APPENDIX P: TRANSPORTATION DISCIPLINE REPORT

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I-405, Bellevue to Lynnwood Improvement Project

INTERSTATE 405 **Corridor Program**

Congestion Relief & Bus Rapid Transit Projects

TRANSPORTATION DISCIPLINE REPORT

April 2011

Washington State Department of Transportation

U.S. Department of Transportation
Federal Highway Administration

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SUMMARY

The Washington State Department of Transportation (WSDOT) is proposing to construct the I-405, Bellevue to Lynnwood Improvement Project (Bellevue to Lynnwood Improvement Project) to improve traffic operations and safety on I-405 between NE 6th Street in downtown Bellevue and I-5 in Lynnwood. This discipline report assesses the project's operational and construction effects on transportation. This report evaluates two Build Alternatives and a No Build Alternative.

Study Area

The study area for the Bellevue to Lynnwood Improvement Project was identified as the section of I-405 between NE 6th Street in Bellevue and I-5 in Lynnwood. These limits were chosen because of where the proposed improvements will be made to I-405. The study area also includes any adjacent intersections and local streets that may be affected by the improvements to I-405. In addition to the study area, we also analyzed the section of I-405 from NE 6th Street to south of I-90, and the adjacent sections of I-5 in Lynnwood, SR 525, SR 522, SR 520, and I-90 because effects in these areas may affect operations in the study area.

Existing conditions

The section of I-405 between NE 6th Street and I-5 in Lynnwood is considered one of the most congested and inefficient highways in the Puget Sound region. The general-purpose lanes on I-405 currently experience congestion and reduced speeds for several hours during the morning and afternoon commutes. For example, average travel speeds can be as low as 15-25 miles per hour at select locations for both southbound in the morning and northbound in the afternoon. The HOV lanes in the study area also experience congestion and reduced speeds during the peak of the morning and afternoon commutes, most notably between SR 520 and SR 522.

Baseline conditions

The baseline conditions represent future conditions in 2015 and assume the existing I-405 network including the recently

constructed Kirkland Nickel Project Stage 1 and the northbound auxiliary lane from NE 195th Street to SR 527. The baseline conditions also assume the completion of the funded I-405, NE 8th Street to SR 520 Braided Ramps Project, which is scheduled to be constructed and operating in the study area by 2015.

This transportation analysis does not include the Kirkland Nickel Project Stage 2 as part of the baseline conditions. The Kirkland Nickel Project Stage 2 has been environmentally cleared but not constructed. It will be constructed at the same time as this project. To show the change in the transportation network that will occur with the project, the transportation analysis assumes it is not included with the baseline conditions. The Kirkland Nickel Project Stage 2 was cleared to add one lane to northbound I-405 from NE 70th Street to NE 85th Street, and one lane to southbound I-405 from SR 522 to NE 124th Street and from NE 85th Street to SR 520.

What are braided ramps?

Braided ramps are grade-separated ramps that divide the traffic merging onto the freeway from traffic exiting the freeway. The braided ramps eliminate the weaving between the on-ramp and off-ramp vehicles.

Project effects

The project will add freeway capacity, improve reliability, increase travel speed, and benefit operations on I-405. The northbound I-405 braided ramps from NE 160th Street to SR 522 will improve traffic flow by removing the heavy weaving volumes between these interchanges. The project will improve safety in the study area by reducing congestion, and, in turn, congestion-related accidents.

The project will construct transit shoulders on the right side of southbound I-405 from SR 527 to NE 195th Street and from SR 522 to NE 160th Street to improve transit travel time.

Measures to avoid or minimize effects

WSDOT will plan project construction to minimize disruptions to the freeway whenever possible. Lane closures will occur in off-peak hours and will be coordinated with local agencies.

Unavoidable adverse effects

We do not foresee the project causing any substantial unavoidable adverse effects to transportation.

ACRONYMS AND ABBREVIATIONS

Term	Meaning
EA	environmental assessment
EIS	environmental impact statement
ETL	express toll lane
FHWA	Federal Highway Administration
GP	general-purpose
HOV	high-occupancy vehicle
HOV 2+	high-occupancy vehicle requirement of two or more persons per vehicle
HOV 3+	high-occupancy vehicle requirement of three or more people per vehicle
LOS	level of service
Metro	King County Metro Transit Agency
mph	miles per hour
MVMT	million vehicle miles of travel
NEPA	National Environmental Policy Act
PSRC	Puget Sound Regional Council
Sound Transit	Central Puget Sound Regional Transit Authority
SOV	single-occupant vehicle
SR	State Route
vph	vehicles per hour
WSDOT	Washington State Department of Transportation

GLOSSARY

Term	Meaning
access	The ability to enter a freeway or roadway via an on-ramp or other entry point.
arterial	A major street that primarily serves through traffic, but also provides access to abutting properties. Arterials are often divided into principal and minor classifications depending on the number of lanes, connections made, volume of traffic, nature of traffic, speeds, interruptions (access functions), and length.
bicycle lane	A portion of a roadway reserved for preferential or exclusive use by bicycles. These lanes are identified using striping, signs, and/or pavement markings.
bottleneck	A narrow or obstructed section of a highway that contributes to traffic congestion.
bus rapid transit (BRT)	An express, or limited-stop, rubber-tired transit system operating predominately in roadway-managed lanes such as high-occupancy vehicle (HOV) lanes.
capacity	The maximum sustained traffic flow of a transportation facility under prevailing traffic and roadway conditions in a specified direction.
congestion	The condition when unstable traffic flows constrain travel speeds to less than the posted limit. Recurring congestion is caused by constant excess traffic volume compared with the highway's capacity. Nonrecurring congestion is caused by unusual or unpredictable events such as traffic accidents.
CORSIM	A traffic analysis software package that simulates roadway intersection operating conditions and the effects of design modifications.
delay	The increased travel time experienced because of circumstances that impede the desirable movement of traffic.
demand	The desire for travel by potential users of the transportation system.
direct-access ramp	A freeway ramp that provides a direct connection to and from managed lanes for buses, carpools, and vanpools. This avoids the need to cross several lanes of general-purpose traffic, saving time and improving traffic flow and safety.

Term	Meaning
enforcement area	A paved 14-foot lane and shoulder extending approximately 1,300 feet along the median side of the freeway and reserved as a refuge for monitoring and enforcement of restrictions on managed lanes use by the State Patrol.
emergency vehicle	Any vehicle used to respond to an incident or accident. Examples include police, fire, ambulance, maintenance vehicles, and incident response tow trucks.
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.
general-purpose lane	A freeway or arterial lane available for use by all traffic.
Growth Management Act (GMA)	Washington State legislation adopted in 1990, and subsequently amended that requires all cities and counties in the state to do some long-range comprehensive planning, and has more extensive requirements for the largest and fastest-growing counties and cities in the state. Such comprehensive plans must address several required topics, including but not limited to land use, transportation, capital facilities, utilities, housing, etc. The GMA requirements also include guaranteeing the consistency of transportation and capital facilities plans with land use plans.
high-occupancy vehicle (HOV)	A high-occupancy vehicle is a special designation for a bus, carpool, or vanpool provided as an encouragement to increase ride-sharing. Specially designated HOV lanes and parking are among the incentives for persons to pool trips, use fewer vehicles, and make the transportation system more efficient. HOV lanes are generally inside (left-side) lanes, and are identified by signs and a diamond on the pavement. Currently, two or more (HOV 2+) occupants are required to use the I-405 HOV lanes. Motorcycles are allowed to use freeway HOV lanes as well.
in-line transit station	A bus transfer facility located along a managed lane such as a high-occupancy vehicle (HOV) lane.
jurisdiction	A municipal government agency, such as a city or county, and as appropriate, federal and state agencies and federally recognized tribes. The term also can mean, “to have authority over.”

Term	Meaning
level of service (LOS)	A measure of how well a freeway or local intersection operates. For freeways, LOS is a measure of traffic congestion typically based on volume-to-capacity ratios. For local intersections, LOS is based on how long it takes a typical vehicle to clear the intersection. Other criteria also may be used to gauge the operating performance of transit, non-motorized, and other transportation modes.
managed lane	Any roadway lane that is managed to balance travel demand and roadway capacity in order to achieve greater person and vehicle throughput. This may include use of one or more of the following techniques to control the number of vehicles using the lane or roadway: user eligibility requirements, such as high-occupancy vehicle (HOV), exclusive bus-only, or truck-only lanes; reversible flow lanes, such as on the I-90 express lanes; limiting access through infrequent on-ramps, such as on the I-5 express lanes; separate toll lanes constructed within freeways; and other pricing mechanisms, such as express toll lanes, high-occupancy/toll (HOT) lanes, and using tolls that vary as travel demand changes.
master plan (I-405)	The master plan for fixing I-405 traffic includes all transportation modes, adding up to two new lanes each direction to I-405, a corridor-wide bus rapid transit (BRT) line and increased local transit service. It will improve bottlenecks such as the SR 167/I-405 interchange, and improve key arterials.
measure of effectiveness	An indicator or criterion used to assess how a roadway performs.
mitigation	An effort to: (1) avoid the impact altogether by not taking a certain action or parts of an action; (2) minimize the impact by limiting the magnitude of the action and its implementation, by using technology or by taking affirmative steps; (3) rectify the impact by repairing, rehabilitating, or restoring the affected environment; (4) reduce or eliminate the impact over time by preservation and maintenance operations; (5) compensate for the impact by replacing, enhancing or providing substitute resources or environments; and/or (6) monitor the impact and take appropriate corrective measures.
modeling	Use of statistics and mathematical equations to simulate and predict real events and processes.
non-motorized	Bicycle, pedestrian, and other modes of transportation not involving a motor vehicle.

Term	Meaning
off-peak	In relation to transportation, public services and utilities, off-peak means those times when fewer persons use the facility, service, or utility.
off-peak direction	Travel direction of the freeway with the lower demand.
park-and-ride	A facility where individuals can park their vehicle for the day and access public transportation or rideshare for the major portion of their trip.
peak direction	Travel direction of the freeway with the higher demand.
peak hour	The hour in the morning or in the afternoon when the maximum demand occurs on a given transportation facility or corridor.
peak period	The period of the day during which the maximum amount of travel occurs. It may be specified as the morning (AM) or afternoon or evening (PM) peak.
person trips	The total number of persons that pass through a section of roadway during a given time period. For example, one vehicle carrying three people comprises three person trips.
Puget Sound Regional Council (PSRC)	The Metropolitan Planning Organization (MPO) and Regional Transportation Planning Organization (RTPO) for the central Puget Sound region, which is comprised of Snohomish, King, Pierce, and Kitsap counties. The MPO and RTPO is the legally-mandated forum for cooperative decision-making about regional growth policies and transportation issues in the metropolitan planning area.
queue	A line of vehicles waiting to move through an access point in traffic, such as a signal or turn lane.
ramp metering	A system used to reduce congestion on a freeway facility by managing vehicle in-flow from local-access on-ramps. An on-ramp is equipped with a traffic signal that allows vehicles to enter the freeway at intervals based on freeway congestion, traffic speeds, and other conditions.
single-occupant vehicle (SOV)	A vehicle having one occupant (i.e., the driver).
State Environmental Policy Act (SEPA)	Washington State legislation adopted in 1974, that establishes an environmental review process for all development proposals and major planning studies prior to taking any action. SEPA includes early coordination to identify and mitigate any substantial issues or significant effects that may result from a project or study.
throughput	The number of vehicles being carried on a facility. This is usually measured at a specific point on the roadway facility for a predetermined period of time.

Term	Meaning
transportation system management (TSM)	An approach to management and operation intended to optimize the performance of transportation facilities through measures that enhance traffic flow, reliability, accessibility, and safety. TSM measures usually are highly cost-effective, and may include improvements such as: traffic signal management; lane controls; ramp metering; work zone, special event, and emergency management; electronic toll collection; traffic incident management; roadway weather management; traveler information services; commercial vehicle and freight management; and coordination of highway, rail, transit, bicycle, and pedestrian operations. Traffic detection and surveillance are often used to support these activities.
travel demand forecasting	Methods for estimating the desire for travel by potential users of the transportation system, including the number of travelers, the time of day, travel mode, and travel routes.
two-directional total	A traffic volume that combines both directions of traffic into one number.
vanpool	A ridesharing arrangement in which a number of people travel together on a regular basis in a public or employer-provided van, usually designed to carry five or more persons.
vehicle	Any car, truck, van, motorcycle, or bus designed to carry passengers or goods. Bicycles and other pedestrian-oriented vehicles are not included in this definition.
vehicle trips	The total number of vehicles that pass through a section of roadway over a given time.
VISSIM	A traffic analysis software package used for the modeling and simulating operation of the transportation system and its elements.

SECTION 1 INTRODUCTION

What are the primary features of the I-405, Bellevue to Lynnwood Improvement Project?

The I-405, Bellevue to Lynnwood Improvement Project will add pavement, restripe existing pavement, and add southbound transit shoulders. Two build alternatives are being proposed for the project and the primary difference between the alternatives is operational. WSDOT will implement these operational differences through different lane striping, and, in the case of Build Alternative 1, adding electronic equipment and signage to implement express toll lanes. With both build alternatives, lanes that are not managed as express toll lanes or HOV lanes will operate as general-purpose lanes.

Build Alternative 1

Build Alternative 1 will result in a two-lane express toll lane system in both directions between NE 6th Street in Bellevue and SR 522, transitioning to a one-lane express toll lane system in both directions between SR 522 and I-5 in Lynnwood.

Build Alternative 2

Build Alternative 2 will result in a one-lane, high-occupancy vehicle (HOV) system in both directions throughout the project length between NE 6th Street in Bellevue and I-5 in Lynnwood. With Build Alternative 2, new lanes added by the project will operate as general-purpose lanes.

What is the purpose of this report?

This Transportation Discipline Report presents the results of our detailed study of the effects of the Bellevue to Lynnwood Improvement Project on I-405 and the adjacent transportation system. The report identifies the meaningful differences between the two build alternatives and the No Build Alternative in terms of freeway and local street performance, safety, and effects to transit and non-motorized facilities. The report is intended to provide information on the effects that will result from each of the proposed alternatives.

What topics are included in the Transportation Discipline Report?

The report includes results from our freeway and local street operations analysis including the number of vehicles moved, changes in freeway congestion, travel time, and intersection level of service. We conducted a safety study for the freeway corridor and examined the effects that constructing the project will have on the transportation system. We identified the effects on transit service and non-motorized facilities. We also describe how the express toll lane system will function, and how it will alter travel in the corridor.

Why is transportation important to consider?

Transportation is vital to the health of the region's economy and affects everyone's quality of life. I-405 plays a crucial role in moving people and goods through the Puget Sound region. As the population and employment within the region increases, it is important that we continually strive to improve the transportation system. Therefore, we need to understand the likely effects of transportation improvements to I-405 before we can efficiently design the project and get approvals from federal agencies.

What studies were completed?

The Puget Sound Regional Council (PSRC) four-county travel forecast model was used as a starting point for determining future travel demand. This model predicts traffic volumes and travel patterns based on adopted land use plans within the region.

In October of 2002, the I-405 Corridor Program Final Environmental Impact Statement (EIS) provided a corridor-wide plan for improvements to I-405 between I-5 in Tukwila and I-5 in Lynnwood.

In February of 2005, the 2005 Kirkland Nickel Project Transportation Discipline Report documented the project's effects on the transportation system.

In April of 2007, the Managed Lanes White Paper studied the effects of incorporating express toll lanes and HOV lane options in the I-405 corridor.

In January 2010, the Eastside Corridor Tolling Study evaluated express toll lane options in the I-405 corridor.

In December, 2010, the Expert Review Panel Final Report endorsed the methodology and findings from the January 2010 Eastside Corridor Tolling Study.

What are the key messages from this report?

