TRANSIT SPEED AND RELIABILITY REPORT

Bellevue Transit Master Plan

CITY OF BELLEVUE

February 2014

Transportation Department

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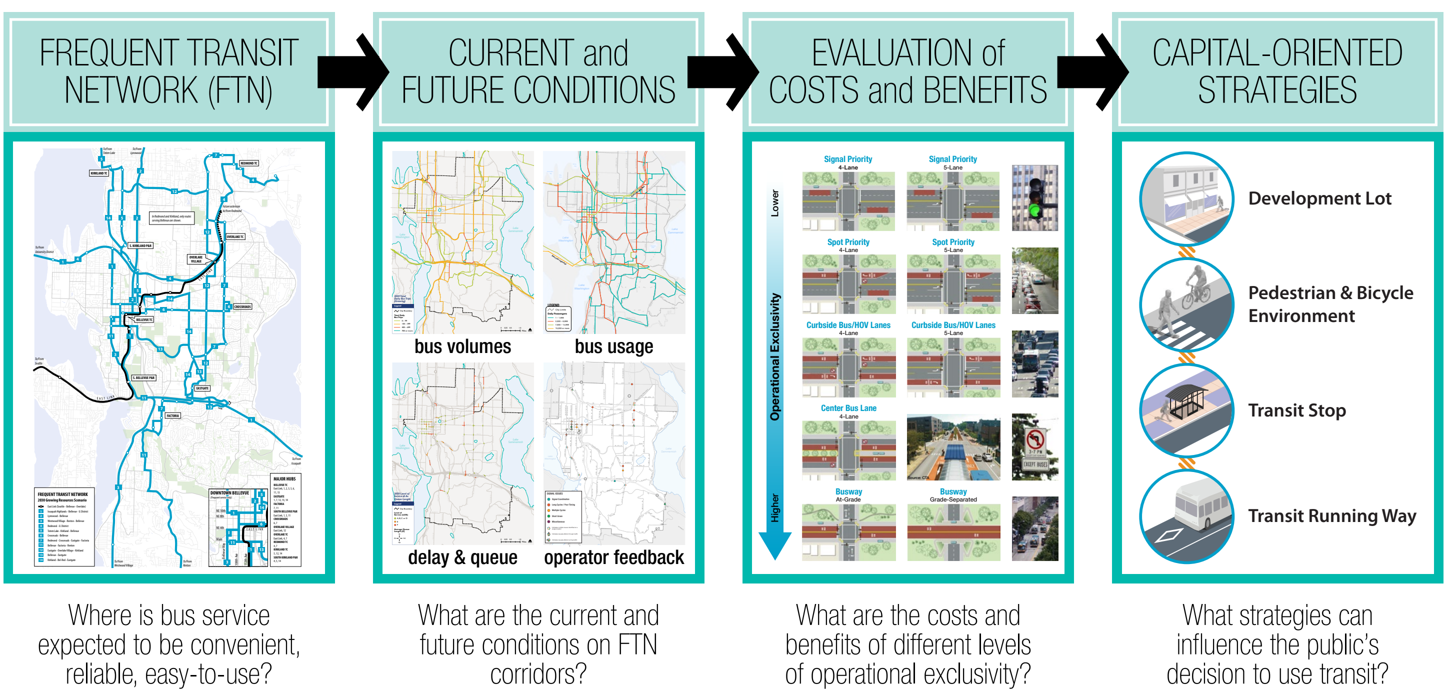


Figure 1 The Transit Master Plan process arrives at capital-oriented strategies based on a detailed review of where bus service is needed to support Bellevue's growing population and an appraisal of what investments can influence the public's decision to use transit.

INTRODUCTION

The Bellevue Transit Master Plan (TMP) will establish short- and long-term policies and projects that help foster a high-quality transit system that is more effective at connecting residents, employees, and visitors in Bellevue with the places they want to go. The *Transit Service Vision Report*, published in October 2013, identified where and how frequently service will operate according to three funding scenarios (Growing, Stable, and Reduced) at three time horizons (2015, 2022, and 2030). The Capital Element of the TMP currently underway will recommend infrastructure investments that help the City realize its proposed 2030 Frequent Transit Network (FTN).

This Draft Transit Speed and Reliability Project Report examines congestion problems on FTN corridors that compromise transit's efficiency, evaluates the tradeoffs associated with different street design decisions on mode choice, traffic delay, person throughput, etc., and assesses roadway, signal system, and other rights-of-way improvements that could enable more people to reach more destinations in less time. Project recommendations in this report will be merged into a broader Transit Capital Vision Report, which will identify locations and corridors that warrant transit speed and reliability treatments, non-motorized infrastructure enhancements, and bus stop and commuter parking investments that support efficient and effective transit operations (see Figure 1).

BACKGROUND

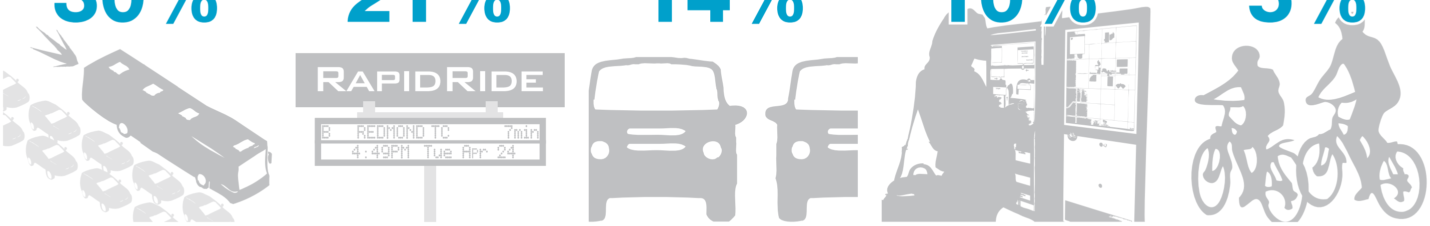
According to respondents of Bellevue's Transit Improvement Survey, improving service speed and reliability by investing in roadway and traffic signal infrastructure is the highest priority for municipal investment in transit among current transit users in Bellevue (see Figure 2). Building from an extensive market analysis, review of future growth patterns, and evaluation of transit needs, the City of Bellevue's Transit Master Plan (TMP) will detail specific capital projects that will improve transit speed and reliability in high ridership bus corridors. This task, identified as the Capital Element in the TMP scope of work, has three primary objectives:

1. Stimulate discussion on congestion in Bellevue that compromises transit's efficiency.
2. Evaluate the trade-offs associated with different street design decisions.
3. Assess roadway, signal system, and other right-of-way improvements that could be made to support the 2030 Frequent Transit Network outlined in the Service Vision Report.

HOW SHOULD THE CITY INVEST?

ACCORDING TO CURRENT TRANSIT USERS

30% | 21% | 14% | 10% | 5%



Improve service speed and reliability by investing in roadway and traffic signal infrastructure. (595)

Provide real-time bus arrival information signs at major stops, similar to the RapidRide B Line at Bellevue Transit Center. (405)

Increase vehicle parking capacity at Park and Ride lots. (264)

Provide additional route, schedule, and wayfinding information at bus shelters. (189)

Install additional bicycle lanes/trails to better connect neighborhoods to bus services. (105)

Figure 2 The most common way current transit users think the City should invest municipal resources to improve transit service in Bellevue is by "improving service speed and reliability by investing in roadway and traffic infrastructure" (30.3%; 595/1,962). The above are the five strategies most commonly selected by respondents to the 2012 Transit Improvement Survey. For full results, see the *Bellevue Transit Improvement Survey Report*.

For the purposes of assessing potential capital projects, the Capital Element references the 2030 Frequent Transit Network (FTN) as proposed in the *Transit Service Vision Report* (see Figure 3 [right] and Figure 5 [on page 6]). This network is comprised of all frequent services operating in the 2030 Growing Resources scenario, which increases service by approximately 47 percent from Spring 2012 levels to accommodate the projected near tripling of citywide transit demand by 2030. This is both the vision to which the City aspires and that with the greatest number of buses in operation—and hence that with the greatest need for capital investments to support fast and reliable service. The FTN supports Downtown growth, planned Bel-Red corridor redevelopment, and Bellevue's other activity centers with well-connected bus routes that seamlessly interface with East Link light rail. People traveling along FTN corridors can expect convenient, reliable, easy-to-use services that are so frequent, riders will not need to refer to a schedule when using these routes or connecting to East Link.

As part of the ongoing outreach supporting the TMP, the Transportation Department held the joint Board/Commission Capital and Policy Workshop on September 6, 2013. Workshop participants engaged in a discussion about the appropriate degree to which transit should be given priority over other modes—if at all—and in which situations. This was considered both in terms of the language used in City policies and in relation to transit priority treatments along Frequent Transit Network corridors. Refer to the *Capital & Policy Workshop Report* for additional information.

Although the Capital & Policy Workshop represented only an initial step in the capital planning process, the perspectives expressed and insights gleaned from it prompted numerous rounds of staff consultation, field assessment, and technical

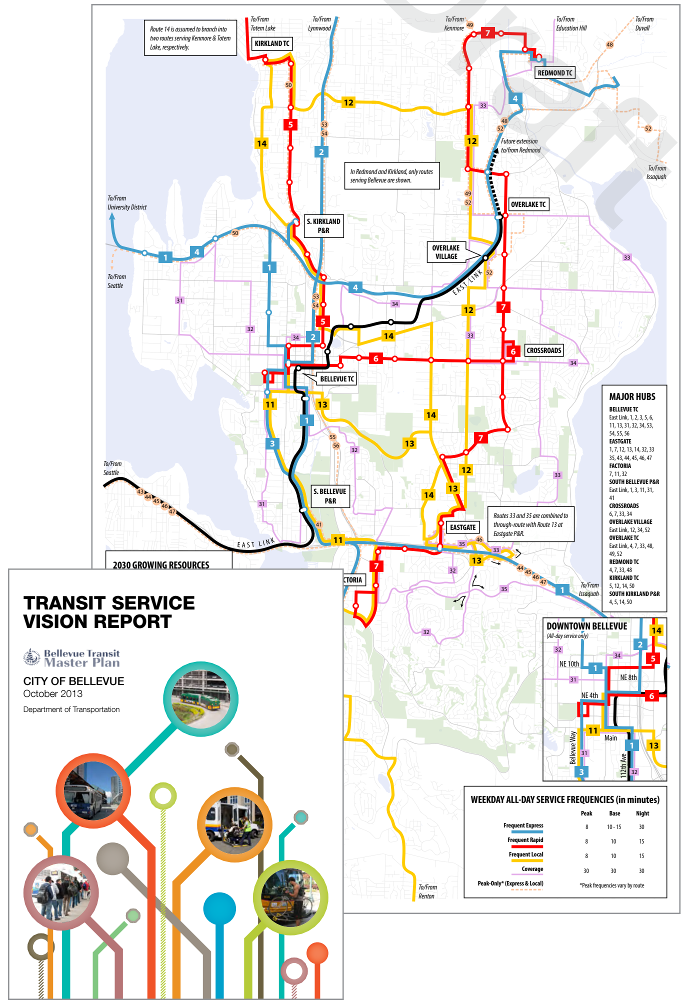


Figure 3 The *Transit Service Vision Report* presents route-level recommendations for transit in Bellevue that are responsive to three financial scenarios and attune to three time horizons. The 2030 Growing Resources Network (pictured above) is the most optimistic of the networks presented.

Figure 4 Boards and Commission members provide their perspective on potential transit priority policy language and treatment options.

evaluation. On November 14, 2013 Bellevue staff published the *Draft Capital Element Background Report (Volume 1: Speed and Reliability)*, which addressed each of the following:

1. **Past Studies and Projects** – Summary of notable previous studies and transit speed and reliability projects implemented since the adoption of the 2003 Bellevue Transit Plan. See pages 7 through 13 of this report.

2. **Toolbox of Corridor Treatments** – A review of best practices compiled into a toolbox of speed and reliability treatments to guide capital improvements along FTN corridors. See pages 15 through 29 of this report.

3. **Speed & Reliability Issue Identification** – Evaluation methodology used to determine where it might be appropriate for Bellevue to consider investing in capital projects along FTN corridors. See pages 31 through 53 of this report.

4. **Potential Improvements** – A preliminary list of potential speed and reliability improvements for each of the FTN corridors. See pages 53 through 77 of the Draft Report. (The current list of projects being proposed is presented on pages 55 through 75 of this report.)

5. **Projected Outcomes** – Assessment of potential speed and reliability improvements on transit and general purpose travel speeds. See pages 77 through 81 of this report.

Preliminary project descriptions and visualizations provided Transportation Commissioners and other interested stakeholders with an opportunity to review and comment on the potential improvements being considered. Over the course of several Commission meetings, staff responded to requests for additional information on many of the projects contained in the Draft Report. In some cases, these requests prompted detailed micro-simulation traffic model analysis (see Appendix 5 on page A118). During this evaluative stage, a number of suggested projects were eliminated from further consideration due to one or more 'fatal flaws' that were identified, but these projects are included for reference in this document in Appendix 7 (see page A152).

The current list of speed and reliability improvements is based on months of technical review and input from the Transportation Commission (see pages 55 through 75). Still, these projects remain conceptual, and the final details of design will be developed as the projects proceed further along in the implementation process.

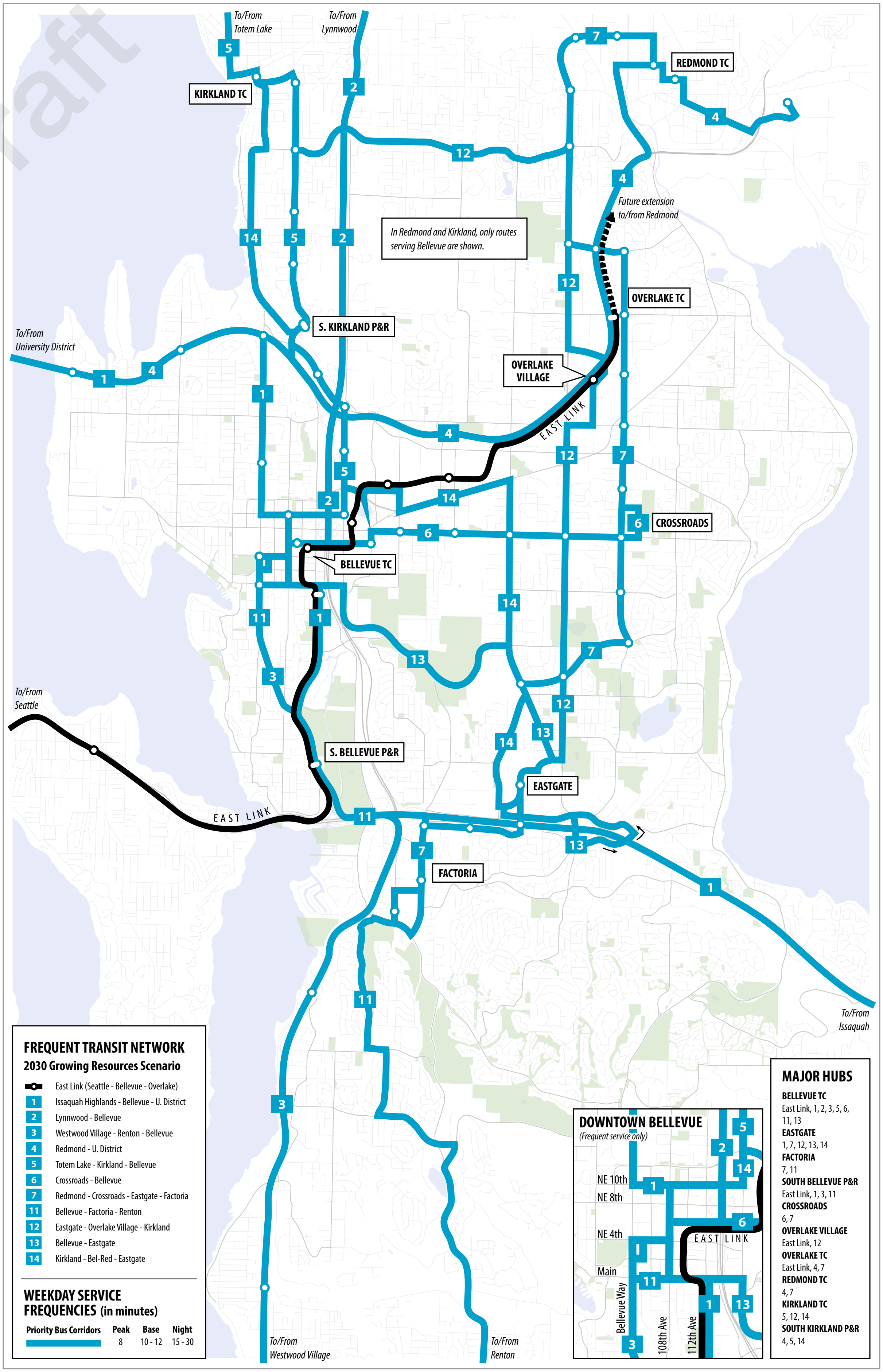


Figure 5 2030 Frequent Transit Network (FTN).

PAST STUDIES & PROJECTS

PAST STUDIES

The first task of the Capital Element was the documentation of previously identified transit and roadway improvements along the corridors served by the Frequent Transit Network (FTN). The following provides a brief summary of the reports referenced.

Downtown Transportation Plan Update (current) – This on-going project will be a focused update to the transportation portion of the Downtown Subarea Plan, which was adopted in 2004. The update will incorporate forecasted growth in population and employment through 2030 to ensure that the Downtown transportation system can function well and support this anticipated growth. A multimodal strategy is being pursued to accommodate both motorized and non-motorized transportation demand. The final report will include a revised list of system improvements to roadways, transit, pedestrian and bicycle facilities, and traffic signal operations. While still on-going, some early results of this effort relating to the Transit Master Plan include the establishment of future transit circulation patterns in Downtown, which are reflected in the networks proposed in the *Transit Service Vision Report*, and the consideration of projects such as the 108th Ave NE Bus Priority Corridor.

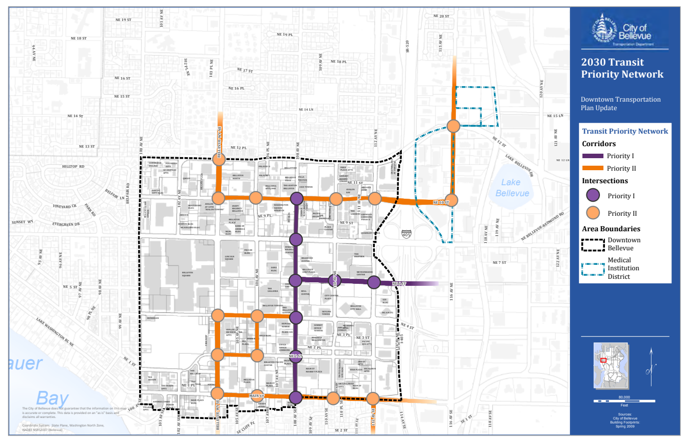


Figure 6 The 2030 Transit Priority Network from the *Downtown Transportation Plan Update*.

East Link Extension Cost Savings Work Plan Findings (2012) – Following the November 2011 execution of a Memorandum of Understanding (MOU) regarding funding and construction of East Link light rail, the City of Bellevue and Sound Transit analyzed cost savings concepts that have the potential to

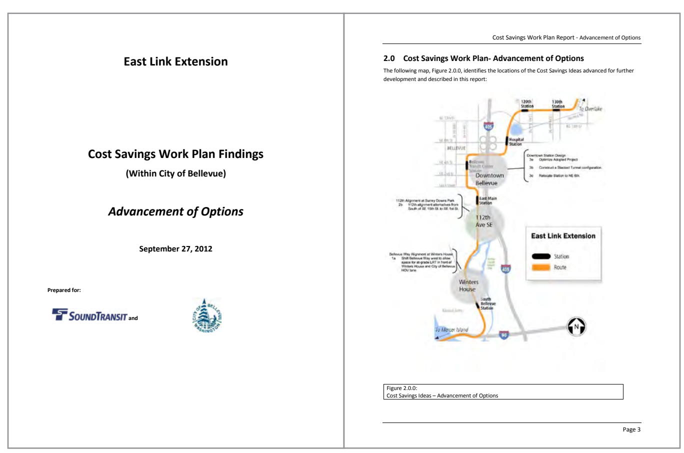


Figure 7 Map of the three areas with cost savings options advanced for further consideration, from the *East Link Extension Cost Savings Work Plan Findings*.

save at least $60 million in project costs while supporting the system's performance. This report summarizes the cost savings options advanced for further development, including alternative alignments for Bellevue Way and 112th Ave SE segments and several options for the Downtown Station design. The review of each of these includes anticipated cost savings, impacts to traffic, vehicle and pedestrian access, noise, visual appearance, and any impacts to adjacent properties, wetlands, and parks. Other projects associated with these concepts, including a southbound HOV lane along Bellevue Way SE between 112th Ave SE and South Bellevue Park-and-Ride.

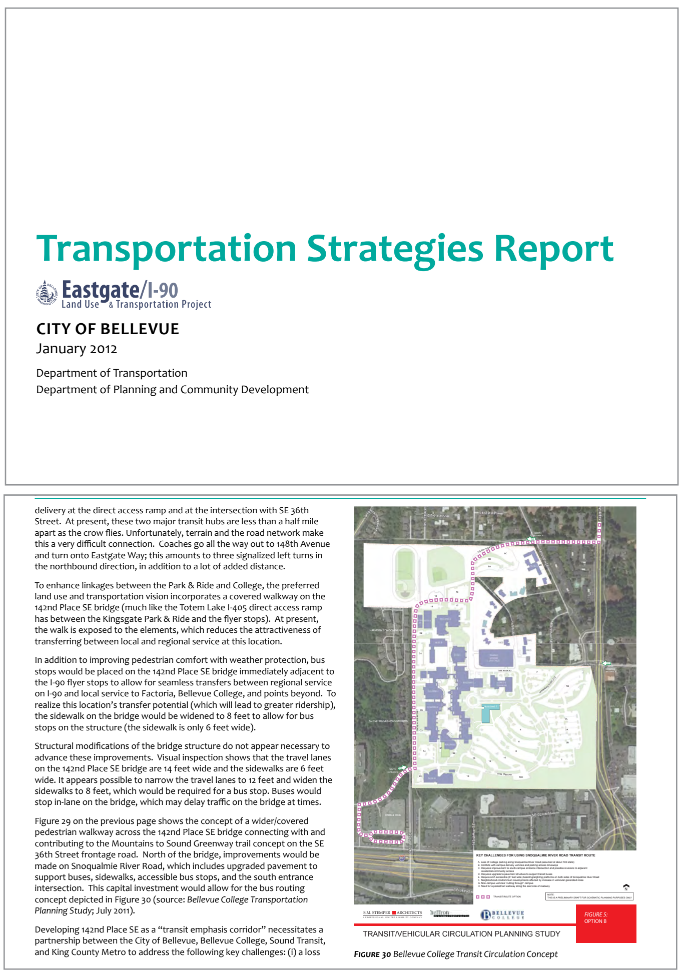


Figure 8 Proposed improvements and revised transit routing around Bellevue College along Snoqualmie River Rd, from the *Eastgate/I-90 Transportation Strategies Report*.

Eastgate/I-90 Land Use and Transportation Project (2012) – The *Transportation Strategy Report* outines a vision that will guide public and private actions, investments, and capital project priorities to improve mobility for all travel modes in the Eastgate/I-90 corridor. Potential improvements advanced by the plan are oriented toward finding the best transportation solutions for the area that are affordable, supported by the community, and can be implemented in a reasonable time frame. The list includes projects that would improve traffic flow at critical intersections, enhance the pedestrian/bicycle environment, and increase the attractiveness of transit as a travel option. One of the transit improvements proposed is the development of 142nd Pl SE as a transit emphasis corridor, including upgrading Snoqualmie River Rd to support buses and accessible bus stops.

