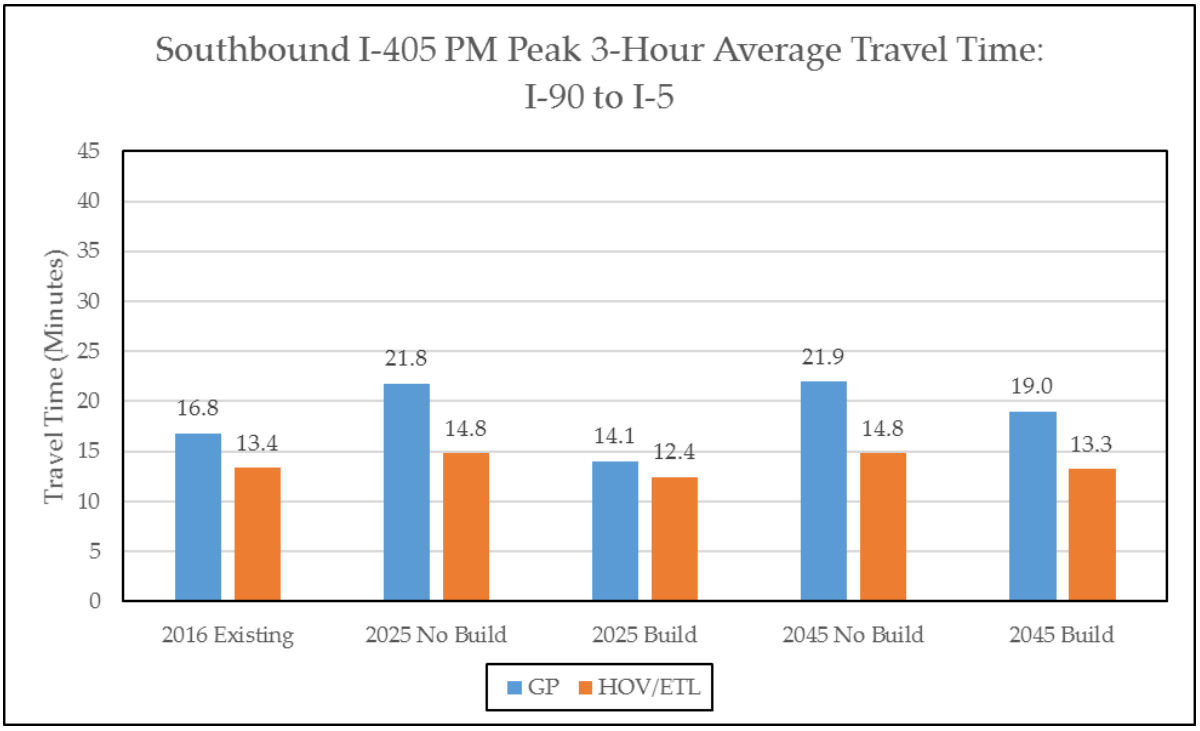
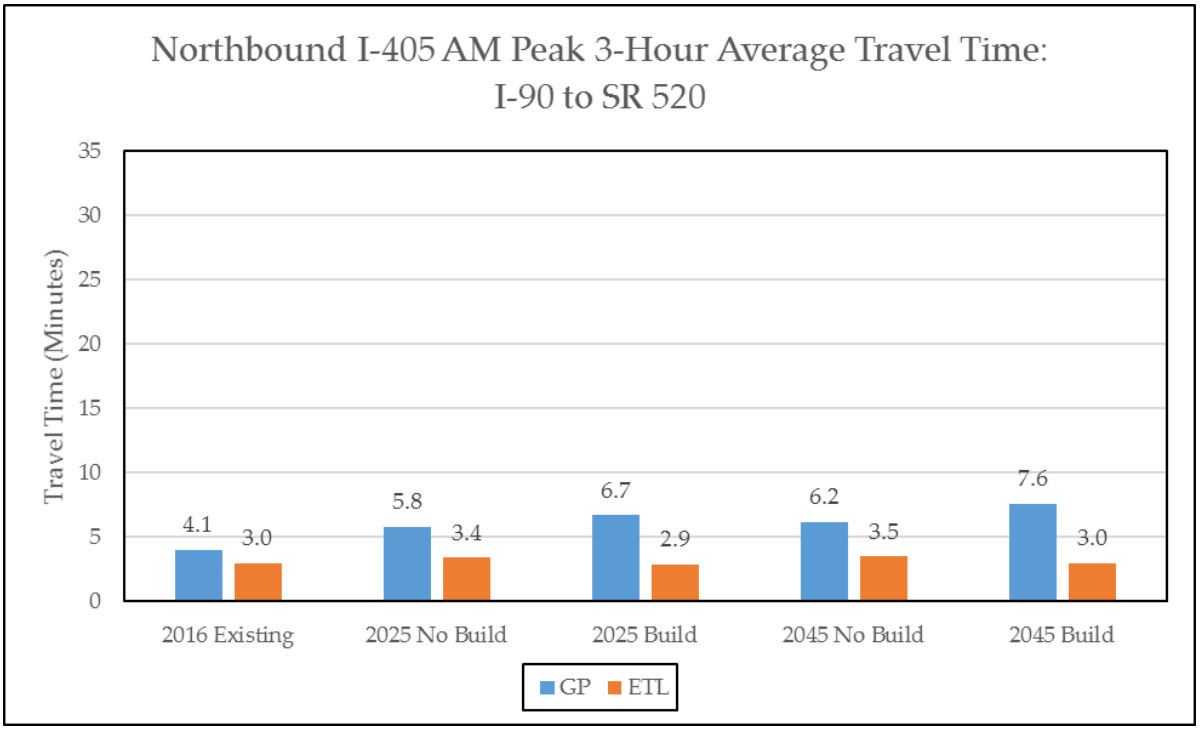


Exhibit 5-2. I-405 AM and PM Peak 3-Hour Average Travel Times, Sheet 3 of 4



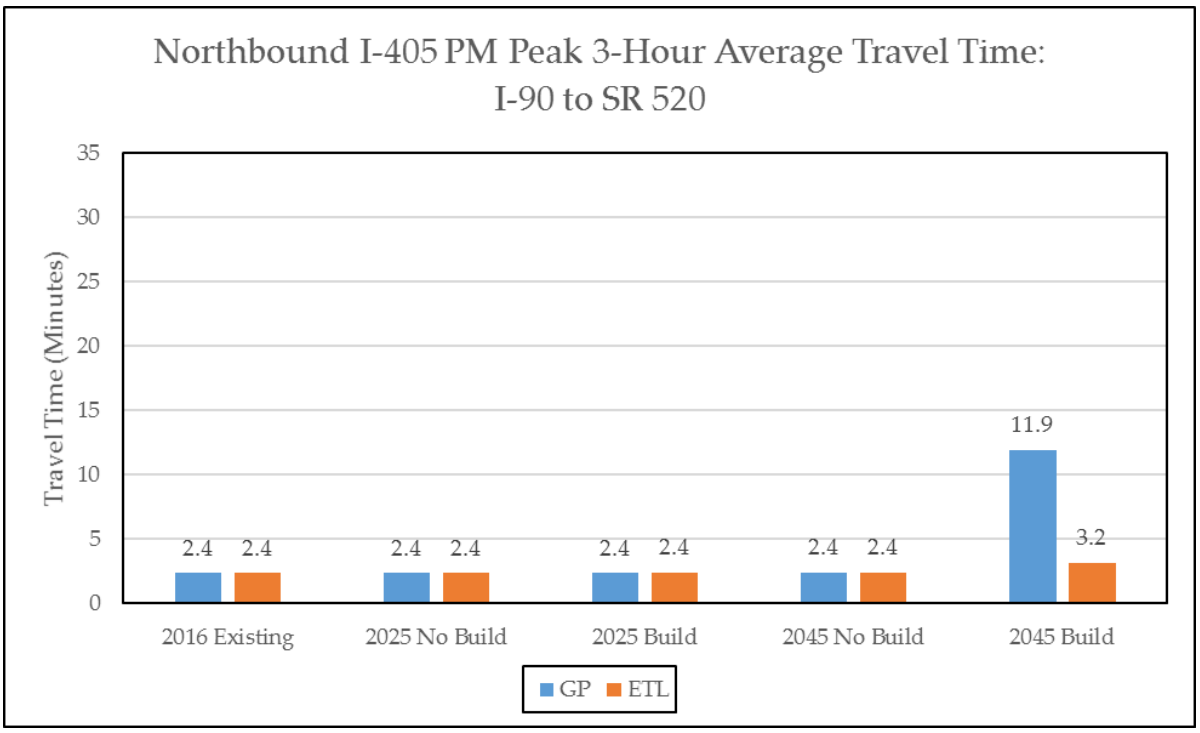
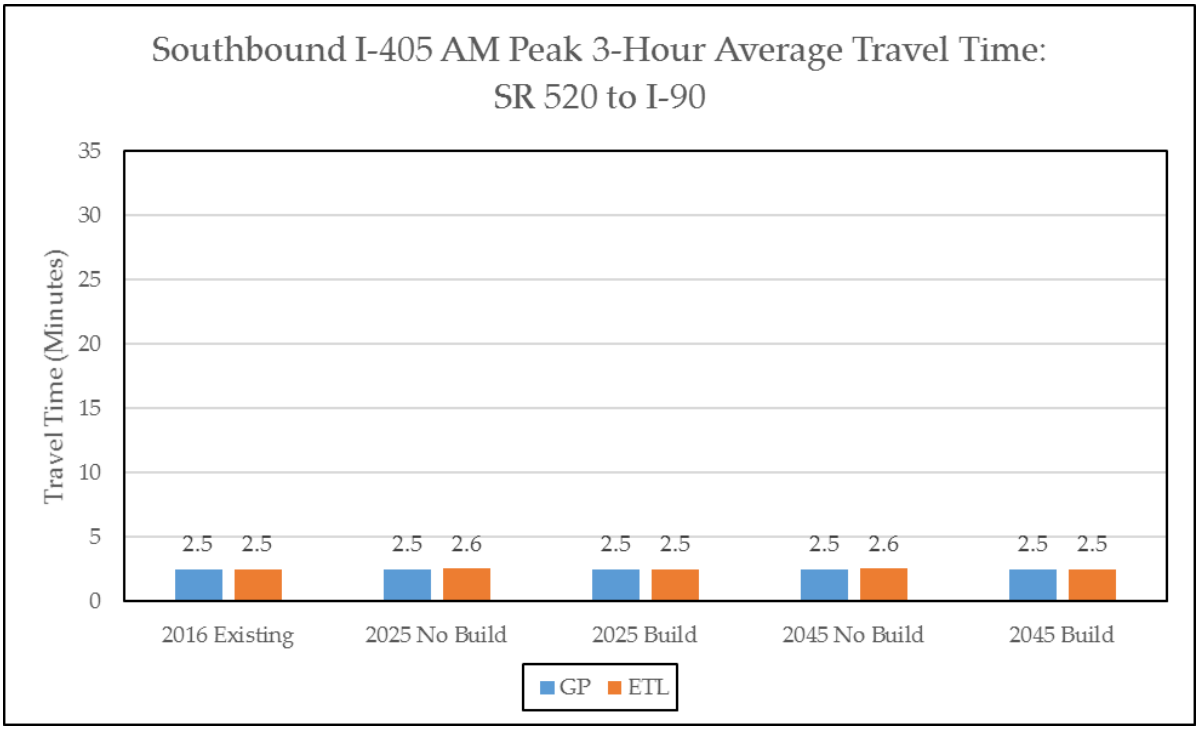
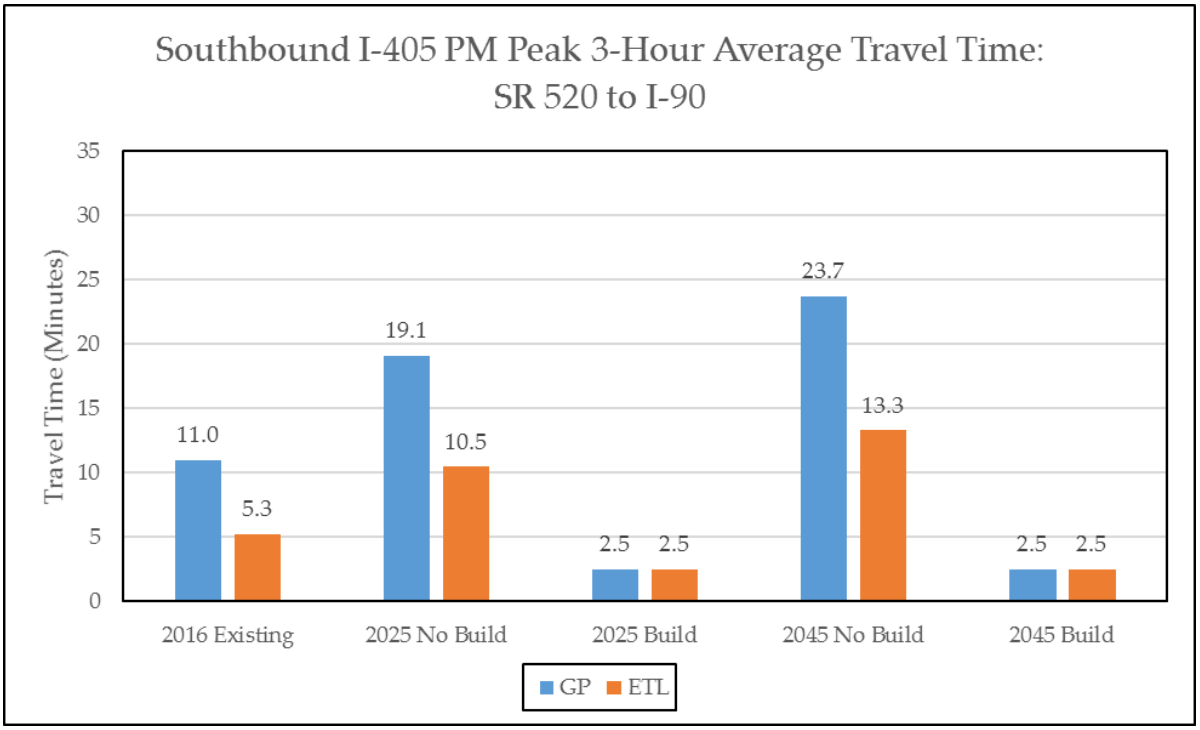


Exhibit 5-2. I-405 AM and PM Peak 3-Hour Average Travel Times, Sheet 4 of 4

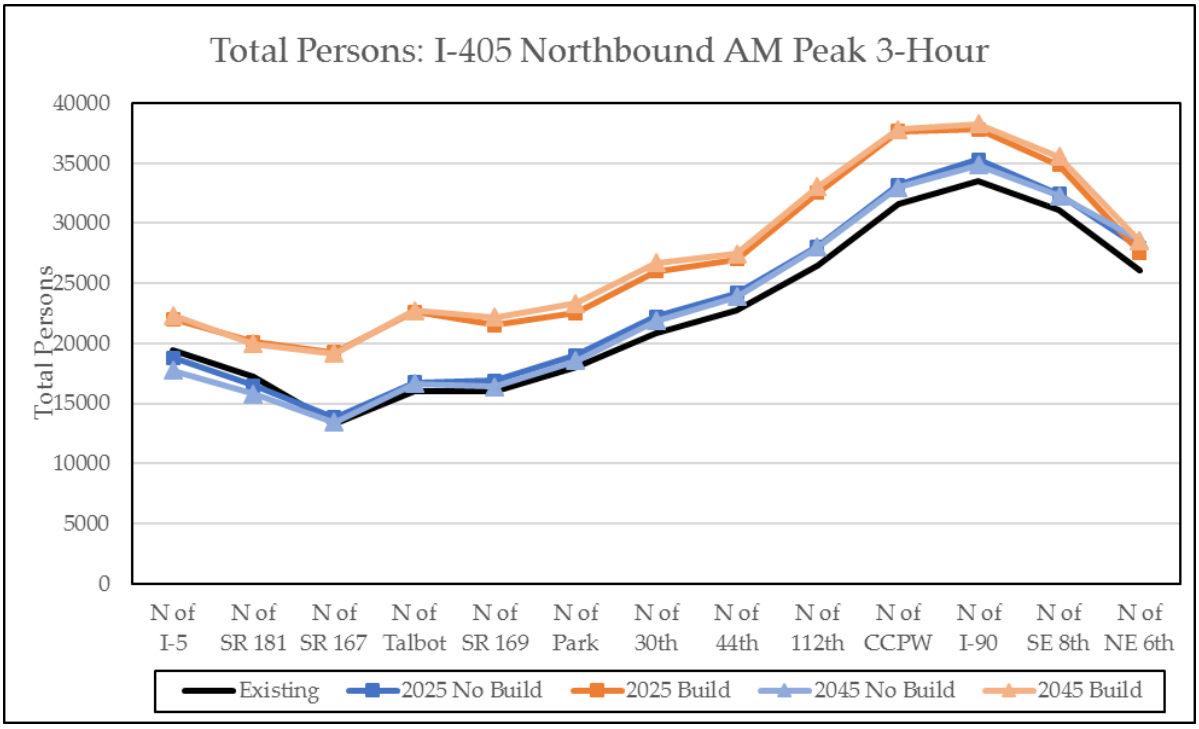




No Build Freeway Person Throughput

Person throughput is the number of persons moved through various freeway sections, which accounts for the occupancy of the different vehicles using the system. Exhibit 5-3 shows peak 3-hour, directional person throughput on I-405 for existing conditions, No Build, and Build. Appendix G, 3-Hour Vehicle and Person Throughput, provides this information in tabular format.

Exhibit 5-3. I-405 AM and PM Peak 3-Hour Total Person Throughput, Sheet 1 of 2



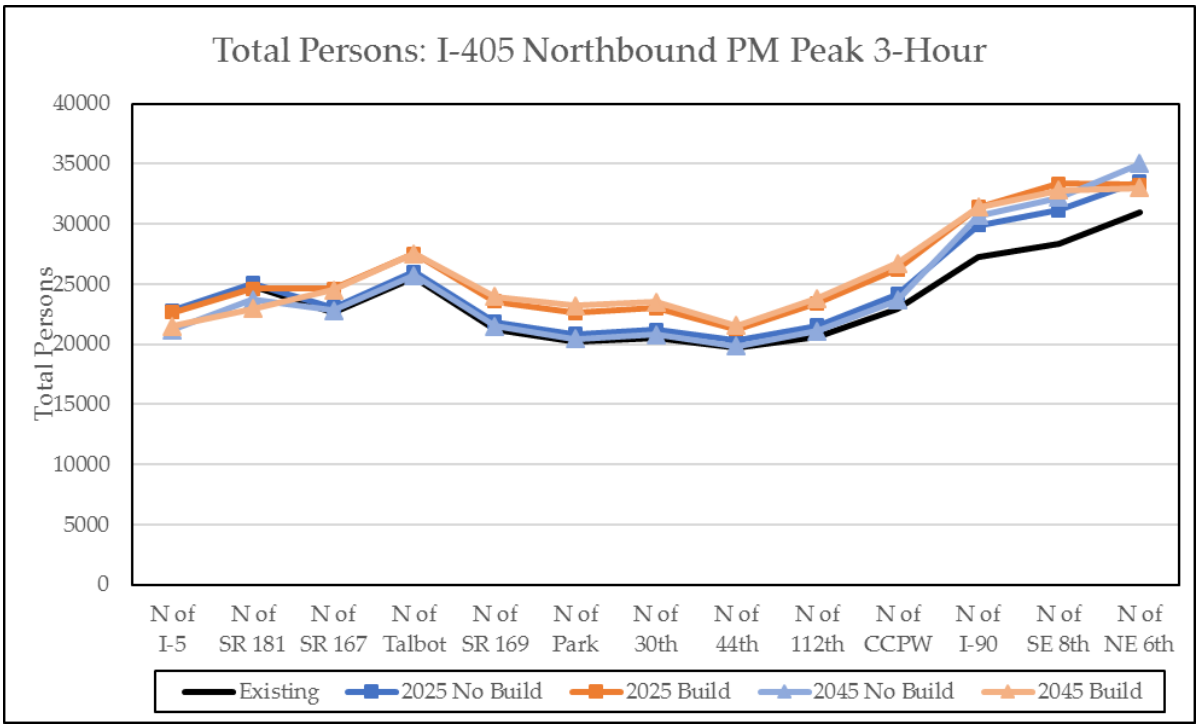
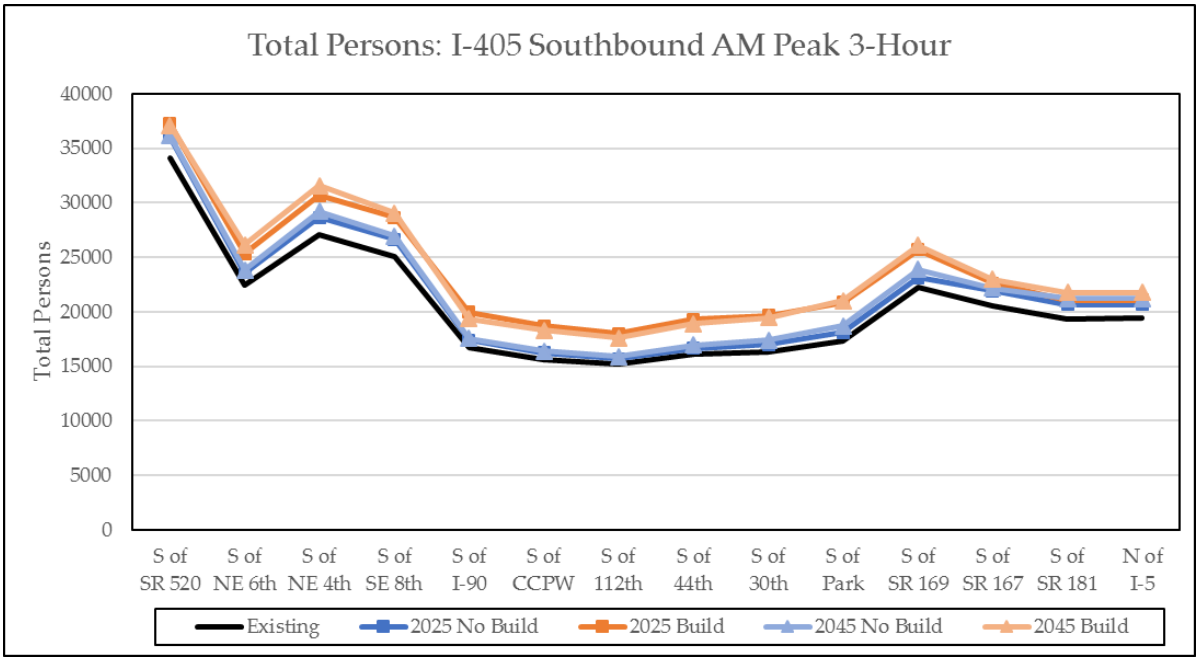
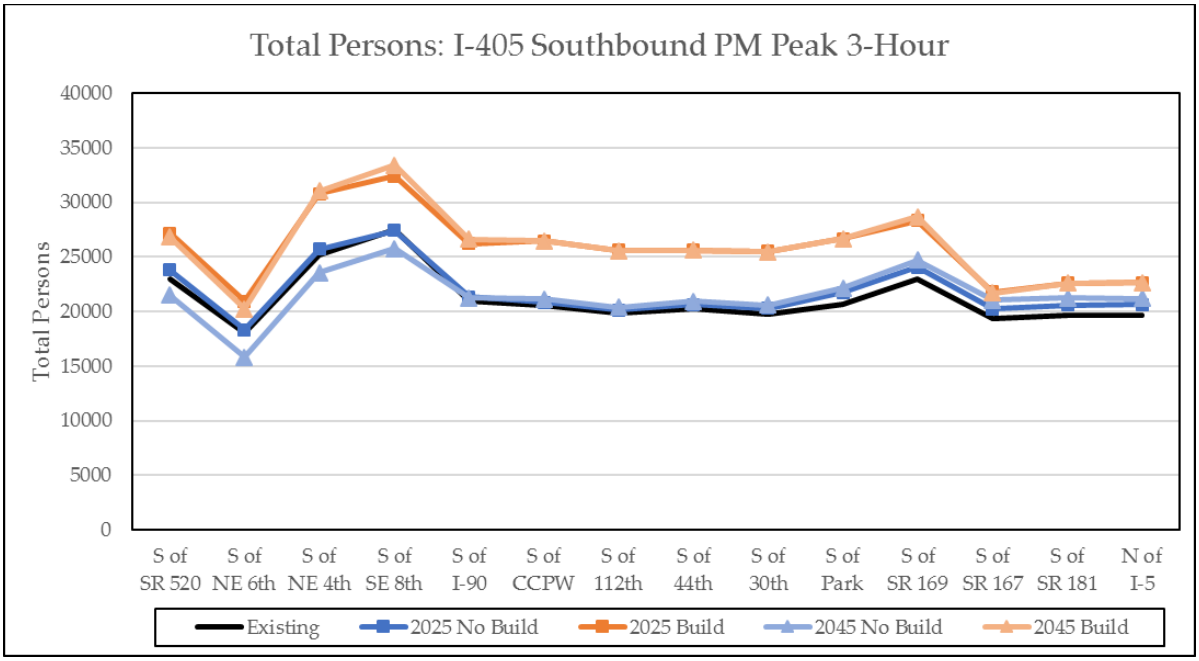


Exhibit 5-3. I-405 AM and PM Peak 3-Hour Total Person Throughput, Sheet 2 of 2





No Build Freeway Operations

Exhibits 5-4 through Exhibit 5-7 show the 2025 and 2045 No Build, AM, and PM period operations by direction and lane type from the VISSIM analysis.