The key messages in this report include the following:

- The general-purpose and HOV lanes in the study area currently experience congestion on southbound I-405 in the morning and northbound I-405 in the afternoon. Projected future regional population and employment growth will increase freeway demand compared to 2009 existing conditions.
- Based on existing HOV lane congestion and projected future growth in HOV volumes, this analysis assumes the HOV lanes occupancy requirement will be increased from the existing two or more persons in a vehicle (HOV 2+) to three or more persons (HOV 3+).
- The express toll lanes in Build Alternative 1 will change how the freeway functions by using tolling and allowing HOV 2 and single-occupant vehicles (SOVs) the choice to use the express toll lanes. Allowing SOV and HOV 2 to use the express toll lanes will improve the efficiency of I-405.
- During the 2015 and 2035 afternoon commutes, Build Alternative 1 will improve northbound vehicle throughput and general-purpose lane travel speeds compared to Build Alternative 2 and the No Build Alternative.
- During the 2015 and 2035 morning commutes, Build Alternative 1 will improve southbound vehicle throughput compared to Build Alternative 2 and the No Build Alternative. Build Alternatives 1 and 2 will improve general-purpose lane travel speeds compared to the No Build Alternative.
- Both build alternatives will improve safety compared to the No Build Alternative by reducing congestion and congestion-related accidents.
- Both build alternatives will construct transit shoulders on the right side of southbound I-405 from SR 527 to NE 195th Street and from SR 522 to NE 160th Street, improving transit travel time.

What is throughput?

Throughput is the number of vehicles being carried on a facility. This is usually measured at a specific point on the roadway for a predetermined period of time.

- The Bellevue to Lynnwood Improvement Project will improve a portion of the I-405 corridor. It will not offer the full solution, but serves as a step in implementing the long-term master plan for the I-405 corridor. The master plan includes additional freeway and transit capacity and will substantially replace and upgrade interchanges along the entire length of the I-405 corridor. Coupled with the other master plan improvements on I-405, the Bellevue to Lynnwood Improvement Project will substantially improve travel speeds and vehicle throughput.

What measures are proposed to avoid or reduce effects?

The purpose of the Bellevue to Lynnwood Improvement Project is to improve personal and freight mobility, reduce traffic congestion, and improve safety in the I-405 corridor from Bellevue to Lynnwood. When the project is built and operational, no mitigation measures related to roadway operations will be required.

Project construction will affect the transportation system in the form of temporary closures and construction vehicles traveling on the roadways. The project will be constructed and staged to minimize the effects whenever possible. We 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 allowing lane closures.

What will happen if we adopt the No Build Alternative?

The No Build Alternative assumes the existing I-405 capacity between SR 520 and I-5 Lynnwood and that the I-405, NE 8th Street to SR 520 Braided Ramps Project is complete. By 2015, traffic demand will increase in the study area and we expect traffic congestion in the general-purpose lanes to worsen and travel speeds to decrease compared to 2009 existing conditions. By 2035, traffic volumes will be more constrained and the duration and intensity of congestion will increase.

For local streets, we expect that future traffic volumes will increase and local traffic operations will generally worsen compared to 2009 existing conditions.

SECTION 2 PROJECT DESCRIPTION

What is the intent of the Bellevue to Lynnwood Project and what are the improvements?

The Bellevue to Lynnwood Improvement Project is intended to improve safety and reduce congestion along I-405 between NE 6th Street in Bellevue and I-5 in Lynnwood. To accomplish this, WSDOT proposes the following improvements:

- Northbound lane from NE 124th Street to SR 522;
- Braided ramps between the I-405 northbound on-ramp from NE 160th Street and the northbound I-405 off-ramp to SR 522;
- Southbound transit shoulders between SR 522 and NE 160th Street and between SR 527 and NE 195th Street;
- New northbound and southbound structures over NE 132nd Street and a new northbound structure over the railroad for the I-405 northbound off-ramp to NE 124th Street; and
- Small amounts of additional widening, between four and eight feet, at several locations for buffers, wider shoulders, tolling equipment, enforcement areas and maintenance pull-outs.

Exhibit 2-1 shows the Bellevue to Lynnwood project vicinity.

What are braided ramps?

Braided ramps vertically separate movements with bridge structures to eliminate traffic conflicts between closely-spaced on-ramps and off-ramps.

What is a transit shoulder?

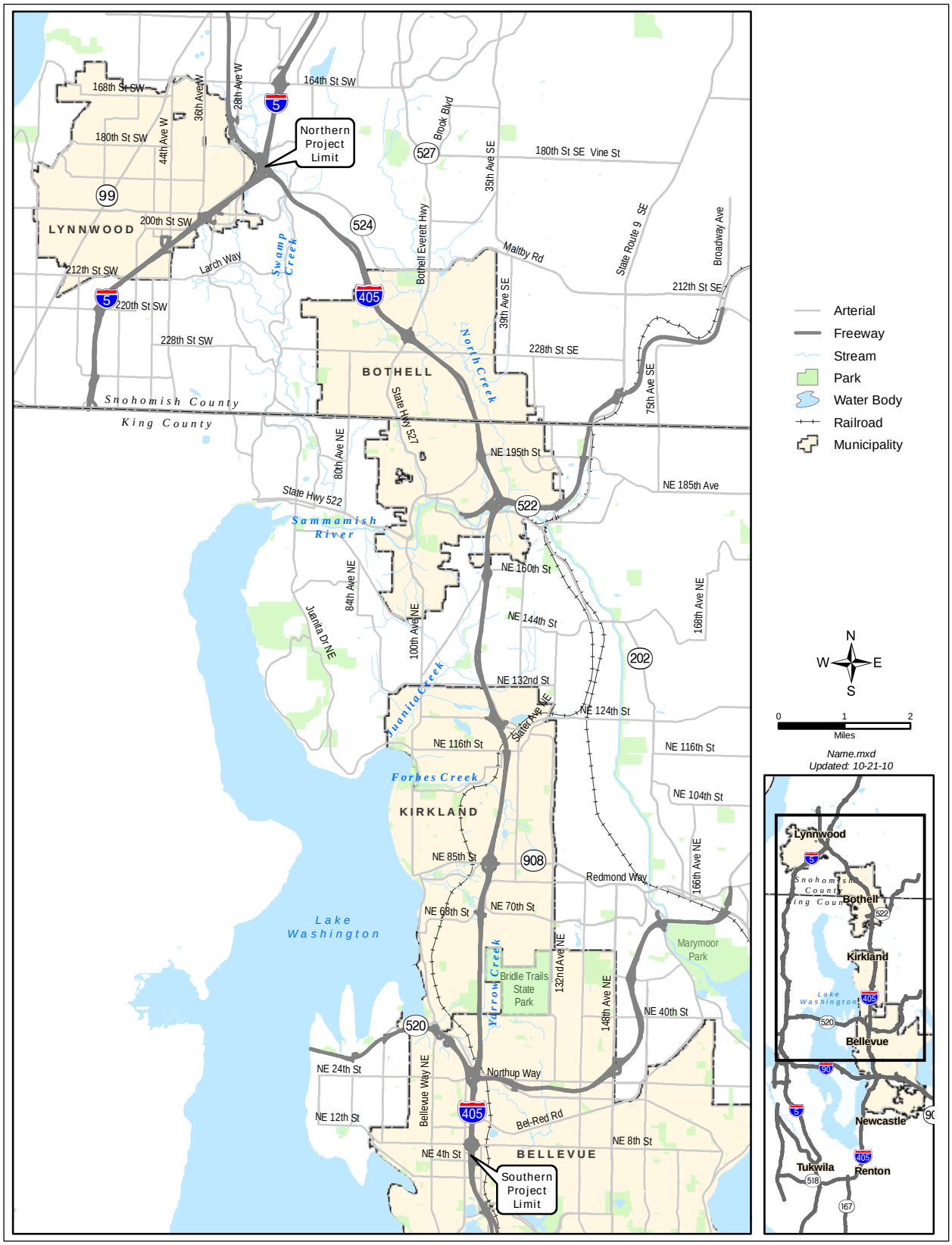
A transit shoulder is a freeway shoulder that is designated for use by buses during specific hours to avoid congestion in the general-purpose lanes. Transit shoulders improve the appeal of transit by helping to maintain travel time and trip reliability. They also have a positive effect on the general-purpose lanes, because buses cannot accelerate as quickly as vehicles and tend to slow traffic. Speeds for buses using the transit shoulder are usually restricted to ensure safety.

Are there related projects?

The Bellevue to Lynnwood Improvement Project is designed to compliment other projects along I-405 including:

- Kirkland Nickel Stage 1 Project, which added one lane in each direction between NE 85th Street and NE 124th Street and opened to traffic in November 2007;
- NE 195th to SR 527 Auxiliary Lane Project, which added one northbound lane between NE 195th Street and SR 527 and opened to traffic in June 2010; and

Exhibit 2-1: Project vicinity



- NE 8th Street to SR 520 Braided Ramps Project, which creates new multi-level "braided" ramps to separate vehicles entering and exiting northbound I-405 between NE 8th Street and SR 520 and is anticipated to be open to traffic during the summer of 2012.

The above projects are included as part of the baseline conditions. The Kirkland Nickel Stage 2 Project was environmentally cleared to build northbound and southbound lanes between NE 70th Street and NE 85th Street, and a southbound lane between SR 522 and NE 124th Street, and between NE 70th Street and SR 520. The Kirkland Nickel Stage 2 Project is not considered part of the baseline conditions for this transportation analysis (see "*What are baseline conditions?*" sidebar). The Kirkland Nickel Stage 2 Project has been environmentally cleared and permitted, and will be constructed at the same time as the Bellevue to Lynnwood Improvement Project.

What are baseline conditions?

Baseline conditions for the Bellevue to Lynnwood Improvement Project represent what will exist in the future after the NE 8th Street to SR 520 Braided Ramps Project is complete. Baseline conditions provide an important point of comparison for understanding the effects of the proposed build alternatives.

Kirkland Nickel Project Stage 2 improvements are a baseline condition for natural environmental analyses such as ecosystems, water resources, and soils and geology, but not for traffic and transportation analysis.

How will this portion of I-405 be operated after the project is completed?

In this environmental document, WSDOT and FHWA are considering two operational alternatives: 1) Express Toll and General-Purpose Lanes (ETL); and 2) High-Occupancy Vehicle and General-Purpose Lanes (HOV). Under both scenarios, the project footprint is the same. The occupancy requirement for HOVs in this portion of the I-405 corridor is the same. It is assumed the occupancy requirement, to maintain HOV performance standards under WSDOT's HOV policy, will be three or more people (HOV 3+). The primary difference is in how the roadway lanes would be managed.

What is WSDOT's HOV Policy?

WSDOT has established performance standards to ensure that the state's freeway HOV system provides reliable travel time and dependability for transit users and carpoolers. Speeds and reliability of the HOV system are monitored year-round.

It is WSDOT's current policy that vehicles in an HOV lane should be able to maintain an average speed of 45 mph or greater at least 90% of the time during the morning and afternoon rush hour.

Alternative 1: Express Toll and General-Purpose Lanes (ETL)

This operational alternative will provide two express toll lanes in each direction between NE 6th Street in Bellevue and SR 522 in Bothell, and one express toll lane in each direction between SR 522 and I-5 in Lynnwood. The express toll lane system will be open toll-free to all HOV traffic with three or more occupants and all transit vehicles. The express toll lane system will also be open to single-occupant vehicles (SOVs) and HOVs with two occupants through tolling.

What are express toll lanes?

Express toll lanes preserve trip reliability for transit and HOV users, while providing a new option to other motorists who choose to pay a toll when lane capacity is available. Express toll lanes on I-405 would be similar to the express toll lanes on SR 167.

Express toll lanes have been successfully implemented in several locations around the U.S: State Route 91 in Orange County; I-15 in San Diego; I-25 in Denver; and I-394 in Minneapolis to name a few. WSDOT is working with engineers from these existing facilities to capture lessons learned.

The southern end of the express toll lane system will be at the existing direct-access ramps at NE 6th Street in Bellevue where one of the two northbound express toll lanes will begin and one of the two southbound express toll lanes will end. South of the NE 6th Street, the other express toll lanes will connect with the existing single northbound and southbound HOV lanes. The northern end of the system would be much like it is today with I-405 becoming SR 525. Exhibit 2-2 shows the Build Alternative 1 and No Build Alternative configuration in each of the project segments.

Access points will be at various locations along the mainline as shown in Exhibit 2-4. The express toll lanes will be separated from the general-purpose (GP) lanes by a two- to four-foot wide buffer. At an access point in the two-lane section, the buffer will open and a section of transition lane may be provided between the express toll and general-purpose lanes to ease ingress and egress to the system. The single express toll lane section between SR 522 and I-5 will only have an opening in the buffer and not a transition lane.

Alternative 2: High-Occupancy Vehicle and General-Purpose Lanes (HOV)

This operational alternative will allow HOV users with three or more occupants and transit vehicles to use the single HOV lane, similar to today's operation. Access between the HOV lane and general-purpose lanes will be allowed throughout the project, except northbound between NE 6th Street and SR 520 where access is not allowed under today's operation. The new northbound lane between NE 124th Street and SR 522 will be operated as a general-purpose lane. Exhibit 2-3 shows the Build Alternative 2 and No Build Alternative configuration in each of the project segments.

Although, the amount of pavement is the same for both build alternatives, Build Alternative 1 will have different lane striping to extend lanes to the NE 6th Street direct-access ramps. Build Alternative 1 will add a lane to northbound I-405 from NE 6th Street to NE 8th Street and a southbound lane from SR 520 to NE 6th Street.

Why is WSDOT considering express toll lanes?

WSDOT is evaluating the option for implementing express toll lanes between NE 6th Street and I-5 because express toll lanes offer a proven and effective management tool to improve

traffic flow. Express toll lanes maximize the benefit of the freeway system for all travelers, while also providing a new option for a more reliable trip in the express toll lanes.

The I-405 HOV lanes between SR 520 and I-5 have been a valued option to many drivers desiring a quicker and more reliable trip. Unfortunately, the lanes have been so well-used that during peak travel times, when a quick and reliable trip is needed, the lanes are often so full under the existing 2+ HOV occupancy requirement that they operate at less than a 45 mile-per-hour average speed. The HOV occupancy requirement is assumed to change to 3+ in the future in order to improve speeds during peak hours (in response to current WSDOT and FHWA policy), the HOV lanes will become underutilized and the adjacent general-purpose lanes would become more congested.

The express toll lane system can maintain an express trip throughout the peak travel period, providing a reliable choice for SOVs and HOV 2.

The express toll lane system benefits the general-purpose lanes by allowing some of the HOV 2 and SOVs from the general-purpose lanes to use the express toll lanes, thereby decreasing general-purpose lane volumes and improving their operation.

What will conditions be like if the project is not built?

No Build Alternative

A No Build Alternative has been evaluated as the basis for comparing effects associated with the build alternatives. No new improvements would be made beyond those constructed as a part of the NE 8th Street to SR 520 Braided Ramps Project.

The No Build Alternative does not include additional stormwater treatment or any roadway improvements that would increase roadway capacity, reduce congestion, or improve safety on I-405. Only routine activities such as road maintenance, repair, and minor safety improvements would occur. As with the two build alternatives, we assume that the occupancy requirement for HOVs in this portion of the I-405 corridor will be three or more people (HOV 3+).