SR-520 High-Capacity Plan (2008) – The *SR-520 High Capacity Transit Plan* outlines a strategy for meeting the demand for cross-lake travel with an incremental implementation of bus rapid transit service that connects employment, residential areas, and activity centers on both sides of Lake Washington. The plan recommends how transit can build on capital investments identified for the SR-520 Corridor Program by substantially increasing service and improving off-corridor transit facilities to help meet future growth in travel. Of the plan's three major elements, that most relevant to the TMP is the near-term implementation of bus rapid transit service on SR-520 supported by HOV lanes and direct-access ramps, transit priority treatments at intersections, intelligent transportation systems (ITS), and improvements in fare collection systems and bus stations.

I-405 Bus Rapid Transit Concept Reports – Several reports related to I-405 Corridor BRT planning were reviewed to help inform the TMP Capital Element, including *White Paper: I-405 Bus Rapid Transit Line Concept* (2003) and the *I-405 South Corridor Bus Rapid Transit Pre-Design Report* (2005). The former describes components of the proposed BRT line for the entire I-405 corridor, including HOV lanes, direct access ramps, BRT station locations and designs, fare collection, ITS, and other features. It also presents ridership forecasts for the corridor with and without implementation of the BRT line and estimates the cost of the various infrastructure investments considered by the plan. The latter report builds on earlier I-405 Corridor studies, focusing on the the southern portion of the corridor from Bellevue to Sea-Tac Airport. It assesses the overall feasibility of operating BRT along this section of the corridor in the short- (2014) and long-term (2030), considers current travel times and sources of delay, and identifies infrastructure needed to support BRT operations along with planning-level cost estimates.

Bellevue Transit Improvement Analysis (2005) – In April of 2004, King County Metro, Sound Transit, and the City of Bellevue collaborated to consolidate all of the proposed transit improvements in Bellevue from various prior studies and to identify immediate transit needs. This report summarizes the results of

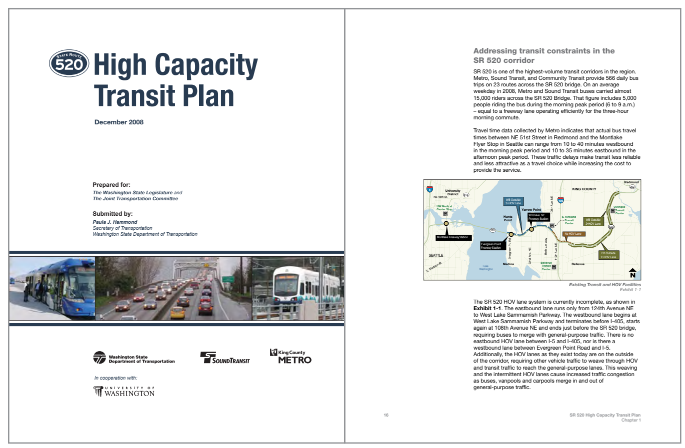


Figure 9 A map depicts the existing transit and HOV facilities on SR-520, from the *SR-520 High-Capacity Plan*.

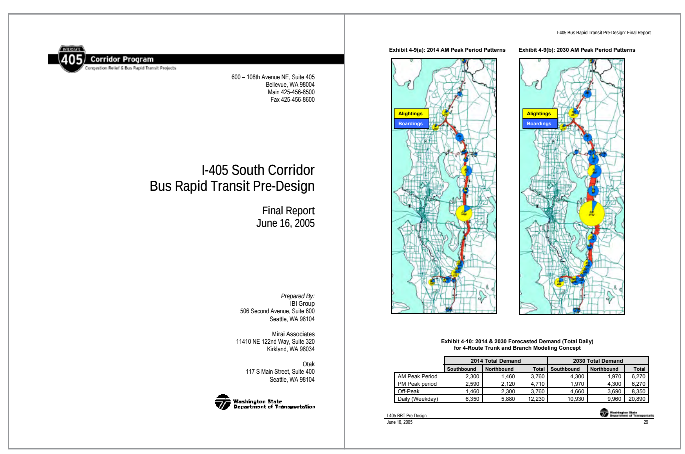


Figure 10 Maps depict I-405 BRT stop-level ridership forecasts for the AM peak period in 2014 and 2030, from the *I-405 Corridor Program: Bus Rapid Transit Line Concept*.

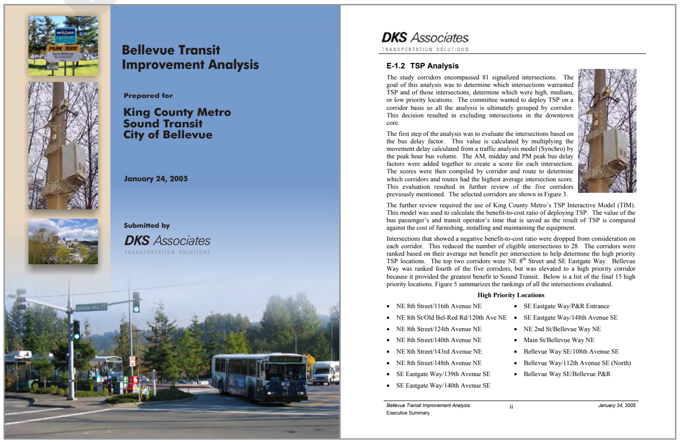


Figure 11 Summary of the TSP analysis process and the fifteen highest-ranked intersections prioritized for transit signal priority (TSP), from the *Bellevue Transit Improvement Analysis*.

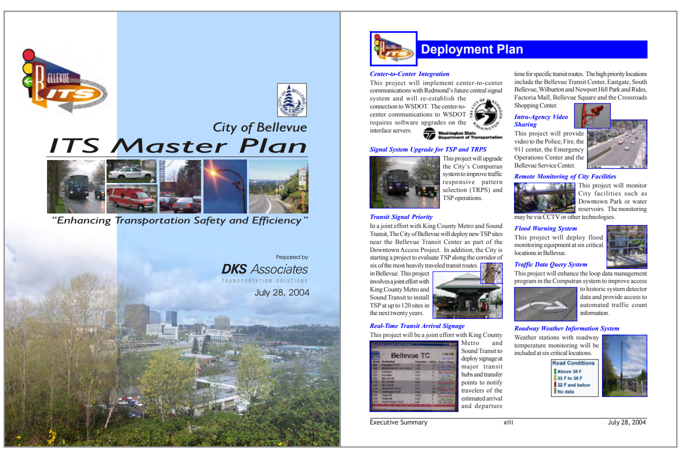


Figure 12 High priority projects identified by the *ITS Master Plan.*

the arterial improvement evaluation and TSP analysis. The goal was to identify routes and corridors with the greatest needs based on a qualitative review of headways, ridership, and historic delay problems. The primary corridors identified include NE 8th St, 156th Ave NE, Bellevue Way, Eastgate Way, and Factoria Blvd. King County Metro's TSP Interactive Model (TIM) was used to calculate the benefit-to-cost ratio of deploying TSP, wherein the value of the bus passenger's and transit operator's time saved is compared to the cost of furnishing, installing, and maintaining the equipment. Of the 81 signalized intersections originally assessed, most were removed from further consideration on the basis of negative benefit-to-cost ratios, leaving 28 eligible intersections. The fifteen highest ranked locations were estimated to cost $543,000 to furnish and install equipment.

ITS Master Plan (2004) – The Bellevue ITS Plan is a road map to implement an integrated system of transportation strategies based on a set of identified opportunities. The plan's purpose is to establish the need for ITS investments in the region, to identify relative priorities to direct ITS investment, to identify specific projects to be deployed to address identified needs, and to prioritize financial resources for ITS opportunities. The plan was coordinated with regional efforts to ensure that ITS strategies are integrated and complementary, which helps ensure that Bellevue is eligible for federal ITS funding. Among the projects identified is a collaborative evaluation with Metro of the potential to deploy TSP at up to 120 along six of Bellevue's most heavily traveled transit routes, which would be implemented over twenty years.

Factoria Area Transportation Study Update (2005) – This report is an update to the 1996 *Factoria Area Transportation Study*, which was completed three years after the area annexed to Bellevue. The update documents the transportation system capacity analysis that was conducted, addresses the needs of all modes of transportation within the area, and provides design guidance for private sector redevelopment along Factoria Blvd. Further, the update provides a strategy to achieve long-term mobility and safety for all transportation system users. It challenges the existing, disconnected suburban land use pattern, providing transportation and urban design recommendations embraced by the community that would create a well-integrated, transit supportive, pedestrian oriented, mixed-use urban neighborhood.

148th Avenue Mobility Improvement Package (2003) – This study addresses the concerns of residents of East Bellevue neighborhoods, who were concerned that excessive traffic in the 148th Ave corridor was resulting in increased traffic on neighborhood streets. The project's vision is to gain community support for transportation improvements to optimize north-south travel on 148th Ave that maximizes the people-moving capacity of the system while minimizing the impacts on parallel arterials and neighborhood streets. The report identifies short- and mid-term projects to manage congestion problems and protect neighborhoods from cut-through traffic. Some transit projects recommended include TSP at slected locations along 148th Ave and a southbound queue jump at SE 24th St.

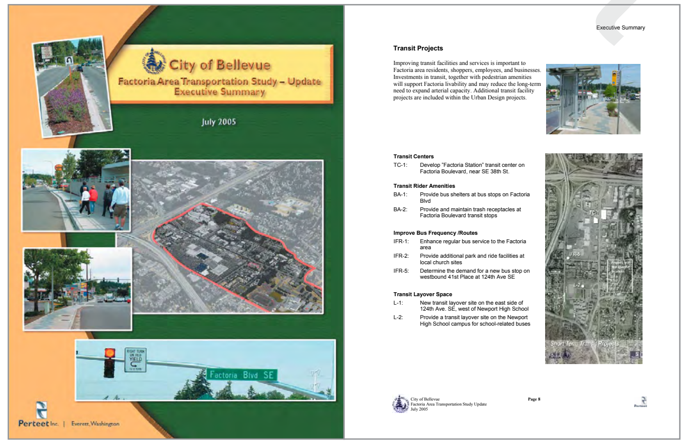
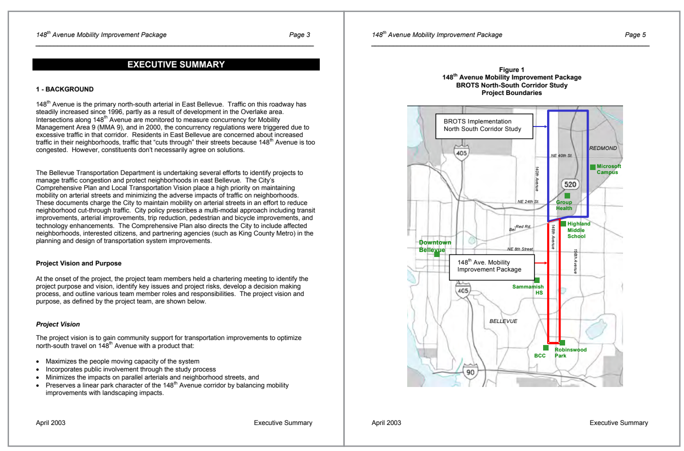


Figure 13 Transit facilities and service improvement projects identified by the *Factoria Area Transportation Study.*


148th Avenue Mobility Improvement Package *Page 3*

EXECUTIVE SUMMARY

1 - BACKGROUND

148th Avenue is the primary north-south arterial in East Bellevue. Traffic on this roadway has steadily increased since 1996, partly as a result of development in the Overlake area. Intersections along 148th Avenue are monitored to measure concurrency for Mobility Management Area 9 (MMA 9), and in 2000, the concurrency regulations were triggered due to excessive traffic in that corridor. Residents in East Bellevue are concerned about increased traffic in their neighborhoods, traffic that "cuts through" their streets because 148th Avenue is too congested. However, constituents don't necessarily agree on solutions.

The Bellevue Transportation Department is undertaking several efforts to identify projects to manage traffic congestion and protect neighborhoods in east Bellevue. The City's Comprehensive Plan and Local Transportation Vision place a high priority on maintaining mobility on arterial streets and minimizing the adverse impacts of traffic on neighborhoods. These documents charge the City to maintain mobility on arterial streets in an effort to reduce neighborhood cut-through traffic. City policy prescribes a multi-modal approach including transit improvements, arterial improvements, trip reduction, pedestrian and bicycle improvements, and technology enhancements. The Comprehensive Plan also directs the City to include affected neighborhoods, interested citizens, and partnering agencies (such as King County Metro) in the planning and design of transportation system improvements.

Project Vision and Purpose

At the onset of the project, the project team members held a chartering meeting to identify the project purpose and vision, identify key issues and project risks, develop a decision making process, and outline various team member roles and responsibilities. The project vision and purpose, as defined by the project team, are shown below.

Project Vision

The project vision is to gain community support for transportation improvements to optimize north-south travel on 148th Avenue with a product that:

- Maximizes the people moving capacity of the system
- Incorporates public involvement through the study process
- Minimizes the impacts on parallel arterials and neighborhood streets, and
- Preserves a linear park character of the 148th Avenue corridor by balancing mobility improvements with landscaping impacts.

April 2003 Executive Summary

148th Avenue Mobility Improvement Package *Page 5*

Figure 1
148th Avenue Mobility Improvement Package
BROTS North-South Corridor Study
Project Boundaries

April 2003 Executive Summary

Figure 14 Project extents assessed by the *148th Avenue Mobility Improvement Package.*

COMPLETED PROJECTS

Since the adoption of the 2003 *Bellevue Transit Plan*, hundreds of millions of dollars in HOV access ramps, transit centers, park-and-ride lots, and speed and reliability projects were completed in Bellevue in support of transit operations. Transit capital projects completed since 2003 include:

Figure 15 Bellevue Transit Center.

Bellevue Transit Center – In 2003, Sound Transit expanded the Bellevue Transit Center to include ten bus bays, shelter improvements, and rider amenities. Additional bus stops and roadway improvements on 108th Ave NE, 106th Ave NE and east of the transit center on NE 6th St have improved transit and traffic flow in Downtown Bellevue and enable more than 100 buses during peak periods to move efficiently through the transit center. *Total funding: $16 million.*

Figure 16 Eastgate Park-and-Ride.

Eastgate Park-and-Ride Expansion – In 2004, King County expanded the Eastgate Park-and-Ride from a 696-stall facility to a structured complex that can accommodate 1,646 vehicles. In spite of the large number of parking spaces, the Eastgate Park-and-Ride is already at capacity with a utilization ratio of 97 percent (Q2 2012). *Total funding: $27 million.*

Figure 17 Downtown Bellevue HOV Access.

Downtown Bellevue HOV Access – Completed in 2005, the Bellevue HOV Access project makes it easier to travel in an out of Downtown Bellevue from the freeway. The project provides a new interchange on I-405 at NE 6th St for buses and carpools, giving buses direct access to the expanded Bellevue Transit Center. It improves freeway interchanges at NE 4th St, NE 8th St, and SE 8th St, including improvements to nearby city street intersections. *Total funding: $144 million.*

Eastgate Direct Access Ramp – WSDOT and Sound Transit partnered in 2006 to complete the Eastgate Transit Access project to connect the existing 142nd Pl SE bridge to I-90 HOV lanes. The addition of two ramps (one each on the east and west sides of I-90) allows a direct connection for bus and HOV users to 142nd Pl SE and the Eastgate Park-and-Ride without having to cross the general lanes to exit the highway. *Total funding: $19 million.*

Figure 18 Eastgate Direct Access Ramp.

I-90 Two-Way Transit & HOV Operations – WSDOT and Sound Transit are working together to improve on-time reliability and access for transit and HOVs on I-90. The project will provide full-time HOV lanes for eastbound and westbound traffic on the outer I-90 roadways and will retain the existing reversible lane operations in the center roadway until East Link light rail construction is ready to begin. HOV direct access on- and off-ramps will enable buses and carpools to access the HOV lanes without crossing other lanes of traffic. The project is being implemented in three stages: stages 1 and 2 were completed in 2008 and 2012, respectively; the third and final stage is in design with construction expected to be complete in. *Total funding: $188 million.*

Figure 19 I-90 Two-Way Transit & HOV Operations.

RapidRide B Line – King County Metro's RapidRide B Line started running between the Downtown Bellevue and Redmond Transit Centers via Crossroads and Overlake in 2011. Customers enjoy enhanced frequencies (service at least every 10 minutes during the busiest morning and evening travel hours and 15 minute service during off-peak periods), real-time bus arrival signs, well-lit shelters, and speed and reliability enhancements offered by transit signal priority (TSP). *Total funding for roadway improvements, communication network, stations and stops and associated amenities: $10 million.*

Figure 20 RapidRide B Line inauguration ceremony.

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TRANSIT PRIORITY TOOLBOX

The Transit Priority Toolbox includes a range of transit priority treatments being considered for implementation on Bellevue's transit corridors by 2030. The purpose of the toolbox is to guide capital improvements on Frequent Transit Network (FTN) corridors that will improve the speed and reliability of these services—both to make them more attractive to the public, and to ensure they achieve operating speeds consistent with estimates in the *Transit Service Vision Report*.

Treatments considered in the Transit Priority Toolbox are generally divided into three categories:

1. **Intersection treatments**, including TSP, queue jump lanes, and left turn restrictions;
2. **Bus stop treatments**, including in-lane stops, curb extensions, and transit islands; and
3. **Running way treatments**, including BAT lanes, arterial HOV lanes, transit-only lanes or streets, contra-flow bus lanes, and busways.

Each category includes strategies with different levels of financial investment, degrees of benefit to transit, and impacts to other travel modes. Some improvements are intended for discrete locations, while others are meant to be coordinated along entire corridors. Some locations or corridors may warrant multiple improvements based on existing configurations and level of transit priority deemed appropriate. Figure 7 provides a graphical summary of the treatment types organized according to the degree of transit operational exclusivity they provide. The following pages describe each of the treatments being considered, their advantages, disadvantages, and approximate cost, and include photographs of their application elsehwere in the Puget Sound region.

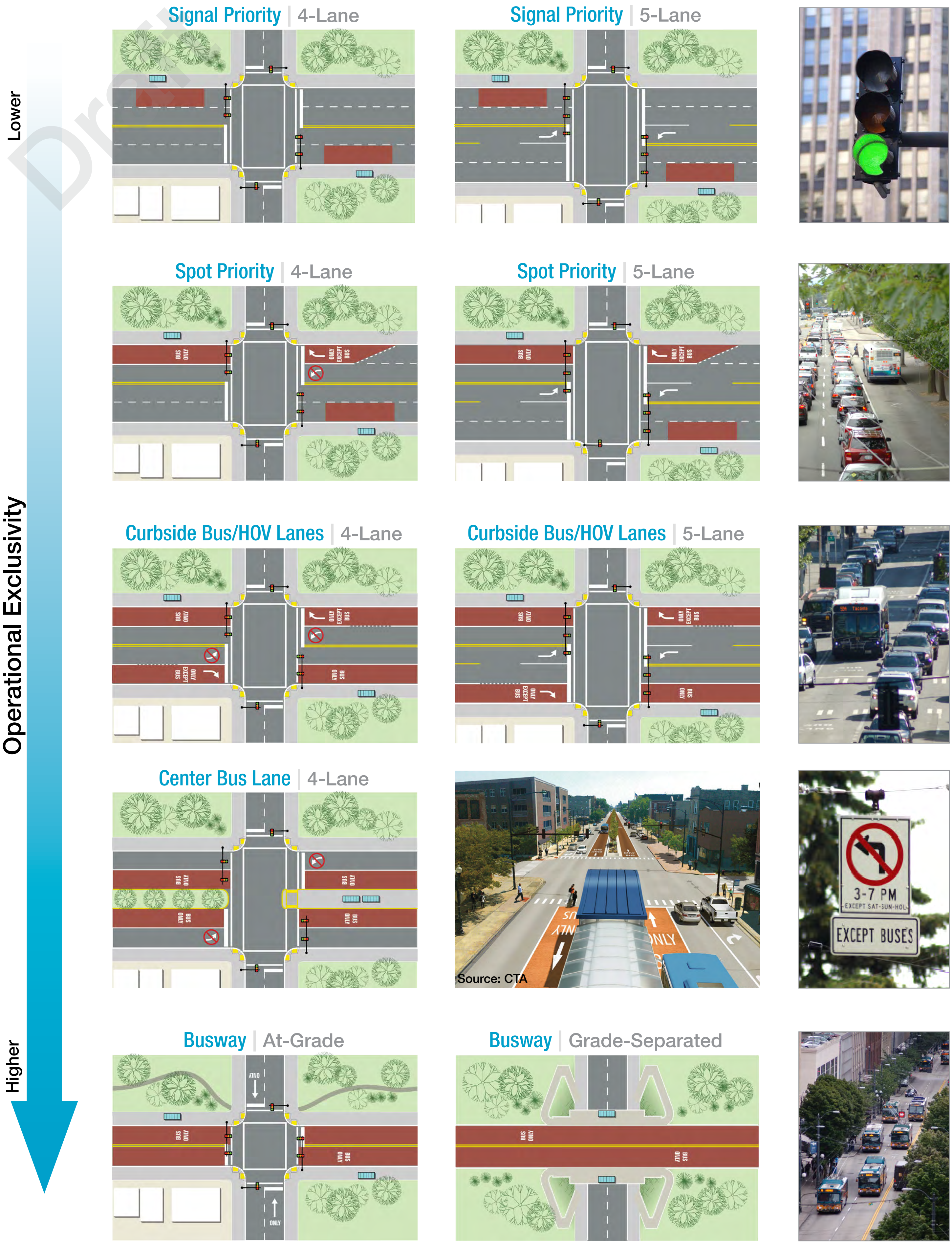


Figure 21 Diagram of the level of operational exclusivity exhibited by the primary categories of treatments in the Transit Priority Toolbox.

Transit Signal Priority

Description

Transit signal priority (TSP) is an operation that adjusts signal timing to prioritize transit vehicle movements along a corridor. There are several types of signal priority treatments, as shown at left, with green extension and early green used most commonly. Intersection context and city policy have a significant impact on the speed and reliability benefits that TSP can provide to transit. Arterials with medium levels of congestion and frequent signalized intersections are ideal for TSP. Many other priority treatments are paired with TSP to improve overall effectiveness.

Passive TSP strategies include signal timing coordination and the addition of a special signal phase. Active TSP offers the additional ability to give a bus priority conditionally based on one or more factors, including whether a bus is running late, the number of passengers on board, and how recently priority was given to another bus. Upgrades to signal controllers and fiber communication lines are often necessary for implementation of active TSP strategies.

Green Extension – This application keeps a signal green for an approaching bus until the bus has passed through an intersection.

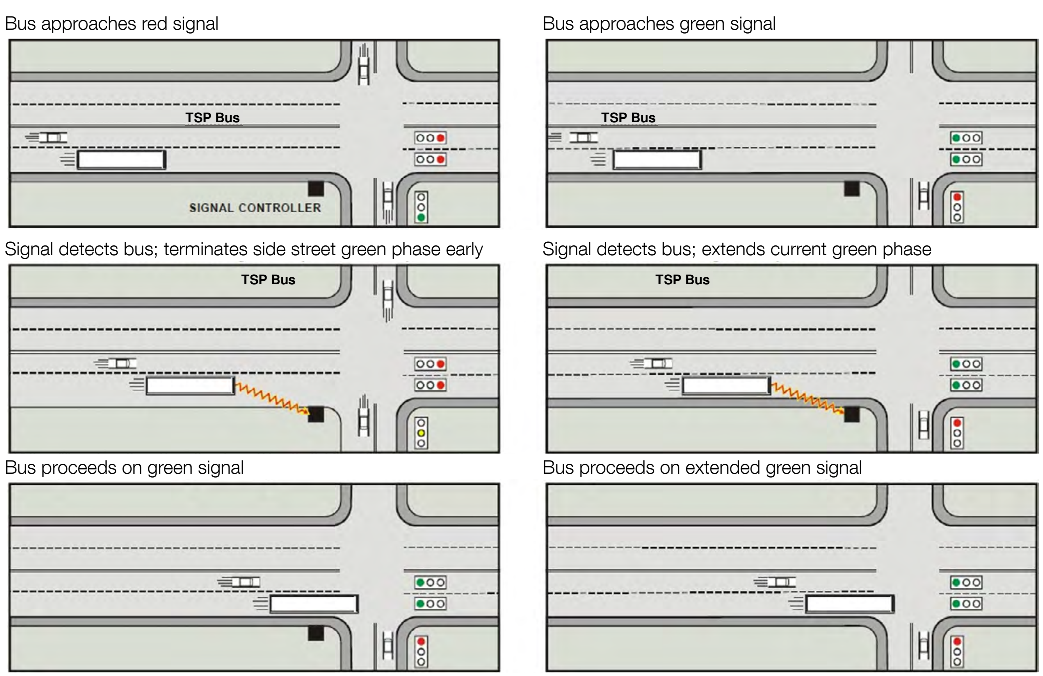
Early Green (Red Truncation) – This application reduces the amount of time a bus waits for a green light by shortening the amount of green time given to other traffic.