Operations would degrade at existing bottleneck locations with the 2025 and 2045 No Build. The reduction in operations would affect both GP and HOV lane speeds and volumes throughout the study area. While demand would increase in these congested sections, the total throughput volume during congested periods would be typically similar to existing conditions and, in some cases, would decrease due to decreased capacity through bottlenecks.

How reliable would the HOV lanes be under No Build?

This section details the speed performance of HOV lanes over entire segments throughout the 6-hour peak period. During the most congested periods at bottleneck locations, HOV facilities would experience congestion that would limit the reliability of transit and carpool trips.

In both 2025 and 2045, freeway speeds under No Build would be slower compared to existing conditions. During the AM peak period, the extent and duration of congestion would continue to degrade. On northbound I-405, congestion would extend between NE 44th Street and I-5 and spill back onto northbound SR 167 and I-5. The northbound HOV lane would also operate with slow speeds.

During the PM peak period, the bottleneck at Coal Creek Parkway on southbound I-405 would remain. Congestion would continue to spill back from this location, through downtown Bellevue and into south Kirkland. The I-90 and SR 520 mainlines would also be affected by congestion spilling back from this location. The HOV lane would continue to operate poorly through this area. Farther south, congestion would continue to occur in Renton. By 2045, congestion would occur throughout most interchanges along southbound I-405. Congestion on northbound I-405 would also continue, starting near the NE Park Drive interchange, and extending south to I-5 in both 2025 and 2045.

Exhibit 5-4. I-405 Operations – 2025 No Build AM Period

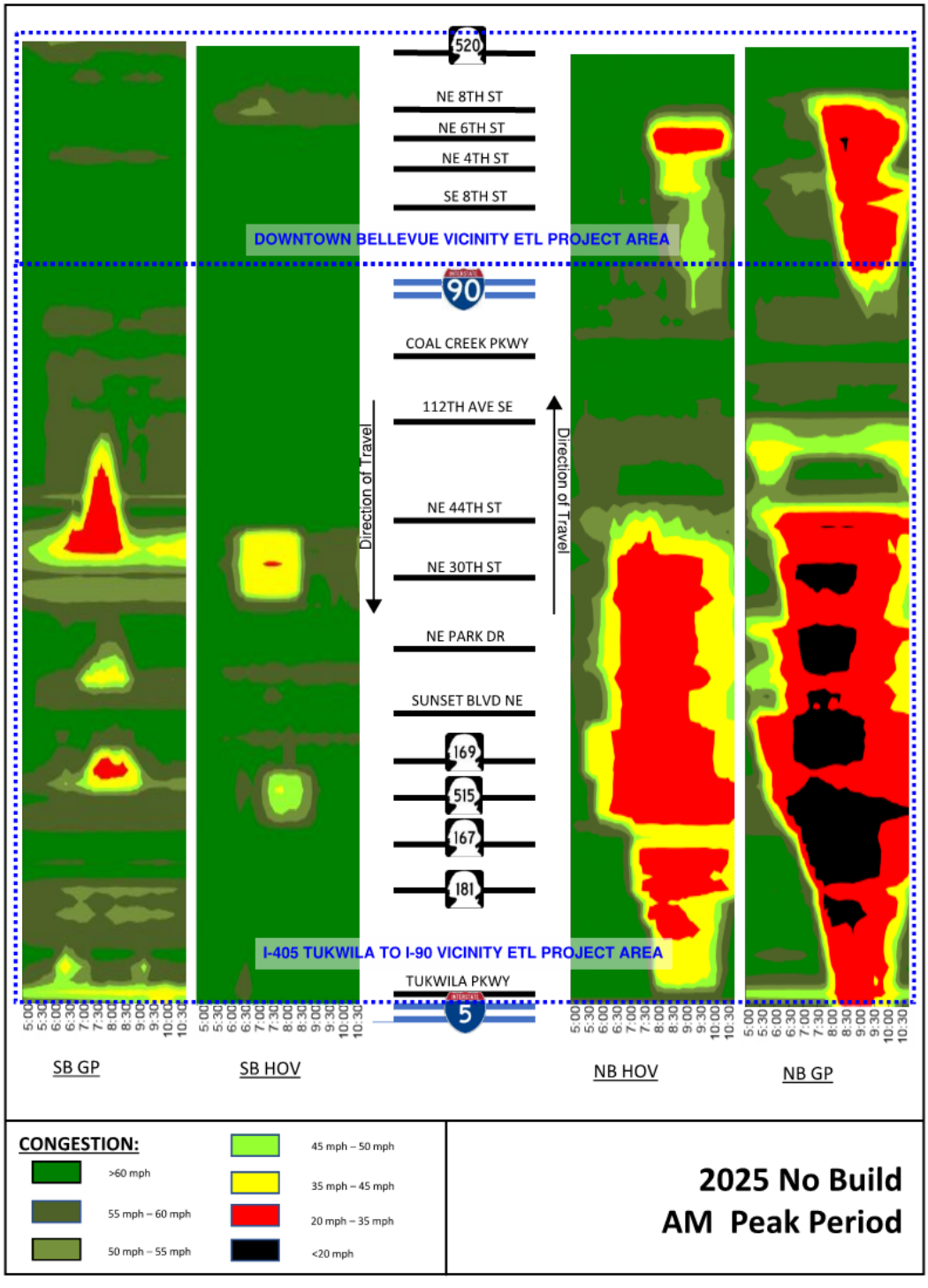


Exhibit 5-5. I-405 Operations – 2025 No Build PM Period

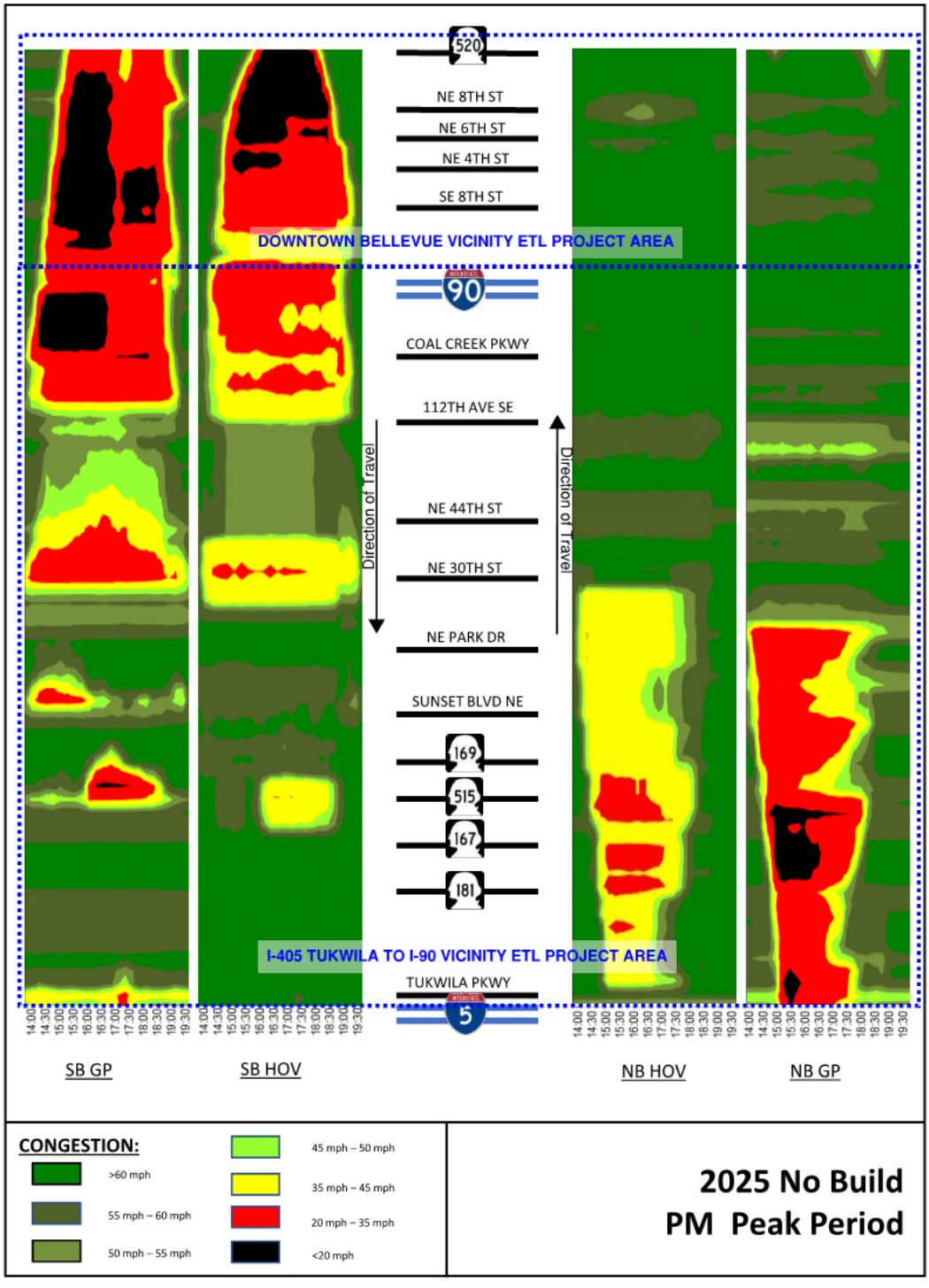


Exhibit 5-6. I-405 Operations – 2045 No Build AM Period

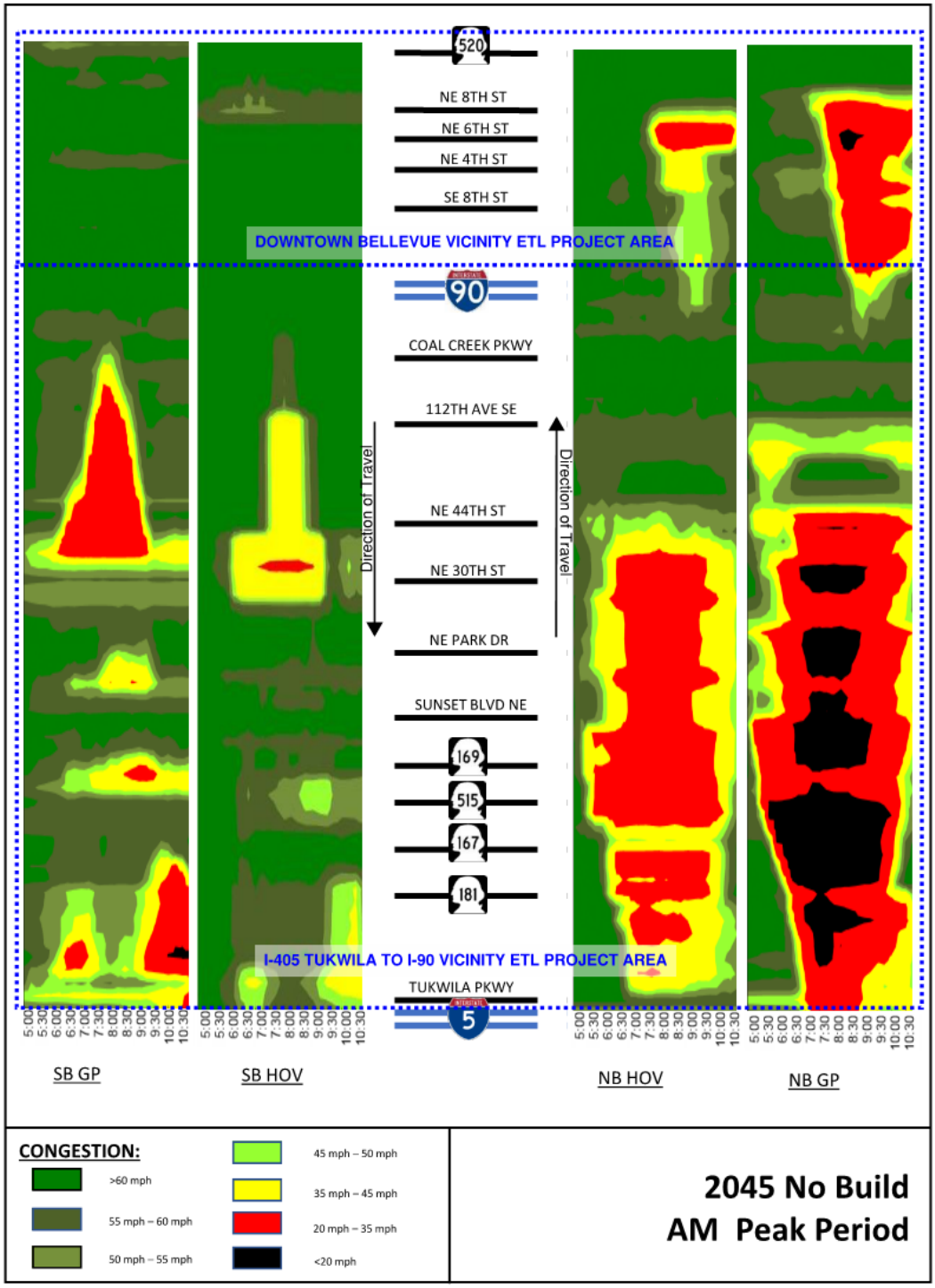
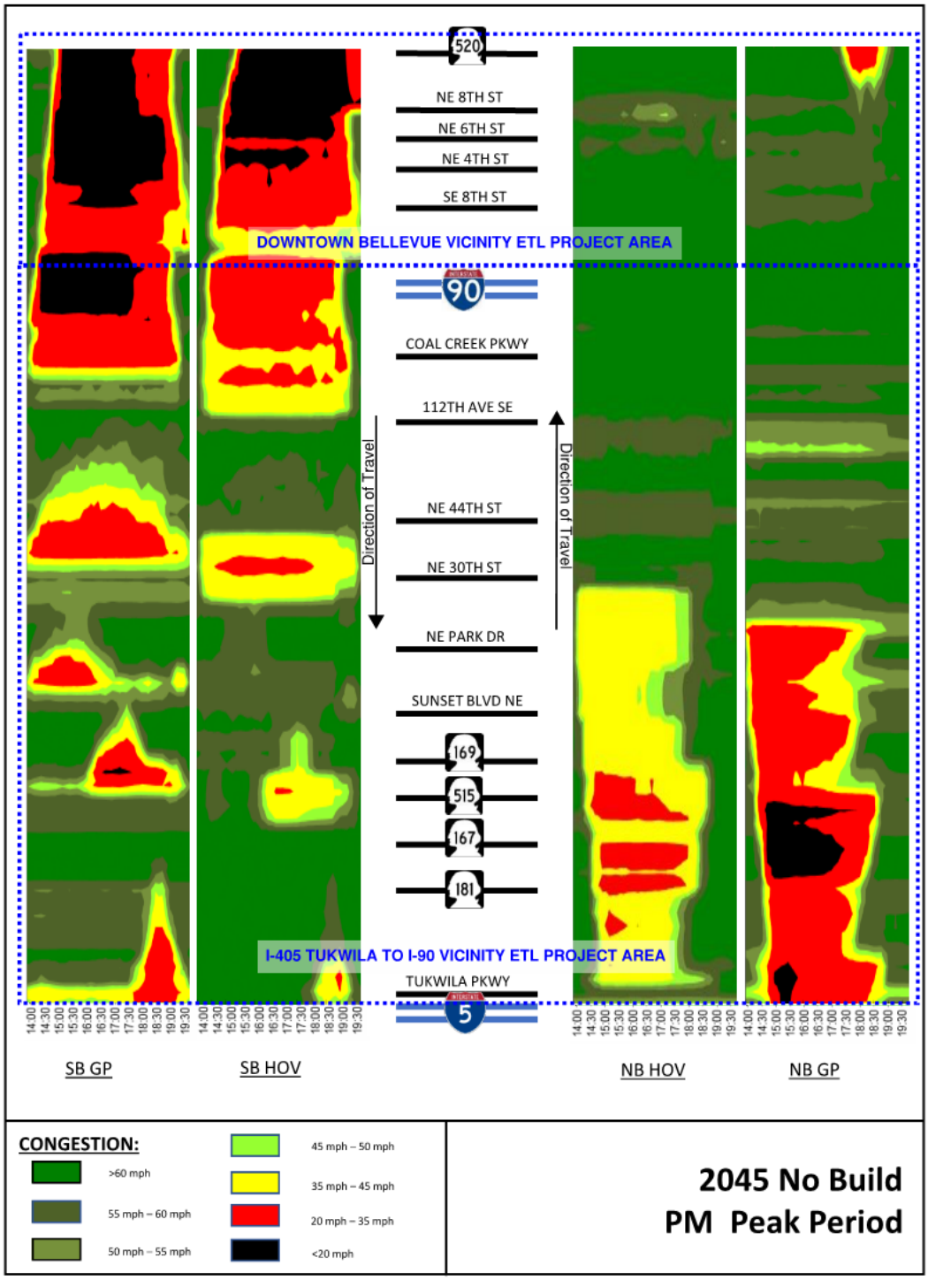


Exhibit 5-7. I-405 Operations – 2045 No Build PM Period



No Build Local Intersection Operations

We analyzed future year traffic operations using Synchro for signalized and unsignalized intersections and Sidra for roundabouts. These models calculate intersection LOS and delay for the No Build. Appendix E, Intersection Analysis Results, shows results of the local intersection analysis, with both Synchro and Sidra results presented with the 2025 and 2045 No Build.

Higher traffic demands are expected at all study intersections, which would degrade operations compared to existing conditions; however, most of the projected growth would occur outside the peak hour because network congestion would limit the amount of additional volume during the peak hour.

We developed future No Build Synchro models that considered volume forecasts and optimized signal timings. As with existing conditions, queuing from adjacent intersections may not always be reflected in LOS performance as measured using HCM methodologies.

The No Build modeling results show similar failing intersections as existing conditions, despite higher demand. By 2025, improvement projects would add capacity to the two-ramp terminal intersections at NE 44th Street and the intersection of NE 44th Street and Seahawks Way. We expect these three intersections to be signalized and have additional capacity. These improvements are required mitigation by new developments near the interchange. These three intersections would operate better than in 2016, despite traffic volume increases, because of these improvements.

Under No Build in the 2025 AM peak hour, two intersections would operate at LOS E or worse, with an additional five intersections operating with at least one approach at LOS E or worse. The remaining intersections would operate at LOS D or better. In the 2045 AM peak hour, three intersections would operate at LOS E or worse, with an additional five intersections with at least one approach operating at LOS E or worse. The remaining intersections would operate at LOS D or better.

In the 2025 PM peak hour, four intersections would operate at LOS E or worse, with at least one approach operating at LOS E or worse. The remaining intersections would operate at LOS D

or better. In the 2045 PM peak hour, eight intersections would operate at LOS E or worse, and four additional intersections would operate with at least one approach operating at LOS E or worse. The remaining intersections would operate at LOS D or better.

No Build Ramp Queuing

WSDOT monitors and manages ramp terminal signals to minimize ramp queueing from affecting I-405 mainline operations whenever possible. Under existing conditions, ramp queuing at ramp terminal intersections can queue back and affect traffic operations on the mainline. While some signalized ramp terminal approaches may operate at LOS E or F, the anticipated queue length would not exceed provided capacities.