Exhibit 2-2: Project description – Build Alternative 1

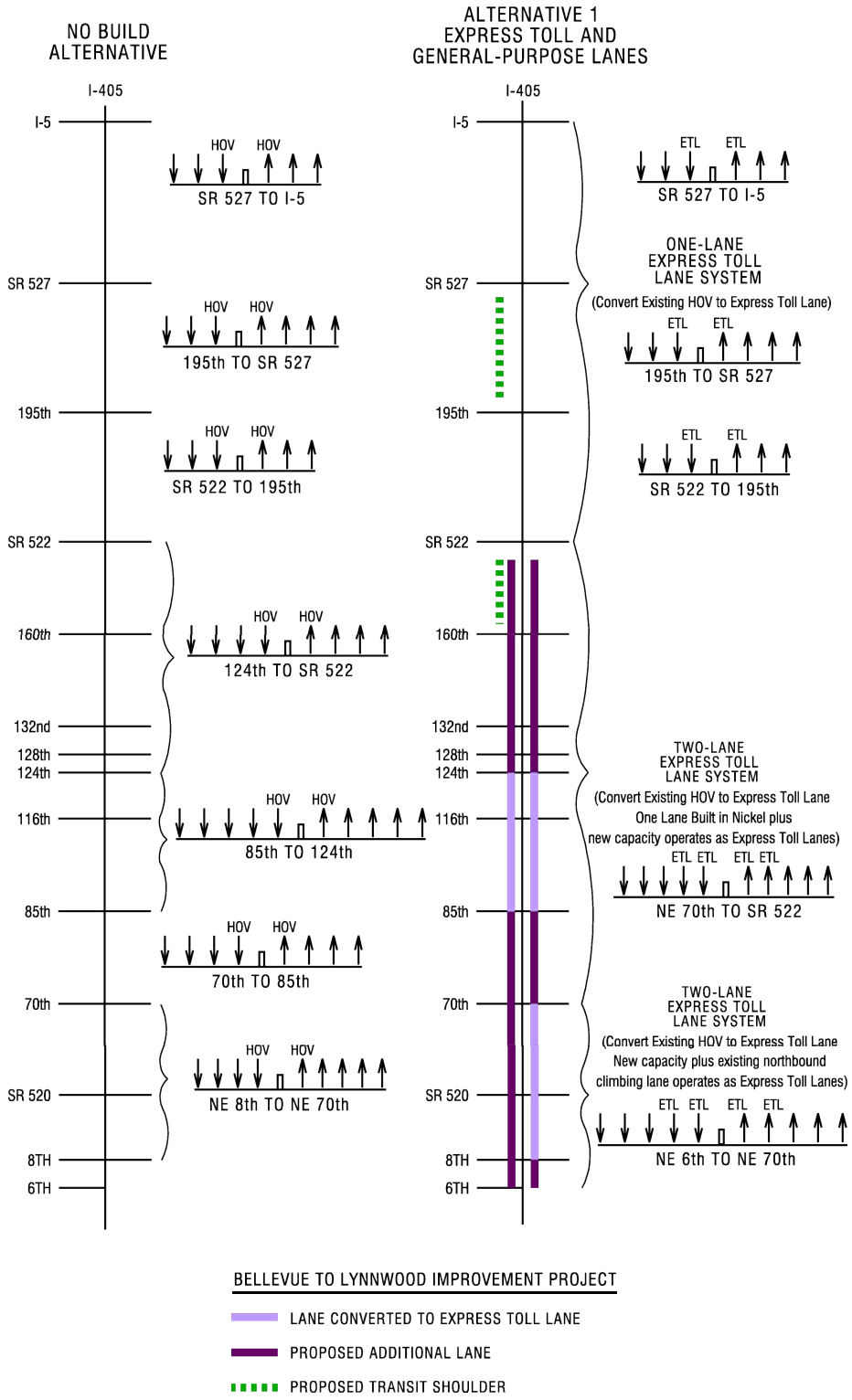


Exhibit 2-3: Project description – Build Alternative 2

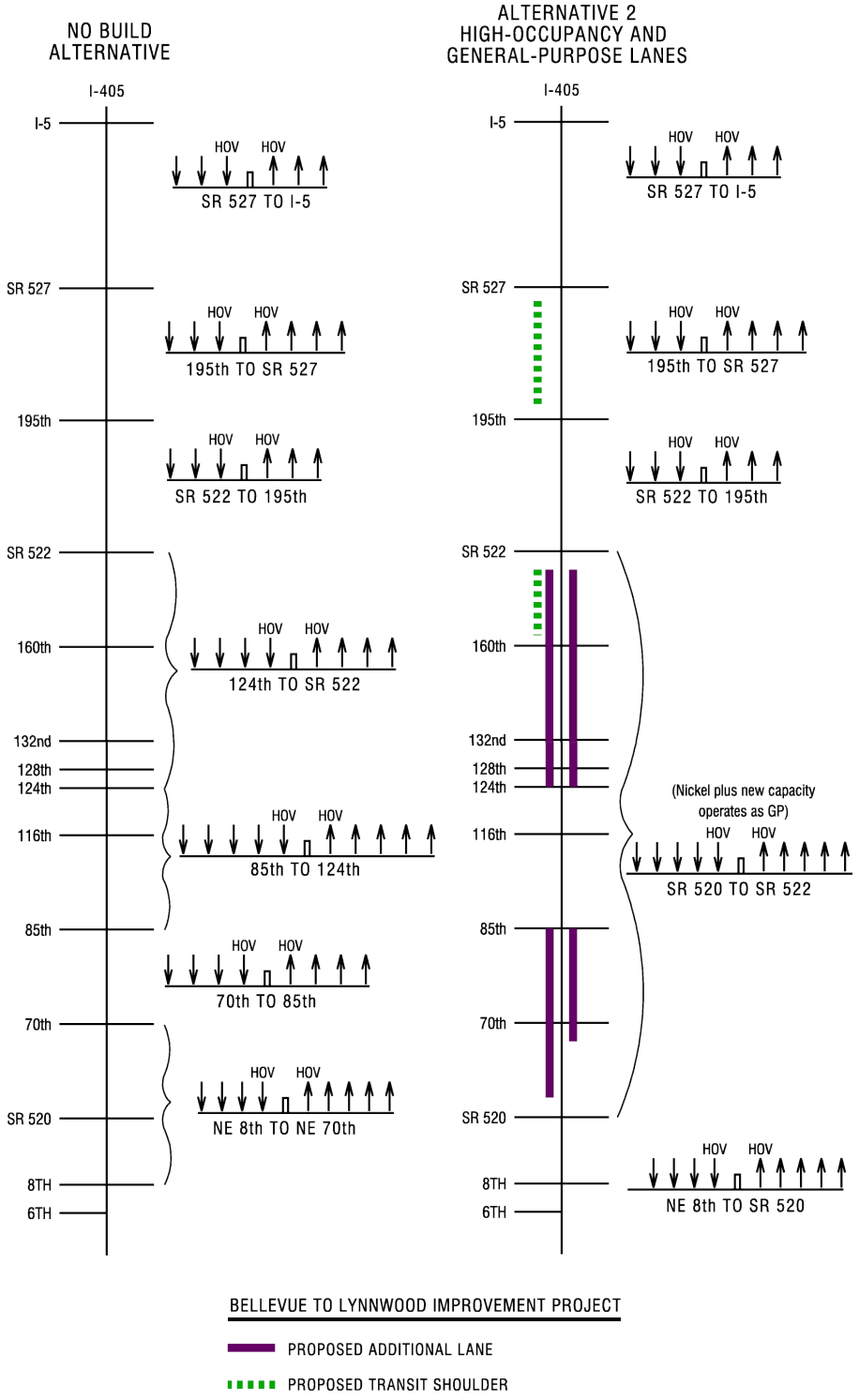
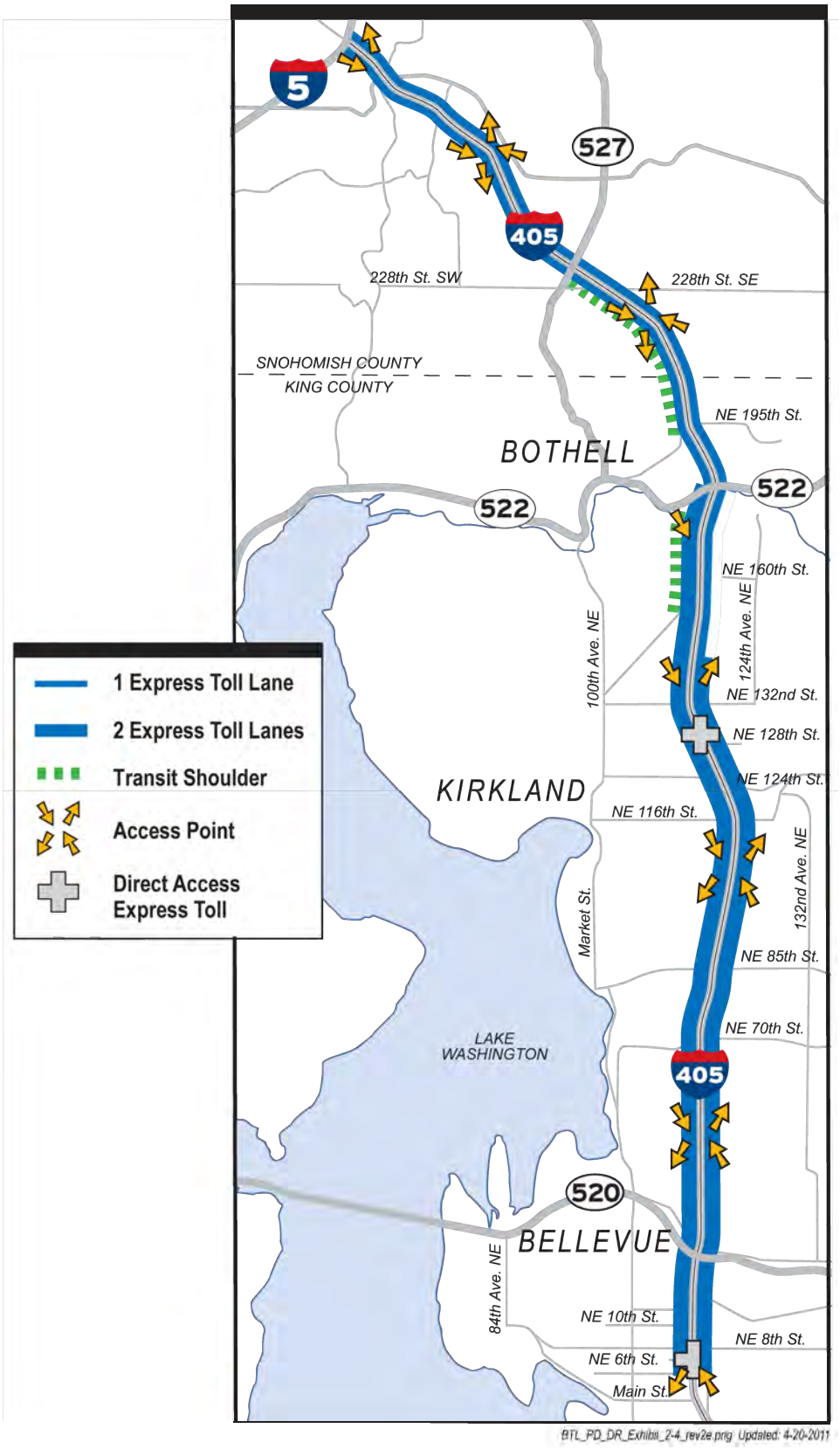


Exhibit 2-4: Express Toll Lanes access locations



SECTION 3 STUDY APPROACH

What is the study area and how was it determined?

The study area for the I-405, Bellevue to Lynnwood Improvement Project encompasses 17 miles of I-405 from NE 6th Street in Bellevue to I-5 in Lynnwood. In addition to the study area, our analysis includes the section of I-405 from NE 6th Street to south of I-90 and adjacent sections of I-5, SR 525, SR 522, SR 520, and I-90. We analyzed the section of I-405 south of the study area and sections of adjacent freeways because effects in these outside areas may impact operations in the study area. In the study area, we also analyzed the local streets and intersections adjacent to I-405 from Bellevue to Lynnwood because they may be affected by the project improvements.

What policies or regulations are related to effects on transportation?

See the Land Use Patterns, Plans, and Policies Discipline Report for the policies and regulations related to transportation.

How did we collect information on transportation for this report?

The Bellevue to Lynnwood Improvement Project used the year 2009 to represent existing conditions in the corridor. We assembled I-405 freeway and ramp traffic volumes from available WSDOT data (2009). Traffic on the freeway currently uses two types of lanes—general-purpose lanes and high-occupancy vehicle (HOV) lanes. We obtained local street traffic volumes from the cities of Bellevue, Kirkland, and Bothell; King County; traffic impact studies; and other transportation sources.

What are general-purpose (GP) lanes?

Roadway lanes available for use by all traffic.

What are high-occupancy vehicle (HOV) lanes?

Roadway lanes that are reserved exclusively for buses, motorcycles, vanpools, and vehicles carrying a specified number of occupants as noted on signs. Currently, vehicles with two or more (2+) occupants are allowed to use the I-405 HOV lanes.

How did we develop forecasts of travel demand for the freeway?

The I-405 Team used the Puget Sound Regional Council (PSRC) four-county travel forecast model as a starting point for determining future travel demand. This model predicts traffic volumes and travel patterns based on adopted land use

plans within the region. We then refined the model to include the specific details of the I-405 freeway.

Time periods

The year of opening for the Bellevue to Lynnwood Improvement Project is 2015. The design year, 2035, is consistent with the corridor planning horizon and federal requirements for environmental documentation because it is 20 or more years past the start of construction. We evaluated the 2015 and 2035 conditions for the No Build (Baseline) Alternative and for Build Alternatives 1 and 2.

What is the peak period?

The period of the day during which the maximum amount of travel occurs. It may be specified as the morning (AM) or afternoon (PM) peak.

What is the peak hour?

The hour within the morning or afternoon peak period when the maximum demand occurs on a given transportation facility or corridor.

The morning and evening commutes along the I-405 corridor last for several hours. To capture these peak commute periods, we evaluated a 3–hour period in the morning (6:00 to 9:00 AM) and a 3–hour period in the afternoon (3:30 to 6:30 PM).

For the local street network, we used the hour of highest traffic volume during the morning and afternoon to evaluate operations. We used this peak hour because it represents the worst case conditions for the local street operations. In the study area, the morning peak hour is typically 7:00 to 8:00 AM, and the afternoon peak hour is typically from 4:30 to 5:30 PM.

Future roadway improvements

The travel forecast model includes funded regional improvement projects and projects that are likely to be built. Appendix A lists the roadway projects included in the travel forecast model. We assumed some projects would be completed by 2015 and others by 2035.

Traffic volumes

The I-405 Team started with existing general-purpose and HOV lane volumes as measured in 2009. Based on this information, we used the regional travel forecast model to estimate future changes. The forecasts for years 2015 and 2035 both assume the HOV lanes will operate differently in the future than they do today. Based on future growth in HOV volumes and WSDOT's goal of maintaining a 45 mile-per-hour HOV lane travel speed, this analysis assumes the HOV lane occupancy requirement will be increased from the existing two or more persons in a vehicle (HOV 2+) to three or more persons (HOV 3+) by 2015.

Express toll lane volumes

This analysis assumes that HOV 3+ and transit will be able to use the express toll lanes for free and the express toll lanes will be managed to ensure reliable travel speeds. If a different tolling structure were implemented, for example, one where HOV 2+ were able to use the express toll lanes for free or one where all vehicles were required to pay to use the express toll lanes, the results of the analysis would be similar. Under all tolling structures, the number of vehicles in the express toll lanes are assumed to be managed to ensure a reliable travel speed and the lanes will perform in a similar manner.

To calculate how tolls could manage the use of the express toll lanes, we were able to forecast general-purpose and HOV lane volumes by using a toll estimation model. To develop toll rates, the model first estimated the travel time difference between the general-purpose lanes and the express toll lanes. The model then predicted how many drivers would be willing to pay a toll to avoid delays in the general-purpose lanes or alternate routes. The model tested several toll rates to determine what rate best balanced volumes between the general-purpose lanes and the express toll lanes to maintain at least a 45 mile-per-hour express toll lane speed.

How did we evaluate the effects on traffic and transportation?

Freeway

Traffic analysts used VISSIM microsimulation software to evaluate the freeway traffic operations for the section of I-405 from I-5 in Lynnwood to south of I-90, as well as the adjacent sections of I-5, SR 525, SR 522, SR 520, and I-90. The software models the movement of individual vehicles and can describe how vehicles accelerate, decelerate, and change lanes in response to freeway geometry and the behavior of other vehicles.

In our analysis, we evaluated freeway performance with respect to effectiveness: vehicle trips, travel time, and speed. Vehicle trips are the total number of vehicles that pass through a section of roadway within a specific time period. We used the microsimulation model to calculate the average travel speeds and travel time for the general-purpose and HOV lanes.

What is a signalized intersection?

An intersection that uses a traffic light to control vehicle and pedestrian movements.

What is an unsignalized intersection?

An intersection without a traffic light that uses signs such as "Stop" and "Yield" to control vehicle and pedestrian movements.

Local streets

For the local streets, we measured traffic operations with intersection delay, which is the average delay experienced by vehicles that travel through an intersection. Transportation analysts rate intersection delay as a level of service (LOS) from A to F. LOS A is the best operating condition with minimal delays. LOS F is the worst condition, with very long delays and heavy congestion. We used CORSIM microsimulation software to calculate the intersection delay. Exhibit 3-1 shows the LOS ranking for signalized and unsignalized intersections.

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: *Highway Capacity Manual*, 2000

We used morning and afternoon peak-hour traffic volumes to measure delay and LOS in the study area. We evaluated 60 signalized and four unsignalized intersections in the study area.