Phase Rotation – This application switches the sequence in which signals turn green, most commonly switching a left turn arrow with a through green for an approach.

Pre-emption – This application is typically used by emergency vehicles and at railroad crossings. Designated vehicles receive a green signal upon approaching an intersection or crossing.

Special Phase – This application is used to give a green light to a bus only signal when a bus is present. This type of application is typically used at or near transit centers when buses make unusual movements through an intersection.

Figure 22 Signal timing operations with early green (left) and green extension (right).



Source: URS for Pace Suburban Bus (2011).

Figure 23 Transit signal priority helps to ensure that buses can move along a corridor with minimal delay incurred by red lights.

Advantages

- Provides modest speed and reliability improvement
- Improves overall travel time between three to fifteen percent and can reduce signal delay for transit up to 75%
- No additional right-of-way required
- Produces a minimal overall impact to general traffic, depending on the level of priority assumed
- Can be implemented with other signal and transit enhancements

Considerations

- Performance depends on many factors including:
  - Number of intersections
  - Priority thresholds
  - Extent of priority
- TSP has limited impact when buses are on highly congested corridors
- May disturb the flow of a coordinated signal system
- Requires inter-jurisdiction coordination
- Side-street bus routes may experience additional delay when favored routes receive priority
- Not as effective with far side stops

Queue Jump Lanes

Description

Queue jumps allow buses to bypass congested choke points through a combination of a short bus-only lane and a dedicated bus signal, which gives buses a green light several seconds before other vehicles. This operation allows buses to enter the intersection ahead of general traffic. Queue jumps are primarily used when the right-of-way at a choke point is constrained, but roadways leading up to the choke point have sufficient space for a dedicated bus-only lane.

Figure 24 A bus approaches an intersection in a bus-only queue jump lane.

Benefits

- Allows buses to bypass congestion at critical locations
- Requires less right-of-way than treatments along a full corridor
- Can improve bus travel time by five to twenty-five percent and reduces delay

Figure 25 The bus-only queue jump lane (right signal) receives a green signal before general purpose traffic (left signal).

Considerations

- Impacts to general purpose traffic varies per improvement strategy (i.e. use of a right-turn lane or conversion of second thru-lane to a right-turn only lane with transit queue jump)
- Effectiveness will vary depending on location of intersection transit stop
- Will be less effective with high volume right-turn lanes

Figure 26 Left turn restriction on general purpose traffic.

Figure 27 A bus turns during a protected phase.

Left Turn Restrictions

Description

Turn restrictions are generally used to improve safety or reduce congestion by restricting left-turns during peak periods. In many cases, turn restrictions reduce delays caused by turning vehicles blocking traffic. This is primarily an issue at intersections without dedicated left-turn lanes, such as 2-lane and 4-lane corridors. Turn restrictions are also used in combination with transit priority treatments. A turn restriction maximizes the capacity of the remaining general purpose lanes or restricts unsafe movements that cross bus traffic. Turn restrictions may also give transit priority at locations with heavy traffic delays.

Benefits

- Improves traffic operations at intersections and along corridors where center turn lanes do not exist
- Can be implemented for specific time periods
- Provides priority for transit vehicles when turning left
- Improves travel time for transit

Considerations

- Can cause confusion for general traffic
- Reduces route options for general purpose traffic during peak periods
- Requires active enforcement
- May increase intersection delays caused by vehicle diversion, degrading intersection levels of service
- Can impact safety at adjacent intersections through the consolidation of left-turning traffic

BUS STOP TREATMENTS

In-Lane Bus Stops

Description

In-lane bus stops are locations where a bus stops in a travel lane to pick-up or drop-off passengers. This type of stop typically generates less delay for the bus as compared to bus pullouts, which require the bus to leave the traffic stream and re-enter after serving passengers. Merging back into the main travel lane can significantly delay buses because passenger vehicles often do not yield to a bus attempting to merge into traffic. This causes additional delay and increased potential for conflicts. In-lane stops reduce re-entry delay and increase safety for the bus and other vehicles. In-lane bus stops are particularly effective on roadways with few gaps in traffic.

Figure 28 RapidRide bus at an in-lane bus stop.

Benefits

- Reduces re-entry delay after serving a bus stop
- Increases transit visibility

Considerations

- Increases vehicle delays for general traffic (may vary with one or two lane directional configurations)
- Can increase bike/transit conflicts

Figure 29 Unlike bull pullt-outs, in-lane stops do not incur delay by requiring buses to re-enter the traffic stream.

Curb Extensions

Description

Curb extensions are locations where the sidewalk has been extended to allow buses to stop in-lane. This design reduces delays for buses by avoiding re-entry delay, with the added benefit of providing additional sidewalk space for waiting passengers and amenities. Curb extensions are typically used in locations were on-street parking is provided; buses experience delay when re-entering traffic; or additional sidewalk space is needed. Roadway capacity may be reduced, and conflicts between bikes and transit might occur in situations where bicycle lanes exist.

Figure 30 Curb extension on the far-side of an intersection.

Benefits

- Reduces re-entry delay after serving bus stop
- Allows for retention of on-street parking or load zones
- Increases pedestrian comfort by allowing for wider sidewalks and bus stop amenities
- Can improve pedestrian safety by reducing crossing distance if incorporated into a mid-block crosswalk or intersection treatment

Figure 31 Curb extension following a short parking lane.

Considerations

- Increases vehicle delays for general traffic (may vary with one or two lane directional configurations)
- Can increase bike/transit conflicts

Transit Boarding Islands

Description

Transit islands provide a bus stop in the road right-of-way separated from the curb through a variety of designs. This treatment enables a bus to travel and stop in a lane that is not adjacent to the curb while still providing amenities to the transit riders. For example, buses may use the left lane of a roadway because of a priority treatment or a necessary maneuver, and a transit island allows buses to serve a bus stop without changing lanes. Transit islands can also reduce bike and transit conflicts by routing the bicycle lane behind the transit island. Transit islands are built within the street right-of-way and often reduce effective crossing distances for pedestrians, which may improve pedestrian connectivity and safety.

Figure 32 Transit island with in-lane bus stop.

Benefits

- Integrates with locations configured with a left side transit lane
- Reduces transit vehicle re-entry delay after serving a bus stop
- Reduces bike/transit “leap-frog” conflicts
- Can be useful at intersections with significant parking activity and right turns

Figure 33 Transit island with bus-only lane.

Considerations

- Increases vehicle delays for general traffic, particularly if unable to pass the bus
- Requires space within standard street ROW
- Could create an unsignalized pedestrian crossing for riders to access the transit island, if configured mid-block

Figure 34 Transit island with in-lane bus stop.

Figure 35 Transit island with bus-only lane.

Business Access & Transit Lanes

Description

Business Access and Transit (BAT) Lanes restrict a curbside lane of a multilane arterial to transit and right-turning vehicles only. At intersections, all vehicles (including high occupancy vehicles) are required to turn right while transit can continue straight through the intersection. This preserves access to businesses and side-streets, but reduces vehicle volumes in the curbside lane such that transit speed and reliability are improved. BAT lanes may not benefit transit operations well in locations with frequent right-turn vehicle movements and heavy conflicting pedestrian volumes.

Benefits

- Can result in significant transit speed and reliability improvements through congested corridors where standing queues from intersections increase congestion
- Works well in locations with infrequent right turn movements

Considerations

- Requires significant ROW to construct or conversion of travel or parking lane to BAT lane
- Can increase general purpose congestion through decreasing general purpose capacity
- Can be blocked by cyclist or turning/merging vehicles especially in highly congested locations or locations with high pedestrian volumes
- Effectiveness is limited along high volume commercial areas with high right-turn volumes

Arterial HOV Lanes

Description

Arterial High-Occupancy Vehicle (HOV) Lanes have similar restrictions as freeway HOV lanes. Only transit, motorcycles, and carpools (2+ or 3+ occupants) are allowed to use the lanes. These lanes are typically located in areas with heavy reoccurring congestion and infrequent right-turns. Allowing carpools can increase the person capacity of the lane and works well in coordination with the freeway HOV system.

Benefits

- Speed and reliability improvement for transit and HOV vehicles in congested corridors
- Works well along road segments where transit volumes might not be high enough to justify an exclusive transit lane and HOV demand is high
- Works well in coordination with freeway HOV system and onramps

Considerations

- Can increase general purpose congestion
- Effectiveness is limited along high volume commercial areas with high right-turn volumes
- Requires on-going enforcement which is complicated by carpools

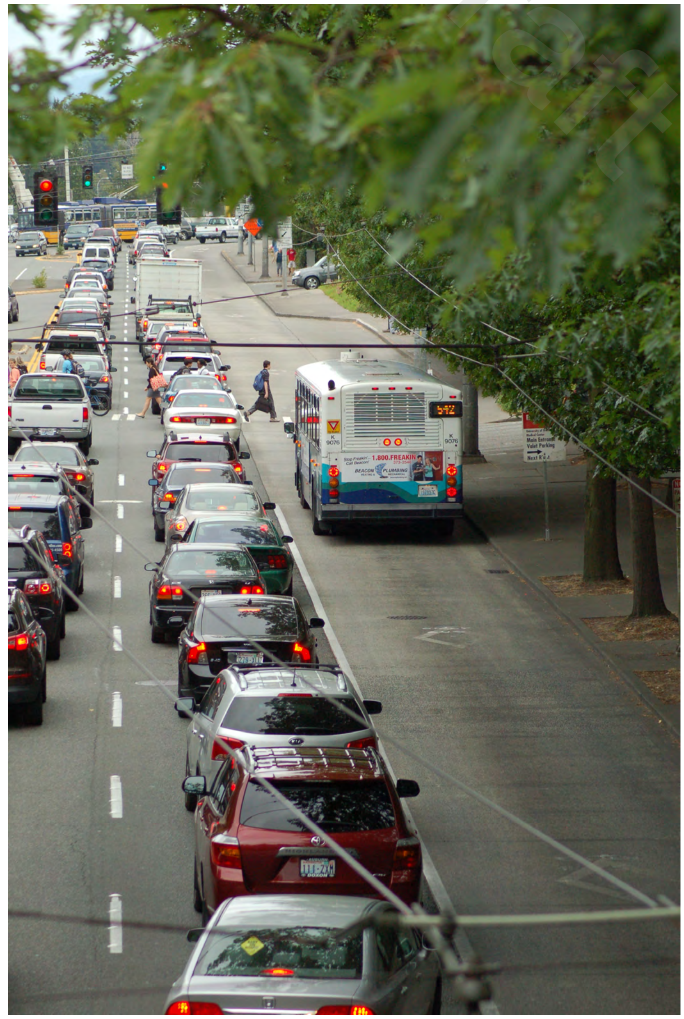


Figure 36 Bus in an HOV lane.

Figure 37 Bus in an HOV lane at a signalized intersection.

Figure 38 Transit-only lane provides non-curb lane for buses.

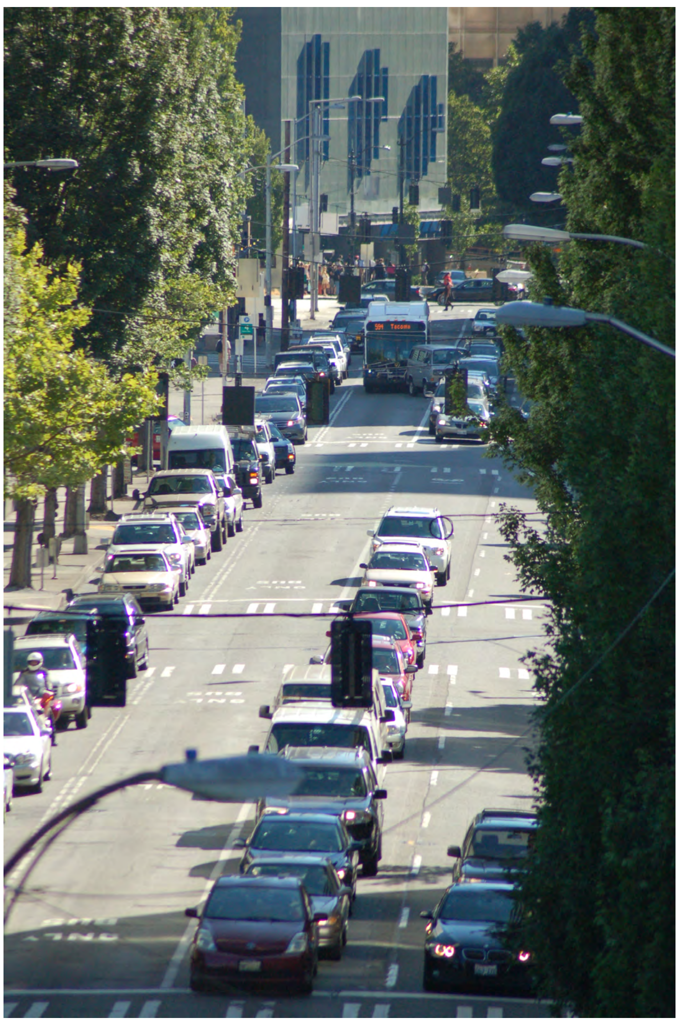


Figure 39 Personal vehicles cannot use a transit-only lane.

Transit-Only Lanes

Description

A transit-only lane reserves a lane for exclusive transit use along a corridor or through a choke point. This provides the highest level of transit priority on "local" streets and is often implemented along corridors with high bus volumes or with median bus rapid transit. Bus-only lanes can result in significant improvements to speed and reliability for transit, especially through choke points. Bus-only lanes can result in turn restrictions for general purpose traffic depending on the overall location and configuration of side streets.

Benefits

- Provides the highest level of transit priority of all arterial priority treatments
- Provides significant speed and reliability benefits in congested areas
- Ideal for locations with high bus volumes

Considerations

- Can increase general purpose congestion due to reduced capacity
- Can result in turn restrictions for general purpose traffic
- Generally the most difficult arterial running way treatment to implement
- Requires on-going enforcement

Transit-Only Street

Description

A transit-only street is a street that is reserved for transit vehicles for part or all of the day. This designation is often implemented to increase transit capacity of a roadway especially in urban centers and to ensure that buses are insulated from general purpose traffic congestion. Transit-only streets also allow for transit service to be consolidated onto a single street, simplifying and improving frequency of service for riders and reducing the impact of transit on general purpose traffic on parallel corridors.

Figure 40 Transit-only streets provide additional maneuvering space for buses.

Benefits

- Improves speed and reliability of multiple transit routes
- Can reduce transit impacts on parallel streets

Considerations

- Restricts general purpose travel on street and can create confusion for general purpose traffic at the interface with multi-purpose roadways
- Impacts access for general purpose traffic to parking garages and business, but can be managed via signage and allowance for access to mid-block locations
- Can increase congestion on parallel streets due to traffic diversion

Figure 41 Transit-only street during peak hours.

Busways

Description

Busways are similar to transit only streets, but are typically built in their own right-of-way, such as abandoned railroad right-of-way. Busways can be fully grade-separated, allowing buses to bypass cross-traffic using bridges or tunnels. Busways can also be at-grade with transit signal priority at intersections. A combination of the two is also possible. Busways offer the highest level of speed and reliability benefits, sometimes similar to light rail. Busways can be expensive to build, especially fully grade-separate ones, and conversion of right-of-way to bus use can be complex due to competing objectives for the corridor and concern from adjacent property owners.

Figure 42 Busways provide dedicated right-of-way for buses.

Figure 43 Busways may include grade-separated lanes for buses.

Benefits

- Separates buses from vehicles to a high degree, with either full grade-separation or transit signal priority for at-grade intersections.
- Provides a reliable corridor, where traffic can't impact bus travel
- Provides a high-capacity corridor for very frequent transit service
- Can allow for higher travel speeds than allowed on city streets
- Can result in transit service with similar speeds and frequency of light-rail

Considerations

- In most cases is only viable on unused utility or rail corridors
- Needs to incorporate grade separation into access locations or primary crossings
- Can have a significant cost if corridor needs to be acquired or grade-separated crossings are built
- Use of corridor often has competing objectives and potential opposition from adjacent property owners

Contra-flow Bus Lanes

Description

Contra-flow bus lanes allow buses to travel against traffic on a one-way street, turning a one-way street into a two-way street for transit. Contra-flow lanes can vary in length and are generally used to address transit routing/access issues.

Benefits

- Facilitates direct, congestion-free routing for otherwise complex routing to important connecting facilities
- Bus lane is less likely to be blocked by parked or loading vehicles
- Two-way routing reduces rider confusion

Considerations

- Can increase congestion due to conversion of travel lane to transit only
- Depending on the circulation needs of transit, could reduce efficiency of one-way street because of signal timing

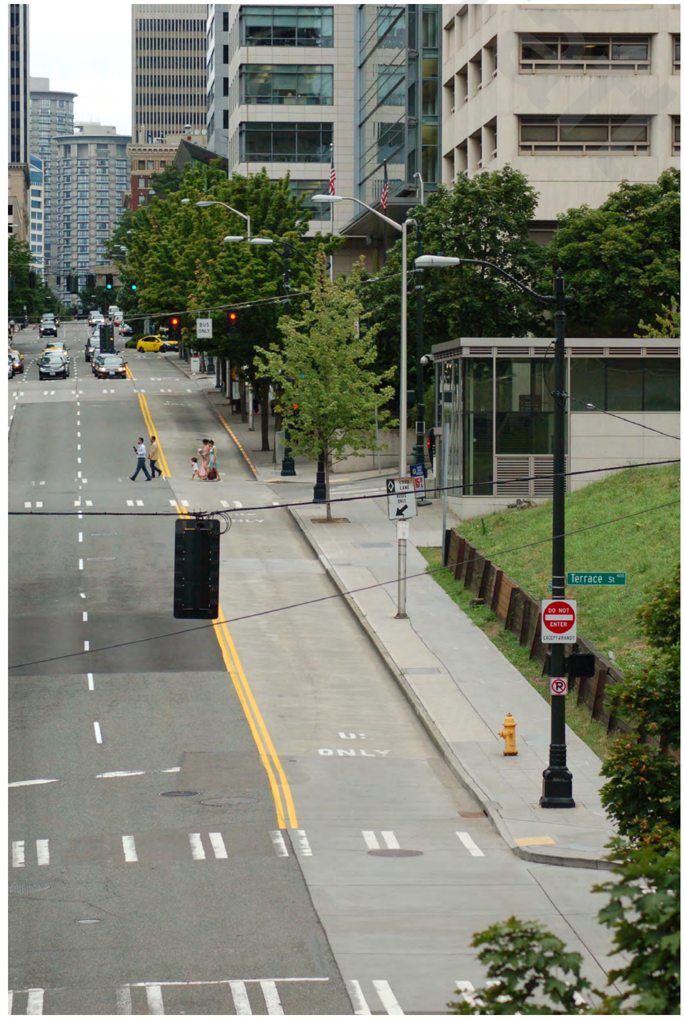


Figure 44 Contraflow lanes provide critical connections for transit networks.

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SPEED & RELIABILITY ISSUES IDENTIFICATION

When the efficiency of transit is reduced, so is its attractiveness to potential riders, and the many economic, social, and environmental benefits that transit provides are then also diminished. While the efficiency of transit service is affected by a variety of factors, the City of Bellevue has the ability to influence some of them, including the timing and coordination of traffic signals, the design of roadways, and the extent to which transit interacts with traffic congestion (see Figure 45).

However, changing any of these factors from their current state requires difficult trade-offs to be made between competing interests. Whereas transit service trade-offs deal primarily with competing interests among different groups of transit users, capital investments in transit need to be balanced against the potential impacts on other modes

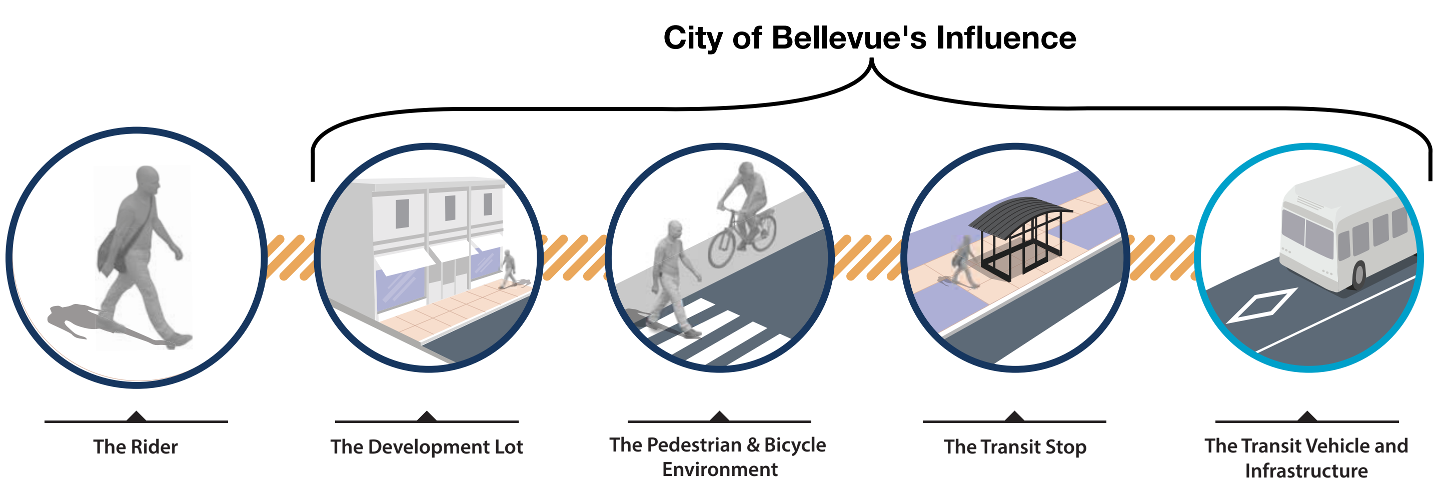


Figure 45 Although the City does not operate its own transit service, it has an influence over several important aspects of how well transit services perform locally. This includes influencing demand for transit by co-locating appropriate land uses to transit services, connecting pedestrians and bicycles to the transit network, providing convenient, safe, and comfortable transit stops, and maintaining roadways, traffic signals, and other infrastructure that supports efficient and reliable operations. This section identifies issues with the latter in order to determine where opportunities exist for the City to help transit service providers improve transit speed and reliability in Bellevue.

Figure 46 Staff and local stakeholders took part in a field review of several corridors being considered for transit priority investments, including Snoqualmie River Rd on the Bellevue College campus, pictured here.

of travel—namely private automobiles, but also bicycles and pedestrians. The extent to which the right-of-way is segmented in favor of any one mode necessarily reduces the availability of this space for other travel modes, so it is vital to carefully consider how alternative courses of action would affect all road users. Due to limitations imposed by financial resources, constrained rights-of-way, and the impacts that transit priority projects could have on other modes of travel, it is not possible to implement such projects everywhere that transit operates. Instead, attention should be directed to locations of particular concern, significance to the success of the overall network, and/or those capable of realizing notable improvement over existing operations.

The issue identification methodology presented in this section highlights candidate roadway segments along Frequent Transit Network corridors (based on congestion, bus volumes, transit usage, and multiple other factors) that would likely benefit from transit speed and reliability improvements.

DATA SOURCES

This section summarizes the data sources used to identify the location and magnitude of transit speed and reliability issues as part of the Capital Element of the TMP. The data sources include multiple measures of existing and future roadway congestion, bus delays as tracked through GPS data from Metro, transit ridership, mode share, bus volumes, and bus operator feedback. Data sources selected for this analysis were considered for the following reasons:

- Data was available in a format that could be used in the analysis.
- Data was relevant to the speed and reliability of transit service in Bellevue.
- Data sources provide information on short- and long-term measurements.