No Build Safety Performance

As described in previous sections, I-405 would become more congested with No Build compared to 2016 existing conditions. The resulting congestion is assumed to increase the number of congestion-related crashes in the study area.

No Build Transit Operations

Transit vehicles experience delay because congestion is present throughout peak periods under existing conditions in HOV lanes throughout the study area. Congested conditions would continue to worsen in No Build future years, thus, further degrading transit operations. This would reduce transit reliability and create more transit travel time variability. Transit agencies that use the I-405 in the study area would be required to account for this increased variability in their budgeting and time schedules in the future. Funded transit investments as part of the ST3 package include BRT within the study area that anticipates the use of express toll lanes for speed and reliability. With No Build, the Sound Transit BRT system would not operate within an express toll lane through any portion of the study area, which would decrease reliability.

No Build Freight Mobility

With No Build, freight would be affected by increased congestion relative to existing conditions. This increase in congestion would affect freight routes throughout the study area for additional hours of congestion relative to existing conditions.

No Build Pedestrian and Bicycle Facilities

Pedestrian travel and bicycle travel would continue to be prohibited, as they are now, on I-405 under No Build. Current pedestrian and bicycle travel provided in the area would remain with the No Build, with area agencies planning to improve connections for the current Eastside Rail Corridor Regional Trail beyond the existing facility.

Build

Build Description

The Build Alternative includes all the assumed future year roadway projects included under No Build and the elements discussed in Section 2, Project Description, for the Tukwila to I-90 Project and the Downtown Bellevue Project. With the Build Alternative, the I-405/SR 167 Direct Connector would be part of the regional 40-mile-long toll lane system and would operate as a tolled facility.

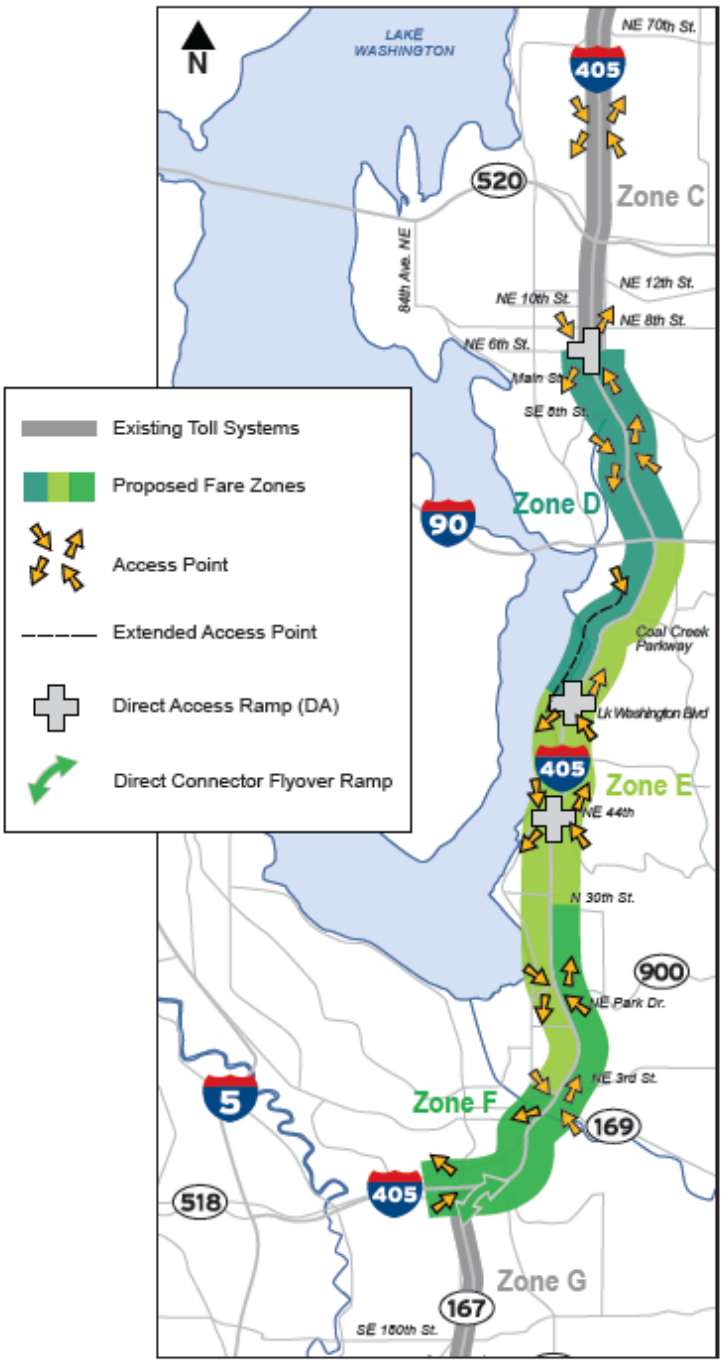
Regional Tolling with the Build Alternative

The Tukwila to I-90 Project and Downtown Bellevue Project are key components of a regional express toll lane system. These projects would connect the existing Bellevue-to-Lynnwood express toll lane system to the SR 167 HOT lane system. The I-405/SR 167 interchange direct connector ramps would connect the SR 167 system to the I-405 system. The SR 167 system is assumed to be converted to an express toll lane system with destination pricing. Additional discussion regarding destination-based pricing is provided in the section below.

When these projects open, there would be one combined 40-mile-long toll lane system between Auburn and Lynnwood. If the SR 167 system is not converted to an express toll lane, the projects, along with the I-405/SR 167 Direct Connector, would still link the two existing systems. With the projects, a user would be able to use all three systems during their trip. Exhibit 5-8 shows the extents of the express toll lane system in the study area, proposed access locations, fare zones, and system decision points.

Exhibit 5-8. Renton to Bellevue Express Toll Lane System

Renton to Bellevue Express Toll Lanes Access Points



Express Toll Lane Operations

At this time, the Washington State Transportation Commission (WSTC) has not established operational hours, user exemptions, occupancy requirements, and operating parameters for the express toll lanes proposed with the Project. The WSTC would set operational requirements for the express toll lanes prior to opening day. For this analysis, we assumed the requirements for the current I-405, Bellevue-to-Lynnwood express toll lane system would be used for this Project. These assumptions, listed below, represent the most recent operating guidance from the WSTC for express toll lanes:

- **Limited Access** – The system would have designated entry and exit points, with a buffer between the express toll lanes and the GP lanes. These access points would vary in length, depending on the location.
- **Dynamic and Destination Pricing** – The I-405 express toll lane system would use both dynamic and destination pricing to determine the travelers toll at the time they enter the express toll lane. With dynamic tolling, rates vary based on congestion within the corridor to maintain performance. Electronic signs would be used to communicate the current toll rate for drivers. Toll rates are updated every few minutes, but the driver's price is set when they enter the system. With destination pricing, the toll price is based on the driver's destination. Toll signs would show up to three toll rates for different toll zones, or destinations. Drivers would pay the rate they see upon entering the express toll lanes to reach their destination, even if they see a different toll rate for their destination farther down the road. When both pricing approaches are used together, it means that the toll that drivers pay is based both on the congestion in the corridor and the distance they are travelling.
- **Operating Hours and *Good To Go!* Passes** – The express toll lane system is expected to operate from 5 a.m. to 7 p.m. on weekdays, with the system toll-free and open to all at other hours and on major holidays. Transit, HOVs, and motorcycles would need to have a *Good To Go!* pass to use the express toll lanes for free

How does dynamic pricing work?

Electronic monitors along the roadway measure real-time information on the speed, congestion, and number of vehicles in the express toll lanes. This information is used to determine whether tolls go up or down to optimize lane use.

As the express toll lanes become congested, toll rates increase, and as congestion decreases, toll rates decrease. The use of dynamic pricing allows the lanes to operate with high volumes but avoid becoming congested.

during operating hours. Eligible HOV users would be required to set the *Good To Go!* pass to the HOV mode to avoid charges. SOVs could choose to pay a toll to use the express toll lanes during operating hours with or without a *Good To Go!* pass.

- **Occupancy Requirement**s – During the peak periods (weekdays from 5 a.m. to 9 a.m. and 3 p.m. to 7 p.m.), transit vehicles and carpools with three or more persons (HOV 3+) would be able to use the lanes for free with a *Good To Go!* pass. From 9 a.m. to 3 p.m., the system would be open toll-free to those with two or more passengers with a *Good To Go!* pass. Motorcycles ride toll-free in the express toll lanes with a *Good To Go!* pass. During non-operating hours, SOVs will not be permitted to enter the express toll lanes from ramps where access is provided directly from local streets. SOV access will only be permitted from freeway GP entry and exit points.
- **Vehicle Weight** – Vehicles over 10,000 pounds gross vehicle weight would be prohibited, which is consistent with HOV lane restrictions throughout Washington.
- **Electronic Tolling** – Payments would be made via electronic tolling with a *Good To Go!* pass. For drivers who choose not to use a *Good To Go!* Pass, WSDOT offers optional photo billing (pay by mail) for an extra fee.

When would tolls be charged to use the express toll lanes?

It is assumed the express toll lanes would operate from 5 a.m. to 7 p.m. on weekdays. At all other times and major holidays, the lanes would be free and open to all without a *Good To Go!* pass.

During operating hours:

· SOVs would pay a toll to use the lanes.

· Transit, HOV 3+, and motorcycles would travel for free with a Good To Go! pass.

· HOV 2+ would travel for free from 9 a.m. to 3 p.m. with a *Good to Go!* pass. From 5 a.m. to 9 a.m. and 3 p.m. to 7 p.m., HOV 2+ would pay a toll to use the express toll lanes with or without a *Good To Go!* pass.

· Large vehicles over 10,000 pounds gross vehicle weight would not be able to use the express toll lanes at any time.

Express Toll Lane Access

Express toll lane access would be provided via a combination of direct access ramps and weaving areas, as shown in Exhibit 5-8. Four interchanges would provide direct access to the express toll lanes. Where direct access ramps are not present, access to and from the express toll lanes would be provided via weaving areas. Each weaving area would have a skip stripe between the express toll lane and GP lanes, indicating access is allowed. Advance signage ahead of direct access ramps and weaving areas would show the appropriate freeway exits at each access point and the given toll rate(s) to enter the express toll lanes.

Express Toll Lane Management and Rate Setting

Posted toll rates would be based on real-time traffic conditions. Similar to the Bellevue-to-Lynnwood express toll lane system, we expect toll rates to be updated every few minutes based on how many cars are in the express toll lanes and how fast they are going. We would operate the system to keep express toll lane traffic moving and would set the toll rates to accomplish this goal.

What is a system decision point?

A Decision Point is the location between express toll lane facilities where a user makes the choice to continue in the express toll lane by paying a new and separate toll or exit from the express toll lane into the GP lanes without incurring an additional charge.

Tolls would be collected in the express toll lanes to manage traffic conditions, not for revenue generation. When traffic is flowing and there is available capacity in the express toll lanes, we would set toll rates to encourage more cars to use them. Conversely, as the lanes start to fill up, toll rates would rise to discourage too many cars from entering the lanes so we can provide a reliable and efficient trip. When I-405 becomes a tolled facility in the study area, FHWA performance metrics requires the express toll lanes to operate so that carpools, transit, and paid users receive a reliable trip at 45 mph for 90 percent of the time.

We projected tolled volume, rates, and revenue for the full 40-mile express toll lane system. Peak-period, peak-direction toll rates are projected to reach and exceed the current $10.00 toll cap in place for the Bellevue-to-Lynnwood express toll lane system in both 2025 and 2045 and exceed $10.00 in the Renton to Bellevue system by 2045. The express toll lanes are expected to operate at capacity through congested sections of the I-405 corridor. This analysis allowed toll rates to exceed the current $10.00 WSTC-set maximum toll rate to represent a condition in which the express toll lanes would be expected to meet the WSTC's policy to manage demand so that carpools, transit, and paid users receive a reliable trip.

Further WSTC action would dictate tolling policy updates. We anticipate any policy changes to remain consistent with the express toll lane purpose to manage demand. If future tolling policy is inconsistent with the assumptions of this report, operations in the express toll lane system and adjacent GP lanes would be different than what is described herein. Notably, if the current $10.00 toll cap is maintained into the future, express toll lane system performance would degrade compared to the results presented in this report.

System Decision Points and Fare Zones

The Projects would connect the existing Bellevue-to-Lynnwood express toll lanes to the SR 167 HOT lanes; however, each toll lane "system" would operate independent of each other. A decision point is the location between each toll lane system where a user makes a choice. A user can continue in the express toll lane by paying a new and separate toll or exit the express toll lane into the GP lanes without incurring an additional charge. At each system decision point, a toll rate sign would include destinations that were not displayed in the previous express toll lane system. With the Projects, system decision points would be located near NE 6th Street in Bellevue and SR 167 in Renton.

The Projects' express toll lanes would have destination-based pricing. We expect to have three fare zones between SR 167 and NE 6th Street. The fare zones are indicated in green in Exhibit 5-8. Dynamic message signs would show a toll rate for each available destination zone. A user's trip would be assigned the toll rate associated with a destination fare zone as displayed on the sign when the vehicle entered the express toll lane. Any express toll lane exit in that zone would be charged the same toll rate until a user passes the next-listed road and enters a new fare zone. Similar to the Bellevue-to-Lynnwood express toll lane system, a user would only pay the toll rate for the fare zone where they exit the express toll lanes.

Toll Revenue

Federal law and state law provide specific requirements on how toll revenues can be used. Federal law regarding the use of toll revenues is contained in 23 USC Section 129 (a)(3). This law states that all toll revenues received from operation of the toll facility are used for such things as debt service, a reasonable return on investment for any private financers of the project, operations and maintenance costs, and payments associated with any public-private partnership agreements.

In addition to these federal requirements, the RCW 47.56.820 requires that all revenue from an eligible toll facility must be used only to construct, improve, preserve, maintain, manage, or operate the eligible toll facility on or in which the revenue is collected. Similar to the federal law, expenditures of toll revenues must be approved by the state legislature and must be used only to cover operations and maintenance costs; to

repay debt, interest and other financing costs; and to make improvements to the eligible toll facilities.

As required by state law, all toll revenue generated from the Projects' express toll lanes would be used to construct, improve, preserve, maintain, manage, or operate the I-405 corridor.

Build Express Toll Lane Transition Areas

The Projects' express toll lane system would connect into existing facilities at the southern and northern terminus. As discussed in the previous section, the Projects' express toll lane system would connect with the Bellevue-to-Lynnwood express toll lane system to the north and the SR 167 HOT system to the south. This section discusses the terminus areas of the express toll lane system in the study area.

Northern Terminus: Southbound

Currently, the two-lane portion of the Bellevue-to-Lynnwood express toll lane system terminates with a single lane exit to NE 6th Street, and the second express toll lane transitions to an HOV 2+ lane. An access area is provided for toll-paying users to exit into the GP lanes and the HOV 2+ users to weave into the new HOV 2+ lane. With the Projects, the single lane would continue as an express toll lane and a second express toll lane would begin as an add-lane from the NE 6th Street southbound on-ramp. There would be a mainline access point at the NE 6th Street interchange area.

Northern Terminus: Northbound

Currently, the two-lane portion of the Bellevue-to-Lynnwood northbound express toll lane system begins by transitioning from a single HOV 2+ lane to a single express toll lane south of the NE 6th Street interchange, with the second express toll lane forming as an add-lane from the NE 6th Street northbound on-ramp (see Exhibit 2-2 in Section 2, Project Description). There is a transition area for HOV 2+ users to exit the lane and express toll lane users to enter the lane. With the Projects, there would be two express toll lanes south of this area, with a single-lane exit to the NE 6th Street exit ramp and the second express toll lane continuing as a single express toll lane through the NE 6th Street interchange area. The second express toll lane from the NE 6th Street northbound on-ramp would match existing conditions. There would be a mainline access point within the NE 6th Street interchange area.

I-405/SR 167 Direct Connector

The I-405/SR 167 direct connector ramps would operate as an HOV 2+ lane matching the HOV designation on I-405 in the study area prior to the Projects' opening. With the Projects, this HOV facility would be converted along with the existing I-405 HOV lane to be part of the express toll lane system, which would give express toll lane users on SR 167 and I-405 the option to use both facilities without exiting the express toll lane system. We assume the I-405/SR 167 would be tolled during normal operating hours and is a toll system decision point.

Southern Terminus: Southbound

The two-lane express toll lane system through Renton would have a single lane continue south through the SR 167 interchange, while the leftmost express toll lane would drop into the southbound I-405 to southbound SR 167 direct connector ramp. The single-lane would end south of SR 167, where there would be a transition area for express toll lane users to exit the lane and HOV users to enter the lane as it transitions to a HOV 2+ lane heading toward the I-5 interchange. Lane configurations and HOV designations on I-405 approaching I-5 would remain unchanged from existing conditions.

Southern Terminus: Northbound

The two-lane express toll lane system through Renton would begin with a single-lane add from the northbound SR 167 to northbound I-405 direct connector ramp. The second lane would begin at the SR 167 interchange, where the single HOV 2+ lane would transition to an express toll lane. There would be a transition area for express toll lane users to enter the lane and HOV users who do not wish to use the express toll lane to exit the lane south of SR 167. Lane configurations and HOV designations on I-405 between I-5 and SR 167 would remain unchanged from existing conditions.

Build Daily Traffic Volumes

The transportation analysis defined weekday daily traffic volumes as two-directional totals (HOV and GP) with northbound and southbound traffic added together. We anticipate future regional population and employment growth in the region, so freeway traffic demand would continue to increase in the future.

With the Build Alternative in 2025, I-405 between I-5 and SR 167, total daily traffic volumes are expected to be 200,000, which is an increase of 5 percent compared to 2025 No Build. SR 169 and SR 900 would carry 200,000 vehicles per day, an 18 percent increase over the 2025 No Build. Approaching downtown Bellevue between I-90 and SE 8th Street, I-405 would carry 279,000 vehicles per day, a 9 percent increase over 2025 No Build. In 2045 with the Projects, there would be 206,000 vehicles per day north of I-5, 215,000 vehicles per day in the segment north of SR 169 and 297,000 vehicles per day in the segment north of I-90. This represents an increase of 20 percent between SR 169 and SR 900 and 13 percent between I-90 and SE 8th Street over the 2045 No Build.

Build Peak Period Traffic Volumes

Similar to the No Build, we used the VISSIM model to analyze freeway operations for the 2025 and 2045 Build. Exhibit 5-1 shows peak 3-hour, directional traffic volumes on I-405 for existing, No Build, and Build.

The Build Alternative would increase capacity, which would allow more vehicles to use I-405 during the peak period. We expect the additional capacity to be fully utilized in the peak directions of travel in 2025. Limited volume growth between 2025 and 2045 is forecasted, as shown in Exhibit 5-1. We anticipate all lanes would be fully utilized in 2025 and 2045 in the peak commute direction during the peak hour.

Build Freeway Travel Times

We determined freeway travel times from the VISSIM modeling efforts. We are reporting two trip pairs: from I-5 in Tukwila to I-90 and from I-90 to SR 520. Exhibit 5-2 shows the reported travel times for existing, 2025, and 2045 No Build and Build Alternatives.

During the AM period, the Projects would improve congestion in the Renton area on northbound I-405. Travel times would decrease in both the GP and express toll lanes compared to No Build. Travel times on southbound I-405 would also decrease with the Projects. A travel time increase would occur on one segment of northbound I-405 between I-90 and SR 520 as the Project would allow more vehicles to reach the bottleneck at SR 520. Due to worse congestion at this location, travel times would increase.

During the PM period, southbound I-405 experiences high congestion at the Coal Creek Parkway interchange area and at points farther south in Renton with the No Build. The Projects would improve congestion in these areas, thus, decreasing travel times in both the GP lanes and the express toll lane relative to the HOV lane with the No Build. A new bottleneck would form in the southbound GP lanes between the SR 169 and Talbot Road interchange. However, a trip between downtown Bellevue and I-5 is expected to be 24 minutes faster with the Build Alternative in the GP lanes compared to the No Build, meaning that travel times in the entire study area would improve with the Projects in 2045.

By 2045 in the PM peak period, northbound I-405 travel times would increase by 9 minutes between I-90 and SR 520 compared to the No Build Alterative. Under the No Build PM peak period, congestion from southbound I-405 spills back onto I-90 and SR 520, which meters traffic to northbound I-405. With the Build Alternative, southbound I-405 operations improve, relieving congestion at interchanges on I-90 and SR 520. In the northbound direction of I-405, this results in more congestion and longer travel times in the greater Bellevue area. Southbound I-405 is able to accommodate the shift in congestion through Bellevue with no negative effects. Other I-405 Master Plan improvements are planned in this part of the study area of the corridor and are expected to provide future benefits that would improve travel times.

Build Freeway Person Throughput

Exhibit 5-3 shows peak hour, directional person throughput on I-405 for existing conditions, No Build, and Build.

Freeway person throughput with the Build Alternative assumes the same vehicle classes as the No Build. In addition, with Build, the person throughput measurement also accounts for BRT operating exclusively in the express toll lanes. We expect increases in person throughput in the study area with the Projects.

Build Freeway Operations

Within the study area, we are forecasting higher traffic demand with the Build than with No Build. With No Build, the freeway would be too congested to handle additional traffic; whereas, with the Projects there would be additional capacity. The additional demand on the freeway system with

the Build Alternative would reduce trips that are bypassing freeway congestion and using local roadways with the No Build. The additional capacity in the study area would improve operations for some sections of the freeway in the study area, while some congestion would shift to other areas. Overall, there would be more traffic volume traveling at higher speeds with the Build Alternative.

Modeling results represent expected typical day operations. Some days would have less congestion than discussed in this report, while other days would have additional congestion. Crashes, weather, and major sporting events would affect I-405 traffic operations in future years. Higher congestion days and other event effects would produce further spillback in congested areas and reduce operations.

Exhibits 5-9 through Exhibit 5-12 show the 2025 and 2045 Build AM and PM period operations by direction and lane type from the VISSIM analysis.