SECTION 4 BASELINE CONDITIONS

For the I-405, Bellevue to Lynnwood Improvement Project, we reference two different points in time—existing conditions and baseline conditions. Existing conditions consist of the current freeway system in 2009 as described below. Baseline conditions represent future conditions in 2015 and assume the existing I-405 network and the completion of the funded I-405, NE 8th Street to SR 520 Braided Ramps Project. This transportation analysis does not include the Kirkland Nickel Project Stage 2 as part of the baseline conditions.

EXISTING CONDITIONS

How do existing conditions help us understand baseline conditions?

By including information about existing conditions (2009) and baseline conditions (2015), readers have more meaningful points of comparison to understand what traffic will be like at the starting point of this project.

What information did we use for the existing conditions?

The I-405 Team used the year 2009 to represent existing conditions in the corridor. We assembled freeway and ramp traffic volumes from the most recently available WSDOT data. Local street traffic data were collected from the cities of Kirkland and Bothell, King County, traffic impact studies, and other transportation sources.

How many vehicles use I-405 today?

Daily traffic

The I-405 Team compiled the existing 2009 average weekday traffic volumes from available WSDOT information. In our analysis, volumes represent two-directional totals with northbound and southbound traffic added together. Traffic volumes are highest in the southern end of the study area and generally decrease toward the northern end of the study area. Beginning at the southern end, the section of I-405 in south Kirkland between SR 520 and NE 70th Street carries 198,000 vehicles per day. The section of I-405 between NE 85th Street and NE 116th Street carries 192,000 vehicles per day. The

northern section of I-405 in Bothell between SR 527 and I-5 carries 117,000 vehicles per day. Truck traffic makes up approximately 2 percent of the average weekday traffic volumes in the study area.

Peak period traffic

The peak period is the time of day when the maximum amount of travel occurs. It may be specified as the morning (AM) or afternoon (PM) peak period. We define the morning peak period as the three hours from 6:00 to 9:00 AM and the afternoon peak period as the three hours from 3:30 to 6:30 PM.

Morning commute

Southbound I-405 is the peak travel direction within the study area during the morning commute. The majority of these vehicles travel to the employment centers in Bellevue, and to Seattle and Redmond via SR 520 and I-90. I-405 generally experiences congestion during the morning peak period when high travel demand exceeds freeway capacity.

The I-405/SR 522 interchange, in the center of the study area, experiences significant congestion during the morning commute. The volume of SR 522 traffic trying to enter southbound I-405, combined with the uphill grade of I-405 in this area, limits the number of vehicles passing through the merge area, which results in backups on I-405. South of SR 522, travel demand increases and intermittent congestion continues to limit vehicles from efficiently traveling through Kirkland to the south end of the study area. Within the study area, the off-peak travel direction (northbound) in the morning generally experiences only minor delays.

Exhibit 4-1 shows the 2009 existing morning peak 3-hour average vehicle trips in the general-purpose lanes and the HOV lane for two I-405 sections: from I-5 in Lynnwood to SR 522; and from SR 522 to SR 520. This exhibit focuses on the peak travel direction (southbound). Southbound I-405 from SR 522 to SR 520 carries an average of 16,930 vehicles in the general-purpose lanes and 3,860 vehicles in the HOV lane during the morning peak 3-hour period.

Afternoon commute

Northbound I-405 is the peak travel direction during the afternoon commute. The majority of vehicles travel from the employment centers of downtown Bellevue, and from Seattle

and Redmond via I-90 and SR 520 to the predominately residential areas in the north. During the afternoon peak period, northbound I-405 experiences congestion from high travel demand exceeding freeway capacity. Within the study area, the off-peak travel direction (southbound) experiences minor delays with the exception of downtown Bellevue, which experiences congestion from traffic queuing back from the I-90 interchange.

Exhibit 4-2 shows the 2009 existing afternoon peak 3-hour average northbound vehicle trips in the general-purpose lanes and the HOV lane for two I-405 sections: from SR 520 to SR 522; and from SR 522 to I-5 in Lynnwood. Northbound I-405 from SR 520 to SR 522 carries an average of 16,880 vehicles in the general-purpose lanes and 4,070 vehicles in the HOV lane during the afternoon peak 3-hour period.

How well does I-405 operate under existing conditions?

The I-405 Team calculated the 2009 average travel speeds and travel times for the general-purpose and HOV lanes with WSDOT speed detector loops, WSDOT Traffic Congestion Maps, and field observations. The travel speeds are a function of traffic volumes and driver comfort.

In the general-purpose lanes, the peak travel directions of southbound I-405 in the morning peak period and northbound I-405 in the afternoon peak period experience congestion in the study area. The off-peak travel directions of northbound I-405 in the morning and southbound I-405 in the afternoon generally experience minimal delays and free-flow speeds of 60 miles per hour.

HOV lanes on I-405 currently experience reduced speeds during peak hours

Similar to the general-purpose lanes, the HOV lanes experience congestion in the peak travel directions, and regularly do not meet WSDOT's goal of maintaining a 45 mile-per-hour speed in the HOV lane. The HOV lane congestion occurs predominately on the section of I-405 between NE 6th Street and SR 522. During the afternoon peak 3-hour period, northbound I-405 from SR 520 to SR 522 has an average travel speed of 42 miles-per-hour in the HOV lane. During the morning peak 3-hour period, southbound I-405 from SR 522 to SR 520 has an average travel speed of 47 miles-per-hour in the HOV lane. Although during the peak travel times, select

locations of southbound I-405 drop below 45 miles-per-hour during the morning commute.

The HOV lane experiences congestion due to the high volume and because traffic in the adjacent and slower general-purpose lane causes HOV drivers to drive more cautiously. Currently, the HOV lane offers open access, and HOV drivers reduce speeds out of concern that vehicles in the general-purpose lanes may suddenly merge in front of them. Also, vehicles attempting to leave the HOV lane often slow down to merge with the slower general-purpose lane traffic. Exhibits 4-1 and 4-2 show the 2009 existing morning and afternoon average 3-hour travel speeds for the general-purpose lanes and the HOV lane. The exhibits show peak travel direction data for the two I-405 sections between SR 520 and SR 522 and between SR 522 and I-5.

Exhibit 4-1: 2009 existing morning peak 3-hour vehicles and speeds - southbound I-405

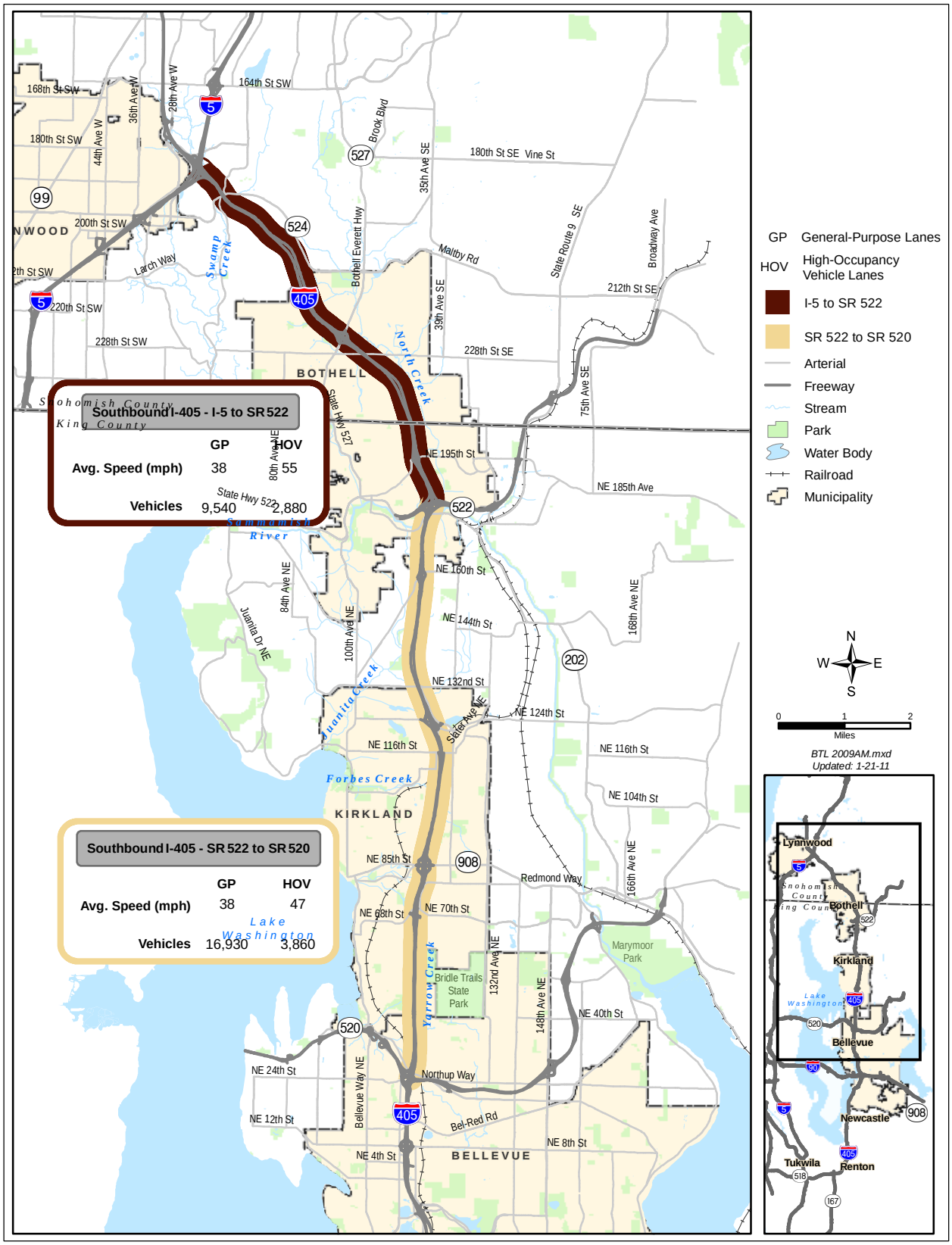
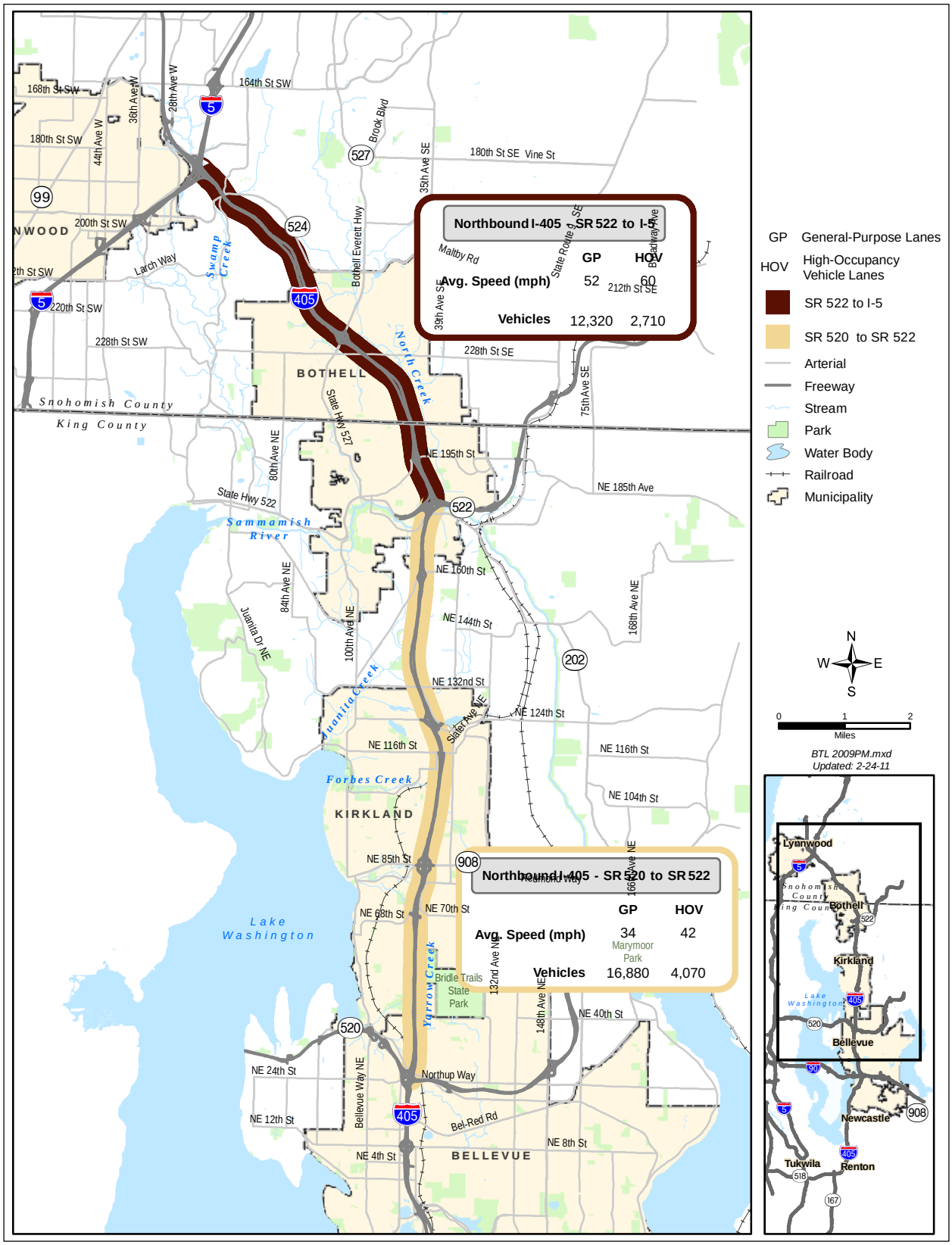


Exhibit 4-2: 2009 existing afternoon peak 3-hour vehicles and speeds - northbound I-405



Are there safety concerns in the study area?

The I-405 Team collected historical crash information for the three year period from November 2006 through November 2009, which were the most recent data available at the time of our analysis. This data provided the frequency, location, and type of crashes along the corridor. The overall crash rate for the entire length of I-405 is 1.09 crashes per million vehicle miles of travel (MVMT). This is similar to other freeways in King County.

What is a crash rate?

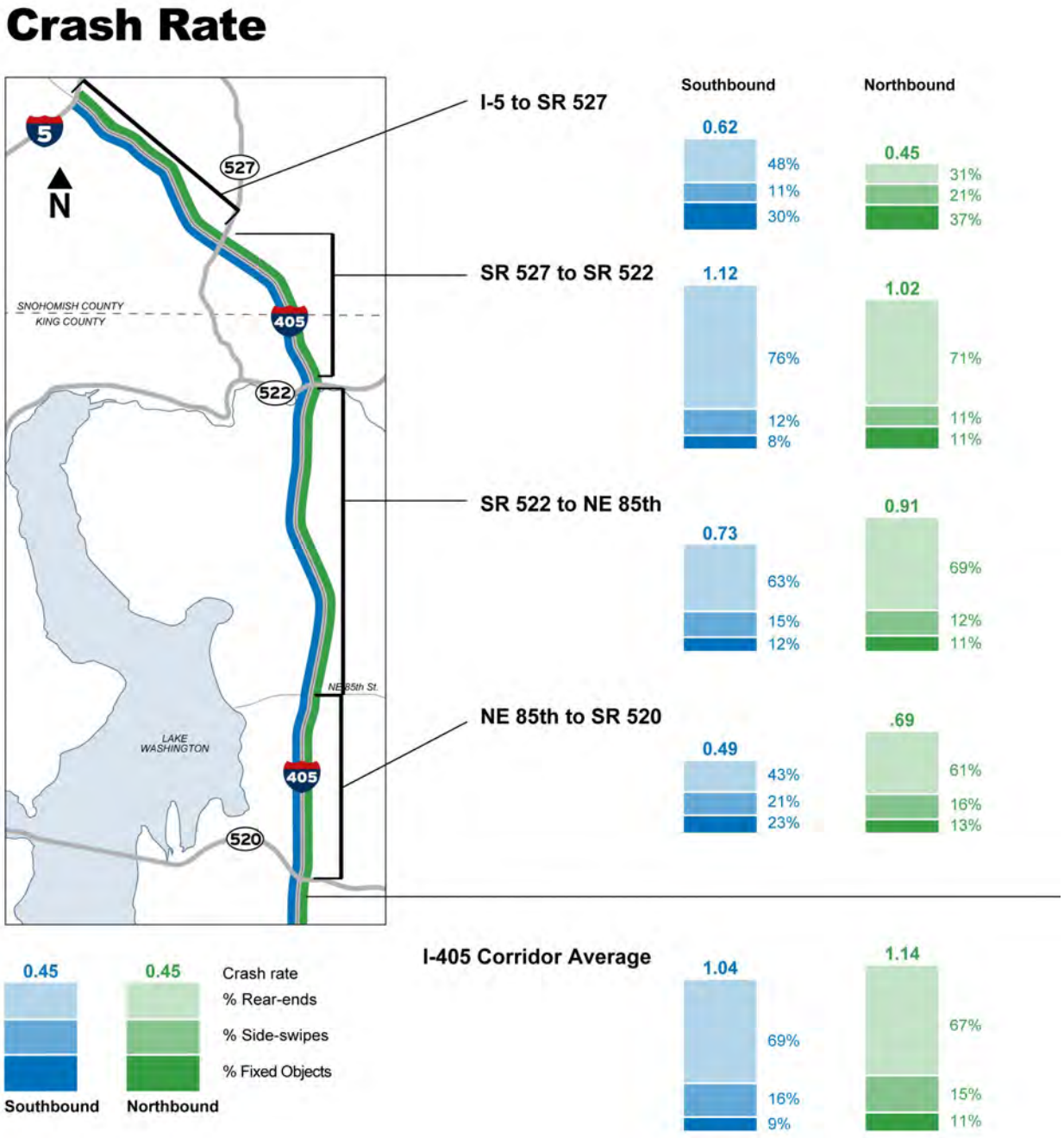
The rate is the number of reported crashes for a specified segment of roadway per one million vehicle miles of travel.