The following provides an overview of each data source used, including a description, review of the data's significance, how it was generated and/or from whom it was obtained, and any limitations that exist. Appendix A summarizes this information.

Figure 47 Bellevue Way NE and NE 12th St facing south. A queue jump lane for northbound buses is among the transit priority projects being considered based on issues identified by the process described here.

Standing Delays

Over the last few years, King County Metro buses have been equipped with a GPS-based tracking system. Data from the GPS system and other instruments like door sensors and the speedometer are integrated and recorded by an onboard computer during every bus trip operated. Using this data, it is possible to estimate the amount of time that buses are stopped by traffic signals and congestion. Time when a bus is stopped to pick up or drop off passengers is not included in this measure, as that is a function of the boarding and exiting process and not related to street congestion.

This is a rich and highly applicable dataset because it is a direct measure of the delay experienced by transit vehicles on a day-to-day basis. Intersections and roadway segments that experience frequent standing delays are easily identified through graphical representation of the data. Standing delay data was provided by King County Metro and compiled by screening GPS data for instances when a bus stopped with its doors closed while not at a bus stop. The data used in this analysis was collected on weekdays between January 7 and February 15, 2013.

Transit Ridership

Transit ridership is measured in terms of the forecasted weekday count of passengers that use transit in both directions along a street segment. Daily transit ridership is critical for highlighting corridors where transit priority investments will benefit the largest number of riders. For example, while transit priority at one location might save five seconds for 1,000 riders, the same improvement on a heavily utilized corridor could save five seconds for 10,000 riders—a tenfold increase. By identifying corridors with strong ridership, high-impact transit priority projects can be identified to ensure greater return on investment.

Weekday ridership data for this measure reflects 2010 observed counts and 2030 forecasts obtained from the Bellevue-Kirkland-Redmond (BKR) travel demand model (EMME version MP30r6.2). Figure 48 on page 36 and Figure 49 on page 37 depict these data sources. Because future transit ridership estimates are based on forecast assumptions, the results may ultimately vary due to real-world divergence from model assumptions.

Bus Volumes

Bus volumes are measured in terms of the number of buses operating each weekday in both directions along a street segment. Total weekday volumes are used—as opposed to volumes during a particular time of day—so that highlighted locations reflect those that exhibit high bus traffic over the course of an entire day, rather than a disproportionate surge exclusively during peak hours.

Bus volumes are an important measure when analyzing the efficiency of the bus network. As with transit ridership, focusing transit priority treatments where the most buses operate multiplies the benefits of transit priority, improving the return on investment. This is important for Metro and the City of Bellevue because each minute of travel, regardless of the number of passengers on-board, costs the same amount of money to operate and hence reflects the same share of total regional service hours allocated locally. The more efficiently transit service can operate within Bellevue, the more service Metro can provide with the same amount of resources. This is true in any circumstance, but it is particularly significant given Metro's continuing budget constraints.

The data used for analysis of bus volumes was compiled by City staff and reflects transit services in Bellevue as operated by the Spring 2012 Baseline Network and consistent with the span and headways

Figure 48 Daily transit usage patterns on Bellevue's arterials in 2010 by transit passenger per day arterial categories.

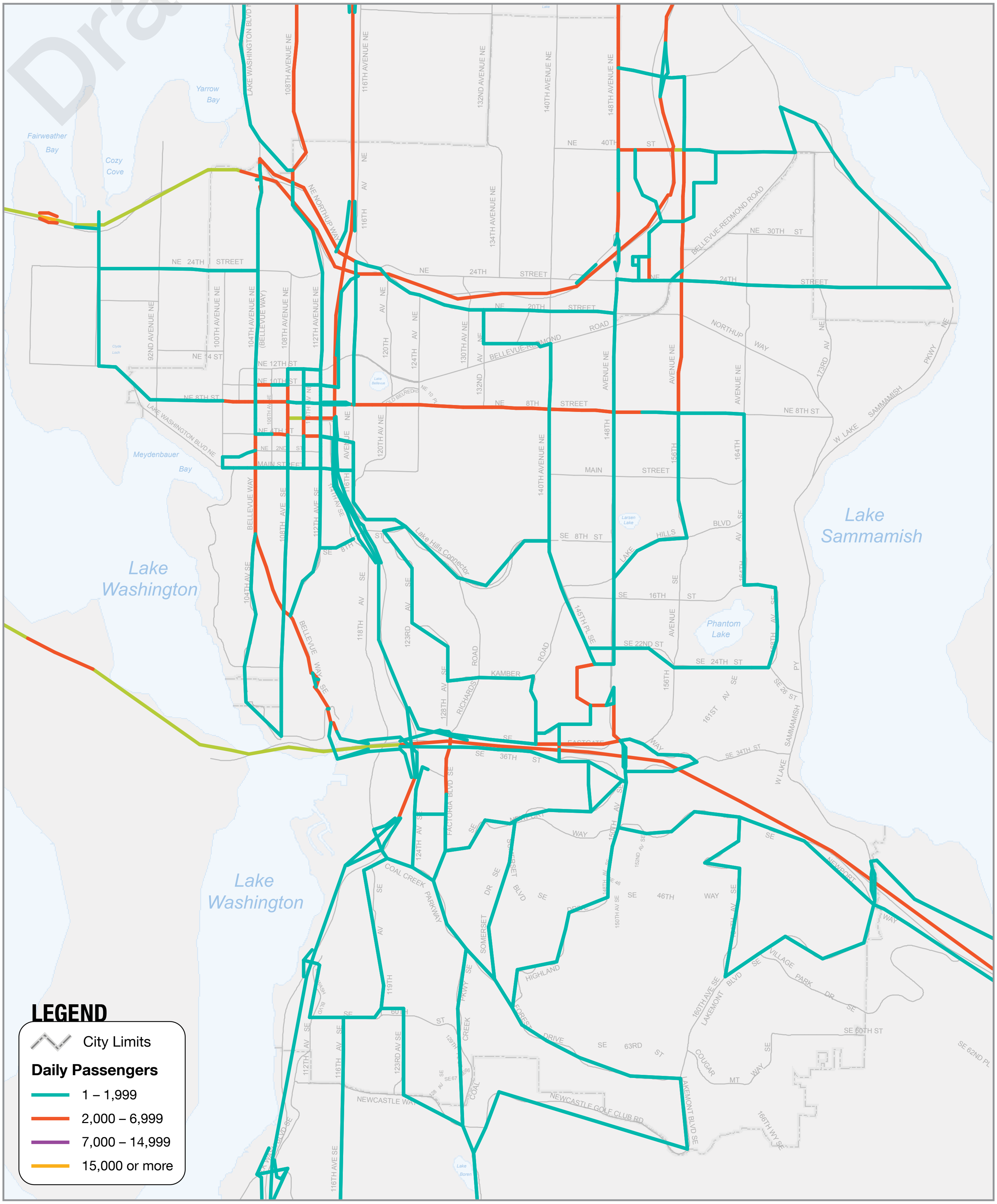


Figure 49 Daily transit usage patterns on Bellevue's arterials in 2030 by transit passenger per day arterial categories (derived from BKR model platform MP30r6.2 with transit routes defined in the 2010 *East Link Bus/Rail Integration Plan*).

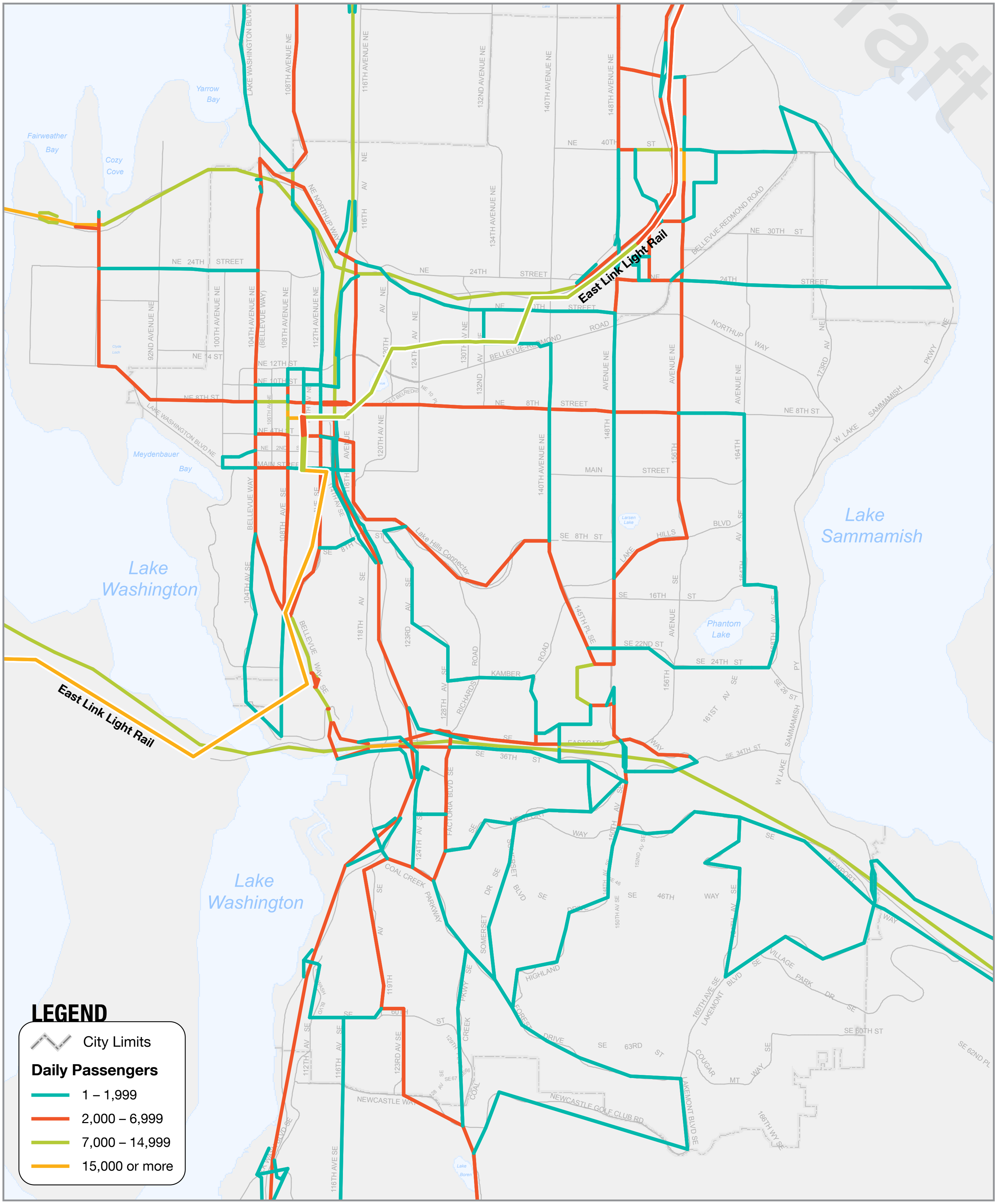


Figure 50 Bus trips operated daily, Spring 2012 Baseline Network.

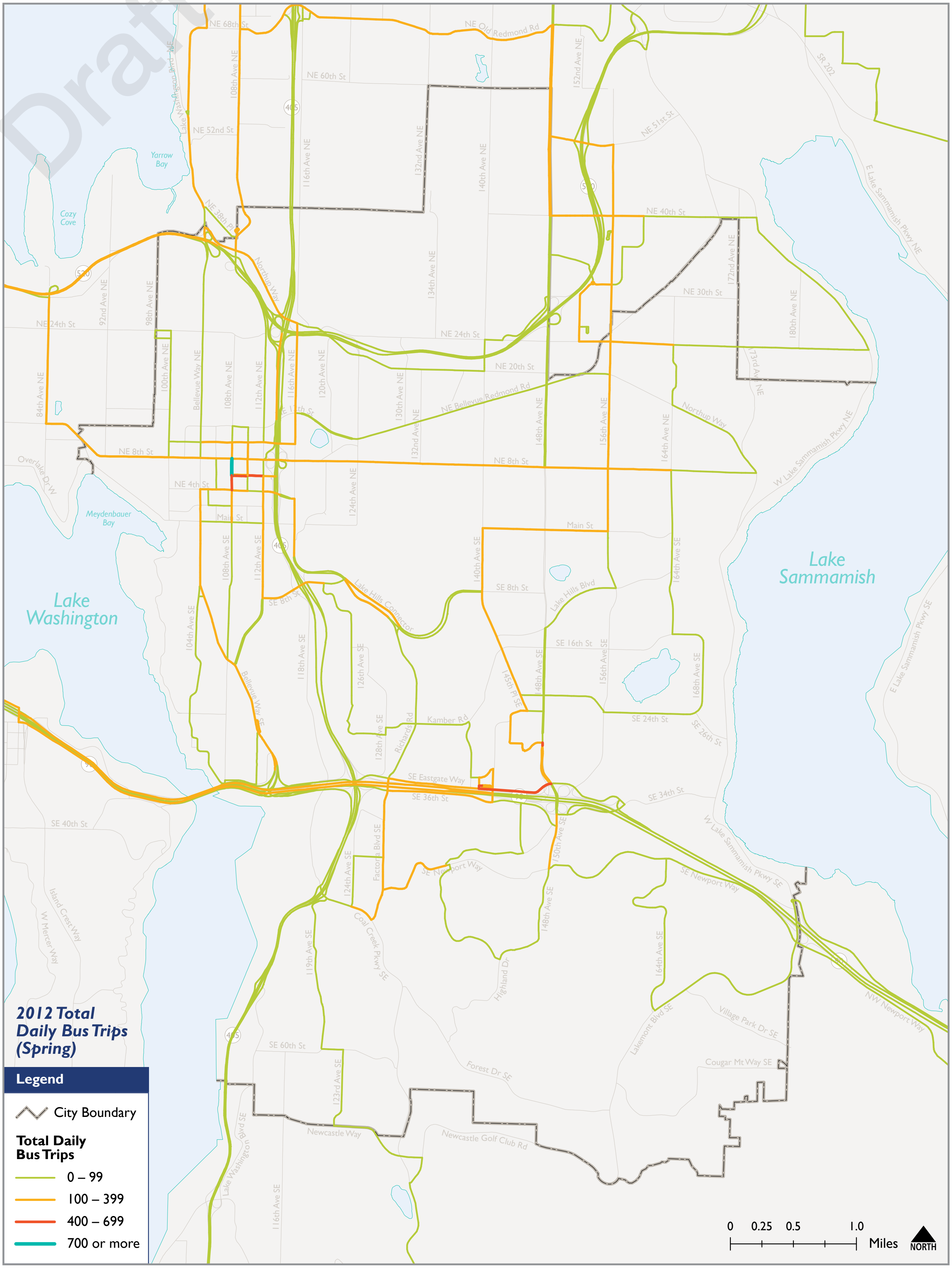
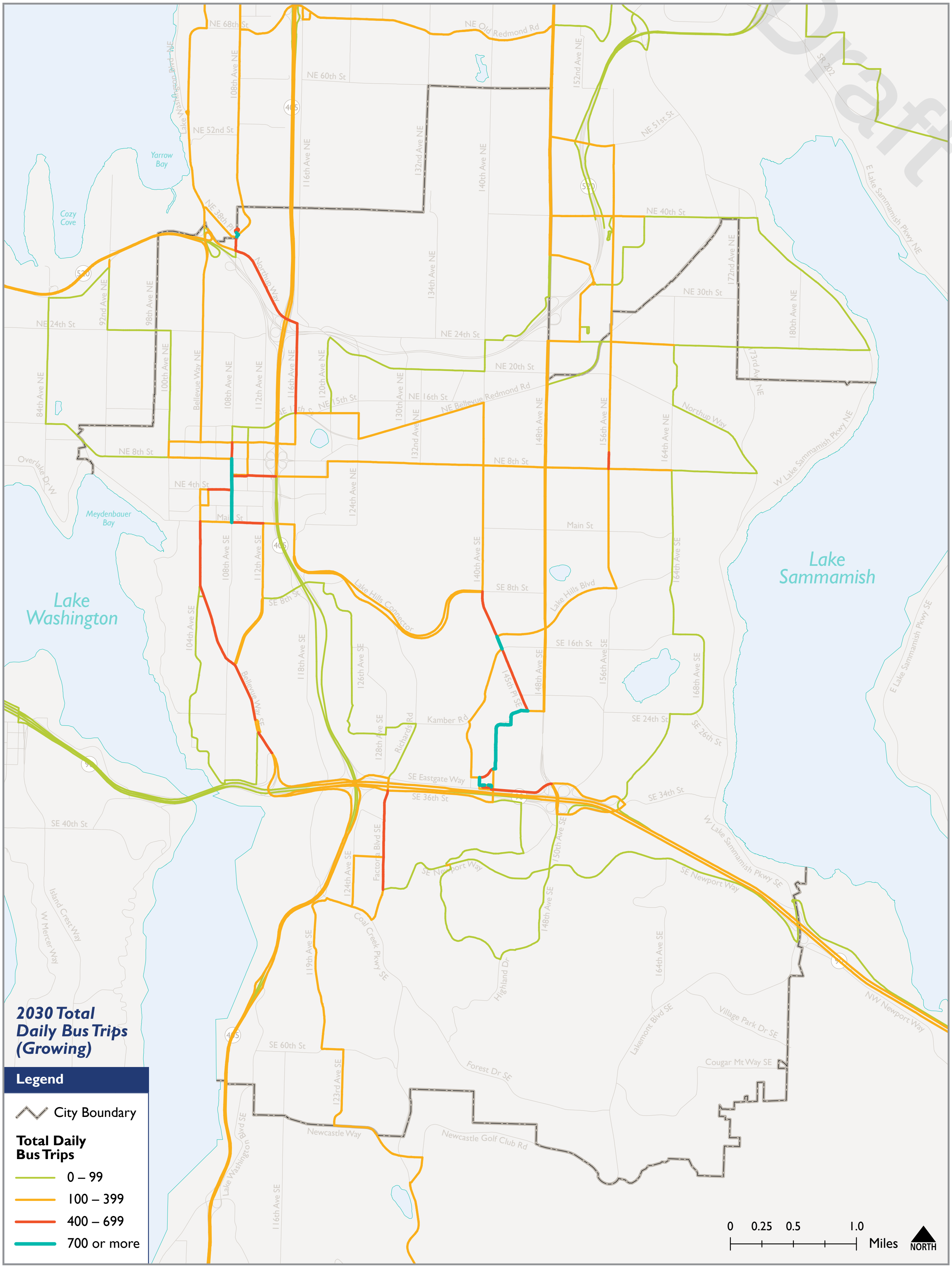


Figure 51 Bus trips operated daily, 2030 Growing Resources Network.



to be operated by the 2030 Growing Resources Network. (See the *Transit Service Vision Report* for details about each of these networks.) Figure 50 on page 38 and Figure 51 on page 39 compare the number of daily bus trips operated in 2012 and 2030, respectively. Among future networks, the bus volume analysis was completed only for the 2030 Growing Resources Network because that represents the maximum number of bus trips that will be operated per day within the TMP's implementation period. All routes were associated to the streets on which they operate, and the number of daily trips operated by each were aggregated for all overlapping segments.

Approach Delay

Delays experienced by vehicles on city streets are primarily the result of intersection related delays from traffic control devices like traffic signals. As vehicle volumes increase during peak periods and congestion builds, delays in the transportation network increase. This is particularly evident at signalized intersections. In congested and high-volume corridors, a single intersection can be a bottleneck for large parts of the network, creating significant delays to general purpose traffic and any buses traveling in general travel lanes.

The measure used in this analysis captures the sum of the average weekday, PM peak intersection approach delay, measured in seconds, along an analysis segment. City staff calculated approach delay for 2010 and 2030 using the Dynameq travel demand model. This model is more detailed than the City's travel demand model because it provides specific operational metrics at an intersection level. However, not all aspects of traffic are modeled, such as the impact of high pedestrian volumes on turning vehicle delays. Only intersection approaches served by bus routes that operate frequent headways were included in the analysis.

Approach Queue

The queue length is measured as the length of vehicles waiting to travel through an intersection. Intersection approach queues are summarized along an analysis segment. The approach queue experienced for an intersection approach is influenced by its signal timing (green time allocated to that approach), signal coordination, and traffic volumes.

Data for the approach queues was included in the TMP Capital Element analysis because it can identify approaches that are currently or expected to experience long vehicle queues, impacting the speed and reliability along key transit corridors. This information can help guide transit priority treatment, such as installation of queue jumps or bus-only lanes so that buses can bypass queued vehicles.

Forecasted average PM peak hour approach queue is reported for 2010 and 2030 in terms of the average length in feet (see Figure 52 on page 42 and Figure 53 on page 43, respectively). This data is based on the City of Bellevue's Dynameq travel demand model.

Intersection Level of Service

The performance of an intersection can be reported in many ways, but intersection level-of-service (LOS) is the measure most commonly used by traffic engineers. LOS uses the average delay experienced by a vehicle at an intersection and assigns a letter grade of A through F, with an intersection of LOS A experiencing little delay and an intersection of LOS F experiencing significant delay.

With respect to transit speed and reliability, intersection level-of-service has several implications. An intersection with a poor LOS indicates a location where transit likely experiences delays; however, it also indicates an intersection where transit priority treatments are likely more difficult to implement successfully due to impacts on other modes or physical limitations. In contrast, intersections with

Figure 52 Intersection level-of-service (LOS) and average queue length (in feet) in 2010.