Exhibit 5-9. I-405 Operations – 2025 Build AM Period

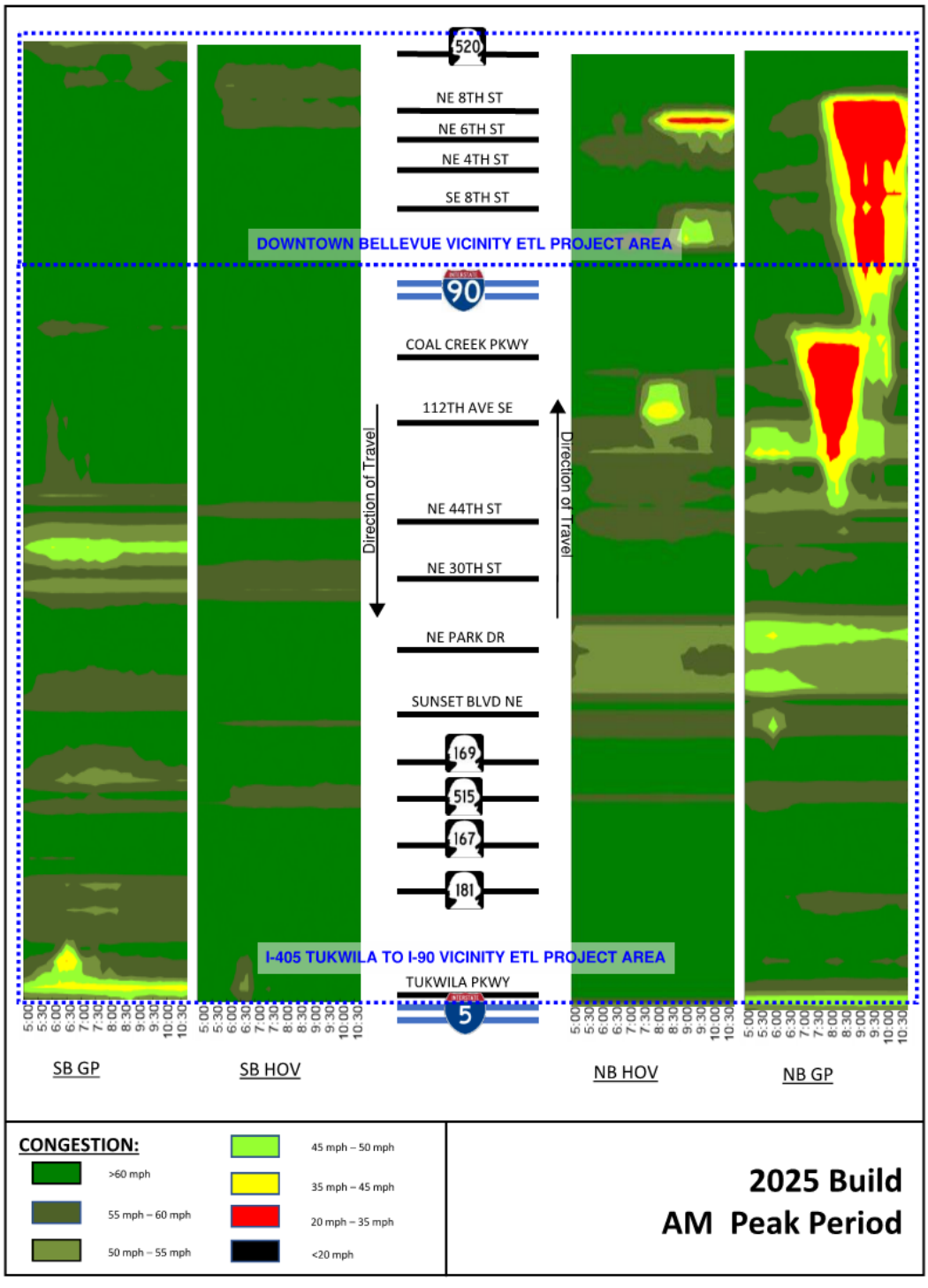


Exhibit 5-10. I-405 Operations – 2025 Build PM Period

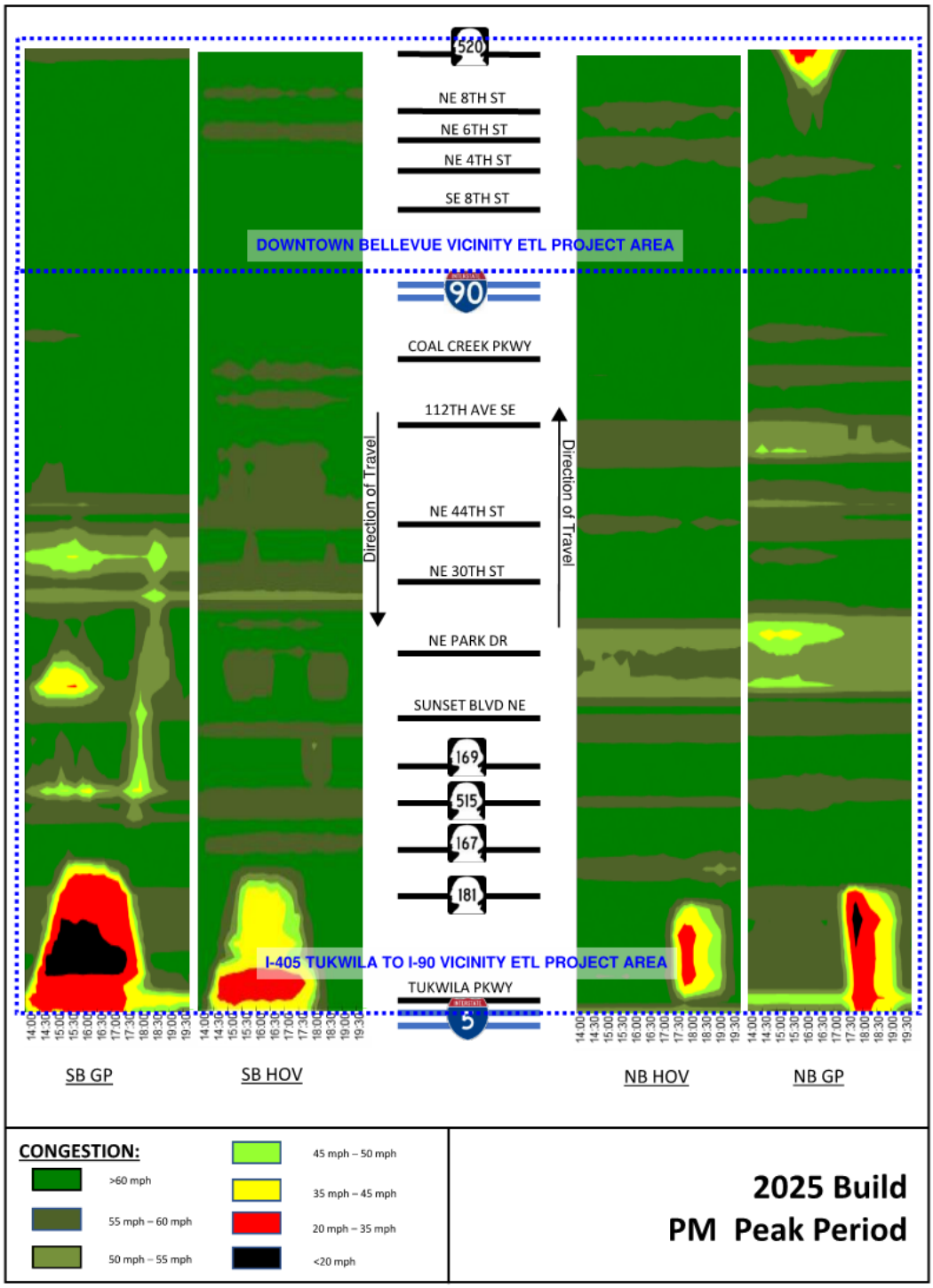


Exhibit 5-11. I-405 Operations – 2045 Build AM Period

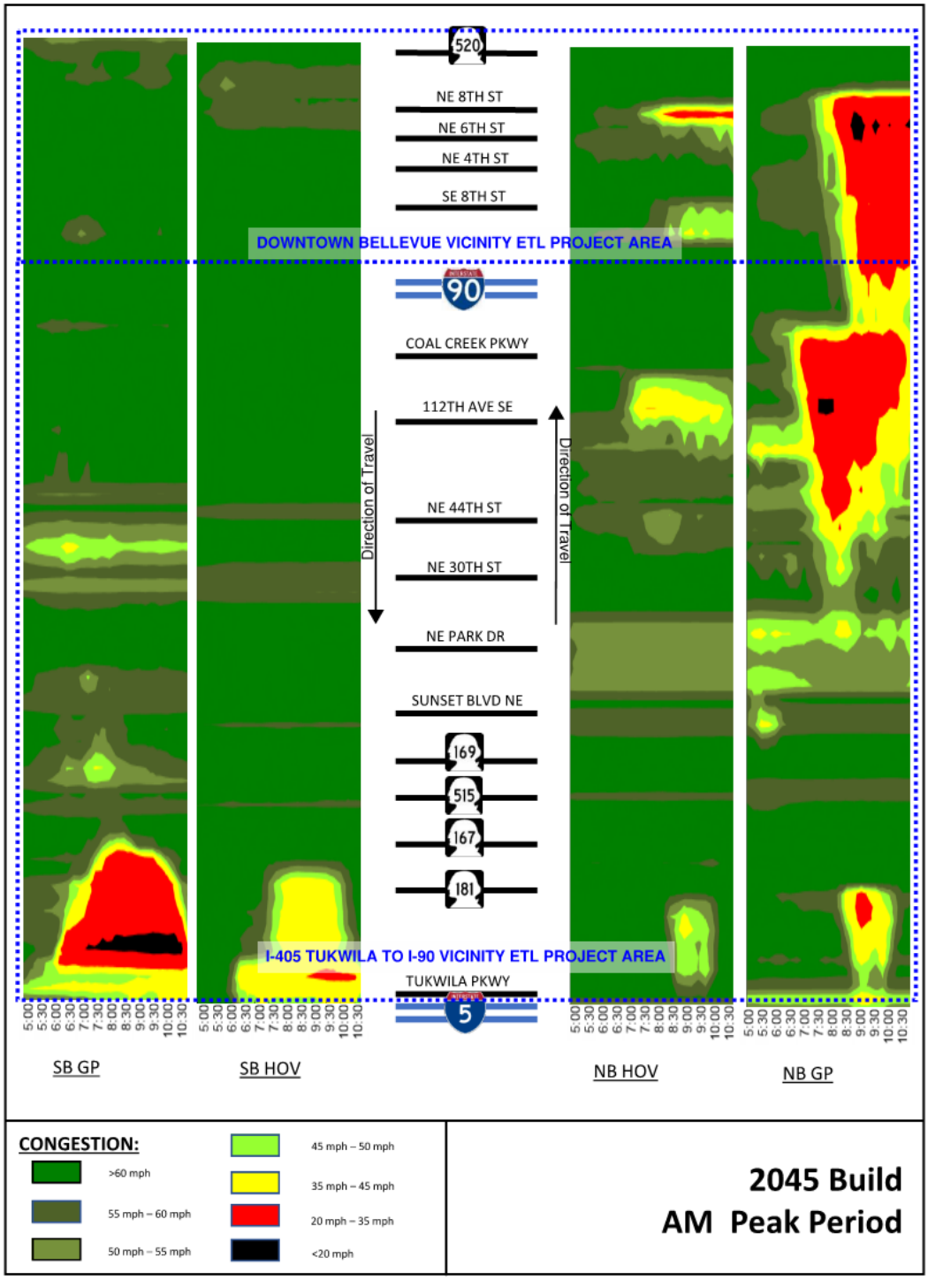
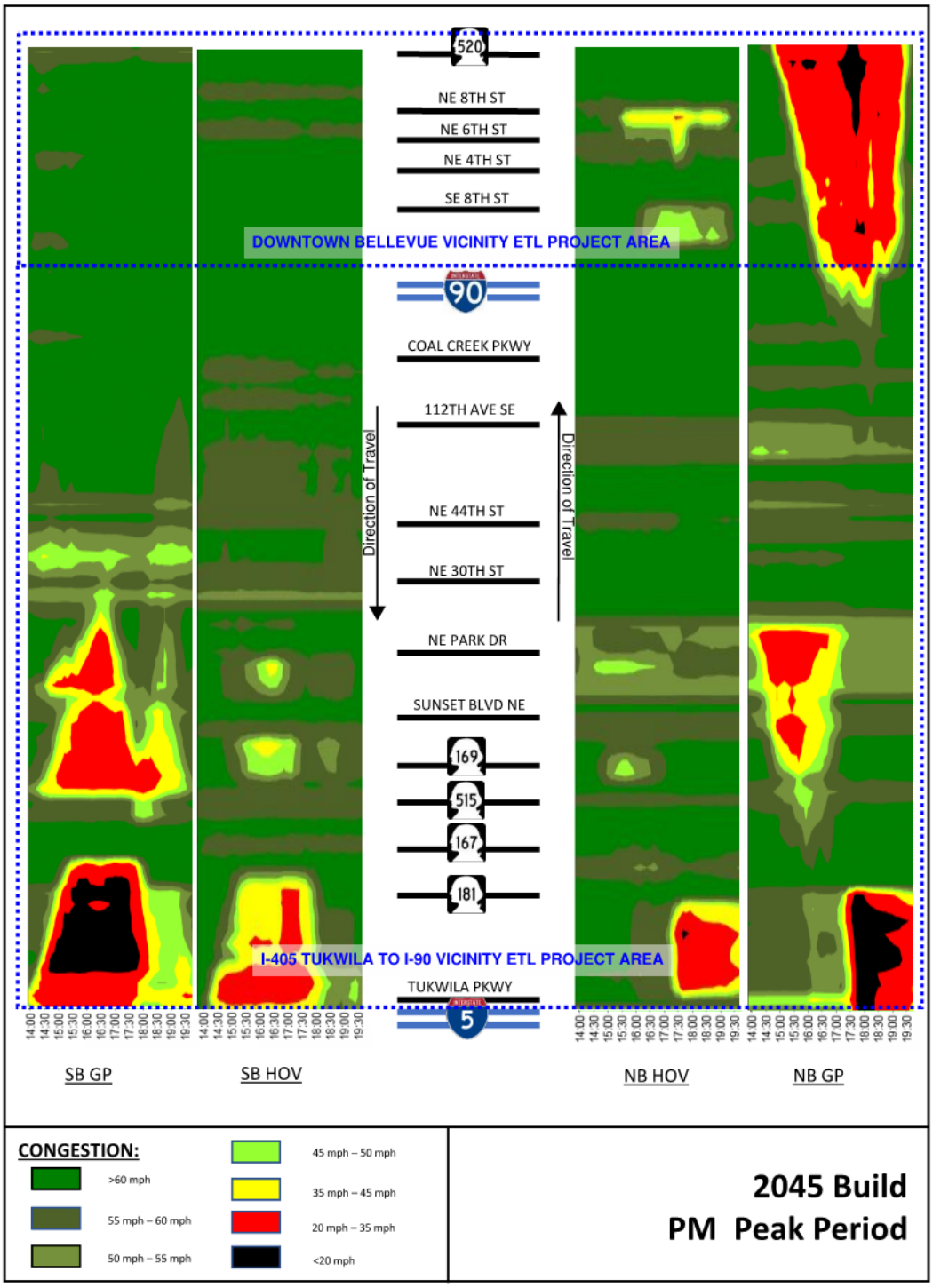


Exhibit 5-12. I-405 Operations – 2045 Build PM Period



AM Freeway Operations

I-405 would operate at higher speeds and accommodate more vehicles with the Build Alternative than with No Build. The following existing and No Build AM period bottlenecks would be affected with the Projects:

- Traffic effects of the existing bottleneck that begins on northbound I-405 at the NE 44th Street interchange, with congestion through most of Renton, would be reduced with the Projects. The additional capacity through this area would allow traffic to travel farther north at a higher rate. This would affect operations at other areas that have capacity constraints and congestion today, such as the ramps to eastbound and westbound I-90 and eastbound and westbound SR 520. Congestion in sections upstream of this existing bottleneck would see increased speeds and higher throughput volumes. The reduction of this bottleneck would improve operations on northbound I-405 south of this point and on northbound SR 167 approaching the I-405/SR 167 interchange.
- The existing bottleneck that begins on northbound I-405 at the SR 520 off-ramp would continue to be congested with the Projects. However, the improvement to the I-405/SR 520 ramp would help alleviate some congestion. Higher traffic volumes would be able to access this area due to the increased capacity upstream of this location, thus, increasing the rate at which vehicles arrive at this interchange area. We still expect congestion to extend through downtown Bellevue and affect operations on the I-405 GP and express toll lanes. WSDOT has identified long-term improvements at the SR 520 interchange to improve operations in this area. However, they are currently unfunded.
- Traffic effects of the existing bottleneck that occurs on southbound I-405 at the Talbot Road interchange, SR 169, and on the Kennydale Hill would be reduced with the Projects. The additional capacity through this area would allow traffic to travel south at a higher rate. This would affect operations at other areas that have capacity constraints and congestion today, such as the ramp to northbound I-5 in Tukwila. Sections of I-405

between downtown Bellevue and SR 167 would see increased speeds and higher volumes, while congestion would increase and speeds would decrease between SR 167 and the I-5 interchange areas.

- Express toll lane access to and from the GP lanes would be provided at several access locations. In general, we expect vehicle speeds to be slower in these access sections because of vehicle lane changes and friction. At the 112th Avenue SE, SE 8th Street, and NE 6th Street express toll lane access points, vehicle speeds would also be slower because of high weaving volumes merging into congested GP lanes.

Overall volumes would increase and speeds in the express toll lane would be more reliable than the HOV lanes with the No Build. This would give more users, including transit and carpools, a faster and more reliable trip. Capacity constraints outside of the study area, including on I-5, I-90, and SR 520, would continue to limit operations in 2025 and would worsen operations in 2045.

PM Freeway Operations

With the Build Alternative, I-405 would operate at higher overall average speeds and accommodate more vehicles than with the No Build. The following sections where there would not be No Build PM peak period bottlenecks would be affected differently with the Projects:

- The Projects would reduce the existing bottleneck that begins on northbound I-405 at the Park Avenue N interchange. The additional capacity through this area would allow traffic to travel farther north at a higher rate. Congestion spilling back from Kirkland would increase and extend south of SR 520. Overall, regional congestion would decrease.
- The Projects would reduce the existing bottleneck that begins on southbound I-405 at the Coal Creek Parkway interchange. The additional capacity through this area would allow traffic to travel farther south at a higher rate and improve operations upstream of this location.
- The Projects would reduce the existing bottleneck that begins on southbound I-405 at the NE 30th Street interchange. The additional capacity through this area

would allow traffic to travel farther south at a higher rate.

- The reduction of the two southbound bottleneck locations during the PM peak period would increase congestion at the I-5/SR 518/I-405 interchange and on southbound SR 167. These facilities are currently capacity-constrained and operate with many hours of congestion during the PM peak period. At the I-5/SR 518/I-405 interchange, southbound I-405 congestion would extend from I-5 to the SR 167 interchange.
- The southbound ramp to eastbound I-90 ramp would have a capacity improvement, which would decrease queuing effects on southbound I-405 mainline while not adversely affecting operations on I-90 during the PM period.
- Express toll lane access to and from the GP lanes would be provided at several access locations. In general, we expect vehicle speeds to be slower in these access sections because of vehicle lane changes and friction. At the NE Park Street and SR 169 accesses, vehicle speeds would also be slower because of high weaving volumes merging into congested GP lanes.

The Projects would relieve bottlenecks but increase congestion outside of the study area, in particular, approaching the I-5/I-405/SR 518 interchange.

Overall, vehicles would travel at higher speeds in the express toll lanes and have a more reliable trip with the Projects than with the No Build HOV lanes. This would give more users, including transit and carpools, a faster trip.

Identified Master Plan Improvements

WSDOT has identified projects as part of the I-405 Master Plan. While currently unfunded, improvements to the I-5/SR 518/I-405 interchange area, as well as SR 167, I-90, SR 520 and within downtown Bellevue could help address existing and future congestion in the area.

Build Local Intersection Operations

We analyzed future year traffic operations using Synchro for signalized and unsignalized intersections, and Sidra for roundabouts. These models calculate intersection LOS and delay for the Build Alternative. Appendix E, Intersection

Analysis Results, shows results of the local intersection analysis, with both Synchro and Sidra results presented under the 2025 and 2045 Build. We studied 37 intersections for the Build (three more than No Build) because the Projects would add new intersections at the NE 44th Street and 112th Avenue SE interchanges.

We expect higher traffic demands at most study intersections with the Build Alternative, compared to existing conditions and No Build. Similar to the No Build, signal timings would be optimized to serve additional demand expected to and from I-405 and to minimize off-ramp queues from spilling back from the intersections to the I-405 mainline.

The difference in traffic demand between the Build and No Build would affect operations at local intersections. The Projects would include geometric changes to local intersections at the NE 44th Street, 112th Avenue SE, Coal Creek Parkway, and NE 6th Street interchange areas. Additional striping and lane designation changes would also occur at local intersections at the SR 169 interchange area. Each of these interchange area changes are discussed in the following sections. All other study area intersections would not have major geometric changes with the Projects; however, changes in ramp-storage lengths, ramp-lane configuration, approach lane and intersection control, signal operations, and metering may also affect operations at the ramp terminal intersections, and were included in the analysis.

The Projects would increase freeway volumes and, in turn, more vehicles would use ramps to enter and exit the freeway. We expect that the increase in ramp traffic would cause some intersections or specific movements in an intersection to operate worse than with No Build. While some intersection operations may degrade, in most cases they would remain above LOS D. In addition, geometric changes at some interchange areas would improve operations compared to No Build.

In the 2025 AM peak hour, we expect all intersections to operate at LOS D or better; however, two intersections would have at least one approach operating at LOS E or worse. In the comparable 2045 AM peak hour, one intersection would operate at LOS E or worse and an additional three intersections would have at least one approach operating at LOS E or worse. The remaining intersections would operate at

LOS D or better. Compared to No Build, the Projects would have fewer intersections operating at LOS E or worse in both 2025 and 2045.

In the 2025 PM peak hour, three intersections would operate at LOS E or worse, and an additional two intersections would have at least one approach operating at LOS E or worse. The remaining intersections would operate at LOS D or better. In the comparable 2045 PM peak hour, seven intersections would operate at LOS E or worse, and an additional two intersections would have at least one approach operating at LOS E or worse. The remaining intersections would operate at LOS D or better. Compared to No Build, with the Projects fewer intersections would operate at LOS E or worse in both 2025 and 2045.

SR 169 Interchange

With the Projects, we assume the intersection of SR 169 and the I-405 southbound on-ramp would have several lane and signal modifications. We are assuming the existing HOV bypass lane would be converted into a GP lane on the southbound I-405 on-ramp and allow for the following improvements at the intersection:

- The southbound approach would be reconfigured to provide two through lanes.
- The westbound approach would have an additional left-turn lane.