The crash rates in the study area are lower than the corridor average with the exception of the section of southbound I-405 from SR 527 to SR 522, which has a crash rate of 1.12 per MVMT. This section of I-405 has high recurring levels of congestion which are consistent with the high percentage of rear-end and sideswipe crashes.

During the three-year reporting period, a total of 1,957 crashes were reported along the section of I-405 between SR 520 and I-5 and the freeway ramps, including five fatal crashes. Rear-end collisions make up 62 percent of these collisions because of the high traffic volumes, traffic congestion, and variable speeds occurring in this area.

Exhibit 4-3 shows the crash rates and percentage of primary crash types for the study area. The data is listed for the northbound and southbound directions and for four sections of I-405.

Exhibit 4-3: Three-year crash rates and types (2006 to 2009)



Source: WSDOT Transportation Data Office, 2010

What transit service is currently available in the study area?

King County Metro (Metro), Sound Transit, and Community Transit (Snohomish County) provide transit service in the study area. A total of 35 bus routes offer weekday service in the study area and 12 routes offer weekend service.

Metro operates 25 bus routes in the study area, of which 13 travel for some part of their trip on I-405. Sound Transit has three bus routes providing regional express service in the study area. Of the three, routes 532 and 535 travel on I-405 and provide service between Everett and Bellevue. Bus routes traveling on I-405 provide service to four main park-and-ride lots along I-405 in the study area:

- Canyon Park at SR 527
- Brickyard at NE 160th Street
- Kingsgate at NE 132nd Street
- Houghton at NE 70th Place

Community Transit operates seven bus routes in the study area, predominantly in the City of Bothell. Community Transit routes 105, 106, 120, and 121 serve the University of Washington Bothell Campus and Cascadia Community College. We further describe existing transit service in the study area in Appendix B.

Transit and HOV 2+ can use can direct-access ramps to directly enter or exit the HOV lanes from two locations in the study area. The NE 6th Street ramps provide a direct connection for downtown Bellevue and the Bellevue Transit Center, and the NE 128th Street ramps provide a direct connection for north Kirkland and the Kingsgate park-and-ride lot.

How well do the local streets operate under existing conditions?

The I-405 Team evaluated local street operations using CORSIM, a microsimulation software that calculates the average delay experienced by vehicles approaching an intersection. Intersection delay is rated as a level of service (LOS) from A to F. We provide the LOS definition for

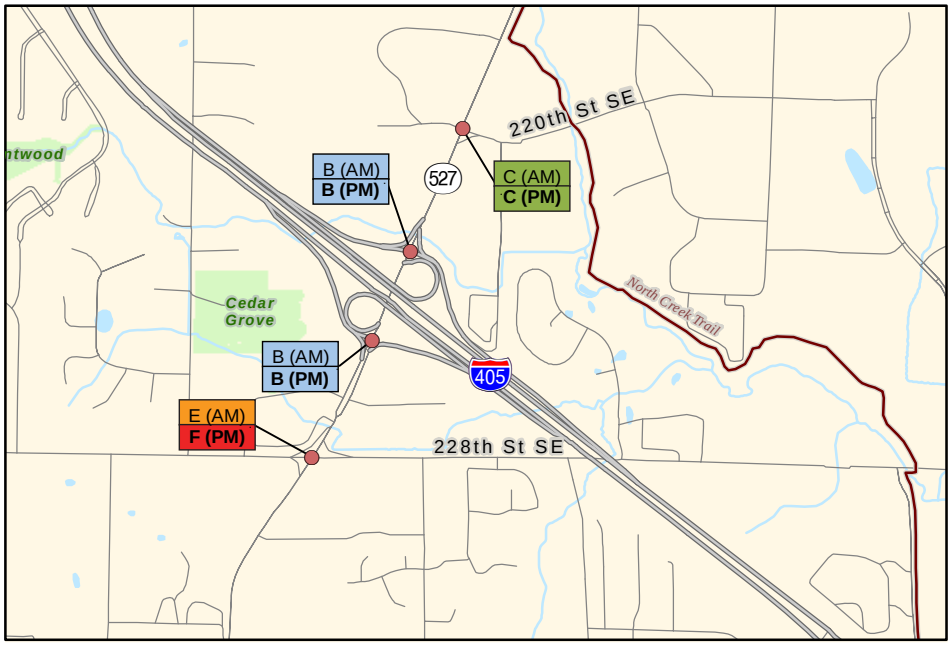
signalized and unsignalized intersections in Exhibit 3-1 on page 3-4.

We used 2009 peak-hour traffic volumes from the morning and afternoon periods to measure delay and LOS in the study area. We selected 64 intersections in the cities of Bellevue, Kirkland, and Bothell, as well as unincorporated King County, for the analysis of the local street system. In the 2009 morning peak hour, two intersections perform at LOS E, and the remaining study intersections operate at LOS D or better. In the afternoon peak hour, two intersections perform at LOS F and four intersections perform at LOS E. The remainder of the study intersections perform at LOS D or better in the afternoon peak hour. Exhibit 4-4 shows the LOS for the 2009 morning and afternoon peak hours.

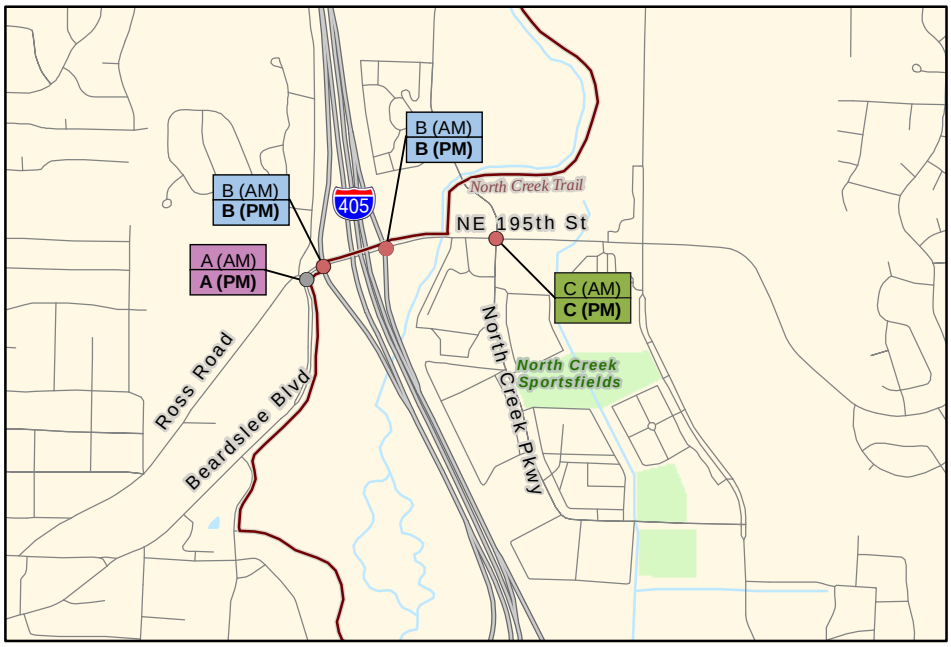
What are the pedestrian and bicycle facilities in the study area?

There are seven pedestrian crossings of I-405 in the study area. Four of the crossings are in the City of Kirkland at NE 65th Street, NE 80th Street, NE 100th Street, and NE 128th Street. The Tolt Pipeline Trail crosses I-405 in unincorporated King County near East Norway Hill Park. The Burke Gilman/Sammamish River regional trail crosses under I-405 near the SR 522 interchange. The Canyon Park pedestrian overpass is in Bothell near SR 527.

Exhibit 4-4: 2009 existing morning and afternoon peak-hour intersection level of service - sheet 1 of 6



SR 527 and I-405 Interchange



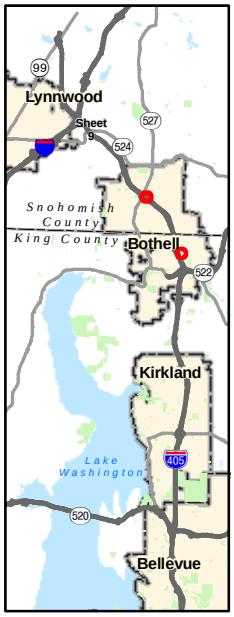
NE 195th St and I-405 Interchange

Signalized Intersection
Unsignalized Intersection
Arterial
Freeway
Stream
Trail
Park
Water Body
Eastside Rail Corridor
Municipality

N
W E
S

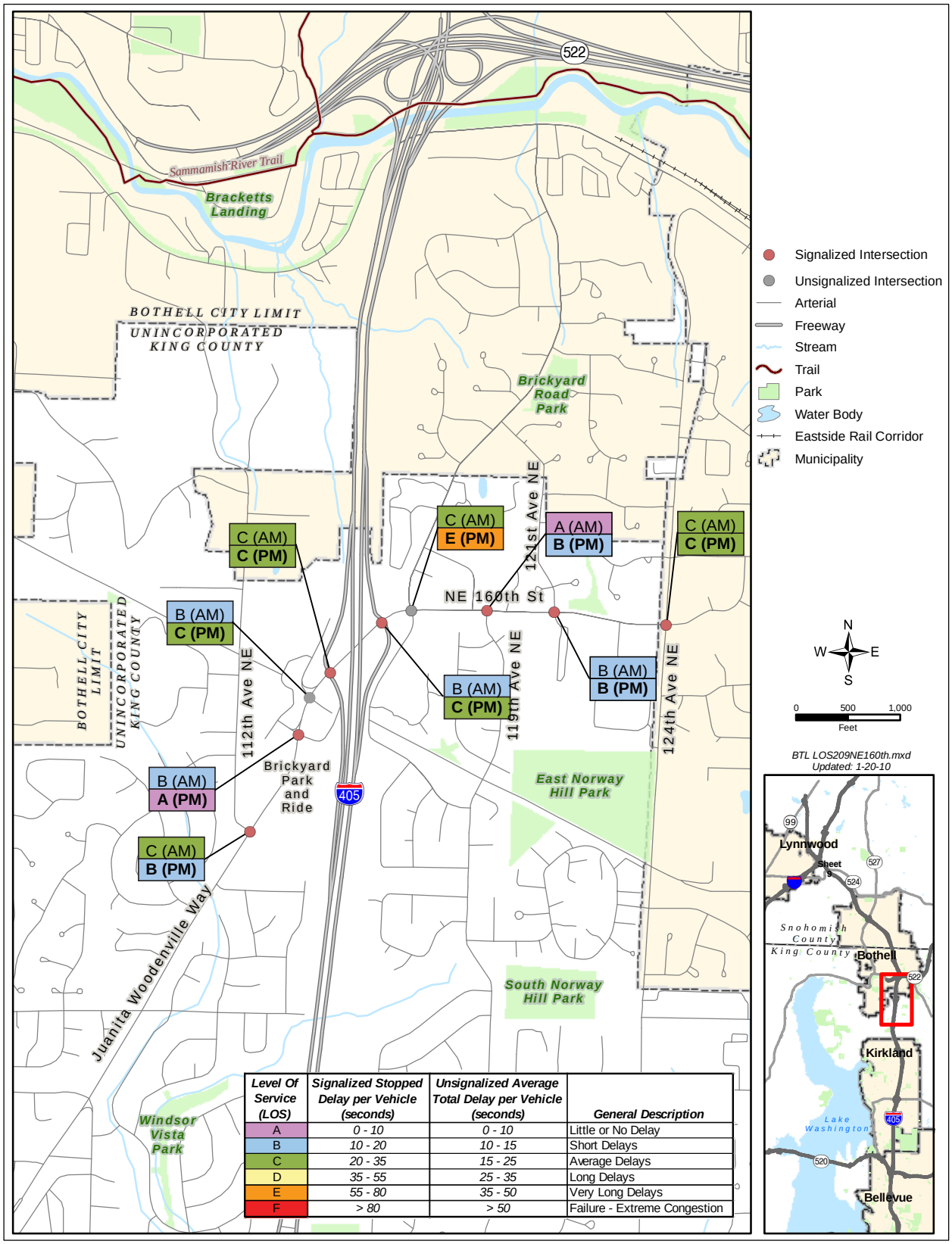
0 500 1,000
Feet

BTL 2009LOS SR527 195th.mxd
Updated: 3-11-11



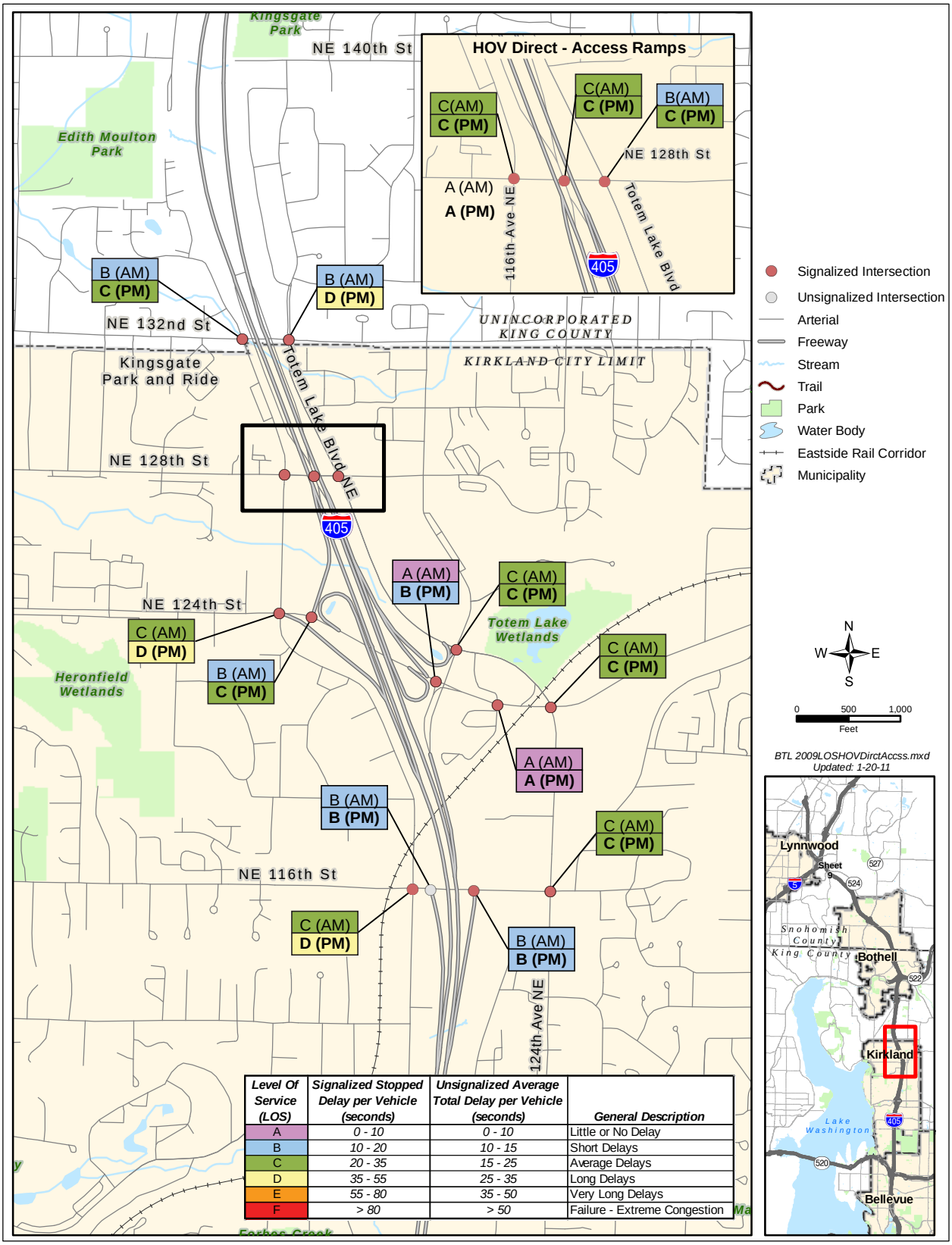
Level Of Service (LOS)	Signalized Stopped Delay per Vehicle (seconds)	Unsignalized Average Total Delay per Vehicle (seconds)	General Description
A	0 - 10	0 - 10	Little or No Delay
B	10 - 20	10 - 15	Short Delays
C	20 - 35	15 - 25	Average Delays
D	35 - 55	25 - 35	Long Delays
E	55 - 80	35 - 50	Very Long Delays
F	> 80	> 50	Failure - Extreme Congestion