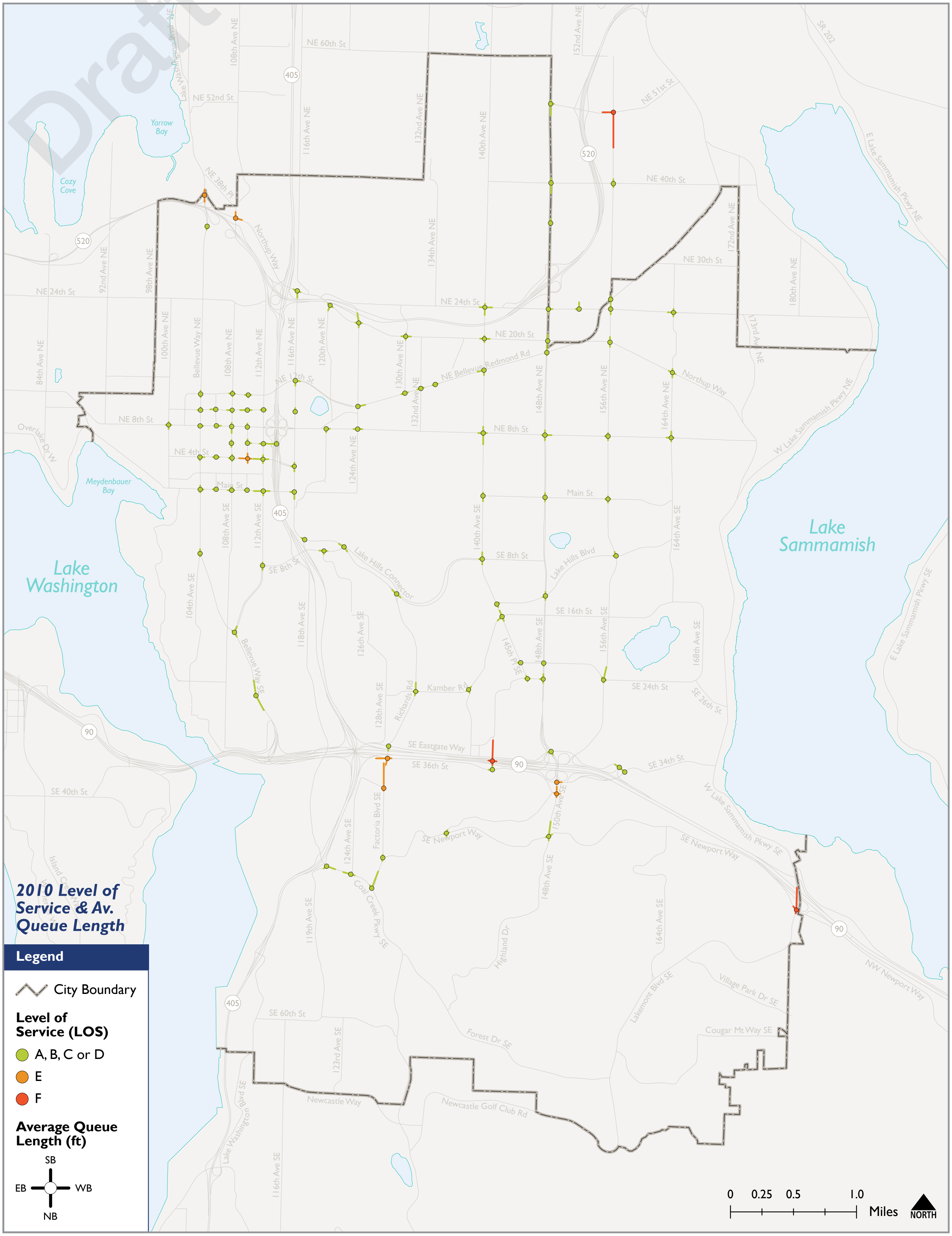
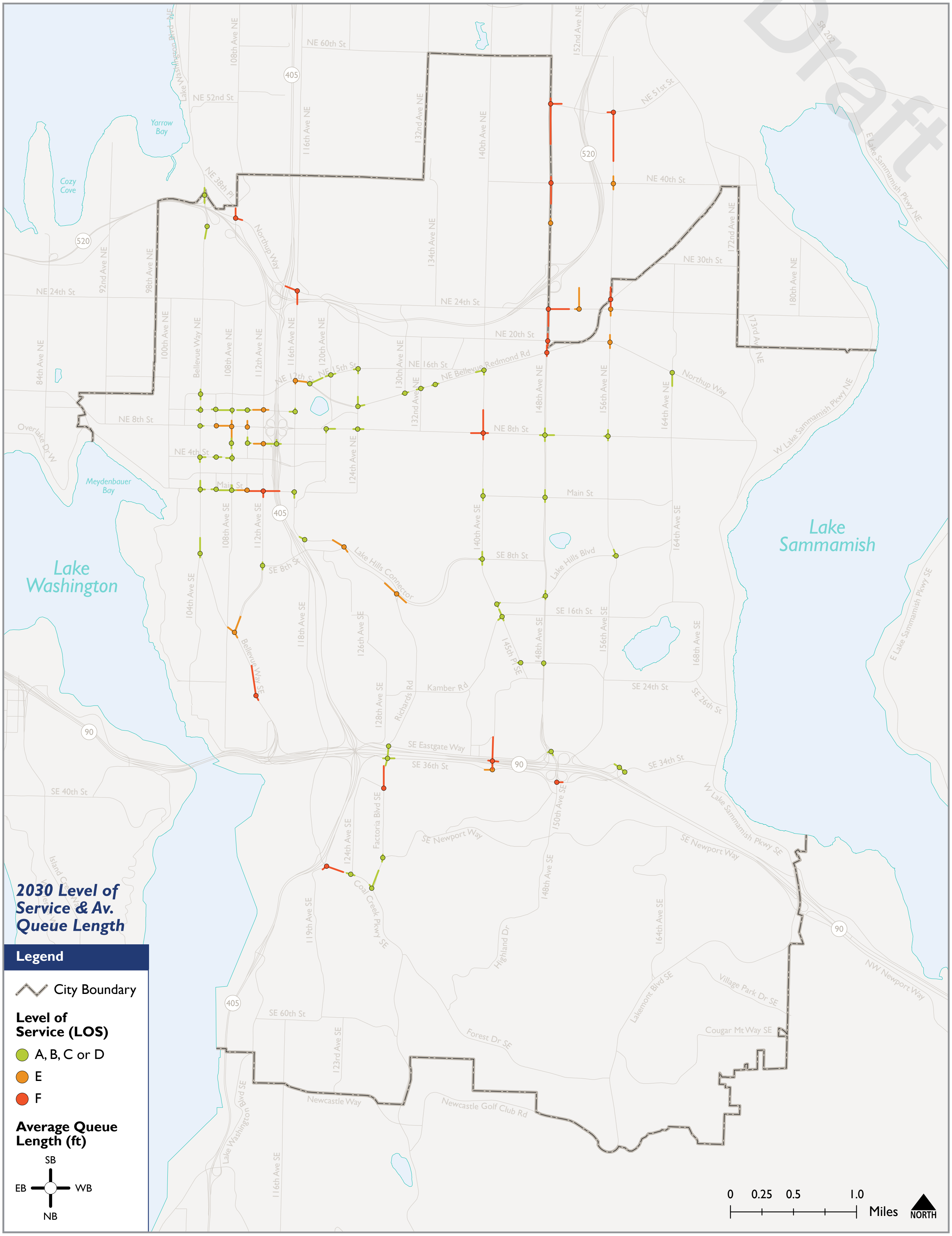


Figure 53 Intersection level-of-service (LOS) and average queue length (in feet) in 2030.



Safety – Safety is always a paramount concern for the City of Bellevue and Metro. Safety issue can result in slower and less reliability travel times as operators slow to ensure they are operating coaches safely.

Signal Failure – At some intersections it can take buses multiple green lights to get through an intersection, adding delay and travel time reliability issues. The cause of these delays vary depending on the location.

Signal Timing – Traffic lights are controlled in several ways and are generally timed in a way to minimize vehicle delay. Identifying locations or corridors where coach operators observed potentially unnecessary delay due to timing of the lights will help identify locations where various operational changes like revised traffic light timing could be made friendlier to transit.

Maneuver Delays – Metro coaches are some of the largest vehicles on many of the roads they serve. Locations which are hard for operators to negotiate can cause speed and reliability issues which can repeat hundreds of times a day. Intersections were coaches make a right turn can be particularly troublesome.

General Delays – While traffic models have been used to identify congestion related delays, there may be locations where, due to some local circumstance or roadway design, additional detail from coach operators could help more clearly understand the cause of delays and possible solutions. Locations with left turns are of particular concern as the models used are not sensitive to these delays.

medium or good LOS have less delay and are likely easier to implement transit priority because impacts on other modes are less significant. However, this also means that the benefits realized by any transit priority treatments implemented are more limited because the delays originally experienced are less substantial.

As with approach delay data, City staff generated intersection LOS data based on the 2010 and 2030 PM peak hour Dynameq travel demand model. Intersection LOS was summarized by analysis segment, using the worst intersection LOS along the segment (see Figure 52 on page 42 and Figure 53 on page 43 for 2010 and 2030 data, respectively).

Operator Feedback

Through their work and often years of experience, Metro coach operators learn traffic patterns in a way that most road users likely never will. They see how traffic changes during the day and over the course of a year, as well as how service changes affect interactions between transit and traffic. Coach operators can therefore provide significant insight into existing traffic congestion on Bellevue streets and help identify critical points in the network that could benefit from closer consideration by planners.

An optional survey was used to solicit feedback from coach operators about several general categories of issues related to transit speed and reliability, as shown at the right. This feedback was valuable because it helped to reaffirm some of the data provided by other sources and filled in the gaps left by those sources in some cases. Responses were collected by paper survey with questions, a map, and an area for written response (see the *Coach Operator Outreach Report*). The primary challenge with leveraging operator feedback is combining this more subjective feedback with the more objective measures used in other analyses.

DATA PROCESSING

Several data processing steps were necessary to convert the above data into information that could be used in the issues identification analysis. Data processing was completed using geographic information systems (GIS) due to the spatial nature of the data and analysis.

The City of Bellevue and King County Metro provided data in several formats, primarily GIS shapefiles. Most data sources were derived from a different source, so extensive discussion between the City and Metro occurred to ensure that data was accurately mapped and used. Some format conversion, data integration, and map modifications of the data were required. Several files required modifications to geometry to ensure that lines overlapped, but no numeric data was modified in the process.

Data analysis segments, or the unit at which the analysis was completed on, was also developed. Analysis segments were based off the street network, with segments primarily extending from one signalized intersection to another. Data from each source was summarized using these analysis segments. Appendix B contains maps of each data source displayed using the analysis segments. The sections below describe in detail the steps completed to prepare data for analysis.

Data Collection

Approach delay, approach queueing and LOS data were provided by the City of Bellevue in separate GIS shapefile and excel files which were joined and verified to ensure the two data sources were correctly joined. This process was completed in coordination with the City of Bellevue as City staff is intimately familiar with the data. Five batches of operator surveys were provided by Metro to the City. The location of applicable, specific and clear operator survey comments were recorded in GIS.

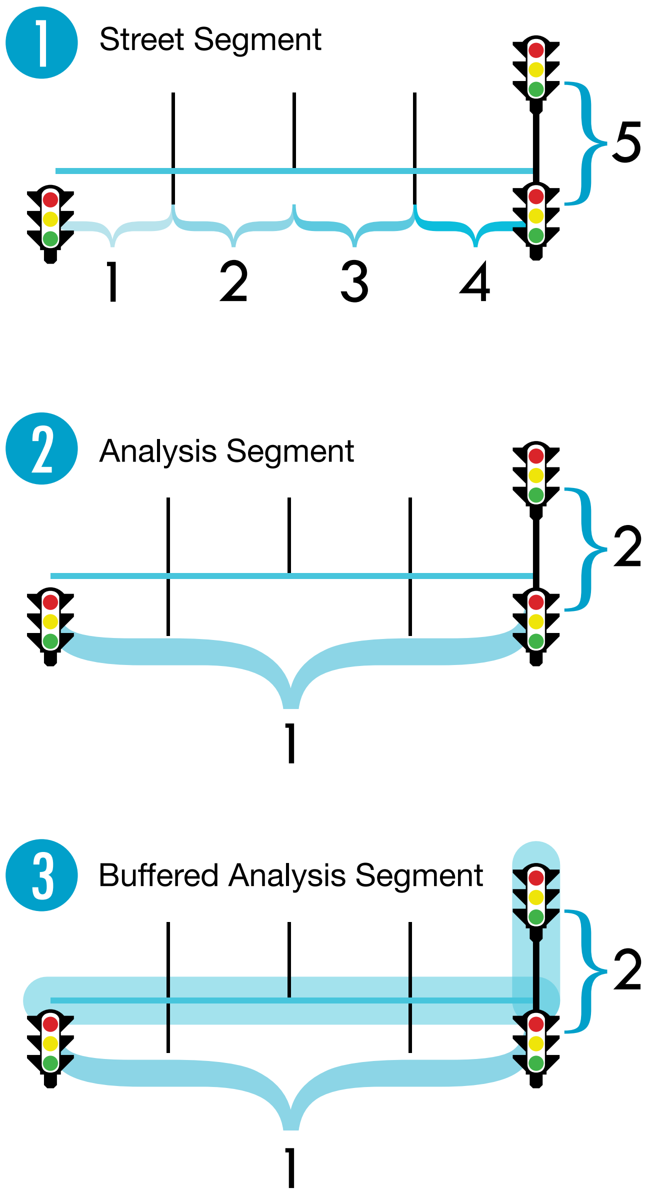


Figure 54 Analysis segment development.

Data Mapping

Once data was mapped in GIS, several of the data sources did not overlap. Overlap was necessary to combine data in later steps. To ensure that all files overlapped, the lines and points of the transit ridership and bus volume data layers were shifted to overlap with the other layers. These changes were generally minor and only involved moving the location of the lines and points; no changes were made to the numeric values of the data.

Analysis Segment Development

A single common analysis unit is required to compare the multiple data sources used in the issue identification. The following process, illustrated in Figure 54, was used to develop the analysis segments:

1. Street segments on which the 2030 Frequent Transit Network (FTN) operates were identified and selected from the City's GIS street centerline shapefile.
2. These street segments, of which there is one for each city block, were grouped into analysis segments comprised of one or more street segments. Signalized intersections were used as the primary break point between analysis segments, however some unsignalized intersections were used in locations where signalized intersections are infrequent.
3. Each analysis segment was then buffered by 40 feet in all directions, creating an 80-foot wide polygon slightly longer than the analysis segment. This polygon, referred to as the buffered analysis segment, was used in the remainder of the analysis to combine, analyze, and display the issue identification data and composite scores.

Analysis Segment Data Transfer

After the buffered analysis segments were developed, data from the various GIS data inputs was spatially joined to these segments. Bus volumes and ridership data was spatial joined to the buffered analysis segment using the line's mid-point to reduce overlap issues. GPS-derived standing delays within the buffered analysis segment polygons were summed to compute the total delay occurring inside the polygons. Approach queue and approach delay for all intersections within each buffered analysis segment polygon were likewise summed. Intersection level-of-service (LOS) was assigned to buffer analysis segments based on the worst LOS of all intersections within the buffered analysis segment. Operator feedback was manually associated to relevant buffered analysis segments.

DATA ANALYSIS

The analysis steps outlined below brings multiple critical measures together into two composite scores focused at different time horizons, one for the short-term and another for the long-term. These composite scores help identify locations along the frequent transit network where multiple issues compound creating larger issues for transit speed and reliability.

The combination of multiple measures into the composite score facilitates comparison of the system. Using the analysis segments previously developed, issue identification was completed. This involved scoring, grouping and weighting of the various important measures. This approach was developed and modified with feedback from City and Metro staff.

Table 1 Quartile Scoring.

Quartile	Score
Fourth (Top 25%)	4
Third (Middle-Top 25%)	3
Second (Middle-Bottom 25%)	2
First (Bottom 25%)	1
None / No Data	0

Data Scoring

Each data source was grouped into four quartiles to evenly distribute data for each measure into four groups. Each data source was then assigned a score of 1 to 4 depending on the quartile in which the data was contained. Data with 2010 and 2030 data such as transit ridership and bus volumes were grouped by quartile using the 2030 results. Table 1 illustrates the scoring system.

Intersection LOS and operator comments, which have different scoring systems, were scored in accordance to Table 2. LOS is scored on a letter basis with A indicating little congestion and F indicating significant congestion. The low number of operator comments and general concentration of the comments received necessitated a unique scoring system.

Table 2 LOS and Operator Survey Scoring.

Level-of-Service (LOS)	Score
F	3
E	2
D	1
A, B, C	0

Operator Comments	Score
4-8	4
3	3
2	2
1	1

Composite Scores

The data analysis structure was designed to capture two key issues. The first issue, related to the time horizon, is addressed by developing two composite scores, one for the short-term and another for the long-term. Current and future needs may be different due to changes in the transit and transportation network or change in congestion. The solutions to short- or long-term problems can also vary, from small spot fixes for short-term issues to significant capital investments in locations with both short- and long-term issues.

Additionally, in the short-term, directly measured rather than modeled data is available. This is especially the case with bus GPS standing delays which are a direct measure of existing transit speed and reliability. The use of two composite measures more directly links each composite to a set of speed and reliability tools.

Short-Term Composite – This composite uses existing GPS bus delays, operator feedback, existing bus volumes and existing ridership volumes. This composite highlight locations where investments in speed and reliability will realize short-term benefits.

Long-Term Composite – This composite uses future bus volumes, future ridership volumes, and future modeled congestion. This is key for guiding capital investments to meet future transit needs and congestion.

Data Weighting

The second issue relates to the relative importance and combination of multiple data sources. When combining multiple measures into a composite score, the relative importance of each component needs to be assessed. More important measures should be elevated, while less important measures should be lowered. These adjustments are done using weighting factors.

Approach delay, approach queue, intersection LOS and bus standing delay are all highly related measure. If one of these four measures is scores poorly, the remaining three are also likely to score poorly. To address the overlap of these data sources and respond to City and Metro comments, approach delay, approach queue and intersection LOS we removed from the short-term composite score.

Table 3 Composite Score Weighting.

Measure	Short-Term Composite		Long-Term Composite	
	Weight	Possible Points	Weight	Possible Points
Standing Delays	4x	16	-	-
Transit Ridership	2x	8	2x	8
Bus Volumes	1x	4	1x	4
Approach Delay	-	-	1x	4
Approach Queue	-	-	1x	4
Intersection LOS	-	-	1x	4
Operator Survey	1x	4	-	-
Total	8x	32	6x	24

Weighting of both short- and long-term composite scores were set such that delay or congestion related factors represent half of the overall composite scores.

Additionally, the Transit Master Planning effort has clearly identified transit ridership as the major driver behind investment in transit service. To account for the significant importance of this measure relative to other measures a weighting factor of 2x was assigned to transit ridership in both the short- and long-term composite.

Table 3 on page 49 contains the weighting factors used both in the short-term and long-term analysis as well as the total score possible for each composite. Four measures are used for the short-term composite, while five measures are used for the long-term composite. Although the two measures are related, they cannot be directly related because point allocations and totals are different.

RESULTS

Using the scoring, grouping, and weighting described above and summarized in Table 4, short- and long-term composite measure maps were developed (see). A map for each measure is also contained in Appendix 1. As previously noted, these maps do not necessarily identify priorities; rather, they indicate locations where a confluence of issues is concentrated and more detailed analysis will be necessary. Buffered analysis segments with low composite scores have fewer issues while areas with higher scores have more compounding issues.

Twenty corridors of particular interest were identified for further consideration, including BKR modeling to compare vehicle throughput to person throughput, consistent with guidance from the Measures of Effectiveness Report. Refer to Appendix 3 on page A96 for additional details.

Table 4 Issue Identification: Sources, Measures, and Weighting.

Short-Term Composite Measure	Data Source	Description	Limitations	Metric	Weight
Standing Delays	AVL GPS Data	GPS-based AVL data for standing buses with their doors closed. Data is summarized by intersection.	Raw data had not yet been processed	Sum of weekday bus standing delays between 1/7 and 2/15 in minutes	4x
Transit Ridership	BKR Model	Estimated average daily transit ridership by model segment.		2010 average weekday transit ridership	2x
Bus Volumes	Spring 2013, 2030 BKR Model	Daily transit trips by road segment based on Spring 2012 service.		2013 average weekday bus volumes	1x
Safety Issues	Operator Survey	Safety issues identified by coach operators that impact speed or reliability.	Subjective	Comment	1x
Signal Failure	Operator Survey	Intersections identified by coach operators that consistently take multiple green lights to get through either due to insufficient green time or congestion.		Comment	1x
Signal Timing	Operator Survey	Signals or corridors identified by coach operators with little vehicle congestion and unnecessary delays due to poorly time signals or long signal cycles.	Subjective	Comment	1x
Maneuver Delay	Operator Survey	Locations identified by coach operators which impact speed and reliability due to difficult turning radii, required lane changes, or other roadway geometry issues.		Comment	1x
General Delay	Operator Survey	Consistent congestion-related delays identified by coach operators.	Subjective	Comment	1x
				Total Possible:	32

Long-Term Composite Measure	Data Source	Description	Limitations	Metric	Weight
Transit Ridership	BKR Model	Estimated average daily transit ridership by model segment.		2030 average weekday transit ridership	2x
Bus Volumes	Spring 2013, 2030 BKR Model	Daily transit trips by road segment based on the 2030 Growing Resources Frequent Transit Network (FTN).		2030 average weekday bus volumes	1x
Approach Delay	Dynameq Model	Estimated average PM peak hour delay in second by approach for signalized intersections in the 2030 Growing Resources Frequent Transit Network (FTN).		2030 sum of average weekday PM Peak hour approach delay (seconds of delay)	1x
Approach Queue	Dynameq Model	Estimated average PM peak hour queue length in feet by approach for signalized intersections in the 2030 Growing Resources Frequent Transit Network (FTN).	Determining meaningful threshold, related to approach delay	2030 sum of average weekday PM Peak hour approach queue length (in feet)	1x
Intersection LOS	Dynameq Model	Estimated PM peak hour LOS for signalized intersections in the 2030 Growing Resources Frequent Transit Network (FTN).		2030 intersection LOS	1x
				Total Possible:	24

Measures Considered But Not Used	Data Source	Description	Limitations
Street Congestion	BKR Model	Estimated PM peak hour vehicle volumes divided by estimated roadway capacity. Ratios near or above 1 indicate roadways with congestion.	Less accurate than Dynameq in areas with closely spaced signals and complex vehicle queues.
Mode Share	BKR Model	Estimated PM peak hour HOV person throughout divided by total roadway person throughput. Ratios closer to 1 indicate higher relative person HOV throughput.	Not available for all corridors
Scheduled Speed	TPI Travel Speed	Scheduled travel time by time of day divided by the distance between origin and destination time point.	Not available
Travel Time Variability	TPI Variability	Variation in travel time per TPI. High variation indicates TPIs with travel time reliability issues.	Not available

Figure 55 Short-term composite score.

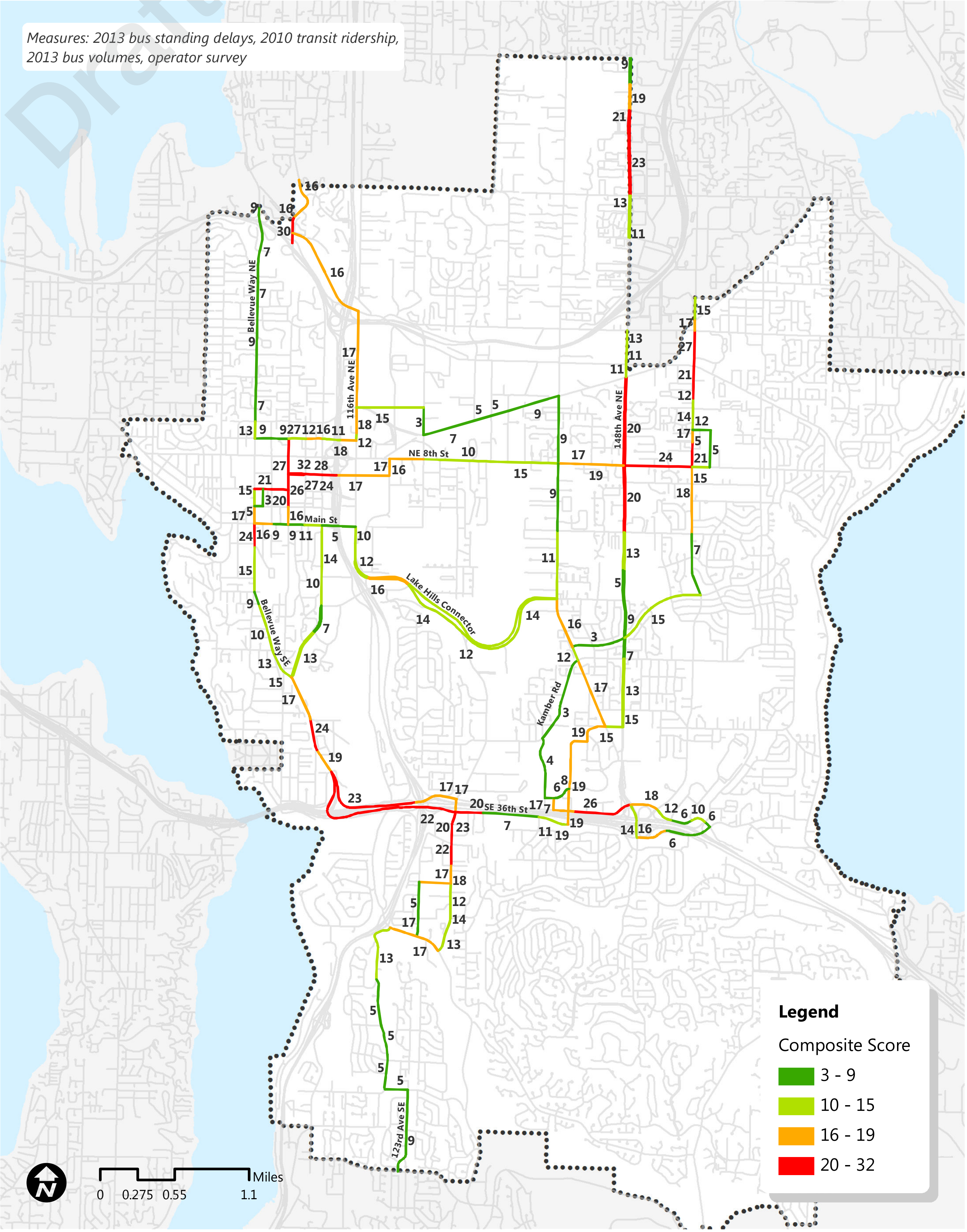
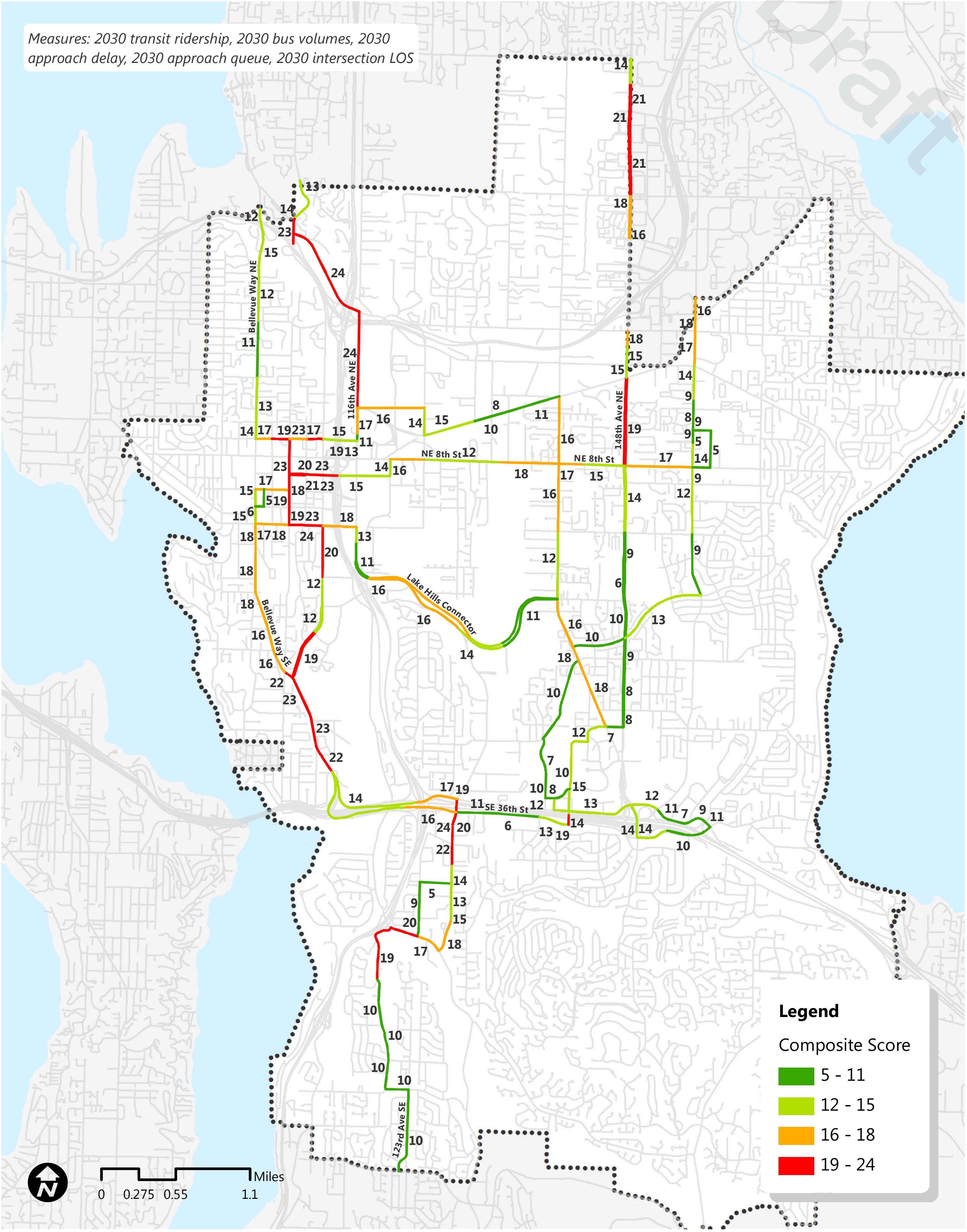


Figure 56 Long-term composite score.