We expect this intersection to operate at LOS E or better in the 2025 and 2045 peak hours with the Projects. This intersection is expected to operate better than the No Build, which is expected to operate at LOS F in the 2045 PM peak hour.

NE 44th Street Interchange

With the Projects, we assume several changes at the NE 44th Street interchange:

- The local road overpass at the interchange would be reconstructed.
- New direct access ramps would be built for transit and express toll lane users in the I-405 median.
- Lake Washington Boulevard would be reconstructed and realigned between NE 44th Street and SE 76th Street.

- The northbound on-ramp to I-405 would be realigned and connected to Lake Washington Boulevard at a new roundabout intersection.
- Reconfigure NE 44th Street to manage traffic with four roundabouts with limited movements at Seahawks Way.

The analysis assumes that a roundabout would be built at the intersection of NE 44th Street/N 43rd Street, with a reconfigured intersection with Seahawks Way when the new park-and-ride in the interchange area is developed.

We expect the intersections to operate at LOS C or better in the 2025 and 2045 AM and PM peak hours under the Projects. If geometric changes at Seahawks Way and N 43rd Street are not completed, NE 44th Street ramp terminal intersections would continue to operate at LOS C or better.

112th Avenue SE Interchange

With the Projects, we assume direct access ramps for transit and express toll lane users in the I-405 median, with an intersection within the bridge structure on 112th Avenue SE. A roundabout would be constructed at the 112th Avenue SE and I-405 northbound ramps intersection.

The direct access ramp may be constructed after the assumed 2025 opening, depending on when allocated funds for the improvements become available. Therefore, improvements at this interchange may be constructed in a phased approach.

Local intersections and the new direct access ramp terminal intersection at this interchange would operate at an acceptable LOS with the Projects. If the direct access ramps are part of a later phase, operations in the interim condition would be similar to the No Build in both the 2025 and 2045 AM and PM peak hours.

Coal Creek Parkway Interchange

With the Projects, all study intersections along Coal Creek Parkway would be converted to roundabouts. The roundabouts may be constructed after the assumed 2025 opening, depending on when allocated funds for the improvements become available. Therefore, improvements at this interchange may be constructed using a phased approach. Should the full conversion to roundabouts be phased after the initial buildout, there would be minor capacity improvements,

such as left- and right-turn lanes, to key movements at the interchange with the initial phase.

After all phases, all four Coal Creek Parkway study intersections would be converted to a series of single- and two-lane roundabouts. The roundabouts would operate better than the No Build, with a LOS of B or better in the 2025 and 2045 AM and PM peak hours.

NE 6th Street Interchange

The Projects would increase traffic volumes at the NE 6th Street direct access ramp because more vehicles would access the express toll lane system to the south via the direct access ramps. The direct access ramp would continue to prioritize HOV and transit vehicles. Managed SOV vehicles would be able to use the ramp as space is available. Geometric changes at the intersection of NE 6th Street and the I-405 direct access ramps would allow for right turns onto the southbound on-ramp to operate concurrently with the northbound left turns. WSDOT would restrict any off-ramp to on-ramp movements at this intersection to eliminate any vehicle conflicts. With the geometric change, we expect this intersection to operate at LOS D or better in the 2025 and 2045 AM and PM peak hours.

Geometric changes at the NE 6th Street and 112th Avenue NE intersection would allow for the westbound traffic lanes to change based on the time of day to accommodate changes in traffic volume using a changeable message sign to indicate allowable movements in each lane. With this change, in the AM peak hour, we expect this intersection would operate at LOS D in 2025 and LOS D in 2045. During the PM peak hour with the change, we expect this intersection would operate at LOS E in 2025 and LOS F in 2045 as traffic shifts from other congested downtown Bellevue streets to this intersection. This would be a degradation from operations under No Build, where the intersection would operate at LOS D or better in the 2025 and 2045 AM and PM peak hours.

What is a changeable message sign?

A changeable message sign is an electronic sign over each lane that indicates the direction of travel and turning movements allowed for each lane. This sign can be changed, depending on peak directional needs.

WSDOT would work with the City of Bellevue to monitor future year operations at this location. Toll rates may be adjusted to manage use at this and other locations as necessary.

Build Ramp Queuing

WSDOT monitors and manages ramp terminal signals to minimize ramp queueing from affecting mainline operations whenever possible.

Our analysis did not find queues at any ramp terminal operations that would affect I-405 mainline under typical operations in the future. While some ramp terminal approaches may operate at LOS E or F, the anticipated queue length would not exceed provided capacities. With the construction of the Projects, affected ramps would undergo design modifications and improvements that would help minimize the occurrence of ramp queuing and traffic backups.

Build Safety Performance

Most crashes under existing conditions are rear-end and sideswipe crashes (91 percent). These crash types are typically associated with congested conditions. The Tukwila to I-90 Project and the Downtown Bellevue Project collectively would add capacity to I-405, which would improve freeway operations and reduce overall congestion. This is expected to, in turn, improve safety performance of these crash types in segments of the study area where congestion is eliminated compared to the No Build.

Overall safety performance with the Projects during off-peak periods is expected to be similar to the No Build as there are not as many congestion-related crashes during these times.

With the Projects, lane and shoulder widths in some sections of I-405 would be increased compared to No Build and widths in some sections would decrease based on physical limitation in the study area. With the Projects, lane widths would vary between 11 and 12 feet and shoulder widths would vary between 2 and 10 feet. Based on research, areas with reduced widths are expected to see a decrease in safety performance while areas with added width are expected to see an increase in safety performance compared to the No Build. The effects of shoulder and lane widths on safety is further discussed in design analysis documentation.

The Projects would introduce tolling to the study area, but we would not expect tolling to influence safety performance.

The Projects would reduce overall congestion by increasing capacity, which is expected to improve safety performance.

However, some congestion would be relocated (e.g., northbound I-405 approaching I-90 in the AM peak period), which is expected to reduce congested-related safety performance in those areas. The reduced lane and shoulder widths are expected to reduce safety performance compared to full width shoulders and lanes. Overall, the Projects are expected to improve safety performance by reducing congestion-related crashes relative to the No Build.

Build Transit Operations

Completing the 40-mile-long toll lane system between Auburn and Lynnwood would provide opportunities for transit improvements in the study area. With the No Build, traffic congestion would increase in both the GP and HOV lanes, thus creating reliability issues for transit operations.

Express toll lanes provide a more reliable travel time for transit vehicles compared to HOV or GP lanes. The Projects would limit the number of vehicles in the express toll lanes, and vehicles would only be allowed to enter the express toll lanes at designated locations. We are projecting the express toll lanes would maintain an average travel speed of at least 45 mph in 2025 and 2045, even when the GP lanes become congested. This would be an improvement over existing conditions or No Build.

Some transit routes would still operate in the GP lanes for some or all of their trip along I-405 in the study area. The Projects would improve GP lane congestion and speeds in the study area, and transit vehicles would operate at similar speeds to other vehicles in these lanes.

The Projects would not create HOV and transit bypass lanes along metered on-ramps in the study area. Where applicable, WSDOT would repurpose existing HOV and transit bypass lanes, which are now on approximately half of the existing on-ramps, into metered lanes. Fully metered ramps would maintain a more consistent volume of traffic accessing the freeway, resulting in better operations for all users; however, a metered lane would increase transit travel time compared to existing HOV and transit bypass lanes.

We assumed there would be several projects funded through Sound Transit in the study area. In November 2016, voters passed an expansion of the regional mass transit system, collectively known as ST3. The ST3 package of projects

includes funding for BRT along I-405 between Lynnwood and south Renton and additional park-and-ride facilities. The ST3 plan provides funding for freeway stations that would allow buses to stop in the freeway right-of-way to pick up and drop off riders. A freeway station would be built at the NE 44th Street interchange in Renton, and connections to this station would be provided by direct access ramps. An additional freeway station may be built at the 112th Avenue SE interchange if additional funding becomes available from Sound Transit. While specific routing of Sound Transit BRT has not been determined, this analysis assumes the express toll lane improvements would serve new BRT service.

Our modeling assumed BRT would primarily operate in the express toll lanes and would benefit from higher speeds and a more reliable trip compared to the GP lanes.

Build Freight Mobility

The Projects would not adversely affect freight travel. We expect the Projects would decrease congestion in the GP lanes through portions of the study area, thus, improving operations for all users, including freight. The express toll lanes would continue to have the same vehicle weight limits as all HOV lanes. With the No Build, freight would be affected by increased congestion relative to existing conditions.

Build Pedestrian and Bicycle Facilities

Pedestrian travel and bicycle travel would continue to be prohibited, as they are now, on I-405 with the Build Alternative. With the Projects, WSDOT has designed improvements to local infrastructure at freeway terminal intersections that include pedestrian and bicycle facilities on local roadways.

The two off-street paths crossing I-405 would not be affected by the construction of the Projects. WSDOT designed a new trail crossing over southbound I-405 that would connect to the future Eastside Rail Corridor Regional Trail. This crossing would be provided at Wilburton, just north of the I-90 interchange. The Projects would also include an extension of the Eastside Rail Corridor Regional Trail that would run parallel to the west side of I-405 between Coal Creek Parkway and Ripley Lane in Renton. WSDOT would also improve connections on the Lake-to-Lake Trail in Bellevue. Currently, this trail crosses Main Street on a narrow sidewalk. WSDOT

would provide a wide multiuse path on the south side of the rebuilt Main Street crossing that would make this crossing more pedestrian and bicycle friendly.

All new crossings of I-405 would provide sidewalk and bicycle lanes on both sides of the street, except along 112th Avenue SE, where a sidewalk would be provided only on the north side of the street to tie into existing pedestrian facilities outside the interchange area. Improvements at the Coal Creek Parkway interchange would include pedestrian facilities on both sides of the local roadway to accommodate connections to existing facilities and the new Eastside Rail Corridor Regional Trail.

Other Effects of the Projects

Our traffic analysis models included portions of freeways outside the study area specific to the Projects, such as I-5 and SR 520. This freeway analysis demonstrated effects on these areas. This section discusses other effects that may be delayed or distant from the study area.

The Projects would reduce congestion that would occur at several bottleneck locations with No Build. Downstream areas would see changes in volume and congestion because of this reduction.

Decreased AM Period Northbound SR 167 Congestion

Congestion spills back on to northbound SR 167 during the morning commute. With the additional capacity on I-405, this congestion would be eliminated and would allow traffic to travel farther north at a faster rate on SR 167.

Increased PM Period Southbound SR 167 Congestion

There would be congestion on southbound SR 167 under both the No Build and Build at the S 277th Street interchange bottleneck. Under No Build, there would be congestion on southbound SR 167 through several bottleneck locations near the S 277th Street interchange and the end of the HOT system south of SR 18. These congested locations would affect operations in both the GP and HOT lanes. With the Projects, lower congestion on southbound I-405 would allow traffic to arrive on SR 167 sooner, which would worsen congestion at the S 277th Street bottleneck. With No Build, some of this volume would be stuck in congestion on southbound I-405.

WSDOT has identified projects on the SR 167 corridor that would reduce congestion in these identified areas. An auxiliary lane between the SR 516 interchange southbound on-ramp and the S 277th Street interchange southbound off-ramp could help reduce congestion at the S 277th Street bottleneck; these projects are currently unfunded.

While the Projects would increase the number of vehicles accessing southbound SR 167, reduced congestion on northbound I-405 would decrease congestion spillback to northbound SR 167 in both the AM and PM periods.

Impacts of Different Project Delivery Schedules

The Build Alternative analyzed in this report assumes improvements as part of the Projects. While both projects are necessary to complete the fully connected express toll lane network as discussed previously, this section discusses effects of individual projects.

Constructing only the Tukwila to I-90 Project

If WSDOT delivered just the Tukwila to I-90 Project, traffic operations in the study area would have similar benefits to the Build Alternative south of I-90 with both projects, and similar conditions to the No Build Alternative north of I-90.

During the AM period, northbound I-405 would see improvements. I-90 is a major destination for northbound AM trips; if construction does not include improvements north of I-90, the Tukwila to I-90 Project alone would still result in similar improvements for trips destined to I-90. The major destinations of downtown Bellevue and SR 520 would continue to see high demand and potential congestion because trips would not have additional capacity nor the option for a reliable trip within an express toll lane to access these destinations. Congestion in downtown Bellevue would be worse compared to conditions with both projects.

During the PM period, congestion at the Coal Creek Parkway interchange area on southbound I-405 would improve compared to No Build. However, with limited capacity through the I-90 interchange, conditions would not improve as much as with both projects. Diversion to adjacent local streets in south Bellevue and congestion through downtown Bellevue and north into Kirkland would continue without the Downtown Bellevue Project in place.

Drivers using the express toll lane would be able to use the inside-to-inside direct connector ramps at the I-405/SR 167 interchange. However, demand for the system would be in a congested portion of the corridor, where the system would end at I-90.

Constructing only the Downtown Bellevue Project

If WSDOT delivered just the Downtown Bellevue Project, traffic operations in the study area would have some benefits compared to conditions with both projects.

During the AM period, traffic operations would be similar to No Build. However, operations on northbound I-405 approaching downtown Bellevue could improve with higher capacity through the weaving area north of I-90 for trips destined to downtown Bellevue using the NE 6th Street direct access ramp. The bottleneck approaching SR 520 would also improve due the additional capacity provided on the collector-distributor roadway with the Downtown Bellevue Project.

During the PM period, congestion at the Coal Creek Parkway interchange area on southbound I-405 would still affect operations on I-405, but with additional capacity north of I-90, the congestion may not reach as far north as it would with the No Build. Both projects together would be needed to improve operations through this congested area.

Extension and operations of the express toll lane through the study area would produce a limited benefit without the ability to serve major demands from Renton and to fully use the inside-to-inside direct connector ramps at the I-405/SR 167 interchange that would occur with a full express toll system.

Transportation Effects During Construction

The Projects would widen I-405 in certain locations; rebuild NE 44th Street, 112th Avenue SE, and Main Street bridges over I-405; and construct new I-405 bridge structures over Coal Creek Parkway, I-90, the I-90 interchange off-ramp to Factoria Boulevard, and the Wilburton crossing. We expect construction to take place between 2019 and 2024, but construction activities in some areas would not take place throughout the entire period. When a contractor is selected for the Projects, they could use multiple work crews and zones to reduce the overall construction period.

WSDOT would maintain existing roadway capacity during construction activities to the extent possible. Lane or roadway closures would be minimized and scheduled to occur when there would be the least effect on traffic in the study area, such as during overnight and weekend periods.

Effects of Construction Traffic on the Transportation Network

Most of the Project construction vehicles would carry dirt and materials to and from construction sites. Access to the construction sites would be located on the I-405 mainline, I-405 ramps, and from local arterials. Construction vehicles would be needed mostly for earthwork and rebuilding bridges. Construction vehicles would increase traffic delay and volume in the study area during the construction period. These delays would occur on freeways and arterials identified as haul routes. The exact haul routes and quantity of construction vehicles would not be known until a construction contract is signed, but we anticipate most construction vehicles would use I-405, SR 167, and I-90 to bring materials to and from construction sites.

Effects of Construction Activities on Freeway Travel

During construction of the Projects, the existing I-405 GP and HOV lanes would be realigned through the construction area. Temporary night and weekend lane closures would be required as WSDOT widens the freeway. Freeway ramps would be closed as needed during construction, but closures would also occur during nights and weekends when traffic demand would be lower and detour routes can better accommodate additional traffic volume.

Full freeway closures in one or both directions of travel would be required at limited times to shift traffic between phases of construction or during demolition, construction, and setting of bridge girders and installation of fish passage culverts. Most of these full closures would occur at night and can be accomplished with rolling slowdowns; however, a longer-duration full closure could be needed. The longer-duration closures would occur at night or over a weekend.

What is a rolling slowdown?

A rolling slowdown is a safe way to accomplish road closures with little disruption to traffic. Traffic is slowed down to a low speed (typically 20 miles per hour or slower) well in advance of the construction area to create a gap in traffic so construction can occur without active traffic in the immediate construction zone.

While motorists are traveling slowly, construction crews are completing the required work without anyone driving through the work zone. These slowdowns generally last a few minutes but could be longer if the work zone activity requires it.

Effects of Construction Activities on Local Arterial Travel

The construction of new bridges with the Projects would be staged to minimize the effects on local street operations.

Temporary closures to arterials would be required for erecting the bridge girders, demolishing existing bridges, and placing the concrete deck slabs. Other closures would be needed for constructing new intersections, building walls, and installing new utilities. These closures would be of short duration and limited to nights or weekends to the extent possible, with the exceptions described below.

We expect the Main Street overpass in Bellevue to be constructed in phases, with an anticipated closing of up to two lanes for over a year. WSDOT would maintain bidirectional traffic flow during construction to the extent possible.

Construction activities may also limit pedestrian and bicyclist movements on local roadways. Safe routes for nonmotorized users would be maintained to the extent possible, with specified detour routes when needed.

The Cedar Avenue S and Renton Avenue S structures would be constructed in phases. We expect a long-term closure of Cedar Avenue S while WSDOT demolishes and rebuilds the structure. Renton Avenue S would remain fully open during the construction of the Cedar Avenue S overpass. WSDOT would use a similar approach when demolishing and rebuilding Renton Avenue S. As that overpass is being constructed, WSDOT would close Renton Avenue S and keep Cedar Avenue S open.

At the Coal Creek Parkway and NE 44th Street interchanges, roundabout construction would be phased to maintain existing capacities to the extent possible. Any major closures would occur during evening and weekend periods, as needed.

SECTION 6 MEASURES TO AVOID OR MINIMIZE EFFECTS

What measures will WSDOT take to mitigate traffic and transportation effects during construction?

Existing capacity will be maintained during construction activities to the extent possible. Lane or roadway closures will be minimized and scheduled to occur when there is the least effect on traffic in the study area, such as overnight and weekend time periods.

WSDOT will coordinate with the local agencies and other projects to prepare a Traffic Management Plan prior to making any changes to the traffic flow or lane closures. Local agencies, the public, school districts, emergency service providers, and transit agencies will be informed of the changes in advance through the media, the Projects' website, and an email listserv. Pedestrian and bicycle circulation will be maintained as much as possible during construction. For any road, bicycle lane, and/or sidewalk closure, clearly marked detours will be provided.

What measures will WSDOT take to mitigate traffic and transportation effects during operation of the Projects?

The project team foresees no adverse effects related to project operation that will require mitigation.

SECTION 7 REFERENCES

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APPENDIX A ACRONYMS AND ABBREVIATIONS

Term	Meaning
BRT	bus rapid transit
FHWA	Federal Highway Administration
GP	general purpose
HOT	high-occupancy toll
HOV	high-occupancy vehicle
I-405	Interstate 405
I-5	Interstate 5
I-90	Interstate 90
LOS	level of service
Metro	King County Metro Transit
MP	milepost
mph	miles per hour
PSRC	Puget Sound Regional Council
RCW	Revised Code of Washington
Sea-Tac Airport	Seattle-Tacoma International Airport
SOV	single-occupant vehicle
SR 167	State Route 167
ST3	Sound Transit 3
TRIP	I-405 Tukwila to Renton Improvement Project
USC	United States Code
WSDOT	Washington State Department of Transportation
WSTC	Washington State Transportation Commission

APPENDIX B GLOSSARY

Term	Meaning
Changeable message sign	A changeable message sign is an electronic sign over each lane that indicates the direction of travel and turning movements allowed for each lane. This sign can be changed, depending on peak directional needs.
Express toll lane	A limited-access freeway lane that is actively managed through a variable toll system to regulate its use and thereby maintain express travel speeds and reliability. Toll prices rise or fall in real time as the lane approaches capacity or becomes less used. This ensures that traffic in the express toll lane remains flowing at express travel speeds of 45 to 60 miles per hour. Transit and carpools do not pay a toll.
Off-street path	WSDOT defines an off-street path as a facility physically separated from motorized vehicular traffic within the highway right-of-way or on an exclusive right-of-way. It is designed and built primarily for bicycles, but can be used by other nonmotorized users.
Recurring bottleneck	A recurring bottleneck is a localized constriction of traffic flow that occurs on a frequent and predicable basis, regardless of weather conditions, crashes, or events.
Rolling slowdown	A rolling slowdown is a safe way to accomplish road closures with little disruption to traffic. Traffic is slowed down to a low speed (typically 20 miles per hour or slower) well in advance of the construction area to create a gap in traffic so construction can occur without active traffic in the immediate construction zone.

APPENDIX C PSRC MODEL RENTON TO BELLEVUE UPDATE

TECHNICAL MEMORANDUM

Date:

To:

From: Robert Sicko, Fehr & Peers

Subject: *I-405 Renton to Bellevue Modeling*

SE16-0478

Introduction

Fehr & Peers was selected by the Washington State Department of Transportation (WSDOT) to provide support for traffic modeling and analysis as part of the I-405 Renton to Bellevue (RTB) Project. The key components of travel demand modeling support are as follows:

- Prepare 2015, 2025 and 2045 demand model databases to allow various options to be analyzed in support of Practical Design and estimation of toll revenues;
- Perform with and without tolling scenarios for the design options identified by WSDOT; and
- Work closely with WSDOT staff to reach agreement on assumptions prior to model runs.

Fehr & Peers recently worked with WSDOT to prepare travel modeling analyses for SR 167 Completion and SR 509 Corridor projects. The project team agreed to build on the models previously used for these WSDOT projects, supplemented by additional detail in the transportation network and transportation analysis zone (TAZ) system in the I-405 study area. This memo provides a summary for the tasks outlined in the approved scope of work.

This report begins by describing key components of the development of the SR 167 and SR 509 Travel Models which form the foundation of the I-405 Travel Model. Subsequently, the modifications made to the I-405 study area, as well as the scenarios tested and performance metrics extracted are summarized.

I-405 Travel Model Development

The version of the regional travel demand model used for the I-405 project last year was used to perform travel demand modeling analysis for the I-405 Project after making appropriate additions and changes relative to the network surrounding the I-405study area. The model is based on the Puget Sound Regional Council (PSRC) 4K V4.05 travel model framework. This

section summarizes the background and updates made to that model, based on consultation with PSRC and WSDOT staff.