Exhibit 4-4: 2009 existing morning and afternoon peak-hour intersection level of service - sheet 2 of 6



Level Of Service (LOS)	Signalized Stopped Delay per Vehicle (seconds)	Unsignalized Average Total Delay per Vehicle (seconds)	General Description
A	0 - 10	0 - 10	Little or No Delay
B	10 - 20	10 - 15	Short Delays
C	20 - 35	15 - 25	Average Delays
D	35 - 55	25 - 35	Long Delays
E	55 - 80	35 - 50	Very Long Delays
F	> 80	> 50	Failure - Extreme Congestion

Exhibit 4-4: 2009 existing morning and afternoon peak-hour intersection level of service - sheet 3 of 6

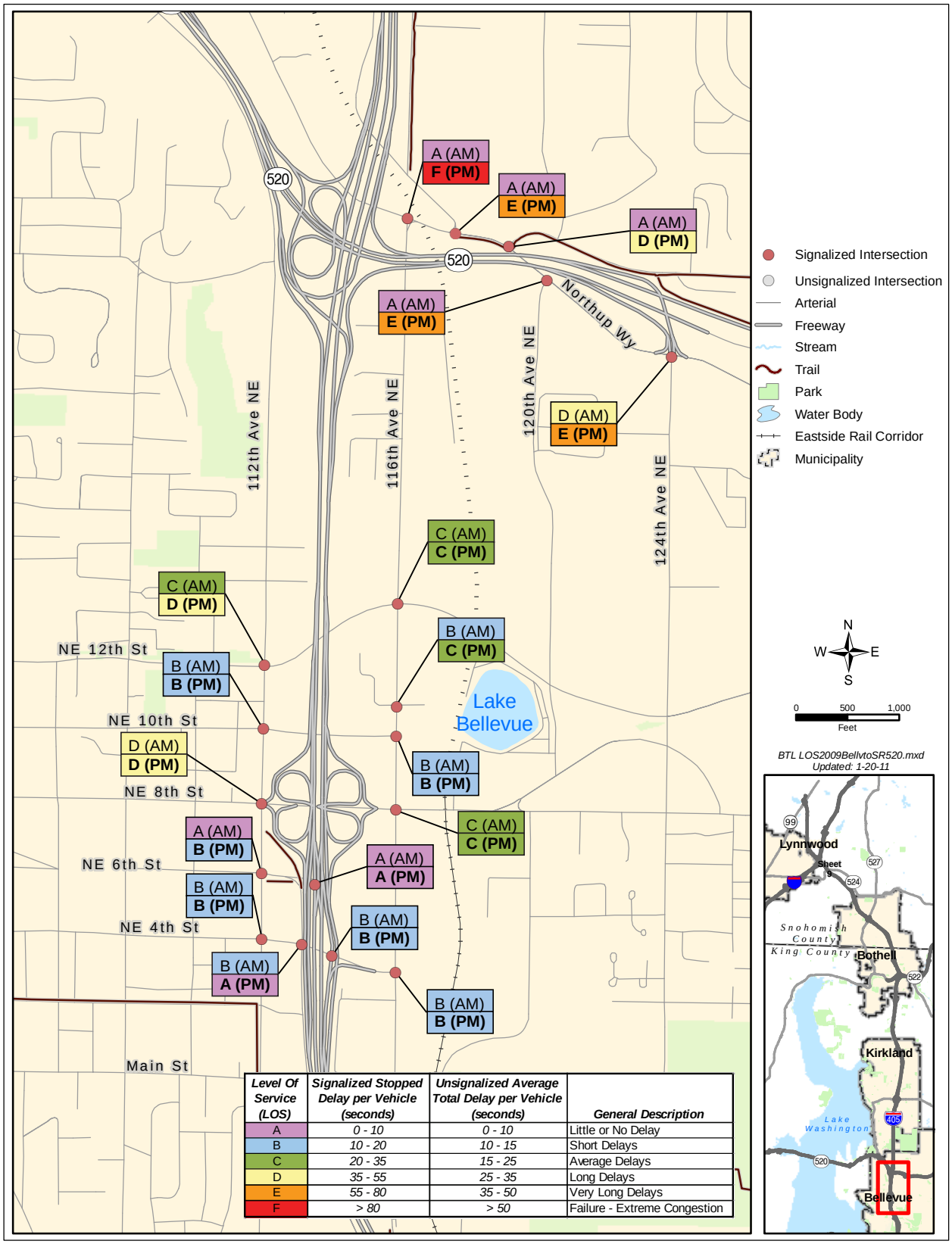


Level Of Service (LOS)	Signalized Stopped Delay per Vehicle (seconds)	Unsignalized Average Total Delay per Vehicle (seconds)	General Description
A	0 - 10	0 - 10	Little or No Delay
B	10 - 20	10 - 15	Short Delays
C	20 - 35	15 - 25	Average Delays
D	35 - 55	25 - 35	Long Delays
E	55 - 80	35 - 50	Very Long Delays
F	> 80	> 50	Failure - Extreme Congestion

Exhibit 4-4: 2009 existing morning and afternoon peak-hour intersection level of service - sheet 4 of 6

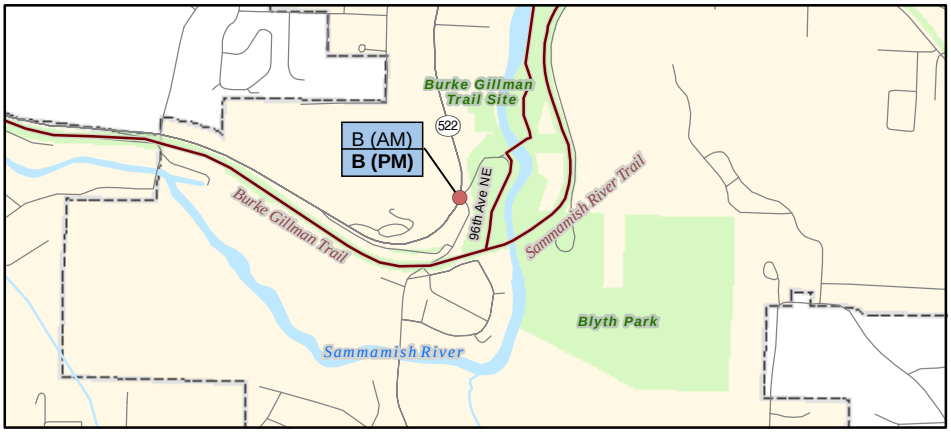
Level Of Service (LOS)	Signalized Stopped Delay per Vehicle (seconds)	Unsignalized Average Total Delay per Vehicle (seconds)	General Description
A	0 - 10	0 - 10	Little or No Delay
B	10 - 20	10 - 15	Short Delays
C	20 - 35	15 - 25	Average Delays
D	35 - 55	25 - 35	Long Delays
E	55 - 80	35 - 50	Very Long Delays
F	> 80	> 50	Failure - Extreme Congestion

Exhibit 4-4: 2009 existing morning and afternoon peak-hour intersection level of service - sheet 5 of 6

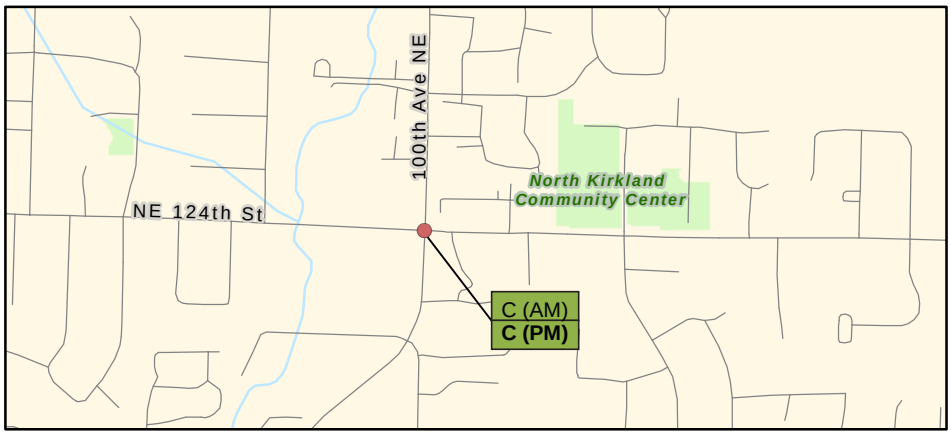


Level Of Service (LOS)	Signalized Stopped Delay per Vehicle (seconds)	Unsignalized Average Total Delay per Vehicle (seconds)	General Description
A	0 - 10	0 - 10	Little or No Delay
B	10 - 20	10 - 15	Short Delays
C	20 - 35	15 - 25	Average Delays
D	35 - 55	25 - 35	Long Delays
E	55 - 80	35 - 50	Very Long Delays
F	> 80	> 50	Failure - Extreme Congestion

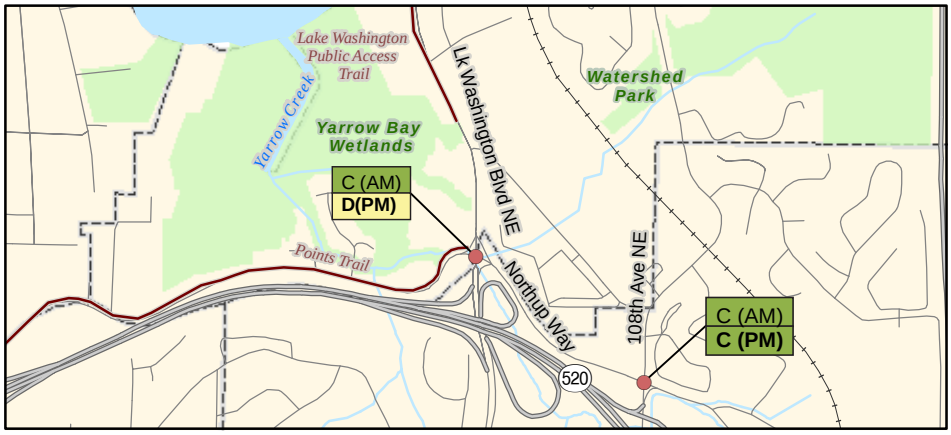
Exhibit 4-4: 2009 existing morning and afternoon peak-hour intersection level of service - sheet 6 of 6



SR 522 and 96th Ave NE



NE 124th St and 100th Ave NE



Northup Way, Lake Washington Blvd NE, and 108th Ave NE

Level Of Service (LOS)	Signalized Stopped Delay per Vehicle (seconds)	Unsignalized Average Total Delay per Vehicle (seconds)	General Description
A	0 - 10	0 - 10	Little or No Delay
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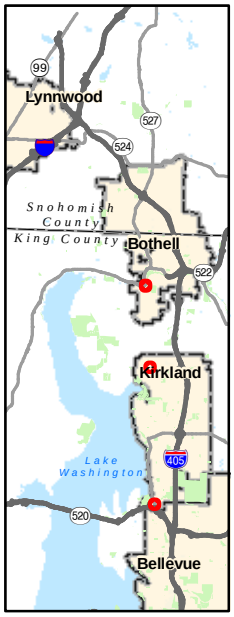
C	20 - 35	15 - 25	Average Delays
D	35 - 55	25 - 35	Long Delays
E	55 - 80	35 - 50	Very Long Delays
F	> 80	> 50	Failure - Extreme Congestion

Signalized Intersection
Unsignalized Intersection
Arterial
Freeway
Stream
Trail
Park
Water Body
Eastside Rail Corridor
Municipality

N
W E
S

0 500 1,000
Feet

BTL 2009LOS 522_124th_Northp.mxd
Updated: 1-20-11



BASELINE CONDITIONS

What are the baseline conditions for the project?

The baseline conditions represent future conditions in 2015 and assume the existing I-405 network and the completion of the funded I-405, NE 8th Street to SR 520 Braided Ramps Project. This transportation analysis does not include the Kirkland Nickel Project Stage 2 as part of the baseline conditions. For the year 2015, the baseline conditions are the same conditions that would occur if the No Build Alternative was adopted.

How many vehicles will use I-405 under the baseline conditions?

Daily traffic

The transportation analysis defined weekday traffic volumes as two-directional totals with northbound and southbound traffic added together. We anticipate future regional population and employment growth in the region will increase freeway demand compared to existing conditions.

In the year 2015, we expect that the baseline conditions daily demand will be 204,000 vehicles for the section of I-405 between SR 520 and NE 70th Street. These baseline conditions will represent a 3 percent increase over 2009 existing conditions. For the section of I-405 between NE 85th Street and NE 116th Street, we estimate the 2015 baseline conditions daily demand will be 200,000 vehicles, a 4 percent increase over existing conditions. Weekday travel demand for the northern section of I-405 between SR 527 and I-5 will be 121,000 vehicles, a 3 percent increase over existing conditions.

Peak period traffic

The total daily traffic is predicted to increase with the 2015 baseline conditions and we forecast the increase in travel demand will cause I-405 to become more congested during the morning and afternoon peak travel periods. This increased congestion during peak travel periods will reduce the number of vehicles able to travel through the study area compared to existing conditions. Southbound I-405 from SR 522 to SR 520 is forecast to carry an average of 15,780 vehicles in the general-purpose lanes during the 2015 morning peak 3-hour period, a

6-percent reduction compared to existing conditions. During the 2015 afternoon peak 3-hour period, we forecast northbound I-405 from SR 520 to SR 522 will carry an average of 10,510 vehicles in the general-purpose lanes, a 38 percent reduction compared to existing conditions.

The forecasts assume the HOV lanes will operate differently than they do today. Based on future growth in HOV volumes and WSDOT's goal of maintaining a 45 mile-per-hour HOV lane travel speed, our analysis assumes the HOV occupancy requirement will be increased from the current HOV 2+ to HOV 3+. This will decrease traffic volumes in the HOV lane compared to existing conditions.

Exhibits 4-5 and 4-6 show the 2015 baseline conditions morning and afternoon average 3-hour travel speeds for the general-purpose lanes and the HOV lane. The exhibits show peak travel direction data for the two I-405 sections between SR 520 and SR 522, and between SR 522 and I-5.

How well will I-405 operate under baseline conditions?

By 2015, traffic volumes will increase, and we expect travel speeds and times in the general-purpose lanes to worsen compared to 2009 existing conditions. During the morning and afternoon peak travel periods, we forecast general-purpose lane travel speeds will decrease between 5 and 15 miles per hour compared to existing conditions.