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POTENTIAL IMPROVEMENTS

This section responds to the Transportation Commission's proposed Capital-Oriented Strategy: "Invest in transit priority measures along Frequent Transit Network corridors" (October 17, 2013). It includes sixty-three discrete running way, spot improvement, or data collection projects, plus forty-two near-term transit signal priority (TSP) projects. Table 5 indicates the number of projects being considered of each type, and Figure 58 on page 57 depicts the location and/or general extent of each project.

This project list and costing was developed by TMP consultant Transpo Group with consideration given to existing data, field investigation, and input from staff and transit agency representatives. The list has undergone various stages of development, review, and refinement, and that presented here includes all of the potentially beneficial projects that have not been eliminated from consideration following preliminary screening based on exceptional technical or contextual limitations. Visualizations have been generated for some of the projects presented here to assist the communication of how a given type of project could be applied to specific situations. It must be emphasized that these visualizations are only conceptual and do not represent final designs or engineering-level detail.

As noted in other sections, the projects identified here include only intersections and roads along Frequent Transit Network (FTN) corridors, a subset of the 2030 Growing Resources scenario. The issue identification results presented in the previous section informed the development of this project list and direct attention to those locations with the most significant issues. Projects identified in past plans are also included in this list. Refinements to the list of potential improvements were informed by the service

Table 5 Summary of speed and reliability projects by type.

Project Type	No. of Projects
Running Way Improvements	19
HOV Lanes	8
BAT Lanes	6
Roadway Construction	5
Spot Improvements	39
Queue Jump Lanes	16
Intersection and Roadway Improvements	13
Signalization Improvements	10
TSP Projects (Near-term)	44
Tracking & Additional Study	5
Total	107

Table 6 Summary of speed and reliability projects by cost.

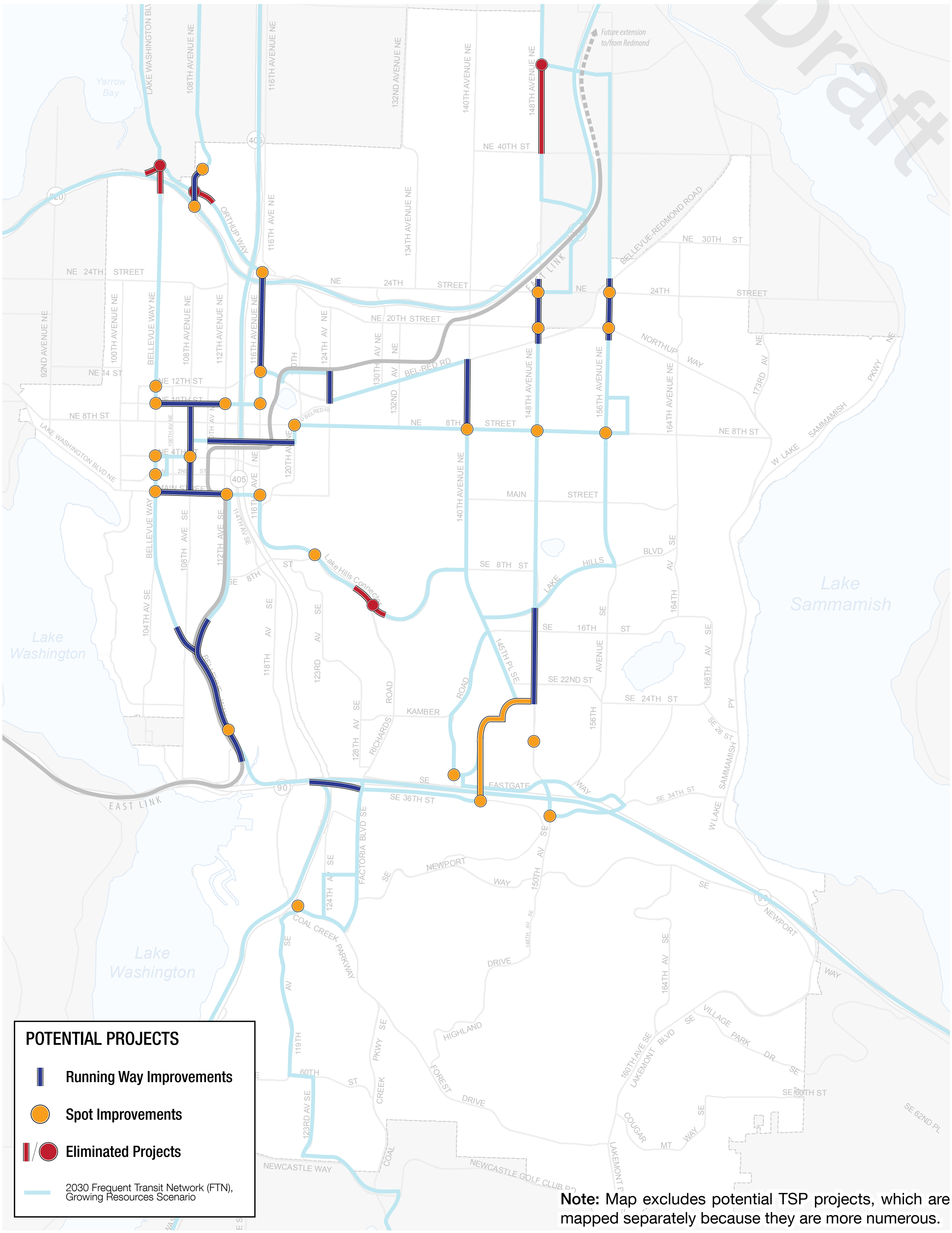
Estimated Project Cost	No. of Projects
No Cost (NC) These projects primarily require staff time to track, review, or revise using existing City resources and staff time.	6
Tens of Thousands ($) These projects primarily include low-cost changes like striping or signal equipment additions or modifications. These projects do not involve any physical changes.	66
Hundreds of Thousands ($$) These projects include more significant striping or signal modification, which could include some small physical modifications to an intersection or signal. More significant projects include lane construction at intersection approaches assuming minimal land acquisition, environmental mitigation, and slope stabilization.	16
Millions ($$$) These projects include construction of new lanes through multiple intersections and/or construction of new lanes along intersections where constraints exist.	18
Not Applicable (N/A) This project highlights a need for improvement but does not recommend a specific solution. Further study of the situation will only require staff time to complete (i.e., no cost), and the cost of subsequent actions can only be estimated after the chosen solution is identified.	1
Total	107

characteristics of bus routes, transit ridership, and bus volumes by time of day; arterial traffic volume by direction; placement of bus stops, intersection geometry, turn movement counts/capacity, and safety considerations; pedestrian and bicycle impacts; and the overall scale of improvements in terms of roadway width and right-of-way.

The cost ranges shown in Table 6 are based on a high-level review of the type and extent of projects, such as re-channelization, widening, signal modification, and sidewalk and road construction, as well as potential environmental mitigation, slope stabilization, utility modifications, or property acquisition. Projects were assigned to each cost range based on a review of the proposed project, site context, and other factors that might impact cost. These ranges are consistent with the scale of the projects, but they do not reflect detailed design or engineering.

Figure 57 Running Way Improvement Project L1: A southbound median HOV lane will be constructed on Bellevue Way SE between the South Bellevue Park-and-Ride and I-90 by Sound Transit as part of the East Link light rail extension project. This will be achieved by constructing a new lane, thereby maintaining all existing general purpose lanes. Aerial images depict roadway striping before and after construction.

Figure 58 Potential spot and running-way improvement projects.



Note: Map excludes potential TSP projects, which are mapped separately because they are more numerous.

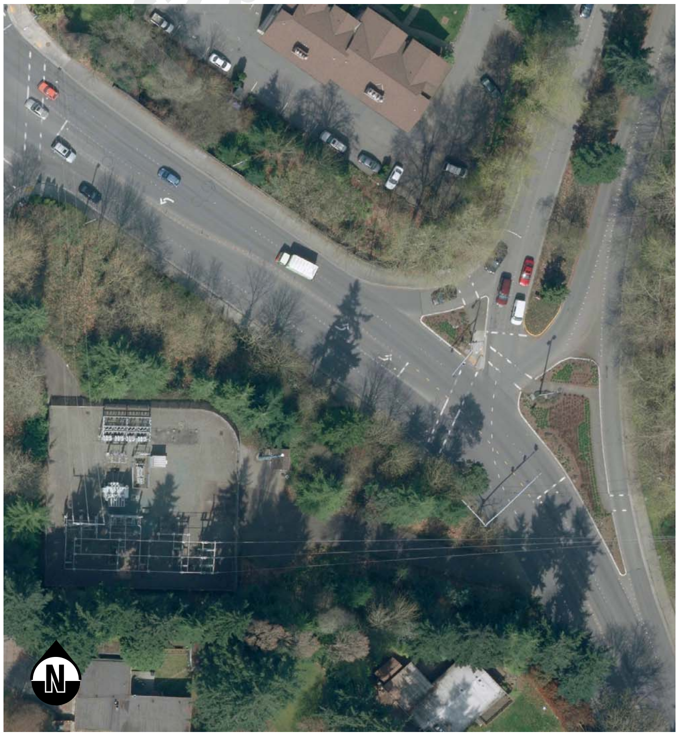


Figure 59 Running Way Improvement Projects L2, L3 and L4: Median HOV lanes on Bellevue Way SE and 112th Ave SE would improve the movement of transit vehicles through this congested Y-intersection southbound to South Bellevue Park-and-Ride. This would be achieved by constructing one lane on Bellevue Way SE and constructing a new median lane on 112th Ave SE. Aerial images depict roadway striping before and after lane reconfiguration. This concept maintains all existing general purpose travel lanes.

TRANSIT RUNNING WAY IMPROVEMENTS

Nineteen projects relating to transit running ways are currently being considered, including the conversion or restriction of general purpose travel lanes and the construction of new lanes for transit (see Figure 61 and Table 7 on the following pages). Potential improvements include High-Occupancy Vehicle (HOV) lanes and Business Access and Transit (BAT) lanes along several Frequent Transit Network (FTN) corridors. Some notable projects include HOV lanes along several segments of Bellevue Way SE and 112th Ave SE (see Figures 60, 62, and 63), BAT lanes and/or other speed and reliability improvements along 108th Ave NE in Downtown, HOV lanes along NE 10th St (see Appendix 5 on page A118), Main St, and the NE 6th St Extension (see Figure 63), and an upgrade of Snoqualmie River Rd through the Bellevue College campus so that it can accommodate bus traffic (see Appendix 6 on page A129).

Figure 59 depicts an early conceptual rendering of how three HOV lane projects (L2, L3, and L4) might be included in the street right-of-way along Bellevue Way SE and 112th Ave SE (see also Figure 60). These treatments are meant to improve travel time for southbound buses through this Y-intersection to the South Bellevue Park-and-Ride (see Appendix 4 on page A117 for 2030 travel time and person and vehicle throughput/volume analysis). Project L2 between the Y-intersection and the park-and-ride was included in Sound Transit's *East Link Extension Cost Savings Work Plan Findings* report in September 2012, but it has since been separated from any improvements being made for East Link by Sound Transit. This corridor ranks among those with the greatest need in the short-term and long-term based on the results of the issue identification process, but it remains a sensitive topic among some members of adjacent neighborhoods. Funding has already been secured for project L1 from the park-and-ride south to I-90 in the 2011 Memordanum of Understanding (MOU) between the City and Sound Transit, and it will be constructed by Sound Transit as part of the East Link project.

Consistent with the Downtown Transportation Plan Update, the *Transit Service Vision Report* proposes that many key routes follow 108th Ave NE through the length of Downtown. BAT lanes and/or other speed and reliability improvements are proposed along 108th (Project L5) to accommodate the significant volume of services that will use this Downtown transit spine, which ranks among the

Figure 60 Running Way Improvement Projects L2: A southbound median HOV lane on Bellevue Way SE would improve the speed and reliability of transit vehicles between 112th Ave SE to South Bellevue Park-and-Ride. This would be achieved by constructing one lane on Bellevue Way SE, thereby maintaining all existing general purpose travel lanes. Aerial images depict roadway striping before and after construction.

Figure 61 Map of potential transit running way projects.

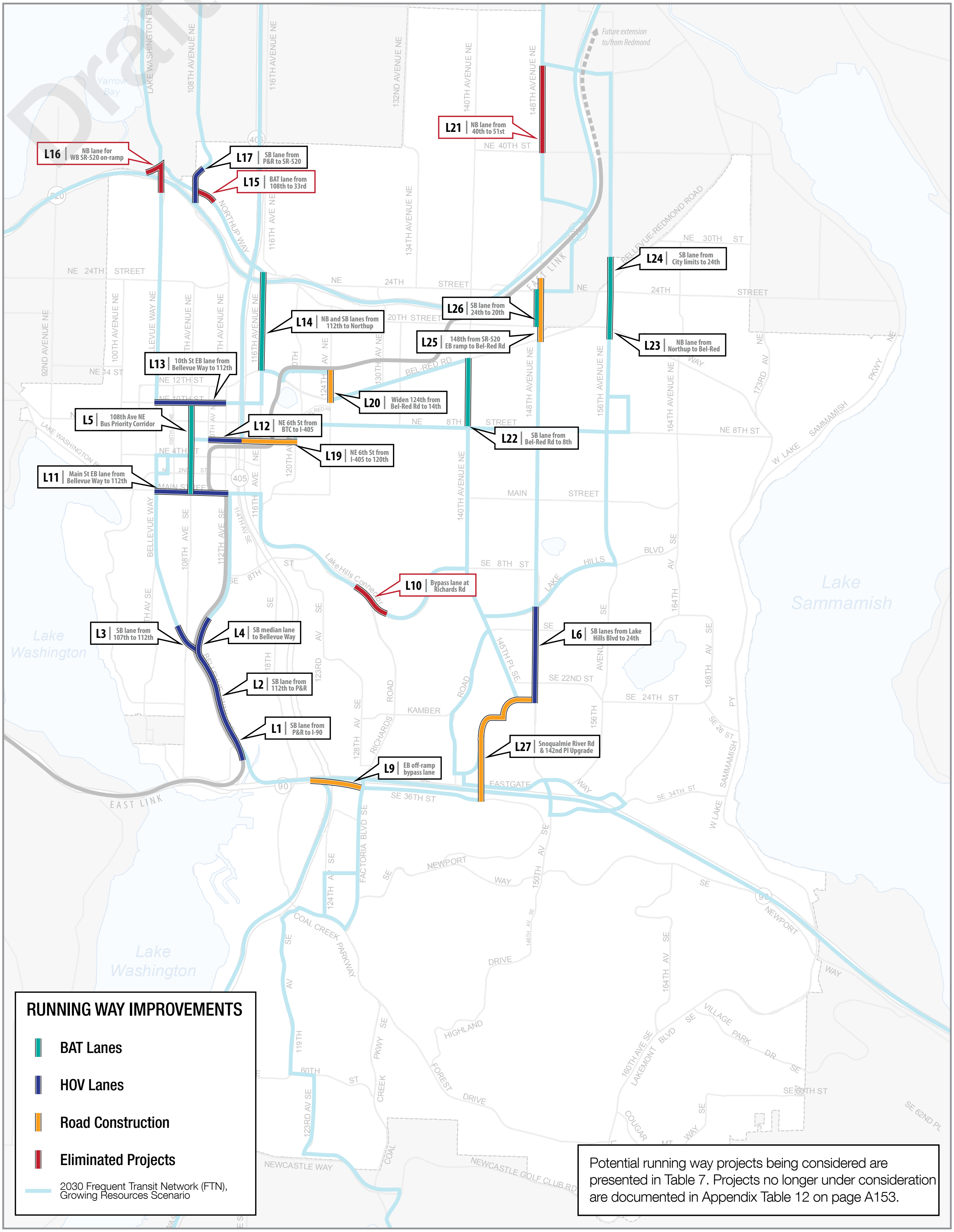


Table 7 Potential transit running way projects.

ID	Project	Type	FTN Service		Project Description	Composite Scores		Project Need / Potential Issues	Cost Range
			Routes	Frequency (Peak/Base/Night)		Short-Term	Long-Term		
L1	Bellevue Way SE HOV Lane - South Bellevue P&R	Lane Construction	1, 3, 11	~3 / 3-4 / 5-6	Construct a southbound HOV Lane on Bellevue Way SE between South Bellevue Park-and-Ride and I-90.	19	22	Previously noted in multiple plans including East Link Cost Saving Negotiations, Bellevue Transit Plan, Bellevue Transit Improvement Analysis, and Transportation Facilities Plan. See TIP-54 and TFP-242.	$$$
L2	Bellevue Way SE HOV Lane - South Bellevue P&R Extension	Lane Construction	1, 3, 11	~3 / 3-4 / 5-6	Construct a southbound HOV lane on Bellevue Way SE between South Bellevue Park and Ride and Y intersection with 112th Ave.	17–24	23	Previously noted in Bellevue plans. See TIP-55 and TFP-242.	$$$
L3	Bellevue Way SE HOV Lane - 112th Ave SE Extension	Lane Conversion/ Restriction	3, 11	4 / 5-8 / 15-20	Construct a southbound median HOV Lane on Bellevue Way SE from 112th Ave SE to approximately 107th Ave SE.	13–15	16–22	Addresses operator feedback, 2030 LOS of E and 2030 queuing, and frequent service. Property impacts on the west side of Bellevue Way SE at the intersection with 112th Ave SE.	$$$
L4	112th Ave SE HOV Lane	Lane Construction	1	8 / 10-15 / 30	Construct a southbound median HOV Lane on 112th Ave SE from Bellevue Way SE to slightly beyond end of intersection queue.	13	19	Addresses operator feedback, 2030 LOS of E and 2030 queuing. See TFP-242. Property impacts on the west side of Bellevue Way SE at the intersection with 112th Ave SE.	$$$
L5	108th Ave NE Transit Corridor	Lane Restrictions	1, 2, 3, 5, 6, 11, 13	~1 / 1-2 / ~2	Convert existing lanes along 108th Ave NE into BAT lanes and/ or implement other speed and reliability treatments as identified by the Downtown Transportation Plan Update from NE 10th St to Main St.	16–27	19–23	Very high bus volumes, revised circulation patterns, increased bus layover needs, and higher passenger boarding/alighting volumes will require additional transit capacity. Previously noted in several plans including the Downtown Transportation Plan Update, Bellevue Transit Plan, and Bellevue Transit Improvement Analysis. See TIP-51 and TFP-230 .	$$
L6	148th Ave SE Improvements - Bellevue College	Lane Construction	12	8 / 10 / 15	Construct a southbound HOV lane and transit queue jump lanes and install TSP on 148th Ave SE between Lake Hills Blvd and SE 24th St.	7–15	8–9	Previously noted in the Bellevue Transit Plan. See TIP-66.	$$$
L9	I-90 Factoria Blvd Exit Expansion	General Purpose Lane Construction	11	8 / 10 / 15	In coordination with the Mountains to Sound Greenway, relocate the current trail undercrossing of the ramp between northbound I-405 and eastbound I-90 to a new bridge south of the existing undercrossing, and add a second off-ramp lane to the current ramp undercrossing. Evaluate how to best stripe the off-ramp lanes to ensure reliable transit operations.	22	16	Addresses 2010 intersection LOS of E and queuing issues. Could be funded in coordination with TIP-35, CIP W/B-78, and TFP-243.	$$$
L11	Main St HOV Lane	Lane Restriction	1, 13	4 / 5-8 / 15-20	Convert one eastbound general purpose lane to a PM peak-only HOV lane on Main St from Bellevue Way NE to 112th Ave NE.	9–11	23–24	Addresses 2030 intersection LOS of E/F at multiple intersections as well as significant queuing issues.	$$
L13	NE 10th ST HOV Lane	Lane Restrictions	5	8 / 10 / 15	Convert one eastbound general purpose lane to a PM peak-only HOV lane on NE 10th St from Bellevue Way NE to 112th Ave NE.	9–16	17–19	Addresses LOS of E at one intersection and long queues at multiple intersections in 2030.	$$
L14	NE 116th Ave NE BAT Lanes	Lane Restrictions	5, 14	4 / 5 / ~8	Modify the channelization to allow BAT lanes between NE 12th St and Northup Way when approaching intersections and/or implement other speed and reliability treatments.	17	24	Addresses LOS of F and long intersection queues at north end of corridor. Very frequent service on corridor.	$$
L17	108th Ave HOV Lanes	Lane Construction	4, 5, 14	~3 / 3-4 / 5-6	Construct a southbound lane for SR-520 westbound traffic and restrict the second lane for SR-520 eastbound and HOV traffic between the SR-520 direct access ramps and the South Kirkland Park-and-Ride.	16–30	14–23	Addresses current and future LOS issues (E and F respectively Very frequent service on this segment. This project represents an expansion by one lane of the intersection's north approach relative to the reconfiguration project currently being implemented by WSDOT as part of the SR-520 Bridge Replacement and HOV Program. Further analysis is required prior to the advancement of this project to ensure effective coordination with the changes currently being made.	$$$
L19	NE 6th St Extension	Road Extension	2, 6	4 / 5-8 / 15-20	Conduct a pre-design analysis for the extension of NE 6th St from its current terminus in the median of I-405 to the east over the northbound lanes of I-405 and 116th Ave NE to a new intersection with 120th Ave NE. Evaluate for additional transit improvements.	17	15	Addresses delay associated with signalized turns. Previously noted in the Bellevue Capital Investment Program and Transportation Facilities Plan. See TIP-14, CIP R-162, and TFP-211.	$
L20	124th Ave NE - Bel-Red Road to NE 14th Street	Road Upgrade	14	8 / 10 / 15	Complete a preliminary design for the widening (to 5 lanes) of 124th Ave NE from Bel-Red Rd to NE 14th St. Coordinate with PW-R-166. Evaluate for additional transit improvements.	3	14	Addresses delay associated with signalized turns. Previously noted in the Bellevue Capital Investment Program and Transportation Facilities Plan. See TIP-18, CIP R-169, and TFP-213.	$
L22	140th Ave NE BAT Lane	Lane Construction	14	8 / 10 / 15	Construct a southbound BAT lane from Bel-Red Rd to NE 8th St.	9	16	Addresses future LOS of F as well as significant queuing.	$$$
L23	156th Ave NE BAT Lane - Northbound	Lane Construction	7	8 / 10 / 15	Construct a northbound BAT lane from south of Northup Way to just north of NE 24th St.	17–27	17–18	Addresses future LOS and queue length issues at multiple intersections.	$$$
L24	156th Ave NE BAT Lane - Southbound	Lane Construction	7	8 / 10 / 15	Construct a southbound BAT lane from City Limits to just south of NE 24th St.	15–17	16–18	Addresses future LOS and queue length issues at multiple intersections.	$$$

Note: These projects are conceptual and the final details of design will be developed as the projects proceed further along in the implementation process.