Land Use

An important input variable for the development of the I-405 travel demand model was an accurate estimate of current land use data (2015) and future year forecasts. Future year land use estimates used the PSRC's Land Use Vision (LUV, January 2016) forecasts to develop total households and total employment allocations that are consistent with County and local jurisdiction land use allocations. The base and future land use estimates were developed by Stantec.

Generally, the 2015 base year land use estimates were developed using a variety of data sources. The 2015 total household and total employment data was created at the census tract geography. The following sources were used to develop household and employment estimates:

- 2010 U.S. Census
- Year 2000 thru 2014 building permit data at census tract geography (PSRC)
- 2015 census tract housing data (Office of Financial Management)
- 2015 census tract household size data (PSRC)
- 2014 PSRC employment summaries derived from the Quarterly Census of Employment and Wages (QCEW), administrative records employers report, by law, to the Washington State Employment Security Department (ESD).
- PSRC's supplemental data from the Boeing Company, the Office of Washington Superintendent of Public Instruction (OSPI), and governmental units throughout the central Puget Sound region

The 2025 land use estimates are based on the PSRC's January 2016 Land Use Vision (LUV) forecasts. Efforts were made to ensure that the growth between the base year (2015) and the 2025 PSRC estimates were logical. Minor adjustments were made to 2015 total household and total employment estimates to minimize illogical growth. The 2015 adjustments were made to Forecast Analysis Zones (FAZs) that did not have an exact equivalency between census tract geographies and FAZ geography.

The PSRC LUV future forecasts extend to year 2040. For this study, a year 2045 land use estimate was required. Working closely with PSRC, the project team developed an estimated land use forecast for 2045. The 2045 forecasts were developed by determining the average annual growth between 2025 and 2040 as well as determining the average annual growth rate between 2035 and 2040. The two growth rates were then averaged and applied to the PSRC 2040 forecasts to extend out an additional five years.

Model Framework

The I-405 Travel Model was initially developed based on the PSRC's older Regional Travel Demand Model, Version 1.00b. The PSRC has extensive model documentation and a User's Guide. Rather than re-write the PSRC documentation, this memorandum summarizes the changes Fehr & Peers made to update the I-405 travel model. These changes include major updates to the following:

- Expansion of TAZ detail from 938 TAZs to 973 TAZs
- Added detail and refined the roadway network in all four counties
- Updated transit network to include current 2015 transit itineraries for King County Metro, Community Transit, and Everett Transit
- Updated park-and-ride component of the model
- Included Tideflats truck trip generation component (special generators)
- Updated demographic inputs from the 2010 Census and employment data from the ESD
- Revised trip generation rates based on the PSRC 2006 Household survey
- Updated assignment methods for traffic, transit, and park-and-ride lots

The following sections describe these items in more detail, including the specific changes that were made to develop the I-405 travel model, why they are relevant for the model, and provide some details about key input and output files.

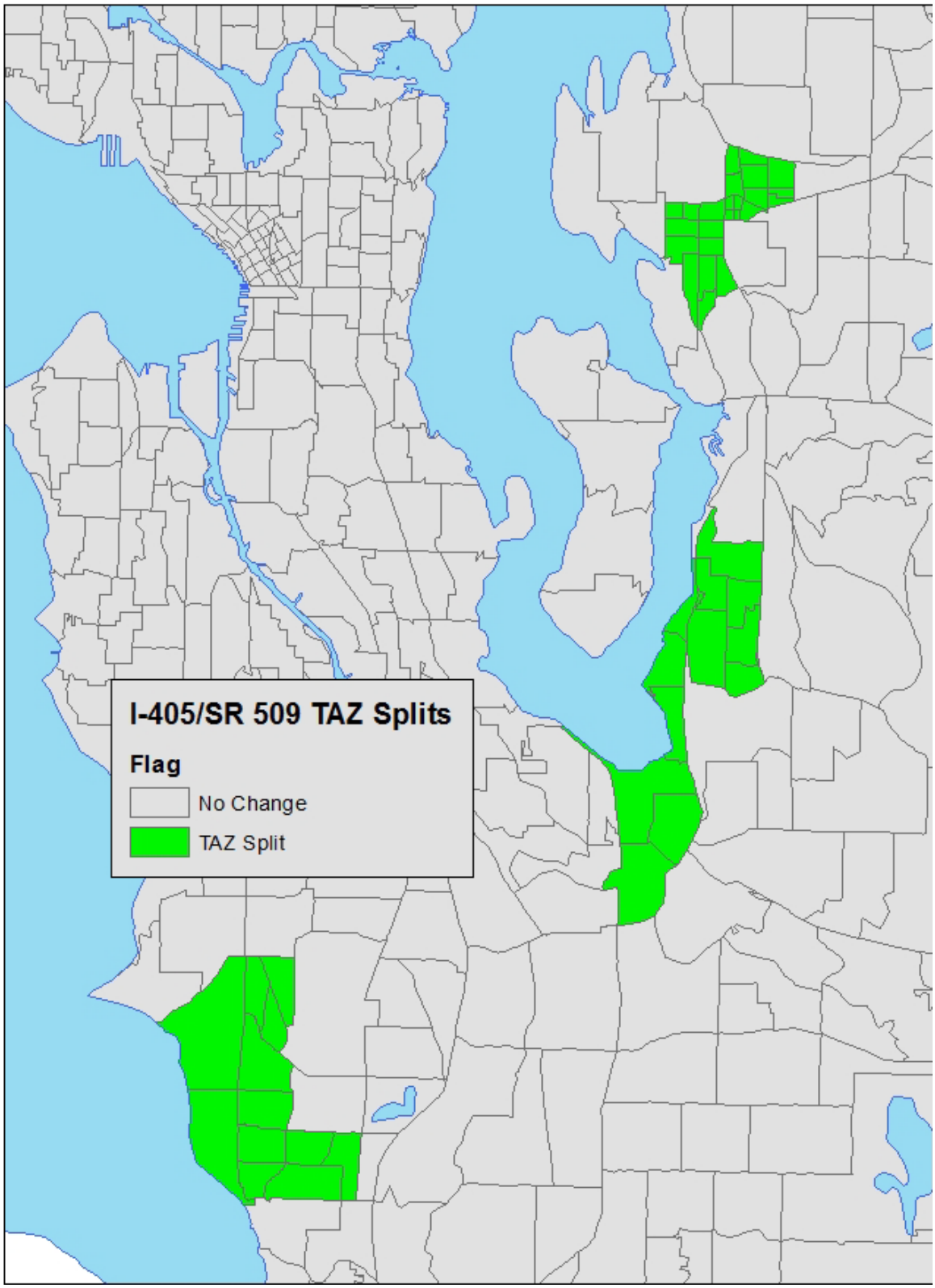
TAZ Updates

TAZs organize land use development data into specific geographic areas. The I-405/SR 509 TAZ equivalencies can be found in **Table 1**. The TAZs that were split for the I-405 and SR 509 modeling are highlighted in **Figure 1.** The TAZ splits were primarily made to enhance the distribution of travel demand into the I-405 corridor.

Table 1 – I-405/SR 509 TAZ Equivalencies

PSRC TAZ	**I-405/SR 509 TAZ**
289	289, 939, 940, 941, 942, 943, 944, 945, 946, 947, 948, 949, 953
291	291, 954, 955, 956
293	293, 952
294	294, 951
295	295, 950
310	310, 957, 958, 959, 960, 961, 962
323	323, 963, 965
324	324, 964
372	372, 970, 971, 972
373	373, 969
374	374, 966, 973
375	375, 967, 969

FIGURE 1: SR 509 & I-405 TAZ SPLITS



Transportation Networks

Highway Network

The highway network developed for the base year SR 509 Travel Model was created by updating the base travel model highway network with additional detail in Snohomish and King County. Much of the highway network modification was done to accommodate the additional TAZs created in the study area. A generalized summary of the modifications made to the SR 509 highway network is shown in **Table 2**.

Table 2 – SR 509 Travel Model Network Modifications

Network Attributes	Modifications
Zone Connectors	The regional TAZs that were split required coding new TAZ connectors to the arterial network. Any TAZ connectors that were connected to intersections were moved to mid-block. Driveway locations were identified with aerial photos and centroid connectors were located appropriately for the small mixed-use center TAZs. Walk access links were added to all regional centers and to park-and-ride lots.
Additional Arterials	Additional base year network detail was added to support the screenline validation effort and future year network assumptions.
Lanes	Modified lanes based on review of aerial photos and field visits. Major changes included coding of center turn lanes (adding 0.2 lanes per the common convention in the area-e.g., a three-lane road is coded as having 1.2 lanes in each direction).
Speed	Speed limits for arterials and collectors in the I-405 study area were set to match field conditions.
Capacity	Roadway capacities were modified where appropriate throughout the region (e.g., correcting inconsistent coding from previous modeling efforts.)
Freeway Interchanges	Modified intersection geometries at all I-405 I-5 interchanges to match actual ramp configurations.
Turn Prohibitions	Added turning restrictions at various locations based on network modifications.
Tolls	Updated SR 16 and SR 520 toll to match current rates. Toll rates are in year 2010 dollars and are a blended rate based on a mix of cash and Good To Go pass usage.

Transit Networks

The transit network and operations inputs for the I-405 Travel Model were updated to reflect 2015 service characteristics (routes and headways) for all transit agencies in the region, including Sound Transit, Pierce Transit, King County Metro, Community Transit, Kitsap Transit, and Everett Transit. The modifications were made for peak period and off-peak service.

The process to determine demand at park and ride lots was also modified. The I-405 travel models incorporated a utility factor to differentiate the attractiveness of a park and ride lot based on transit connectivity and capacity of the lot. The PSRC model does not assume such a factor.

Sociodemographic Data

As described in Chapter 5 of the PSRC model documentation, a key element of the overall model structure is the sociodemographic characteristics of households. This data influences model components such as vehicle availability, mode choice, and trip generation. Version 1.00b of the PSRC model was based on sociodemographic data from the 2000 US Decennial Census. As part of the I-405 Travel Model development, the sociodemographic data were updated using the most recent 2010 Decennial Census data from the US Census Bureau. This data updates the proportions of the households in each of the 256-household cross-classification categories defined in the model.

Trip Generation Rates

In conjunction with the updated sociodemographic information, the PSRC updated the trip generation rates for their trip base models. The primary source of changes in trip rates for households were derived from the 2006 household travel survey. Trip rates for employment were also modified. Summaries of all the trip rate changes can be found in the PSRC publication, *Puget Sound 4K Model Version 4.03, Draft Model Documentation, June 2015*. The new rates have been incorporated into the I-405 Travel Model.

External Trips

The external trips for the travel models were updated to be reflective of the year 2015 traffic counts. The future year external trips are assumed to grow at approximately two percent a year, to be consistent with PSRC's latest regional model.

Special Generators

The travel models for the I-405 project used similar special generators as the PSRC trip model. The only differences compared to the PSRC's approach to model special generators are as follows:

- The modeling of Sea-Tac International Airport trips was modified to better reflect origins and destinations of trips to and from the airport. PSRC has recently incorporated the modifications used in the I-405 model.
- The travel model also includes Bremerton Navy base and the Snohomish County Boeing facility as special generators.

Transit Assignment

The transit assignment process has been modified from the approach used by PSRC in the regional travel model. The transit assignment methodology used in the I-405 travel model mirrors the methodology used in the Sound Transit Incremental Transit Ridership Model. Specifically, the models incorporate Sound Transit's Boarding Penalty and Wait Time Factors used in the regional transit assignment. The Sound Transit methodology better accounts for passenger bias in selecting both mode and station locations for boarding/alighting based on factors other than transit headways/speeds that are considered in the PSRC 4K model framework. To work with the updates in the transit assignment macro, the transit nodes in the

network file have been flagged to identify the following, consistent with the Sound Transit methodology:

- Regular bus stops
- Transit centers
- Rail stations (e.g., Sounder, Central and Tacoma Link)

The approach in the Sound Transit model has been approved by the Federal Transit Administration (FTA) and provides greater flexibility in how different stations are represented in the model and more accurately reflects observed boarding and transfer patterns.

Traffic Assignment

Fehr & Peers updated the volume delay functions (VDFs) to improve the performance of the traffic assignment portion of the I-405 Travel Model. The VDFs were developed based on the Highway Capacity Manual's (2010) recommendations for VDFs for large regional travel demand models (Chapter 30 – Area wide Analysis Appendix C). The VDF changes were initially made in conjunction with WSDOT for Fehr & Peers' earlier work on the I-405 Eastside Tolling Corridors project. The VDFs were specifically developed to reduce the PSRC model's tendency to "over-assign" traffic to the freeway corridors compared to adjacent arterial corridors with less congestion. In other words, the standard PSRC VDFs tend to make major regional roadways more "attractive" compared to typical city arterials and collectors. These VDFs have been used on more than 20 model updates over the past 15 years due to their superior performance for forecasting local traffic patterns. The new VDFs are based on functional class and speed. The VDFs used in the PSRC 4K Version 4.03 and the I-405 travel model are shown in **Table 3**.

Table 3 –Volume Delay Functions

Speed (MPH)	PSRC Version 1.00b	I-405/SR 509 Travel Model
< 30	fd5 = (length*60/ul2)*(1+0.60* (HRFAC *volau/ (ul1*lanes))^5.8) +el1/((1-get(1)).max.0.01)	fd1 =(length*60/ul2)*(1 + 1.5*(HRFAC*(volau) / (lanes*ul1)) ^4)
30		fd2 =(length*60/ul2)*(1 + 1.2*(HRFAC*(volau) / (lanes*ul1)) ^5)
35		fd3 =(length*60/ul2)*(1 + 1*(HRFAC*(volau) / (lanes*ul1)) ^ 5)
40		fd4 =(length*60/ul2)*(1 + 0.7*(HRFAC*(volau) / (lanes*ul1)) ^5)
45		fd5 =(length*60/ul2)*(1 + 0.72*(HRFAC*(volau) / (lanes*ul1)) ^5)
50	fd3 = put((length*60/ul2)*(1+0.56*(HRFAC *volau/ (ul1*lanes))^6.0))+length*((0.5639+	fd6 =(length*60/ul2)*(1 + 0.74*(HRFAC*(volau) / (lanes*ul1)) ^5)

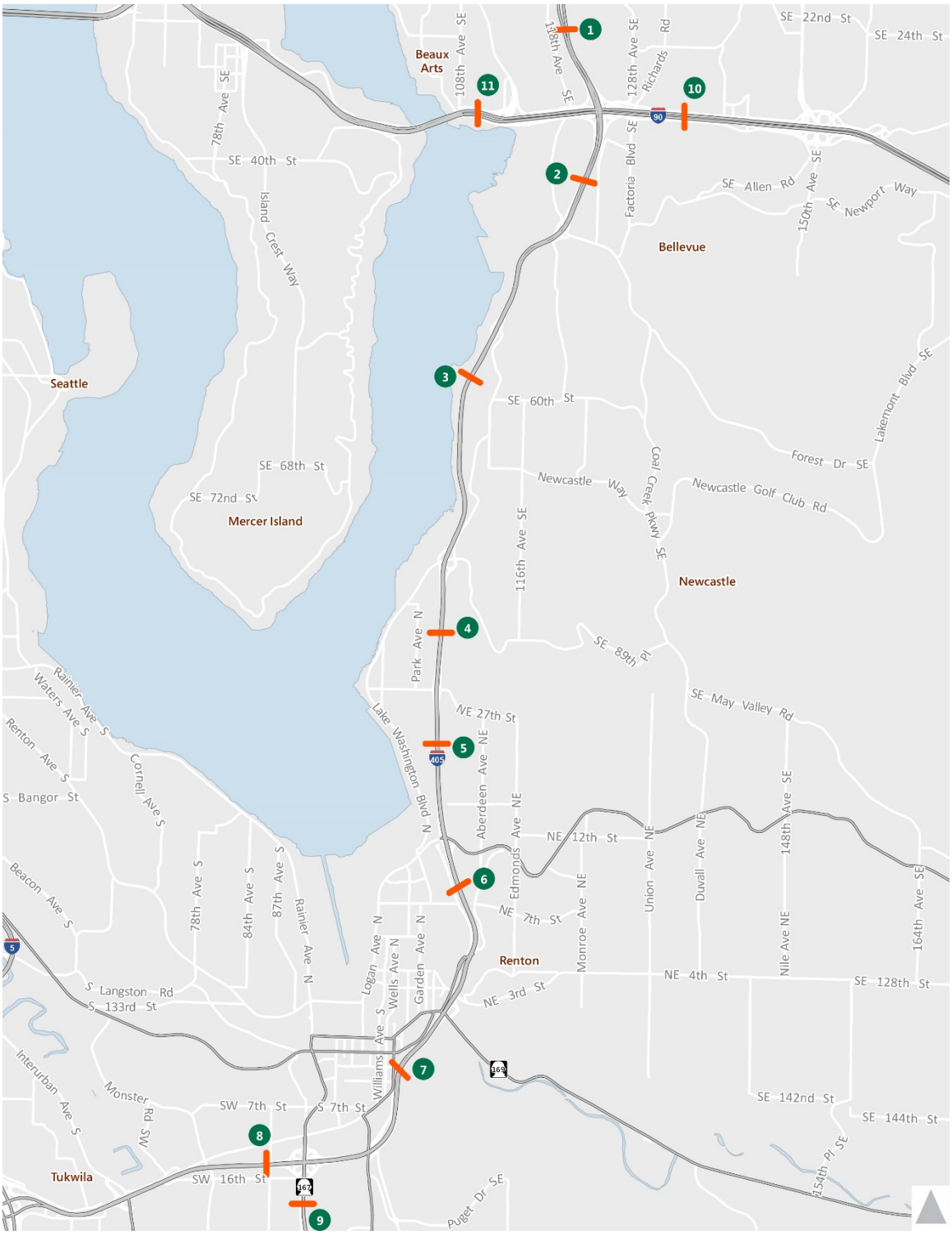
55	put(get(1)/ length)*(0.6398+get(2)*(-0.0712+get(2)* (0.0004+0.00009*get(2))))))	fd7 =(length*60/ul2)*(1 + 0.1*(HRFAC*(volau) / (lanes*ul1)) ^10)
60	fd1 = put((length*60/ul2)*(1+0.72*(HRFAC *volau/(ul1* lanes))^7.2))+ length*(0.max.(-.5639+put(get(1)/ length)*(0.6398+get(2)*(-0.0712+get(2)* (0.0004+0.00009*get(2))))))	fd8 =put((length*60/ul2)*(1 + 0.72*(HRFAC*(volau) / (lanes*ul1)) ^7.2))+length*(0.max.(-0.5639+put(get(1)/length)*(0.6398+get(2)*(-0.0712+get(2)*(0.0004+0.00009*get(2))))))
70		fd10 =(length*60/ul2)*(1 + .32*(HRFAC*(volau) / (lanes*ul1)) ^7)
Centroid	fd9 =(length*60/ul2)	fd9 =(length*60/ul2)*(1 + 1.5*(HRFAC*(volau) / (lanes*ul1)) ^4) or (length*60/ul2)

Notes:
fd: Function Definition (part of EMME macro language)
length: Link distance
UL2: Speed in EMME model
HRFAC: EMME Time Period Peak Hour Factor (AM=.375, PM=.35,MD=.184,EV=.354,NI=.255)
Volau: EMME Total Vehicle Demand for Time Period
Lanes: Number of Lanes
UL1: EMME Capacity (vphpl)

Base Year 2015 I-405 Travel Model Validation

The I-405 model validation was done for the AM and PM peak hours. **Figure 4** shows the locations chosen for the validation effort. The observed data was generally obtained from the WSDOT 2015 Compact Data Retrieval (CDR) database.

FIGURE 4: I-405 VALIDATION LOCATIONS



Tables 4a, 4b and 4c show the results of the validation for the I-405 validation locations for the AM and PM peak periods.