We assume that the HOV occupancy requirement will be increased from HOV 2+ to HOV 3+ by 2015. Once HOV 3+ is implemented, the resulting decrease in the number of vehicles in the HOV lane will improve travel speeds. However, the HOV bypass lanes at the freeway on-ramps will retain the HOV 2+ requirement. Exhibits 4-5 and 4-6 show the 2015 baseline conditions morning and afternoon average 3-hour travel speeds for the general-purpose lanes and the HOV lane. The exhibits show peak travel direction data for the two I-405 sections between SR 520 and SR 522, and between SR 522 and I-5.

Exhibit 4-5: Baseline/2015 No Build morning peak 3-hour vehicles and speeds - southbound I-405

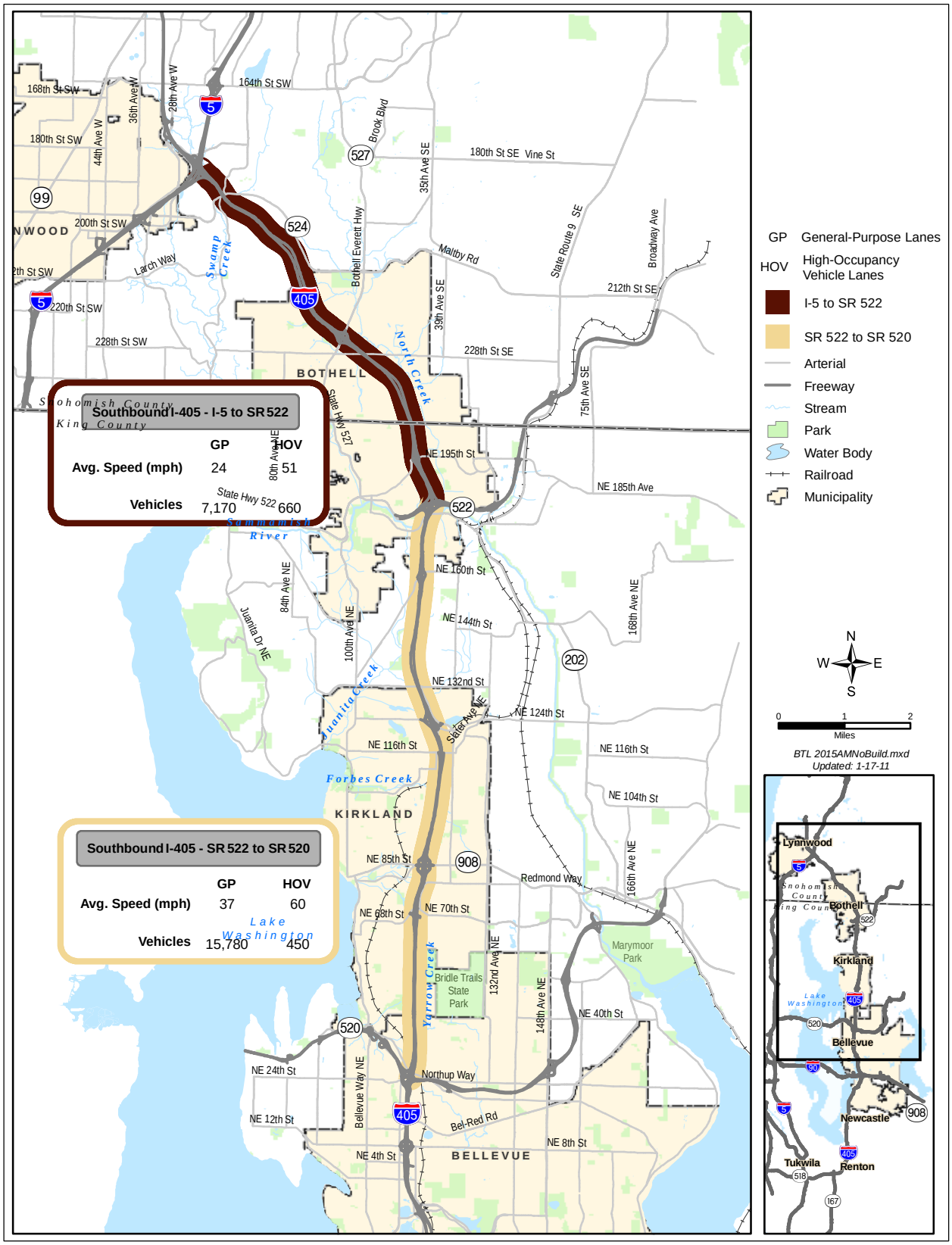
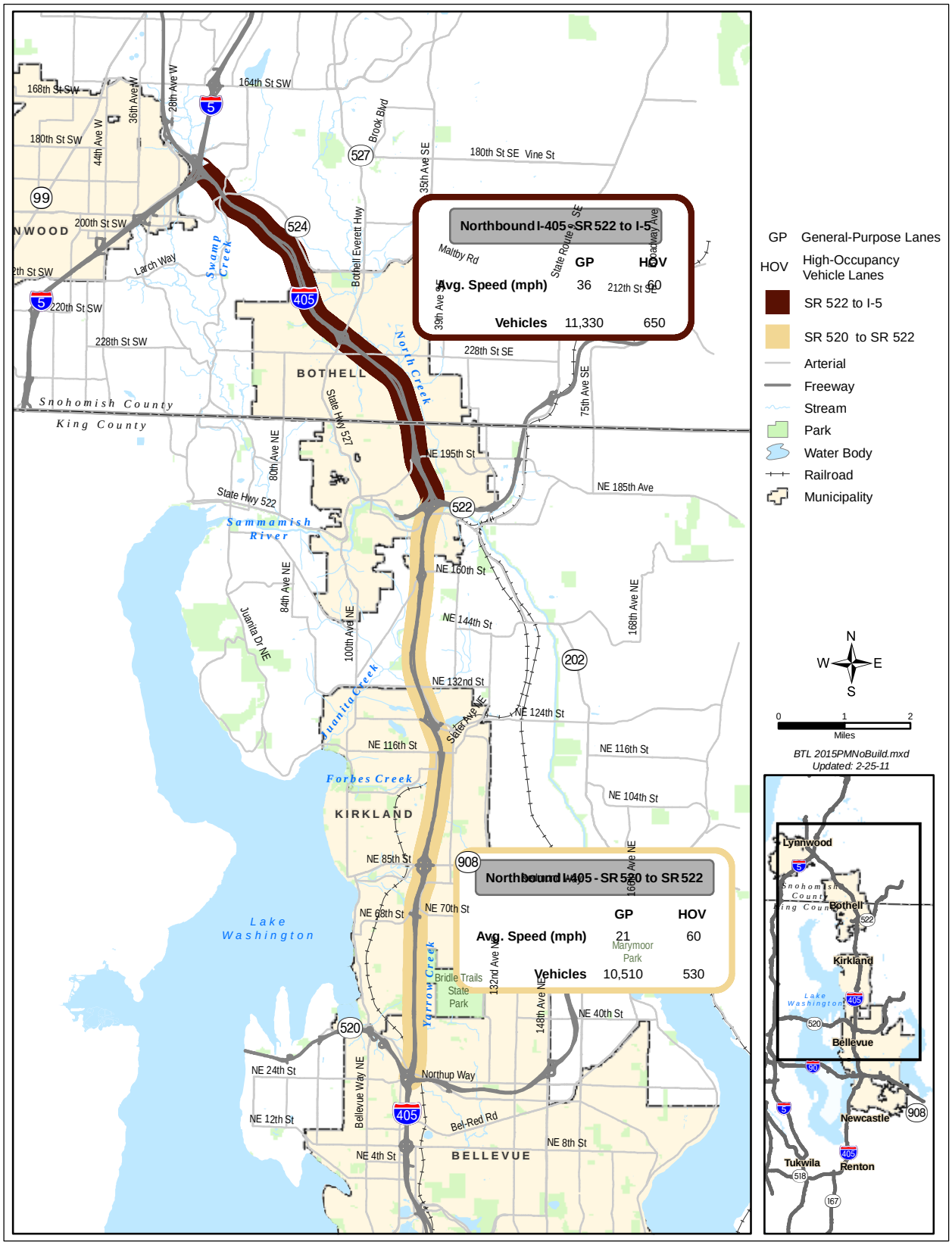


Exhibit 4-6: Baseline/2015 No Build afternoon peak 3-hour vehicles and speeds - northbound I-405



What will the safety conditions be like under the baseline conditions?

As described above, I-405 will become more congested with the baseline conditions compared to 2009 existing conditions. The worse congestion will increase the number of congestion-related accidents in the study area.

How will transit operate under the baseline conditions?

By the year 2015, the assumed change in HOV lane designation from the current HOV 2+ to HOV 3+ will decrease the number of vehicles in the HOV lane. This change will improve the operations of the HOV lane and increase travel speeds for buses using the HOV lane. However, buses traveling in the general-purpose lanes will experience slower speeds compared to existing conditions.

How well will the local streets operate under baseline conditions?

The I-405 Team anticipates that future traffic volumes will increase and local traffic operations will generally worsen compared to 2009 existing conditions. Our analysis of intersection LOS under baseline conditions focused on the 2015 morning and afternoon peak hour. See Exhibit 3-1 on page 3-4 for a definition of intersection LOS and delay.

By the year 2015, improvement projects will add capacity to several intersections in the study area. In some cases, these projects will improve an intersection's LOS from the year 2009 to 2015 despite traffic volume increases. The City of Kirkland plans to add lanes to the following study intersections:

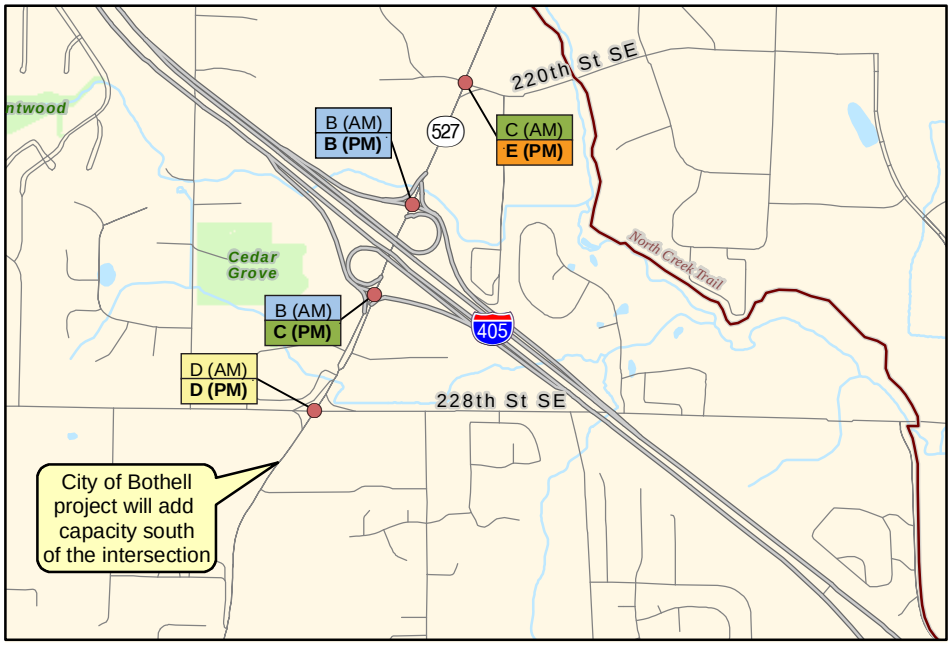
- NE 70th Street/132nd Avenue NE
- NE 85th Street and Kirkland Way/114th Avenue NE
- NE 85th Street and 120th Avenue NE
- NE 85th Street and 124th Avenue NE
- NE 85th Street and 132nd Avenue NE
- NE 116th Street and 124th Avenue NE
- NE 124th Street and 124th Avenue NE

As part of the Kirkland Nickel Project, WSDOT is rebuilding the I-405 interchange at NE 116th Street to add capacity and improve traffic operations. The existing intersections at the I-405 southbound on-ramp from NE 116th Street, and the I-405 northbound off-ramp to NE 116th Street, will be combined into one intersection. Also at this interchange, the Kirkland Nickel Project will reconfigure and add capacity to the intersection at NE 116th Street and 120th Avenue NE.

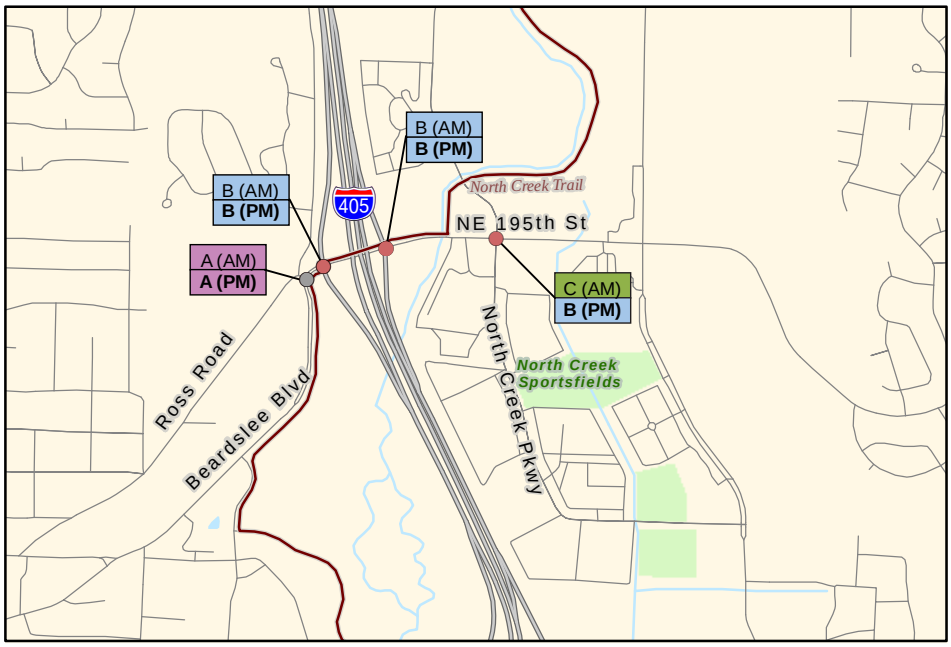
The I-405, NE 8th Street to SR 520 Braided Ramps Project will construct a new northbound on-ramp from NE 10th Street. The new on-ramp will require a signalized intersection to be located on the NE 10th Street bridge over I-405.

Exhibit 4-7 shows the baseline conditions intersection LOS for the study intersections during the 2015 morning and afternoon peak hours. In the 2015 morning peak hour, one intersection performs at LOS F, three intersections perform at LOS E, and the remaining study intersections operate at LOS D or better. During the 2015 afternoon peak hour, six intersections perform at LOS F, and five intersections perform at LOS E. The remaining study intersections operate at LOS D or better.