Table 7 continued.

ID	Project	Type	FTN Service		Project Description	Composite Scores		Project Need	Potential Issues
			Routes	Frequency (Peak/Base/Night)		Short-Term	Long-Term		
L25	148th Avenue NE Master Plan Improvements	Road Upgrade	12	8 / 10 / 15	Construct the following: – A third NB through lane on 148th Ave NE from 350 ft south of Bel-Red Rd to the SR-520 eastbound on-ramp; – NB right turn lane and EB/WB dual left turn lanes at 148th Ave NE/Bel-Red Rd; – EB/WB dual left-turn lanes at NE 20th St/148th Ave NE; – Extend NB and WB right turn lanes at NE 24th St/148th Ave NE; – EB and WB dual left-turn lanes at NE 24th St/148th Ave NE; – Configure the NB three-lane approach on 148th Ave NE at the SR-520 eastbound on-ramp to right-turn only.	11–13	15–18	Investigate how improvements can be implemented to prioritize HOV and transit. Previously noted in the Transportation Facilities Plan. See TIP-61 and TFP-250.	$$$
L26	148th Ave NE BAT Lane - Overlake	Lane Construction/ Restriction	12	8 / 10 / 15	Modify the channelization to allow BAT lanes on 148th Ave NE between NE 24th St and NE 20th St.	11–13	15–18	Addresses future LOS of F for multiple intersections.	$$
L27	Bellevue College Connection: 142nd Pl SE/ Snoqualmie River Road Multimodal Corridor	Road Upgrade	14	8 / 10 / 15	Upgrade the Snoqualmie River Rd roadway surface and facilities to support very frequent transit service. Includes stronger road surface, sidewalks, bicycle facilities, bus stops, and parking relocation components. Non-motorized improvements to the NE 142nd Pl SE bridge are also included.	15–19	7–19	Previously noted in the Eastgate/I-90 Land Use and Transportation Project. See TIP-63 and TFP-252.	$$$

Note: These projects are conceptual and the final details of design will be developed as the projects proceed further along in the implementation process.

Figure 62 Running Way Improvement Project L13: PM peak-only HOV lane on NE 10th St for eastbound buses between Bellevue Way NE and NE 112th St. Aerial images depict roadway striping before and after lane reconfiguration.

corridors with the greatest long-term needs for speed and reliability investments based on projected ridership, bus volumes, approach delay, and queue length (see Appendix 3 page A98). As a complement to the 108th corridor improvements, eastbound HOV lanes are being considered along NE 10th St (see Figure 62) and Main St between Bellevue Way and 112th Ave NE to address approach delay and queue length issues, as well as high bus volumes and projected ridership. Both HOV projects would convert an existing travel lane during PM peak hours only. See Appendix 5 on page A118 for the results of a Vissim micro-simulation traffic model analysis of these Downtown HOV lane projects.

Another important project assumed by the *Transit Service Vision Report* to be complete by 2030 is the NE 6th St HOV Extension, which is already included in Bellevue's Capital Investment Program (Project L19; see Figure 63). This project will extend the existing NE 6th St HOV direct access ramp bridge from the center of I-405 east to 120th Ave NE. This would make it possible to remove all transit services from NE 8th St west of 120th Ave NE, thereby bypassing multiple intersections with long approach queues, delays, and poor level-of-service (LOS) associated with general purpose traffic entering and exiting I-405.

Projects L23 and L24, both pictured in Figure 64, provide examples of how BAT lanes would be implemented in Bellevue, in this case on 156th Ave NE. Project L23 is a northbound BAT lane that extends from just south of Northup Way to just north of NE 24th St, while Project L24 is a southbound BAT lane extending from the city limits to just south of NE 24th St. Both of these projects involve the construction of an additional lane to address long queue lengths and an LOS of 'E' and 'F' at multiple intersections along this segment in 2030. Because these projects are BAT lanes, the additional road capacity would primarily benefit transit, but by providing right-turn access to businesses for general purpose traffic, these projects would also benefit private vehicles by moving turning vehicles out of the general purpose travel lanes.

Another project specifically noted by the *Transit Service Vision Report*—and previously proposed by the *Eastgate/I-90 Transportation Strategies Report*—is an upgrade of Snoqualmie River Rd, which is a central factor in increasing service frequency and reliability through Bellevue College. This project (L27) involves improving the roadway surface to be capable of supporting very frequent bus service, new bus stops, and associated pedestrian and bicycle facilities. Without this improvement, long route deviations would continue to be required to serve both Bellevue College and the Eastgate Park-and-Ride, resulting in an unreasonable waste of limited transit resources and a likely need to reconsider the route structure in the Eastgate area. See Appendix 6 on page A129 for a preliminary design concept to improve circulation to and through the campus for transit, pedestrians, and bicyclists.

Also being considered is a unique roadway project that would relocate a portion of the Mountains to Sound Greenway Trail and expand the I-90 eastbound off-ramp roadway to two lanes (Project L9; see

Figure 63 Running Way Improvement Project L19: Artist rendering of East Link LRT integrated with the NE 6th St HOV Extension.

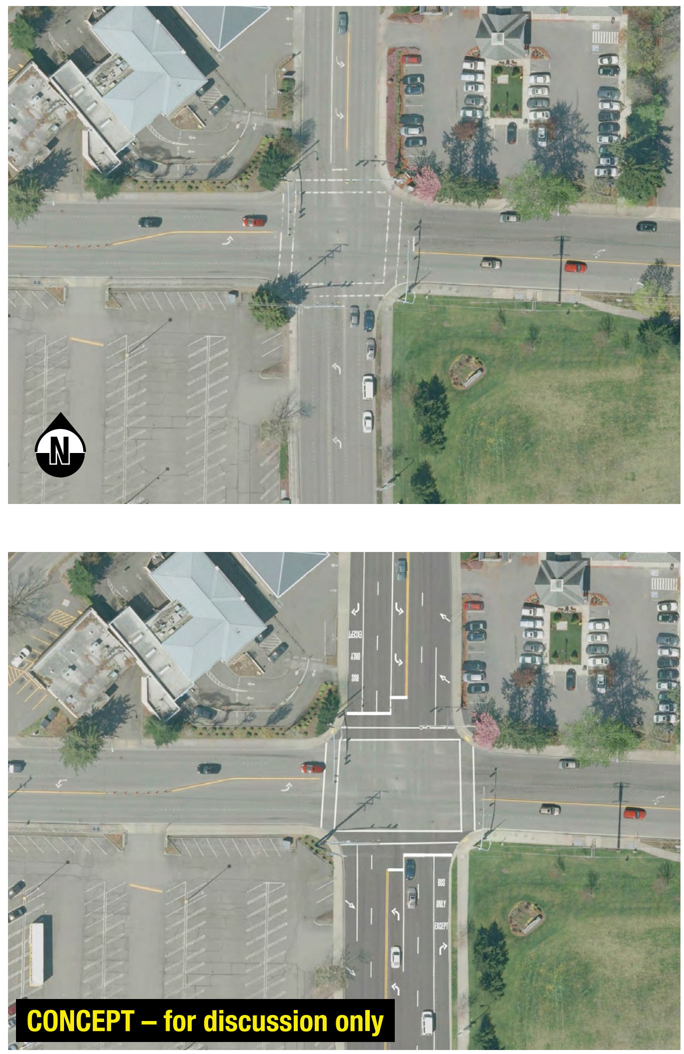


Figure 64 Running Way Improvement Projects L23 and L24: BAT lanes would be constructed on 156th Ave NE northbound from Northup Way to NE 24th St and southbound from city limits to NE 24th St, respectively. Aerial images depict roadway striping before and after lane reconfiguration. These concepts both maintain all existing general purpose travel lanes.

Figure 65). Presently, the off-ramp diverges from one lane to three in the short distance between the underpass and the intersection with Factoria Blvd, causing long queues, signal operation issues, and a PM peak LOS of 'E'. Widening the existing bridge to accommodate both an additional lane and the trail would be expensive, but the existing pavement width passing under the bridge is sufficiently wide to accommodate two vehicular travel lanes if the trail is relocated. The concept design shown in Figure 65 considers constructing a bridge for the trail that spans both I-405 ramps to I-90 eastbound, which also facilitates a direct connection from the Greenway Trail to the existing Factoria Trail before continuing east adjacent to I-90. This would improve the Greenway Trail while simultaneously alleviating delays to transit and general purpose traffic exiting I-90 eastbound to Factoria. As such, funding for Project L9 could be pursued in coordination with the ongoing Mountains to Sound Greenway Trail project (TFP-243). Further study is required to determine how to best utilize the additional lane to the benefit of transit and other road users.

Although the Transit Priority Toolbox (pages 15 through 29) includes improvements that afford transit greater operational exclusivity—treatments like bus-only lanes and transit-only streets—no such projects are included in this list.

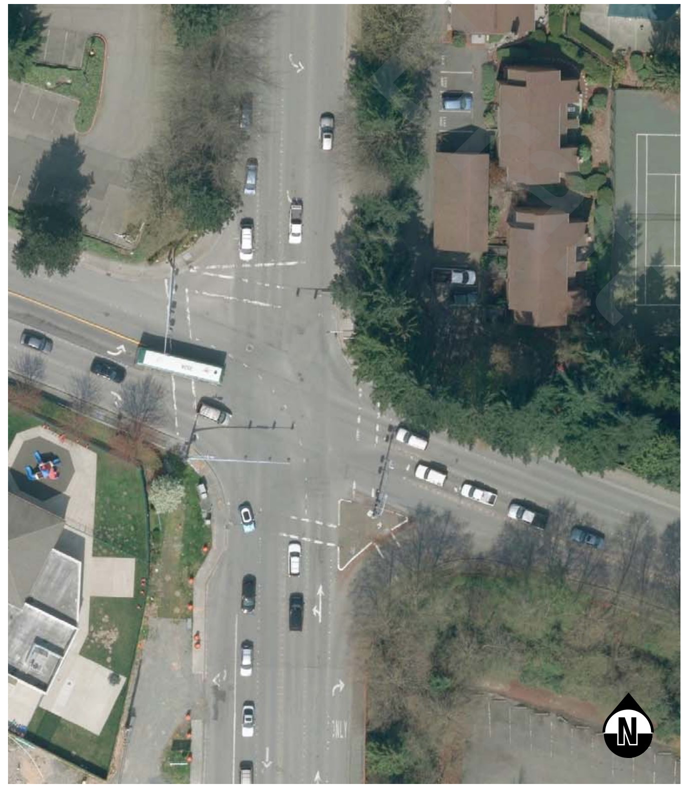
Figure 65 Running Way Improvement Project L9: The eastbound I-90 off-ramp would be widened from one lane to two by relocating the Mountains to Sound Greenway Trail. This project would help reduce signal and queuing delay caused by the signal at Factoria Blvd, helping both transit and general purpose traffic.

SPOT IMPROVEMENTS

Thirty-nine spot improvement projects are currently being considered, including sixteen queue jump lanes, thirteen intersection or roadway improvement projects, and ten signalization improvement projects. Intersection and roadway projects relate primarily to turning movements and include improvements to turn radii and the construction of new turning lanes. Signalization improvements relate primarily to adjusting signal timing to increase the amount of green time allocated to movements operated by FTN routes, but they also include some turn restrictions on general purpose traffic during peak hours and improvements to the responsiveness of existing TSP controllers.

Queue Jumps

Queue jumps can be implemented in one of three basic configurations, as shown in Figure 68. Which variant is pursued for any given project depends primarily on the amount of right-of-way available on the near and far sides of the intersection. Queue jumps require either a complimentary lane on the far-side of the intersection (right diagram) or TSP treatment to allow buses to advance through the intersection before general purpose traffic (left and center diagrams). Where permitted by the amount of right-of-way available, it is operationally preferable to use a designated queue jump lane with an advance green signal, as shown by the left and right diagrams. The alternative depicted by the center diagram involves restriction of the right lane so that only transit vehicles can continue through the intersection; for general purpose traffic, it becomes a right-turn only lane. This latter configuration is less desirable both because it removes a through-lane from general purpose traffic and because of the potential for buses to be caught behind a queue of right-turning vehicles, reducing the benefit afforded to transit by the queue jump.



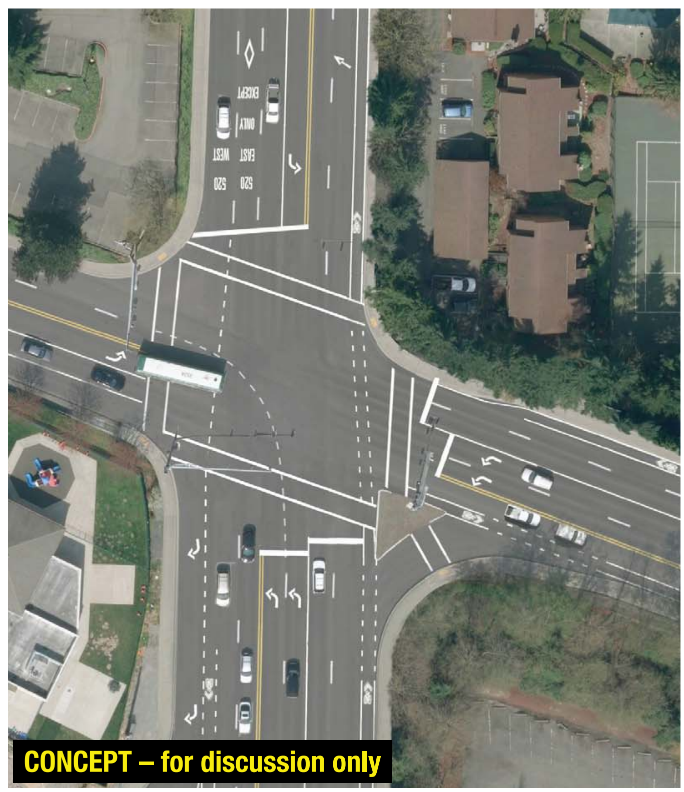


Figure 66 Running Way Improvement Project L17: Construction of a southbound HOV lane on 108th Ave NE between South Kirkland Park-and-Ride and SR-520. Aerial images depict roadway striping before and after lane reconfiguration. This concept adds one lane to the north approach relative to the WSDOT intersection reconfiguration currently being implemented. A northbound queue jump lane was also previously being considered at this intersection (see Project Q4 on page A155), but it is no longer being considered because it cannot be accommodated by WSDOT's plans.

Figure 67 Spot Improvement Project Q5: Queue jump lane on NE 116th St for left turning, northeast-bound traffic at Northup Way. Aerial images depict roadway striping before and after lane reconfiguration. This concept maintains all general purpose travel lanes and requires no new lane construction—both suitable qualities for a potential 'quick win' project.

Although the conceptual visualizations presented here reflect one of these three configurations, this does not imply that there is only one way to implement a queue jump at a given location. Specific queue jump configurations have not yet been determined for any of the potential projects, but the conceptual renderings indicate one possibility. As queue jump projects are advanced through feasibility screening and project prioritzation, potential design strategies will be assessed based on signal operations, right-of-way availability, and constructability restrictions.

Some notable queue jump projects being considered include one on 116th Ave NE for northbound buses turning west (left) onto Northup Way (see Figure 67) and two for nothbound traffic on Bellevue Way NE—one at Main St and another at NE 12th St. A potential queue jump for northbound buses on 108th Ave NE at Northup Way, considered in the *Draft Capital Element Background Report (Volume 1: Speed and Reliability)*, was removed from the project list due to space constraints created by the SR-520 Bridge Replacement and HOV Project (see Appendix 7 page A155).

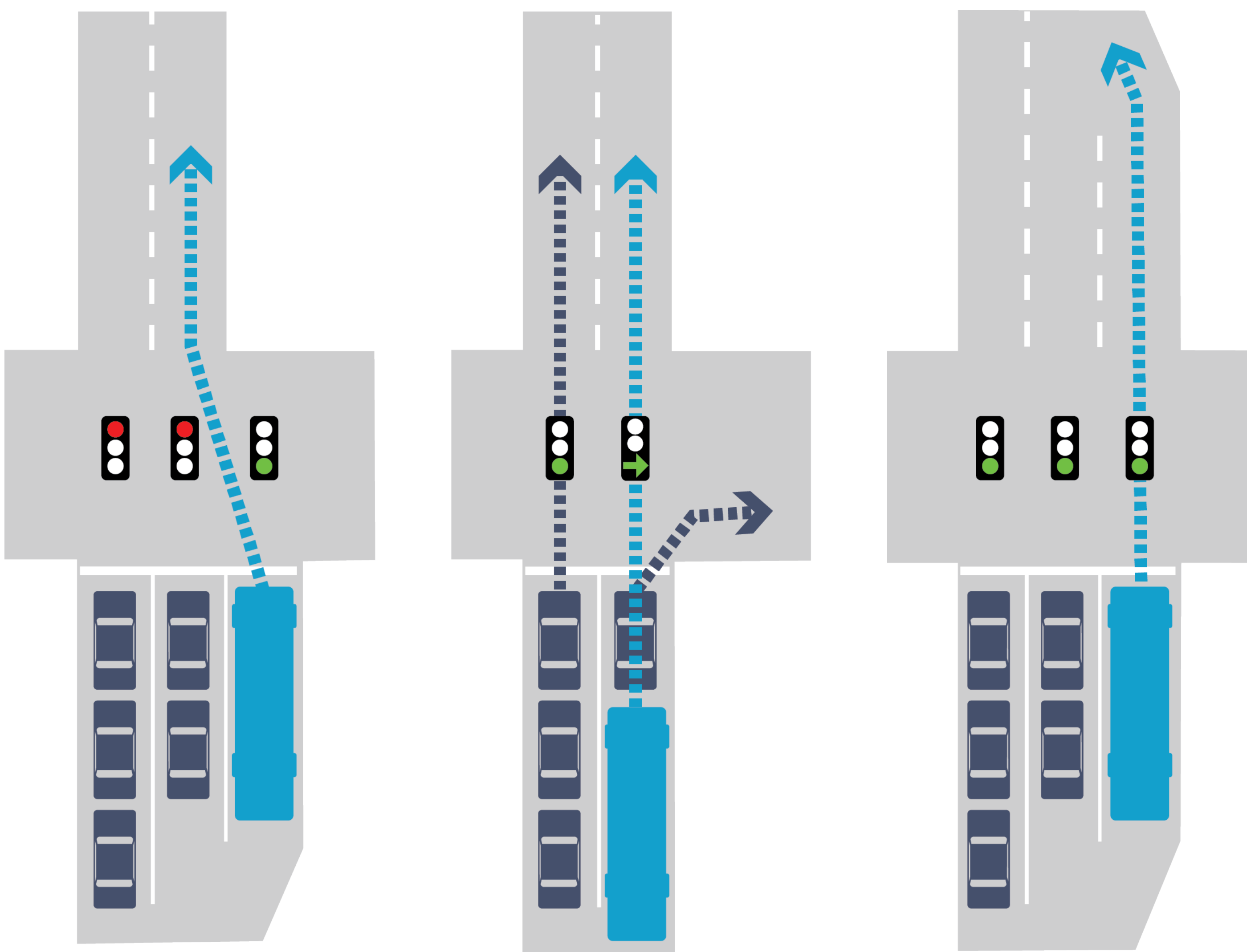
Intersection & Roadway Improvements

All but one of the potential intersection and roadway improvement projects deal with improving turn radii to better accommodate buses or adding new turn lanes to increase traffic flow and help buses pass through intersections more reliably in a single signal cycle. The only project that does not fall into these two categories (R14) simply seeks to improve the clarity of the existing channelization on NE 10th St. No negative impacts to general purpose traffic are anticipated from these improvements, as any right-of-way adjustments are lane additions, not conversions, and are not restricted to use by HOVs or buses.

Signalization Improvements

Signalization improvements relate primarily to extending the length of green phases associated with troublesome transit turning movements, either by adjusting normal signal timings or improving existing TSP controller responsiveness. New TSP implementation projects are categorized separately and are addressed in the following section. Two city-wide projects are also being considered—one to upgrade any non-SCATS traffic signals to that system, and another to coordinate with Metro to establish standards for TSP equipment and software.

Figure 68 Various configurations of queue jump lanes.



Queue Jump through Advanced Green Signal

Queue Jump through Transit Vehicle Exception

Queue Jump through Transit Receiving/Merge Lane

Figure 69 Potential spot improvement projects.