Table 4a – I-405 Peak Period Validation Results

1: I-405 S. of SE 8th St							
AM	1Hr Est 2015	Observed 2015	Model / Observed	PM	1Hr Est 2015	Observed 2015	Model / Observed
NB GP	6889	6952	0.99	NB GP	6806	5770	1.18
NB HOV	719	1221	0.59	NB HOV	723	801	0.90
Total	7608	8173	0.93	Total	7528	6571	1.15
SB GP	6557	5266	1.25	SB GP	5227	4394	1.19
SB HOV	982	495	1.98	SB HOV	1246	1234	1.01
Total	7539	5761	1.31	Total	6473	5628	1.15
2: I-405 N. of Coal Creek Pkwy							
AM	1Hr Est 2015	Observed 2015	Model / Observed	PM	1Hr Est 2015	Observed 2015	Model / Observed
NB GP	4088	4547	0.90	NB GP	3492	3892	0.90
NB HOV	683	1194	0.57	NB HOV	671	676	0.99
Total	4771	5740	0.83	Total	4163	4568	0.91
SB GP	3462	3325	1.04	SB GP	3640	2544	1.43
SB HOV	1031	715	1.44	SB HOV	1214	1557	0.78
Total	4494	4040	1.11	Total	4854	4102	1.18
3: I-405 S. of SE 52nd St							
AM	1Hr Est 2015	Observed 2015	Model / Observed	PM	1Hr Est 2015	Observed 2015	Model / Observed
NB GP	3213	3678	0.87	NB GP	3096	3695	0.84
NB HOV	615	1413	0.44	NB HOV	641	901	0.71
Total	3827	5090	0.75	Total	3737	4596	0.81
SB GP	3306	3398	0.97	SB GP	3730	3157	1.18
SB HOV	1004	766	1.31	SB HOV	1033	1602	0.64
Total	4310	4164	1.04	Total	4763	4759	1.00

4: I-405 S. of NE 44th St							
AM	1Hr Est 2015	Observed 2015	Model / Observed	PM	1Hr Est 2015	Observed 2015	Model / Observed
NB GP	3792	3378	1.12	NB GP	3394	3819	0.89
NB HOV	754	1569	0.48	NB HOV	816	1074	0.76
Total	4546	4948	0.92	Total	4210	4893	0.86
SB GP	3592	3611	0.99	SB GP	4012	3465	1.16
SB HOV	1318	928	1.42	SB HOV	1055	1577	0.67
Total	4910	4539	1.08	Total	5066	5041	1.00

Table 4b – I-405 Peak Period Validation Results

5: I-405 S. of NE 30th St							
AM	1Hr Est 2015	Observed 2015	Model / Observed	PM	1Hr Est 2015	Observed 2015	Model / Observed
NB GP	3692	2875	1.28	NB GP	3321	3650	0.91
NB HOV	768	1461	0.53	NB HOV	813	1088	0.75
Total	4459	4336	1.03	Total	4134	4739	0.87
SB GP	3607	3600	1.00	SB GP	3596	3347	1.07
SB HOV	1169	1585	0.74	SB HOV	1055	1946	0.54
Total	4777	5185	0.92	Total	4651	5293	0.88
6: I-405 S. of NE Park Dr.							
AM	1Hr Est 2015	Observed 2015	Model / Observed	PM	1Hr Est 2015	Observed 2015	Model / Observed
NB GP	4025	2475	1.63	NB GP	3031	3149	0.96
NB HOV	304	1383	0.22	NB HOV	556	1052	0.53
Total	4329	3858	1.12	Total	3587	4201	0.85
SB GP	3037	3133	0.97	SB GP	3227	2964	1.09
SB HOV	1230	735	1.67	SB HOV	687	1321	0.52
Total	4268	3868	1.10	Total	3914	4285	0.91

7: I-405 N. of Talbot St.							
AM	1Hr Est 2015	Observed 2015	Model / Observed	PM	1Hr Est 2015	Observed 2015	Model / Observed
NB GP	3773	2442	1.54	NB GP	4392	4421	0.99
NB HOV	328	1002	0.33	NB HOV	606	998	0.61
Total	4101	3445	1.19	Total	4999	5420	0.92
SB GP	4479	4570	0.98	SB GP	3720	3650	1.02
SB HOV	1183	616	1.92	SB HOV	692	859	0.81
Total	5662	5186	1.09	Total	4412	4509	0.98
8: I-405 W. of SR 167							
AM	1Hr Est 2015	Observed 2015	Model / Observed	PM	1Hr Est 2015	Observed 2015	Model / Observed
NB GP	2329	3558	0.65	NB GP	4259	4818	0.88
NB HOV	877	495	1.77	NB HOV	1466	909	1.61
Total	3206	4053	0.79	Total	5725	5727	1.00
SB GP	4713	4640	1.02	SB GP	3551	3927	0.90
SB HOV	1527	705	2.17	SB HOV	1170	787	1.49
Total	6241	5345	1.17	Total	4721	4714	1.00
9: SR 167 S. of I-405							
AM	1Hr Est 2015	Observed 2015	Model / Observed	PM	1Hr Est 2015	Observed 2015	Model / Observed
NB GP	3263	3558	0.92	NB GP	4259	4818	0.88
NB HOV	877	495	1.77	NB HOV	1466	909	1.61
Total	4140	4053	1.02	Total	5725	5727	1.00
SB GP	4713	4640	1.02	SB GP	3551	3927	0.90
SB HOV	1527	705	2.17	SB HOV	1170	787	1.49
Total	6241	5345	1.17	Total	4721	4714	1.00
10: I-90 E. I-405							
AM	1Hr Est 2015	Observed 2015	Model / Observed	PM	1Hr Est 2015	Observed 2015	Model / Observed
EB GP	4736	4554	1.04	EB GP	6065	6497	0.93
EB HOV	351	178	1.97	EB HOV	941	737	1.28
Total	5087	4732	1.08	Total	7005	7234	0.97
WB GP	5642	6152	0.92	WB GP	4779	4425	1.08
WB HOV	417	721	0.58	WB HOV	601	451	1.33
Total	6059	6873	0.88	Total	5380	4877	1.10

11: I-90 East Channel Bridge							
AM	1Hr Est 2015	Observed 2015	Model / Observed	PM	1Hr Est 2015	Observed 2015	Model / Observed
EB GP	4473	4639	0.96	EB GP	5130	5290	0.97
EB HOV	490	248	1.98	EB HOV	1110	882	1.26
Total	4963	4887	1.02	Total	6239	6172	1.01
WB GP	5553	6104	0.91	WB GP	5929	4981	1.19
WB HOV	1104	1266	0.87	WB HOV	657	875	0.75
Total	6657	7370	0.90	Total	6586	5856	1.12

City	Project Name	Description	Source	Planned Completion year
Bellevue	110th Avenue NE/NE 6th Street to NE 8th Street	Five-lane roadway section.	Bellevue 2017-2022 TIP	
Bellevue	120th Ave NE (Stage 3) NE 12th St to NE 16th St	Extend the 120th Avenue NE widening from NE 12th Street to NE 16th Street to consist of five lanes, including two travel lanes in each direction with turn pockets or a center turn lane;	Bellevue 2015-2021 CIP	2017
Bellevue	120th Ave NE Stage 2 - NE 8th St to NE 12th St	Extend, realign, and widen 120th Ave NE. Build a new signalized intersection at Lake Bellevue Drive/Old Bel-Red Road. The section will consist of five lanes, including two travel lanes in each direction with turn pockets or a center turn lane.	Bellevue 2015-2021 CIP	2017
Bellevue	124th Avenue NE/NE 18th Street to Northup Way	Widen the roadway to five lanes.	Bellevue 2017-2022 TIP	
Bellevue	124th Avenue NE/NE 8th Street to NE Spring Blvd	Widen 124th Avenue NE between Bel-Red Road and Spring Boulevard. The roadway cross-section of this segment will consist of five lanes, including two travel lanes in each direction with turn pockets or a center turn lane.	Bellevue 2017-2022 TIP	
Bellevue	130th Avenue NE/NE 20th to NE Bel-Red Road	From NE 20th Street to NE Spring Blvd will include two travel lanes; NE Spring Blvd to Bel-Red Road will include one	Bellevue 2017-2022 TIP	

City	Project Name	Description	Source	Planned Completion year
		through lane in each direction, a center turn lane.		
Bellevue	143rd Place NE/NE 20th Street to Bel-Red Road/ NE 20th Place signal	New two-lane road starting at the NE 20th Street/143rd Place NE traffic signal and extending to the end of the existing NE 20th Place north of Bel-Red Road. Install signal, eastbound to northbound left turn pocket at the existing Bel-Red Road and NE 20th Place intersection.	Bellevue 2017-2022 TIP	
Bellevue	Bel-Red Rd/NE 20th St to NE 24th St	Widen to five lanes, including two travel lanes in each direction, with center turn lane	Bellevue 2017-2022 TIP	
Bellevue	Eastside Rail Corridor Grade Separated Crossing at NE 4th Street	Construct a grade separated crossing over NE 4th Street along the Eastside Rail Corridor.	Bellevue 2017-2022 TIP	
Bellevue	NE Spring Blvd (Zone 1) - 116th to 120th Avenues NE	Construct a new arterial street between NE 12th Street/116th Avenue NE and 120th Avenue NE. NE 12th Street will be widened between 116th Avenue NE and the new street connection west of the Eastside Rail Corridor. The roadway will have two travel lanes in each direction with turn pockets, along with new traffic signals at the NE 12th Street and at 120th Avenue NE intersections	Bellevue 2015-2021 CIP	2021
Bellevue	NE Spring Boulevard - 130th to 132nd Ave NE	Construct the westbound lane and other improvements on the north half of a new arterial roadway connection between 130th Avenue NE and 132nd Avenue NE. The project includes traffic signals at the 130th Avenue NE and 132nd Avenue NE and a single travel lane outside the LRT alignment.	Bellevue 2015-2021 CIP	2021
Bellevue	NE Spring Boulevard – 130th Avenue NE to 132nd Avenue NE (eastbound)	Construct the eastbound lane and other improvements on the south half of a new arterial roadway connection between 130th Avenue NE and 132nd Avenue NE.	Bellevue 2017-2022 TIP	
Bellevue	Northup Way/156th Avenue NE to	Add median left-turn lane	Bellevue 2017-2022 TIP	

City	Project Name	Description	Source	Planned Completion year
	164th Avenue NE			
Bothell	228th St SE from 35th Ave SE to 39th Ave	Widen 228th Ave to a 4-lane roadway; add EB right turn pocket at 228th/35th.	Bothell 2017-2022 TIP	
Bothell	Beardslee Boulevard Widening (Campus to I-405)	Add an EB lane along Beardslee Blvd from 110th Ave NE to I-405.	Bothell 2017-2022 TIP	
Bothell	Main Street Extension	Extends the current Main Street from Bothell Way to 98th Avenue NE.	Bothell 2015-2021 CFP	
Bothell	Multiway Blvd: Phase 2 (SR 522 to NE 188th St - Excluding West Side)	Multiway Boulevard consists of four travel lanes, a left turn lane.	Bothell 2015-2021 CFP	
Bothell	Pop Keeney Way (NE 185th St / 98th Ave NE)	Construct a road that connects the new NE 185th Street near the bend at 98th Avenue NE to Pop Keeney Field.	Bothell 2015-2021 CFP	
Bothell	SR 522 Stage 2B Improvements (Wayne Curve to NE 180th St)	Installation of a BAT lane westbound.	Bothell 2015-2021 CFP	
Bothell	SR 522 Stage 3 Improvements	Widen the GP lanes; add BAT lanes in each direction (including the missing Seattle outbound direction of the BAT lane from 91st Avenue NE to approximately 800 feet west of the 96th Avenue NE intersection).	Bothell 2015-2021 CFP	
Kirkland	124th Ave NE Roadway Improvements (North Section) Design	Widen the existing roadway between intersections at NE 116th Street and NE 124th Street from 3 lanes to 5 lanes, to include 2-way center turn lane.	Kirkland CIP 2017-2022	design phase
Lynnwood	194th St SW - 33rd Ave W to 40th Ave W	Construct a new 2 lane road from 40th Ave W to 33rd Ave W.	Lynnwood CFP 2017-2022	

City	Project Name	Description	Source	Planned Completion year
Lynnwood	196th St SW (SR-524) - 37th Ave W to 48th Ave W	Widen 196th St SW from five lanes to seven lanes.	Lynnwood CFP 2017-2022	2019
Lynnwood	200th St SW - 40th Ave W to 48th Ave W	Widen 200th St SW from three lanes to 5/7 lanes; turning lanes at the 44th Ave W/200th St SW intersection.	Lynnwood CFP 2017-2022	2022
Lynnwood	200th St SW 64th Ave W to Scriber Lk Rd	Widen 200th St SW.	Lynnwood CFP 2017-2022	2022
Lynnwood	36th Ave W Maple Road to 164th St SW	36th Ave W will be widened to a three-lane arterial; roundabout will be installed at 179th St SW; Maple Road and 172nd St SW will be realigned into a single intersection with a traffic signal.	Lynnwood CFP 2017-2022	2020
Lynnwood	42nd Ave W 200th St SW to 194th St SW	Build a new road from Alderwood Mall Blvd. to 194th St SW.	Lynnwood CFP 2017-2022	2020
Lynnwood	44th Ave W I-5 to 194th St SW	Build a new northbound lane from 200th to 194th. Construct a new southbound lane from 194th to 195th.	Lynnwood CFP 2017-2022	2022
Lynnwood	52nd Ave W 168th St SW to 176th St SW	Widen from 2 to 3 lanes	Lynnwood CFP 2017-2022	2022
Lynnwood	Beech Road Extension AMP to Ash Way Underpass	Construct two extensions of Beech Road.	Lynnwood CFP 2017-2022	2022
Lynnwood	Maple Road Extension AMP to 32nd Ave W	Construct a new road.	Lynnwood CFP 2017-2022	2020
Lynnwood	Poplar Extension Bridge Phase I&II	Construct a bridge across I-5 to connect Poplar Way with 33rd Ave W.	Lynnwood CFP 2017-2022	2020
Redmond	Redmond Way and Cleveland St. Couplet Conversion	Convert Redmond Way from 160th Ave NE to Avondale Way to one through lane in each direction and center turn lane. Convert Cleveland Street to one through lane in each direction; A BAT lane will be completed from the Bear Creek Bridge	Redmond TIP 2017-2022	

City	Project Name	Description	Source	Planned Completion year
		near SR 520 to 168th Ave with a queue jump at Avondale Way.		
Renton	SW 27th St/Strander Blvd Connection	Provides a critical four/five-lane arterial that will serve as a connector to West Valley Highway (SR 181) and East Valley Road.	Renton TIP 2017-2022	
Renton	S 7th St - Rainier Ave S to Talbot Rd S	Widen the existing roadway to 3 lanes (2 lanes EB and 1 lane WB; new eastbound right-turn lane at the intersection of S 7th St and Shattuck Ave S and a traffic signal at this location.	Renton TIP 2017-2022	
Renton	Carr Road Improvements	Widen to 5-lane roadway (2 lanes westbound, 3 lanes eastbound).	Renton TIP 2017-2022	
Renton	Park Ave N Extension	Extend Park Ave N to the north of Logan Ave N.	Renton TIP 2017-2022	
Renton	Houser Way N - N 8th St to Lake Washington Blvd	Widen a one lane roadway to a two-lane roadway.	Renton TIP 2017-2022	
Renton	116th Ave SE Improvements	Widen roadway to provide a 3-lane roadway.	Renton TIP 2017-2022	
Renton	Rainier Ave N Corridor Improvements - Phase 5	Narrow the street from 5 to 3 lanes where feasible.	Renton TIP 2017-2022	
Renton	Lind Ave SW - SW 16th St to SW 43rd St	Widen existing roadway to five lanes where required.	Renton TIP 2017-2022	
Renton	Oakesdale Ave SW/Monster Rd SW/68th Ave S to SR 900	Widen existing roadway to four lanes plus two-way-left-turn-lane where needed.	Renton TIP 2017-2022	
Tukwila	Strander Blvd Extension Phase 3	Build a new roadway extending Strander Blvd/SW 27th St from West Valley Highway to Oakesdale Ave in the City of Renton.	Tukwila CIP 2017-2022	2020
Tukwila	West Valley Hwy (I-405 - Strander Blvd)	Design and construct completion of 7 lane sections of West Valley Hwy.	Tukwila CIP 2017-2022	

City	Project Name	Description	Source	Planned Completion year
Woodinville	171st Urban Parkway	Construct three lane urban parkway 131st lo 14o0th.	Woodinville TIP 2017-2022	
Woodinville	Trestle Replacement - SR202 Corridor	Widen existing roadway.	Woodinville TIP 2017-2022	
Woodinville	Sammamish Bridge Replacement (SBRP)	Widen existing two-lane road and bridge section from 127th to 131st to provide additional lanes.	Woodinville TIP 2017-2022	
Woodinville	140th Ave NE	Widen NE 181st St to Woodinville-Snohomish Road to 5 lanes.	Woodinville TIP 2017-2022	
Woodinville	Woodinville-Snohomish Widening	Widen the road to a 5-lane section.	Woodinville TIP 2017-2022	
Woodinville	NE 173rd St	New 2/3 lane grid road; 135th Ave to 138th Ave.	Woodinville TIP 2017-2022	
Woodinville	135th Ave NE	New 2/3 lane grid road; 175th St to Little Bear Creek Parkway.	Woodinville TIP 2017-2022	
Woodinville	Garden Way	New 2/3 lane grid road; NE 171st St to NE 175th St.	Woodinville TIP 2017-2022	
Woodinville	State Route 202 Corridor Improvement	Add additional lanes from 12th Pl NE to NE 148th.	Woodinville TIP 2017-2022	
Woodinville	Little Bear Creek Parkway	SR 202 to NE 190th -Widen the existing two-lane road sections to provide additional lanes.	Woodinville TIP 2017-2022	
Woodinville	NE 178th St (Mill Place)	140th Ave NE -Wood-Duvall - New three lane grid road.	Woodinville TIP 2017-2022	
Woodinville	1351h Ave NE South	NE 175th lo NE 171st - New 2/3 lane grid road.	Woodinville TIP 2017-2022	

APPENDIX D TRAFFIC AND REVENUE FORECASTING

Stantec Consulting Services Inc. (Stantec) was tasked with forecasting traffic and gross potential revenue for the I-405 express toll lanes. The first step in this process was to calibrate the existing Puget Sound Regional Council (PSRC) 4k model for the I-405 corridor. Utilizing WSDOT data for the general purpose lane counts and speeds combined with actual I-405 express toll lane usage provided by the WSDOT Toll Division, Stantec created a successfully calibrated existing conditions model. The I-405 express toll lane was calibrated based on both origin-destination (O-D) volumes and toll rates.

BERK Consulting (BERK) conducted an independent review of available regional and subarea land use forecast products for the Central Puget Sound region. The purpose of this review was to assess whether adjustments would be necessary to develop a revised forecast data product that is suitable to inform the development of traffic and revenue estimates for the I-405 express toll lane. When necessary, BERK performed additional analysis to prepare land use forecast data for all PSRC transportation analysis zones (TAZ) in the Central Puget Sound region.

BERK's review and adjustment of PSRC's land use forecast product was conducted at four levels of geographic scale: regional, county, jurisdiction, and TAZ. Each level serves as the control totals for the level below. BERK focused exclusively on population forecasts for the regional, county, and jurisdictional reviews.

Toll diversion modeling was completed utilizing Stantec's proprietary toll diversion algorithm. The regional EMME model was transferred into Cube Voyager for the toll diversion process. The model was stratified into hourly models for the AM and PM peak periods (six 1-hour models each) and a 2-hour midday model (14 total tolling hours). Value of time information by trip purpose and vehicle occupancy was incorporated from other regional tolling studies conducted by Stantec. The characteristics of the existing I-405 express toll lane toll algorithm was incorporated into the model. This algorithm sets tolls based on express toll lane speeds and volumes and helps forecast appropriate toll levels based on corridor conditions.

Stantec modeled both the existing geometries with separate tolling policies and configurations for the existing I-405 express toll lane and the SR 167 high-occupancy toll (HOT) lanes and the future condition when the facilities will be connected via the I-405 express toll lane from Renton to Bellevue. Once the system is completed, uniform tolling and high-occupancy vehicle (HOV) policies will be adopted.

Stantec produced a 40-year forecast of traffic and gross potential revenue for the system. These forecasts were incorporated into the operational VISSIM model to identify any problem areas that need to be addressed and updated in the forecast.

APPENDIX E INTERSECTION ANALYSIS RESULTS

This appendix presents AM and PM intersection analysis results. The tables show existing, 2025 No Build, 2025 with the Projects (Build), 2045 No Build, and 2045 with the Projects (Build).

AM Intersection Analysis Results

Intersection	Intersection Control	Level of Service (LOS)					
	Existing/ No Build	Build	2016	2025	2025	2045	2045
			Existing	No Build	Build	No Build	Build
NE 8th St @ 112th Ave NE	Signal	Signal	D	D	D	D	D
NE 8th St @ 116th Ave NE	Signal	Signal	C	C	C	C	C
NE 6th @ 112th Ave NE	Signal	Signal	C	C	D	C	D
NE 6th @ I-405 DA Ramps	Signal	Signal	B	B	B	C	B
NE 4th @ 112th Ave NE	Signal	Signal	C	C	C	C	C
NE 4th @ I-405 SB Ramps	Signal	Signal	B	B	C	B	C
NE 4th @ I-405 NB Ramps	Signal	Signal	C	C	B	D	B
NE 4th @ 116th Ave NE	Signal	Signal	C	C	C	C	C
SE 8th @ 114th Ave SE	Signal	Signal	C	C	C	C	C
SE 8th @ I-405 SB Ramps	Signal	Signal	B	B	B	B	B
SE 8th @ I-405 NB Ramps	Signal	Signal	B	B	B	B	B
Lake Hills @ I-405 NB Ramp	Signal	Signal	A	A	A	A	A
Coal Creek @ 120th Ave SE	TWSC	Roundabout	C	C	A	C	A

AM Intersection Analysis Results

Intersection	Intersection Control	Level of Service (LOS)					
	Existing/ No Build	Build	2016	2025	2025	2045	2045
			Existing	No Build	Build	No Build	Build
Coal Creek @ I-405 SB Ramps	Signal	Roundabout	C	C	A	C	A
Coal Creek @ I-405 NB Ramps	Signal	Roundabout	F	F	A	F	A
Coal Creek @119th Ave SE	Signal	Roundabout	C	D	A	D	A
112th @ 106th Ave SE	TWSC	TWSC	A	A	A	A	A
112th @ I-405 SB Ramps	TWSC	TWSC	B	B	B	B	B
112th @ I-405 DA Ramps	N/A	TWSC	-	-	B	-	B
112th @ I-405 NB Ramps	TWSC	Roundabout	C	C	A	D	A
N 44th @ N 43rd St	TWSC	Roundabout	C	B	A	B	A
N 44th @ Seahawks Way[1]	TWSC/Signal	TWSC	C	C	C	C	C
NE 44th @ I-405 SB Ramps[1]	TWSC/Signal	Roundabout	F	D	A	E	A
NE 44th @ I-405 DA Ramps	N/A	Roundabout	-	-	A	-	A
NE 44th @ I-405 NB Ramps[1]	AWSC/Signal	Roundabout	F	B	A	C	A
Lake Washington Blvd NE@ I-405 NB Ramp	N/A	Roundabout	-	-	A	-	A
N 30th @ I-405 SB Ramps	AWSC	AWSC	A	A	B	A	B

AM Intersection Analysis Results

Intersection	Intersection Control	Level of Service (LOS)					
	Existing/ No Build	Build	2016	2025	2025	2045	2045
			Existing	No Build	Build	No Build	Build
N 30th @ I-405 NB Ramps	AWSC	AWSC	C	C	D	C	E
NE Park @ I-405 SB Ramps	Signal	Signal	C	C	C	C	C
NE Park @ I-405 NB Ramps	Signal	Signal	C	C	A	C	B
Sunset @ I-405 SB Ramp	Free	Free	A	A	A	A	A
Sunset at I-405 NB Ramp	Free	Free	A	A	A	B	B
SR 169 @ Houser Way N	Signal	Signal	A	A	B	A	B
SR 169 @ I-405 SB Ramp	Signal	Signal	E	E	C	E	D
SR 169 @ I-405 NB Ramps	Signal	Signal	B	C	D	C	D
Talbot @ I-405 SB Ramp	Signal	Signal	B	B	C	C	C
Talbot @ I-405 NB Ramp	Signal	Signal	A	A	A	A	A

Notes:
TWSC: Two-Way Stop Controlled (worst movement level of service reported)
AWSC: All-Way Stop Controlled
[1] Intersection is signalized in No Build