Exhibit 4-7: Baseline/2015 No Build morning and afternoon peak-hour intersection level of service - sheet 1 of 6



SR 527 and I-405 Interchange



NE 195th St and I-405 Interchange

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A	0 - 10	0 - 10	Little or No Delay
B	10 - 20	10 - 15	Short Delays
C	20 - 35	15 - 25	Average Delays
D	35 - 55	25 - 35	Long Delays
E	55 - 80	35 - 50	Very Long Delays
F	> 80	> 50	Failure - Extreme Congestion

Signalized Intersection
Unsignalized Intersection
Arterial
Freeway
Stream
Trail
Park
Water Body
Eastside Rail Corridor
Municipality

N
W E
S

0 500 1,000
Feet

BTL LOS2015NB SR27 195th.mxd
Updated: 1-20-11

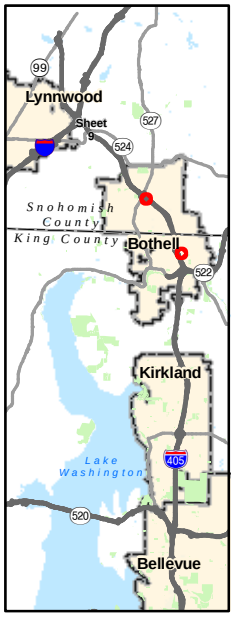
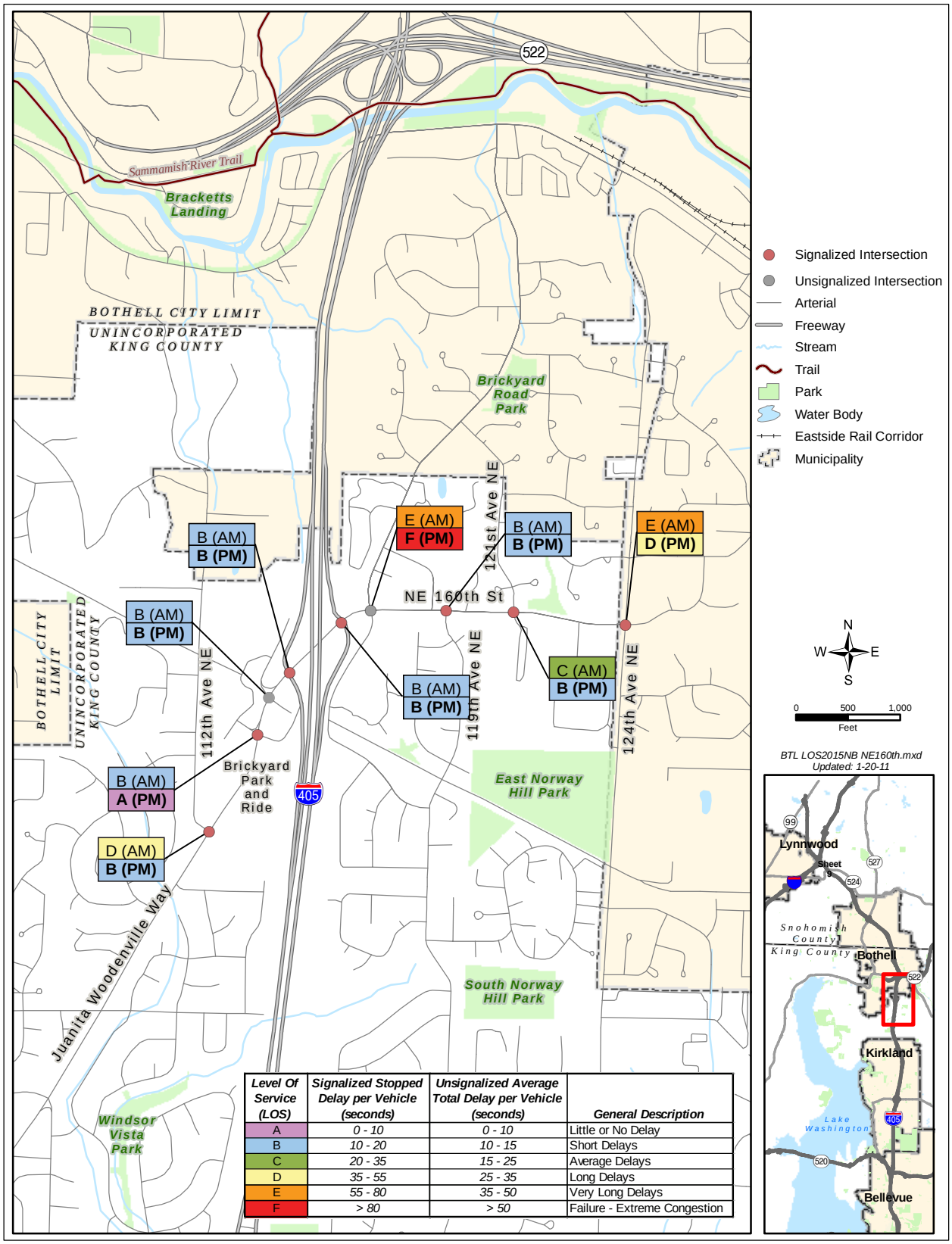


Exhibit 4-7: Baseline/2015 No Build morning and afternoon peak-hour intersection level of service - sheet 2 of 6



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E	55 - 80	35 - 50	Very Long Delays
F	> 80	> 50	Failure - Extreme Congestion

Exhibit 4-7: Baseline/2015 No Build morning and afternoon peak-hour intersection level of service - sheet 3 of 6

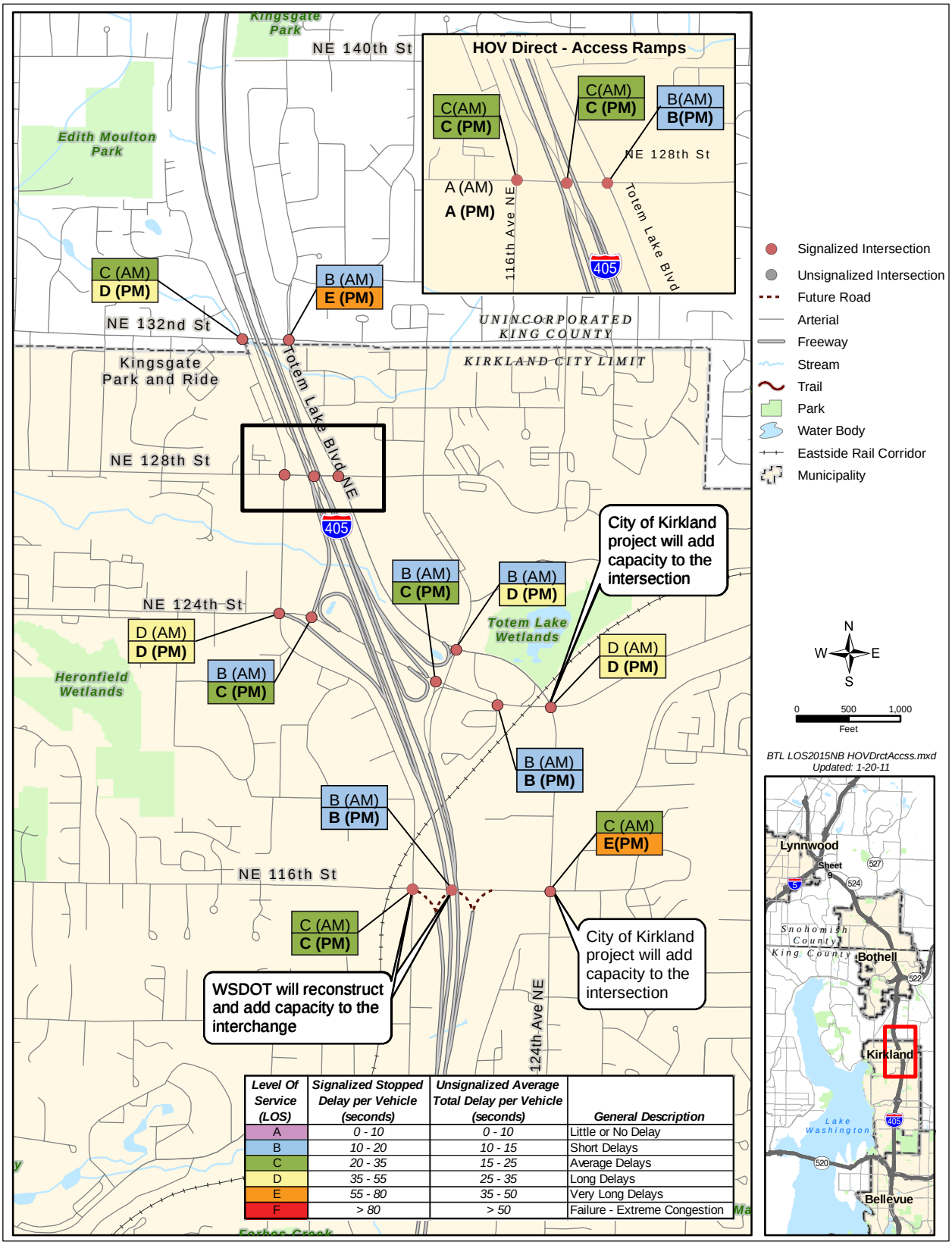

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Exhibit 4-7: Baseline/2015 No Build morning and afternoon peak-hour intersection level of service - sheet 4 of 6

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Exhibit 4-7: Baseline/2015 No Build morning and afternoon peak-hour intersection level of service - sheet 5 of 6

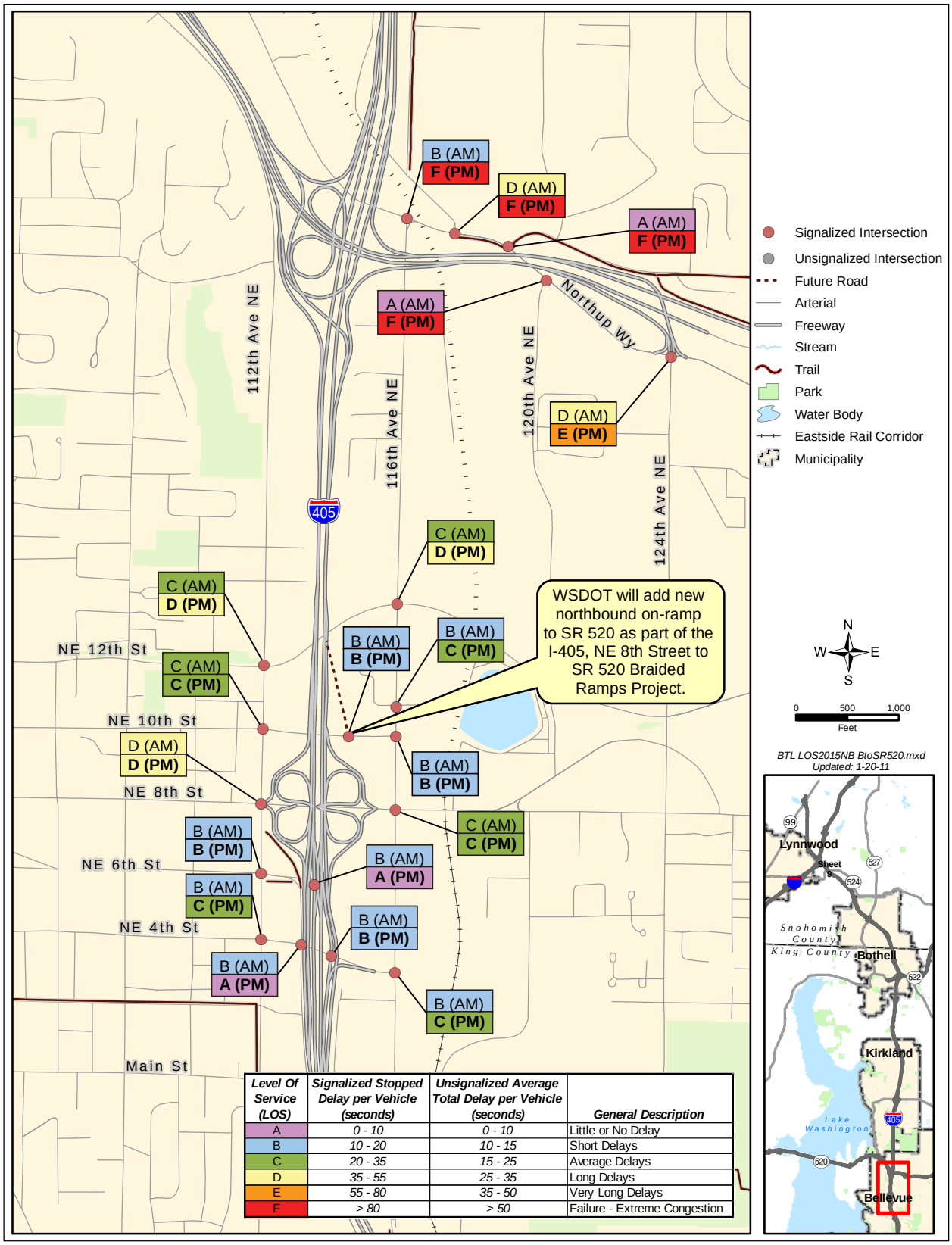

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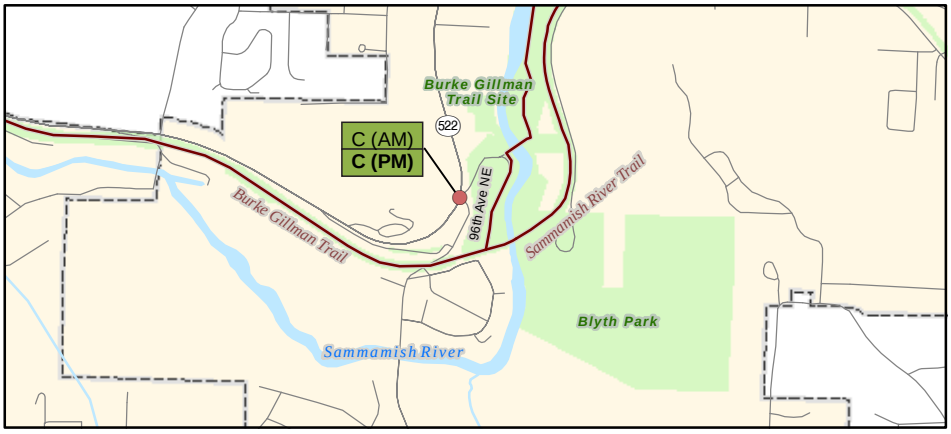
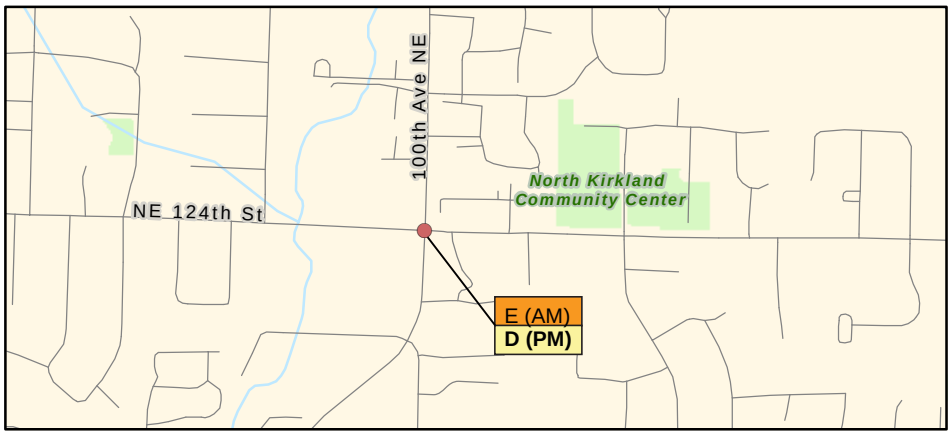
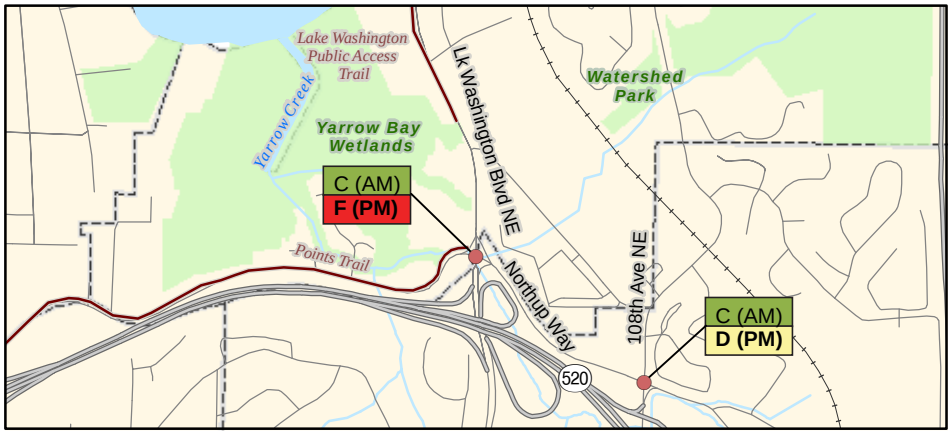
Exhibit 4-7: Baseline/2015 No Build morning and afternoon peak-hour intersection level of service - sheet 6 of 6



SR 522 and 96th Ave NE



NE 124th St and 100th Ave NE



Northup Way, Lake Washington Blvd NE, and 108th Ave NE

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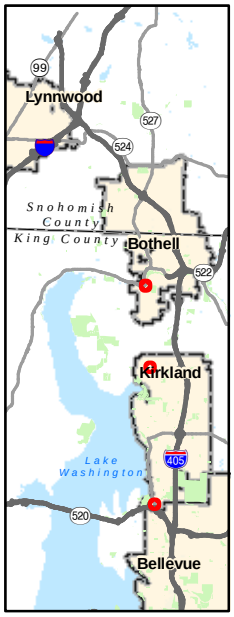
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