AM Intersection Approaches with LOS E or F

Intersection	Intersection Control		Approaches with LOS E or F				
	Existing/ No Build	Build	2016	2025	2025	2045	2045
			Existing	No Build	Build	No Build	Build
NE 8th St @ 112th Ave NE	Signal	Signal	NB, SB	NB, SB, SW	SW	WB, NB, SB, SW	SB, SW
NE 8th St @ 116th Ave NE	Signal	Signal					
NE 6th @ 112th Ave NE	Signal	Signal					WB
NE 6th @ I-405 DA Ramps	Signal	Signal					
NE 4th @ 112th Ave NE	Signal	Signal					
NE 4th @ I-405 SB Ramps	Signal	Signal					
NE 4th @ I-405 NB Ramps	Signal	Signal				NB	
NE 4th @ 116th Ave NE	Signal	Signal					
SE 8th @ 114th Ave SE	Signal	Signal					NB
SE 8th @ I-405 SB Ramps	Signal	Signal					
SE 8th @ I-405 NB Ramps	Signal	Signal					
Lake Hills @ I-405 NB Ramp	Signal	Signal					
Coal Creek @ 120th Ave SE	TWSC	Roundabout					
Coal Creek @ I-405 SB Ramps	Signal	Roundabout	SB	SB		SB	

AM Intersection Approaches with LOS E or F

Intersection	Intersection Control		Approaches with LOS E or F				
	Existing/ No Build	Build	2016	2025	2025	2045	2045
			Existing	No Build	Build	No Build	Build
Coal Creek @ I-405 NB Ramps	Signal	Roundabout	WB	WB		WB	
Coal Creek @119th Ave SE	Signal	Roundabout	NB	NB		NB	
112th @ 106th Ave SE	TWSC	TWSC					
112th @ I-405 SB Ramps	TWSC	TWSC					
112th @ I-405 DA Ramps	N/A	TWSC	-	-		-	
112th @ I-405 NB Ramps	TWSC	Roundabout					
N 44th @ N 43rd St	TWSC	Roundabout					
N 44th @ Seahawks Way[1]	TWSC/Signal	TWSC					
NE 44th @ I-405 SB Ramps[1]	TWSC/Signal	Roundabout	SB	WB		WB	
NE 44th @ I-405 DA Ramps	N/A	Roundabout	-	-		-	
NE 44th @ I-405 NB Ramps[1]	AWSC/Signal	Roundabout	NB, SB				
Lake Washington Blvd NE@ I-405 NB Ramp	N/A	Roundabout	-	-		-	
N 30th @ I-405 SB Ramps	AWSC	AWSC					
N 30th @ I-405 NB Ramps	AWSC	AWSC			WB		WB

AM Intersection Approaches with LOS E or F

Intersection	Intersection Control		Approaches with LOS E or F				
	Existing/ No Build	Build	2016	2025	2025	2045	2045
			Existing	No Build	Build	No Build	Build
NE Park @ I-405 SB Ramps	Signal	Signal					
NE Park @ I-405 NB Ramps	Signal	Signal	EB	EB		EB	
Sunset @ I-405 SB Ramp	Free	Free					
Sunset at I-405 NB Ramp	Free	Free					
SR 169 @ Houser Way N	Signal	Signal					
SR 169 @ I-405 SB Ramp	Signal	Signal	SB	SB		EB, SB	
SR 169 @ I-405 NB Ramps	Signal	Signal					SB
Talbot @ I-405 SB Ramp	Signal	Signal					
Talbot @ I-405 NB Ramp	Signal	Signal					

Notes:
TWSC: Two-Way Stop Controlled (worst movement level of service reported)
AWSC: All-Way Stop Controlled
[1] Intersection is signalized in No Build

PM Intersection Analysis Results

Intersection	Intersection Control		Level of Service (LOS)				
	Existing/ No Build	Build	2016	2025	2025	2045	2045
			Existing	No Build	Build	No Build	Build
NE 8th St @ 112th Ave NE	Signal	Signal	E	E	E	F	F
NE 8th St @ 116th Ave NE	Signal	Signal	D	D	D	E	E
NE 6th @ 112th Ave NE	Signal	Signal	C	C	E	C	F
NE 6th @ I-405 DA Ramps	Signal	Signal	B	B	C	B	D
NE 4th @ 112th Ave NE	Signal	Signal	C	C	D	D	E
NE 4th @ I-405 SB Ramps	Signal	Signal	B	B	B	B	B
NE 4th @ I-405 NB Ramps	Signal	Signal	C	C	B	C	B
NE 4th @ 116th Ave NE	Signal	Signal	D	D	D	E	F
SE 8th @ 114th Ave SE	Signal	Signal	D	E	E	F	F
SE 8th @ I-405 SB Ramps	Signal	Signal	C	C	C	C	C
SE 8th @ I-405 NB Ramps	Signal	Signal	B	B	C	C	C
Lake Hills @ I-405 NB Ramp	Signal	Signal	A	A	A	A	C
Coal Creek @ 120th Ave SE	TWSC	Roundabout	C	C	A	C	A
Coal Creek @ I-405 SB Ramps	Signal	Roundabout	E	E	A	E	A

PM Intersection Analysis Results

Intersection	Intersection Control		Level of Service (LOS)				
	Existing/ No Build	Build	2016 Existing	2025 No Build	2025 Build	2045 No Build	2045 Build
Coal Creek @ I-405 NB Ramps	Signal	Roundabout	F	F	A	F	A
Coal Creek @119th Ave SE	Signal	Roundabout	D	D	A	E	A
112th @ 106th Ave SE	TWSC	TWSC	A	A	A	A	A
112th @ I-405 SB Ramps	TWSC	TWSC	B	B	B	B	B
112th @ I-405 DA Ramps	N/A	TWSC	-	-	B	-	B
112th @ I-405 NB Ramps	TWSC	Roundabout	B	B	A	B	A
N 44th @ N 43rd St	TWSC	Roundabout	B	C	A	C	A
N 44th @ Seahawks Way[1]	TWSC/Signal	TWSC	C	A	B	A	B
NE 44th @ I-405 SB Ramps[1]	TWSC/Signal	Roundabout	E	B	A	B	A
NE 44th @ I-405 DA Ramps	N/A	Roundabout	-	-	A	-	A
NE 44th @ I-405 NB Ramps[1]	AWSC/Signal	Roundabout	F	B	A	B	A
Lake Washington Blvd NE@ I-405 NB Ramp	N/A	Roundabout	-	-	A	-	A
N 30th @ I-405 SB Ramps	AWSC	AWSC	B	B	B	B	B
N 30th @ I-405 NB Ramps	AWSC	AWSC	B	B	B	B	B

PM Intersection Analysis Results

Intersection	Intersection Control		Level of Service (LOS)				
	Existing/ No Build	Build	2016	2025	2025	2045	2045
			Existing	No Build	Build	No Build	Build
NE Park @ I-405 SB Ramps	Signal	Signal	B	C	C	C	C
NE Park @ I-405 NB Ramps	Signal	Signal	B	B	B	B	B
Sunset @ I-405 SB Ramp	Free	Free	A	A	A	A	A
Sunset at I-405 NB Ramp	Free	Free	A	A	A	A	A
SR 169 @ Houser Way N	Signal	Signal	A	B	B	B	B
SR 169 @ I-405 SB Ramp	Signal	Signal	D	D	D	F	E
SR 169 @ I-405 NB Ramps	Signal	Signal	B	A	B	A	B
Talbot @ I-405 SB Ramp	Signal	Signal	C	C	C	C	D
Talbot @ I-405 NB Ramp	Signal	Signal	A	A	A	A	A

Notes:
TWSC: Two-Way Stop Controlled (worst movement level of service reported)
AWSC: All-Way Stop Controlled
[1] Intersection is signalized in No Build

PM Approaches with LOS E or F

Intersection	Intersection Control		Approaches with LOS E or F				
	Existing/ No Build	Build	2016	2025	2025	2045	2045
			Existing	No Build	Build	No Build	Build
NE 8th St @ 112th Ave NE	Signal	Signal	EB, NB, SB, SW	SB, SW	EB, WB, NB, SB	All 5 Approaches	EB, WB, NB, SB
NE 8th St @ 116th Ave NE	Signal	Signal	SB	SB		WB, SB	EB SB
NE 6th @ 112th Ave NE	Signal	Signal			EB, WB, SB	EB	EB, WB, SB
NE 6th @ I-405 DA Ramps	Signal	Signal					
NE 4th @ 112th Ave NE	Signal	Signal					EB, SB
NE 4th @ I-405 SB Ramps	Signal	Signal					
NE 4th @ I-405 NB Ramps	Signal	Signal				WB	
NE 4th @ 116th Ave NE	Signal	Signal	EB	EB, SB	EB	EB, SB	EB, SB
SE 8th @ 114th Ave SE	Signal	Signal	NB, SB, NE	All 4 Approaches	NB, SB, NE	All 4 Approaches	All 4 Approaches
SE 8th @ I-405 SB Ramps	Signal	Signal				SB	
SE 8th @ I-405 NB Ramps	Signal	Signal	NW	NW	NW	NW	NW
Lake Hills @ I-405 NB Ramp	Signal	Signal					
Coal Creek @ 120th Ave SE	TWSC	Roundabout					

PM Approaches with LOS E or F

Intersection	Intersection Control		Approaches with LOS E or F				
	Existing/ No Build	Build	2016	2025	2025	2045	2045
			Existing	No Build	Build	No Build	Build
Coal Creek @ I-405 SB Ramps	Signal	Roundabout	SB	SB		SB	
Coal Creek @ I-405 NB Ramps	Signal	Roundabout	WB, NB	EB, WB, NB		EB, WB, NB	
Coal Creek @119th Ave SE	Signal	Roundabout	NB	NB		WB, NB	
112th @ 106th Ave SE	TWSC	TWSC					
112th @ I-405 SB Ramps	TWSC	TWSC					
112th @ I-405 DA Ramps	N/A	TWSC	-	-		-	
112th @ I-405 NB Ramps	TWSC	Roundabout					
N 44th @ N 43rd St	TWSC	Roundabout					
N 44th @ Seahawks Way[1]	TWSC/Signal	TWSC					
NE 44th @ I-405 SB Ramps[1]	TWSC/Signal	Roundabout	SB				
NE 44th @ I-405 DA Ramps	N/A	Roundabout	-	-		-	
NE 44th @ I-405 NB Ramps[1]	AWSC/Signal	Roundabout	NB, SB				
Lake Washington Blvd NE@ I-405 NB Ramp	N/A	Roundabout	-	-		-	
N 30th @ I-405 SB Ramps	AWSC	AWSC					

PM Approaches with LOS E or F

Intersection	Intersection Control		Approaches with LOS E or F				
	Existing/ No Build	Build	2016	2025	2025	2045	2045
			Existing	No Build	Build	No Build	Build
N 30th @ I-405 NB Ramps	AWSC	AWSC					
NE Park @ I-405 SB Ramps	Signal	Signal					
NE Park @ I-405 NB Ramps	Signal	Signal					
Sunset @ I-405 SB Ramp	Free	Free					
Sunset at I-405 NB Ramp	Free	Free					
SR 169 @ Houser Way N	Signal	Signal					
SR 169 @ I-405 SB Ramp	Signal	Signal				EB	SB
SR 169 @ I-405 NB Ramps	Signal	Signal					
Talbot @ I-405 SB Ramp	Signal	Signal					SB
Talbot @ I-405 NB Ramp	Signal	Signal					

Notes:
TWSC: Two-Way Stop Controlled (worst movement level of service reported)
AWSC: All-Way Stop Controlled
[1] Intersection is signalized in No Build

APPENDIX F CURRENT TRANSIT ROUTES

I-405 Influence	Route	Route Name	Service Area	Service Type
Use	111	Maplewood to Lake Kathleen to Downtown Seattle	Maplewood, Lake Kathleen, Renton Highlands P&R, Kennydale, Newport Hills P&R, Downtown Seattle	Weekday
Use	114	Renton Highlands to Downtown Seattle	Renton Highlands, New Castle, Newport Hills, Downtown Seattle	Weekday
Use	167	South Renton P&R to University District	South Renton P&R, Renton Transit Center, Newport Hills P&R, Evergreen Point Station, Montlake, University District	Weekday
Use	237	Woodinville P&R to Bellevue TC	Woodinville P&R, Brickyard Freeway Station, Totem Lake Freeway Station, Houghton P&R, Bellevue Transit Center	Weekday
Use	342	Shoreline P&R to Renton TC	Shoreline P&R, Aurora Village Transit Center, Kenmore P&R, Bothell P&R, Totem Lake Freeway Station, Houghton P&R, Bellevue Transit Center, Renton Boeing, Renton Transit Center	Weekday
Use	ST 560 / ST 566	Auburn/West Seattle to Bellevue	Auburn Station, Auburn P&R, Kent Station, Westwood Village, Burien, Sea-Tac Airport, Renton Transit Center, Kennydale Freeway Station, Newport Hills P&R, Bellevue Transit Center, Overlake Transit Center	Weekdays, Saturday, Sunday
Use	ST 567	Kent to Overlake	Kent Station, Bellevue Transit Center, Overlake Transit Center	Weekdays
Use	952	Auburn P&R to Kennydale to Boeing Everett	Auburn P&R, Kent Station, Kennydale Freeway Station, Newport Hills Freeway Station, Wilburton Freeway Station, Houghton Freeway Station, Brickyard Freeway Station, Canyon Park Freeway Station, BOMARC, Boeing Everett	Weekdays
Use	887	Newport Hills to International School	Coal Creek Pkwy Freeway Station, Lake Washington Boulevard, International School	Weekday

I-405 Influence	Route	Route Name	Service Area	Service Type
Use	989	Eastgate P&R to Lakeside (Haller Lake)	Eastgate P&R, Factoria, Mercer Island, University Prep, Lakeside School	Weekday
Cross	240	Bellevue TC to Renton TC	Bellevue Transit Center, Wilburton P&R, Eastgate P&R, Factoria, Newport Hills, New Castle, Renton Highlands, Renton Boeing, Renton Transit Center	Weekdays, Saturday, Sunday
Cross	246	Eastgate P&R to Somerset to Bellevue TC to Clyde Hill	Eastgate P&R, Somerset School, Factoria, Woodridge P&R, Bellevue Transit Center, Clyde Hill/Yarrow Point Freeway Station	Weekdays
Cross	271	Issaquah to University District	Issaquah, Issaquah Transit Center, South Cove, Eastgate P&R, Bellevue College, Bellevue Transit Center, Montlake, University District	Weekdays, Saturday, Sunday
Cross	886	Newport High School to International School	Newport High School, Coal Creek Pkwy Freeway Station, International School	Weekday

APPENDIX G 3-HOUR VEHICLE AND PERSON THROUGHPUT

3-Hour Vehicle Throughput - Northbound AM Peak Period

	N of I-5	N of SR 181	N of SR 167	N of Talbot	N of SR 169	N of Park	N of 30th	N of 44th	N of 112th	N of CCPW	N of I-90	N of SE 8th	N of NE 6th
Existing	14,040	12,270	9,420	11,280	10,950	12,240	14,160	15,660	18,270	21,600	23,790	22,110	18,600
2025 No Build	13,560	11,700	9,210	11,220	11,220	12,480	14,670	16,260	18,960	22,380	24,870	22,890	19,770
2025 Build	15,870	14,340	12,810	15,060	14,070	14,670	17,070	17,670	21,660	25,080	26,310	24,270	19,440
2045 No Build	12,780	11,220	9,090	11,250	10,890	12,210	14,490	16,110	18,960	22,290	24,510	22,740	20,070
2045 Build	16,080	14,160	12,750	15,120	14,460	15,150	17,490	17,970	21,960	25,140	26,550	24,660	19,980

3-Hour Vehicle Throughput - Southbound AM Peak Period

	S of SR 520	S of NE 6th	S of NE 4th	S of SE 8th	S of I-90	S of CCPW	S of 112th	S of 44th	S of 30th	S of Park	S of SR 169	S of SR 167	S of SR 181	N of I-5
Existing	24,570	16,260	19,380	17,910	12,780	12,030	11,700	12,330	12,510	13,200	17,010	15,900	15,060	15,060
2025 No Build	24,960	16,440	19,920	18,450	13,230	12,420	12,030	12,750	13,020	13,830	17,700	16,860	15,960	15,990
2025 Build	25,890	17,460	21,120	19,650	14,460	13,590	13,110	14,010	14,310	15,090	18,870	16,980	15,930	15,960
2045 No Build	25,050	16,620	20,250	18,690	13,350	12,570	12,180	13,020	13,320	14,280	18,300	17,010	16,350	16,380
2045 Build	25,800	18,060	21,780	19,950	14,100	13,350	12,870	13,830	14,190	15,270	19,260	17,490	16,680	16,680

3-Hour Vehicle Throughput - Northbound PM Peak Period

	N of I-5	N of SR 181	N of SR 167	N of Talbot	N of SR 169	N of Park	N of 30th	N of 44th	N of 112th	N of CCPW	N of I-90	N of SE 8th	N of NE 6th
Existing	15,960	17,610	16,140	18,030	14,970	14,250	14,430	13,830	14,460	15,840	18,420	19,260	21,060
2025 No Build	16,200	17,910	16,530	18,510	15,450	14,730	15,000	14,310	15,120	16,680	20,130	21,090	22,620
2025 Build	15,750	17,220	17,040	18,960	16,050	15,420	15,690	14,520	15,900	17,700	20,940	22,410	22,380
2045 No Build	15,090	16,950	16,530	18,480	15,330	14,550	14,820	14,100	14,940	16,440	20,580	21,660	23,460
2045 Build	14,850	15,990	16,980	18,990	16,320	15,840	16,050	14,730	16,260	18,030	20,850	21,900	22,050

3-Hour Vehicle Throughput - Southbound PM Peak Period

	S of SR 520	S of NE 6th	S of NE 4th	S of SE 8th	S of I-90	S of CCPW	S of 112th	S of 44th	S of 30th	S of Park	S of SR 169	S of SR 167	S of SR 181	N of I-5
Existing	16,680	12,780	17,460	18,930	14,910	14,730	14,250	14,580	14,220	14,880	16,470	14,460	14,580	14,580
2025 No Build	17,070	12,630	17,550	18,540	15,000	14,730	14,250	14,670	14,400	15,480	17,100	15,120	15,240	15,240
2025 Build	19,230	15,690	20,910	21,870	18,000	18,180	17,610	17,640	17,490	18,390	19,620	15,900	16,380	16,410
2045 No Build	15,360	10,950	15,930	17,220	14,940	14,910	14,430	14,820	14,580	15,750	17,580	15,720	15,690	15,630
2045 Build	18,630	15,180	20,820	22,260	18,180	18,120	17,520	17,580	17,430	18,300	19,710	15,840	16,350	16,380

3-Hour Person Throughput - Northbound AM Peak Period

	N of I-5	N of SR 181	N of SR 167	N of Talbot	N of SR 169	N of Park	N of 30th	N of 44th	N of 112th	N of CCPW	N of I-90	N of SE 8th	N of NE 6th
Existing	19,410	17,190	13,350	15,990	15,990	18,060	20,820	22,770	26,460	31,590	33,480	31,110	26,040
2025 No Build	18,840	16,500	13,860	16,770	16,920	19,020	22,230	24,210	28,050	33,210	35,280	32,460	27,960
2025 Build	22,020	20,100	19,290	22,620	21,510	22,560	25,980	27,000	32,550	37,650	37,800	34,830	27,570
2045 No Build	17,760	15,810	13,440	16,650	16,380	18,570	21,870	23,910	27,990	33,000	34,860	32,310	28,560
2045 Build	22,320	19,950	19,170	22,740	22,170	23,340	26,700	27,480	33,030	37,830	38,280	35,550	28,500

3-Hour Person Throughput - Southbound AM Peak Period

	S of SR 520	S of NE 6th	S of NE 4th	S of SE 8th	S of I-90	S of CCPW	S of 112th	S of 44th	S of 30th	S of Park	S of SR 169	S of SR 167	S of SR 181	N of I-5
Existing	34,110	22,410	27,060	25,050	16,740	15,660	15,240	16,080	16,290	17,280	22,230	20,520	19,380	19,410
2025 No Build	36,060	23,580	28,650	26,670	17,400	16,230	15,690	16,650	16,980	18,120	23,130	21,900	20,670	20,670
2025 Build	37,260	25,320	30,690	28,680	19,950	18,690	18,000	19,290	19,680	20,850	25,680	22,620	21,030	21,060
2045 No Build	36,150	23,850	29,190	26,970	17,550	16,410	15,870	16,950	17,400	18,690	23,880	22,170	21,210	21,240
2045 Build	37,080	26,130	31,590	29,040	19,380	18,330	17,610	18,930	19,440	21,000	26,100	22,980	21,780	21,780

3-Hour Person Throughput - Northbound PM Peak Period

	N of I-5	N of SR 181	N of SR 167	N of Talbot	N of SR 169	N of Park	N of 30th	N of 44th	N of 112th	N of CCPW	N of I-90	N of SE 8th	N of NE 6th
Existing	22,710	24,810	22,680	25,530	21,210	20,250	20,550	19,710	20,640	22,950	27,240	28,380	30,990
2025 No Build	22,800	25,050	23,040	26,010	21,840	20,850	21,210	20,340	21,540	24,150	29,880	31,170	33,540
2025 Build	22,650	24,630	24,600	27,540	23,580	22,620	23,010	21,270	23,430	26,250	31,380	33,360	33,240
2045 No Build	21,210	23,700	22,800	25,740	21,480	20,430	20,820	19,860	21,090	23,670	30,720	32,190	35,010
2045 Build	21,510	22,980	24,510	27,540	23,940	23,190	23,490	21,540	23,790	26,730	31,410	32,820	33,000

3-Hour Person Throughput - Southbound PM Peak Period

	S of SR 520	S of NE 6th	S of NE 4th	S of SE 8th	S of I-90	S of CCPW	S of 112th	S of 44th	S of 30th	S of Park	S of SR 169	S of SR 167	S of SR 181	N of I-5
Existing	23,010	18,090	25,170	27,540	20,940	20,610	19,860	20,250	19,800	20,700	22,980	19,320	19,710	19,710
2025 No Build	23,790	18,330	25,710	27,450	21,360	20,850	20,130	20,640	20,310	21,750	24,060	20,250	20,610	20,640
2025 Build	27,180	20,970	30,810	32,400	26,250	26,490	25,620	25,620	25,500	26,700	28,350	21,810	22,620	22,650
2045 No Build	21,510	15,810	23,580	25,770	21,270	21,150	20,400	20,940	20,580	22,170	24,720	21,060	21,240	21,180
2045 Build	26,820	20,250	31,050	33,420	26,640	26,490	25,560	25,620	25,470	26,670	28,680	21,720	22,620	22,680