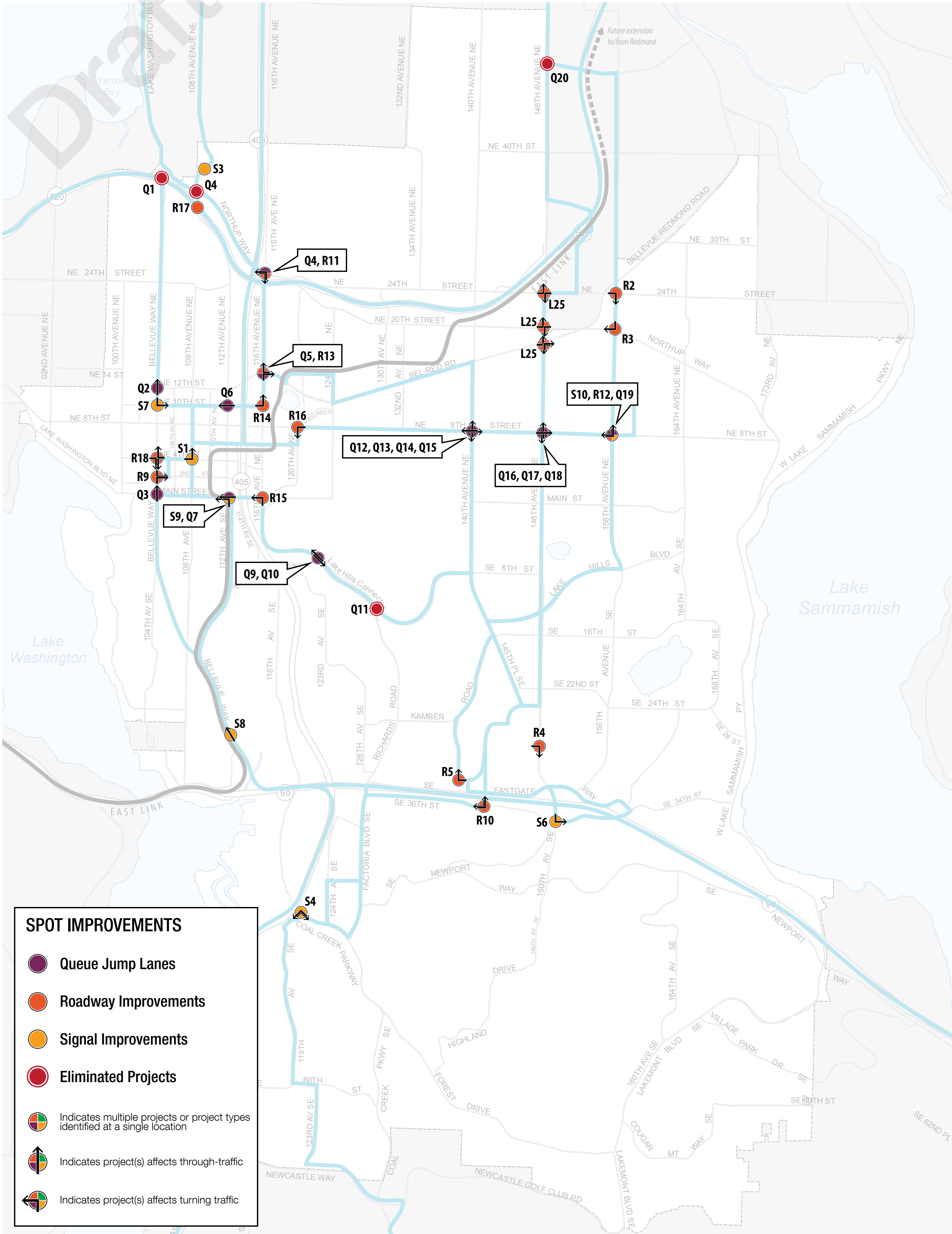


Table 8 Potential queue jump, intersection, roadway, and signalization projects.

ID	Project	Type	FTN Service: Routes	FTN Service: Frequency (Peak/Base/Night)	Project Description	Composite Scores: Short-Term	Composite Scores: Long-Term	Project Need / Potential Issues	Cost Range
Queue Jump Lanes									
Q2	Bellevue Way and NE 12th St - Northbound	Queue Jump	1	8 / 10-15 / 30	Add a queue jump to the northbound right turn lane.	13	14	High frequency transit service	$
Q3	Bellevue Way and Main St - Northbound	Queue Jump	3, 11	4 / 5-8 / 15-20	Modify channelization to allow a northbound queue jump.	24	18	Addresses operator comments and high bus volumes. Uses existing facilities to prioritize transit.	$
Q4	Northup Way and 116th Ave NE - Northbound	Queue Jump	2, 5, 14	2-3 / 3-4 / 8-10	Add a northbound to westbound queue jump lane.	17	24	Addresses future LOS and queuing issues, and very high bus volumes	$
Q5	116th Ave NE and NE 12th St - Southbound	Queue Jump	5, 14	4 / 5 / ~8	Add a queue jump without a far side lane to the northbound approach in the right-turn only lane.	17	24	Addresses high bus volumes	$
Q6	NE 10th St and 112th Ave NE - Westbound	Queue Jump	5	8 / 10 / 15	Add a queue jump to the westbound approach in the right-turn only lane.	11	15	Addresses future intersection LOS of E.	$
Q7	Main St and 112th Ave NE - Westbound	Queue Jump	1, 13	4 / 5-8 / 15-20	Add a queue jump to the westbound approach in the right-turn only lane.	11	24	Addresses future intersection LOS of F and significant queuing.	$
Q9	Lake Hills Connector and SE 8th St - Eastbound	Queue Jump	13	8 / 10 / 15	Add a queue jump to the eastbound approach in the right-turn only lane.	16	16	Addresses future intersection LOS of E and significant queuing.	$$
Q10	Lake Hills Connector and SE 8th St - Westbound	Queue Jump	13	8 / 10 / 15	Add a queue jump to the westbound approach in a newly constructed queue jump lane.	14	16	Addresses future intersection LOS of E.	$$
Q12	NE 8th Street and 140th Ave NE - Eastbound	Queue Jump	6	8 / 10 / 15	Add a queue jump to the eastbound approach in the right-turn only lane.	15	18	Addresses future intersection LOS of E and queuing.	$
Q13	NE 8th Street and 140th Ave NE - Northbound	Queue Jump	6, 14	4 / 5 / ~8	Add a queue jump to the northbound approach in a newly constructed queue jump lane.	9	16	Addresses future intersection LOS of E.	$
Q14	NE 8th Street and 140th Ave NE - Westbound	Queue Jump	6, 14	4 / 5 / ~8	Add a queue jump to the westbound approach in a newly constructed queue jump lane.	17	17	Addresses future intersection LOS of E.	$$$
Q15	NE 8th Street and 140th Ave NE - Southbound	Queue Jump	6, 14	4 / 5 / ~8	Add a queue jump to the southbound approach in the right-turn only lane.	9	16	Addresses future intersection LOS and significant queuing issues.	$
Q16	NE 8th St and 148th Ave NE - Eastbound	Queue Jump	6, 12	4 / 5 / ~8	Add a queue jump to the eastbound approach in the right-turn only lane.	19	15	Addresses operator comments. Right turn volumes might be too high to make this viable.	$
Q17	NE 8th St and 148th Ave NE - Northbound	Queue Jump	6, 12	4 / 5 / ~8	Add a queue jump to the northbound approach in the right-turn only lane.	20	14	Addresses operator comments.	$
Q18	NE 8th St and 148th Ave NE - Southbound	Queue Jump	6, 12	4 / 5 / ~8	Add a queue jump to the southbound approach in the right-turn only lane.	20	19	Addresses operator comments.	$
Q19	NE 8th St and 156th Ave NE (NB)	Queue Jump	6, 7	4 / 5 / ~8	Modify channelization to allow a queue jump.	21	14		$
Intersection and Roadway Improvements									
R2	156th Ave NE and NE 24th St Turn Radii	Turn Radii	7	8 / 10 / 15	Improve the turn radius for the eastbound right turn on 156th Ave NE at NE 24th St.	N/A	N/A	Previously noted in the Eastgate/I-90 Land Use and Transportation Project.	$$
R3	Northrup Way and 156th Ave NE Turn Radii	Turn Radii	7	8 / 10 / 15	Improve the turn radius for the southbound right turn on Northup Way at 156th Ave NE.	27	17	Previously noted in the Bellevue Transit Plan and Bellevue Transit Improvement Analysis.	$$
R4	Landerholm Circle and 148th SE Radii Improvements	Turn Radii	7, 13	4 / 5 / ~8	Improve the turn radius for the eastbound right turn on 148th Ave SE at Landerholm Circle.	N/A	N/A	Previously noted in the Bellevue Transit Plan and Bellevue Transit Improvement Analysis.	$$
R5	SE 32nd St and 139th Ave SE Radii Improvement	Turn Radii	14	8 / 10 / 15	Improve the turn radius for the westbound right turn on 139th Ave SE at SE 32nd St.	7	8	Previously noted in the Bellevue Transit Plan and Bellevue Transit Improvement Analysis.	$$
R9	NE 2nd St and Bellevue Way NE Turn Improvement	Road Upgrade	3, 5, 6	~3 / 3-4 / 5-6	Add a northbound right-turn lane and a second southbound left turn lane.	15–17	15	Previously noted in the Bellevue Transit Plan and Bellevue Transit Improvement Analysis.	$$$
R10	SE 36th ST and 142nd Ave SE	Turn Lanes	7	8 / 10 / 15	Improve eastbound to northbound and southbound to westbound turn movement through construction of southbound right turn lane and northbound bus stop pullout.	11–19	13–19	Previously noted in the Eastgate/I-90 Land Use and Transportation Project.	$$$
R11	Northup Way and NE 116th St Turn Improvement	Turn Lanes	5, 14	4 / 5 / ~8	Add an eastbound to southbound right turn lane.	16	24	Addresses future intersection LOS of F with queuing issues, high bus frequency.	$$

Note: These projects are conceptual and the final details of design will be developed as the projects proceed further along in the implementation process.

Table 8 continued.

ID	Project	Type	FTN Service Routes	FTN Service Frequency (Peak/Base/Night)	Project Description	Composite Scores Short-Term	Composite Scores Long-Term	Project Need	Cost Range
Intersection and Roadway Improvements (cont.)									
R12	NE 8th St and 156th Ave NE Turn Radii	Turn Radii	6, 7	4 / 5 / ~8	Improve the southbound to westbound turn radius.	21	14	Addresses operator comment.	$$
R13	NE 12th St and 116th Ave NE Turn Lane	Turn Lanes	5, 14	4 / 5 / ~8	Add a westbound to northbound right turn lane.	15	16	Addresses future intersection LOS of E and queuing issues.	$$
R14	NE 10th St and 116th Ave NE Channelization	Channelization	5	8 / 10 / 15	Clarify channelization of the eastbound approach such that right lane feeds into curb right-turn only lane and first left-turn only lane.	18	13	Prioritizes lane with transit at closely spaced intersection.	$
R15	116th Ave SE and Main St Turn Lane	Turn Lanes	13	8 / 10 / 15	Add a second northbound to westbound turn lane. Time of day ITS solutions might eliminate the need for lane construction.	10	13	Addresses existing left turn queuing issues.	$$$
R16	NE 8th St and 120th Ave NE Turn Lane	Turn Lane	6	8 / 10 / 15	Add a second westbound to southbound turn lane and restrict to HOV and transit.	16	16	Addresses existing left turn queuing issues.	$$
R18	NE 4th St and Bellevue Way Turn Improvement	Turn Improvement	3, 5, 6	~3 / 3-4 / 5-6	Add a southbound right turn lane, a westbound right turn lane, and dual westbound left turn lanes.	21	17	Previously noted in the Transportation Facilities Plan. See TIP-48 and TFP-222.	$$$
Signalization Improvements									
Citywide-S1	Traffic Computer System Upgrade	ITS	NA	NA	Citywide replacement of traffic signal and software to upgrade to SCATS traffic system.	N/A	N/A	SCATS implementation has shown to reduce travel times across, which will generally result in improved speed and reliability of transit service.	NC
Citywide-S2	Controller Equipment and Software Standards	Standards	NA	NA	Coordinate with King County Metro on equipment and software TSP standards for all new signal controllers.	N/A	N/A	Ensures TSP treatments can be easily implemented in the future with existing equipment and software	NC
S1	NE 4th St and 108th Ave Turn Improvement	Turn Improvement	3, 6	4 / 5-8 / 15-20	Improve the eastbound left turn level-of-service (LOS) for transit through increased time allocation or TSP. Explore strategies to reduce southbound right turn delays caused by pedestrians.	26	18	Addresses top operator comment location.	$
S3	South Kirkland P&R Signalizations	Signalization	4, 5, 14	~3 / 3-4 / 5-6	Signalize 108th Ave NE at the South Kirkland Park-and-Ride entrance.	16	13–14	Previously noted in the Bellevue Transit Plan and Bellevue Transit Improvement Analysis	$$
S4	Coal Creek Pkwy SE and 119th Ave SE Turn Improvement	Turn Improvement	11	8 / 10 / 15	Improve the westbound to southbound and northbound to eastbound turn movements through timing prioritization and TSP.	13–17	19–20	Addresses future intersection LOS of F and queuing issues.	$
S6	SE 37th St and 150th Ave SE Turn Restriction	Turn Restriction	13	8 / 10 / 15	Restrict southbound to eastbound turns during PM peak hours to HOV and transit to reduce volumes and ensure that eastbound SE 37th St is not blocked by queuing traffic from I-90 eastbound.	14	14	Addresses existing and future LOS of E and F.	$
S7	Bellevue Way and NE 10th St Turn Improvement	Turn Improvement	1	4 / 5 / 15	Improve the southbound to eastbound turn movement through signal timing prioritization and TSP. Improve the westbound to northbound movement through conversion of the right through lane to a right-turn only lane.	13	14	Reduces intersection signal delay	$
S8	Bellevue Way and South Bellevue Park and Ride TSP Improvement	TSP Improvement	1, 3, 11	~3 / 3-4 / 5-6	Improve the responsiveness of northbound TSP operations.	19	22	Addresses multiple operator comments that northbound TSP was not responsive enough	$
S9	112th Ave NE and NE Main St Turn Improvement	Turn Improvement	1, 13	4 / 5-8 / 15-20	Improve the northbound to westbound turn movement through timing prioritization and TSP.	14	20	Addresses future intersection LOS of F.	$
S10	NE 8th St and 156th Ave NE Turn Improvement	Turn Improvement	6, 7	4 / 5 / ~8	Improve the eastbound to northbound left turn through timing prioritization and TSP. If improvements are inadequate, consider construction of a second left turn lane.	24	17	Addresses multiple operator comments.	$$$

Note: These projects are conceptual and the final details of design will be developed as the projects proceed further along in the implementation process.

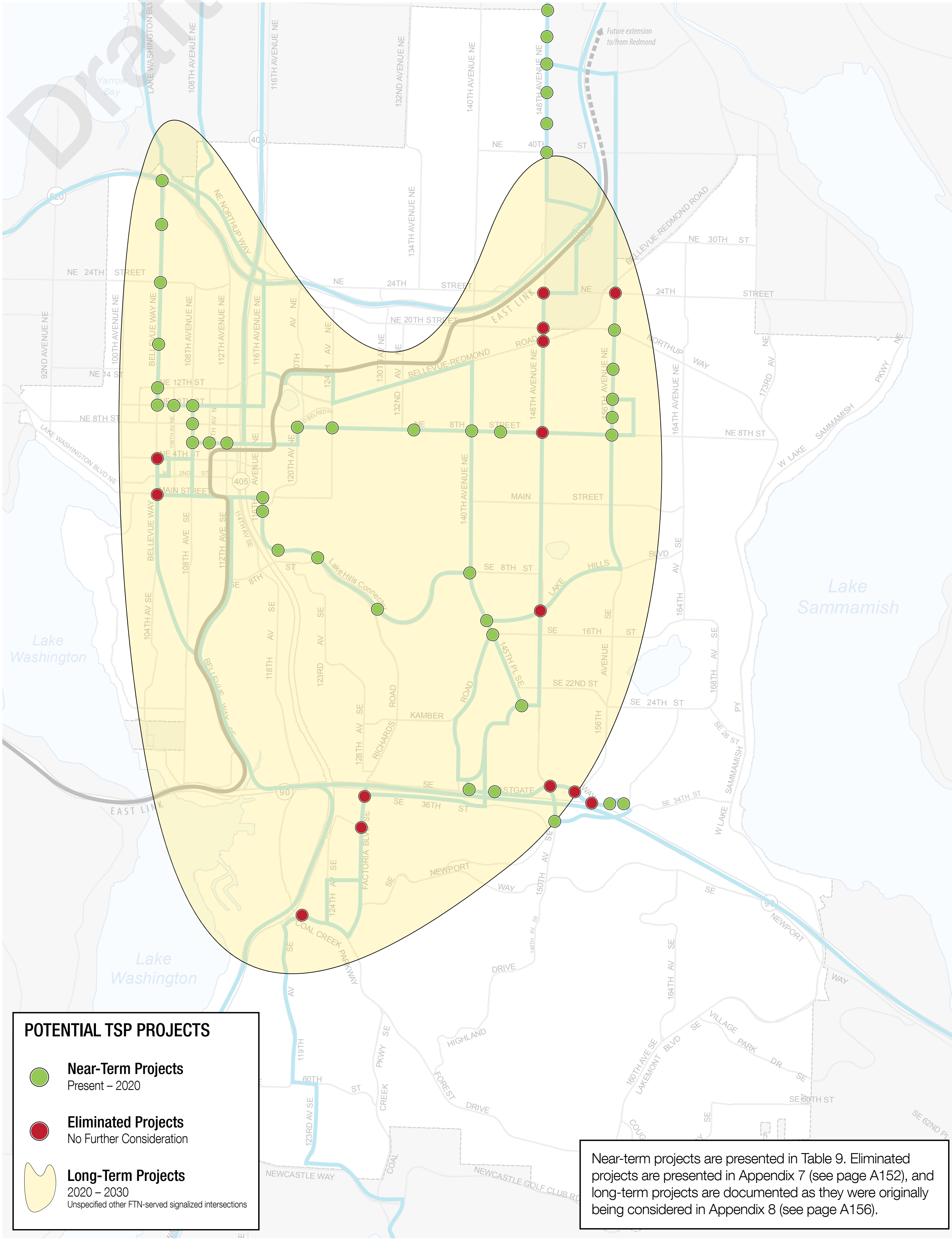
TRANSIT SIGNAL PRIORITY

Potential transit signal priority (TSP) projects were initially being considered at all signalized intersections through which 2030 Frequent Transit Network (FTN) routes will operate. Following the completion of early feasibility screening, potential transit signal priority (TSP) projects were then divided into three groups. The first group, shown in Table 9 on page 73, includes forty-four near-term projects that will be pursued through 2020. These represent all signalized intersections that are served by existing Route 271 (FTN Routes 1 and 13) and the RapidRide B Line (FTN Routes 6 and 7) that have not been eliminated by early feasibility screening. While TSP has already been deployed on some intersections served by the B Line, near-term projects along NE 8th St, 156th Ave NE, and 148th Ave NE would complete implementation associated with that route.

A cost estimate is not provided for near-term TSP projects in Table 9 because the cost of implementation at each intersection is estimated to be $15,000. TSP costs for each intersection were estimated based on approximate costs provided by King County Metro. These estimates do not include capital or operational costs of communication, nor do they include signal controller, cabinet, or foundation upgrades. More detailed analysis of the communication, cabinet, controller, and signal upgrades necessary for TSP implementation is required for more detailed cost estimates to be developed.

The second group of projects (see Appendix Table 13 on page A154) are those that have been eliminated from further consideration following 'fatal flaw' early feasibility screening. Twelve intersections for which potential signal projects were identified have been eliminated based on known signal and/or roadway limitations, and two additional intersections were removed by project consultants. Generally, the intersections with 'fatal flaws' identified are those that

Figure 70 Potential transit signal priority (TSP) projects.



Near-term projects are presented in Table 9. Eliminated projects are presented in Appendix 7 (see page A152), and long-term projects are documented as they were originally being considered in Appendix 8 (see page A156).

Table 9 Potential near-term transit signal priority (TSP) projects.

Intersection ID	Cross Streets	Direction(s)	Approach Composite Scores Short-Term	Approach Composite Scores Long-Term	FTN Route(s)	Previous TSP Priority	Related TMP Project	Related TFP Project
5	Bellevue Way NE & NE 12th Ave	Northbound, Southbound	7–13	13–14	1			
6	Bellevue Way NE & NE 10th Ave	Southbound, Westbound	9–13	14–17	1		X	
21	NE 8th St & 108th Ave NE	Northbound, Southbound	27	23	1, 5		X	X
33	NE 8th St & 120th Ave NE	Northbound, Westbound	16–17	14–16	6		X	X
35	NE 8th St & 124th Ave NE	Eastbound, Westbound	10–16	12–16	6	X		
41	NE 8th St & 140th Ave NE	Eastbound, Westbound, Northbound, Southbound	9–17	16–18	6, 14		X	
43	Lake Hills Connector & 140th Ave SE	Eastbound, Northbound, Southbound	11–16	11–16	13, 14			X
43	Lake Hills Connector & SE 8th St	Northbound, Southbound	12–16	12–16	13, 14			X
44	Lake Hills Blvd & 145th Pl SE	Eastbound, Northbound, Southbound	11–16	11–16	7, 13, 14			X
45	Kamber Rd & 145th Pl SE	Northeastbound, Northwestbound, Southeastbound	3–17	10–18	7, 13, 14			X
46	NE 8th St & 143rd Ave NE	Eastbound, Westbound	17–19	15–17	6	X		
54	SE 24th St & 145th Pl SE	Eastbound, Southbound	17–19	12–18	7, 12, 13			
62	156th Ave NE & Northup Way	Northbound, Southbound	21–27	14–17	7		X	
63	NE 8th St & 156th Ave NE	Eastbound, Westbound, Northbound, Southbound	15–24	9–17	6, 12		X	
66	156th Ave NE & NE 15th St	Northbound, Southbound	12–14	8–9	6, 7			
67	156th Ave NE & NE 10th St	Northbound, Southbound	17–21	9–14	7			
69	Bellevue Way NE & NE 24th Ave	Northbound, Southbound	7–9	11–12	1			
70	156th Ave NE & NE 13th Way	Northbound, Southbound	12–14	8–9	7			
73	Main St & 116th Ave	Eastbound, Northbound	5–10	13–18	13		X	
79	148th Ave NE & NE 40th St	Northbound, Southbound	13–23	18–21	12		X	
91	SE Eastgate Way & 160th Ave SE	Westbound	10	9	13			
92	SE Eastgate Way & 161st Ave SE	Westbound	6	7	13			
107	NE 6th St & 112th Ave NE	Eastbound, Westbound	24–28	23	2, 6		X	
124	NE 6th St & 110th Ave NE	Eastbound, Westbound	27–32	20–21	2, 6		X	
126	NE 6th St & 108th Ave NE	Northbound, Southbound, Westbound	26–32	18–23	1, 2, 5, 6		X	X
131	116th Ave SE & SE 1st St	Northbound, Southbound	10–12	11–13	13			
134	Lake Hills Connector & Richards Rd	Eastbound, Westbound	12–14	14–16	13		X	
136	Bellevue Way NE & 2900 Block Crosswalk	Northbound, Southbound	7	12–15	1			
137	Bellevue Way NE & 1700 Block Crosswalk	Northbound, Southbound	7–9	11–13	1			
154	NE 10th St & 106th Ave NE	Eastbound, Westbound	9	17–19	1		X	
190	NE 10th St & 108th Ave NE	Eastbound, Northbound, Westbound	9–27	19–23	1, 5		X	X
213	Bellevue Way NE & SR-520 SPUI	Northbound, Eastbound	7	15	1		X	
227	150th Ave SE & SE 37th St	Southbound	14	14	13		X	
249	148th Ave NE & NE 51st St	Northbound, Southbound, Westbound	19–21	21	7, 12		X	
272	SE Eastgate Way & 139th Ave SE	Eastbound, Westbound, Southbound	7–26	12–14	13, 14	X		
287	148th Ave NE & NE 60th St	Northbound, Southbound	9	14	7, 12			
288	NE 8th St & 13300 Block Crosswalk	Eastbound, Westbound	10–15	12–18	6			
299	NE 8th St & 158th Ave NE	Eastbound, Westbound	5–15	5–14	6			
319	SE Eastgate Way & 140th Ave SE	Eastbound, Southbound, Westbound	17	12–15	7, 13, 14	X		
NA_1	Lake Hills Connector & I-405 NB off-ramp	Eastbound, Westbound	12–16	11–16	13			
NA_2	SE Eastgate Way & Eastgate P&R Entrance	Westbound, Eastbound	19–26	13–14	13			
NA_3	148th Ave NE & NE 4200 Block	Northbound, Southbound	13–23	18–21	12		X	
NA_3	148th Ave NE & NE 5600 Block	Northbound, Southbound	9–19	14–21	7, 12			
NA_4	148th Ave NE & NE 46th St	Northbound, Southbound	21–23	21	12		X	

Note: These projects are conceptual and the final details of design will be developed as the projects proceed further along in the implementation process.

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have such significant congestion—often in all travel directions—that the use of signal pre-emption for transit would seriously interfere with signal phasing and cause unacceptable delays to cross traffic. For example, the intersections of 148th Ave NE/NE 20th St and Factoria Blvd/SE 36th St both experience substantial congestion due to nearby freeway interchanges, making TSP implementation untenable there.

The final group of potential TSP projects are those that may be pursued between 2020–2030. This group includes an unspecified number of the remaining signalized intersections served by 2030 FTN routes, indicated in Figure 70 by a yellow area covering much of the city (see Appendix 8 on page A156). If transit efficiency and reliability were the only two considerations necessary in determining where TSP should be deployed—that is, if cost were no object, impacts to other travel modes were deemed insignificant, and no technical limitations existed on where TSP could be deployed—then TSP might reasonably be pursued at all or most of these signals. However, this is of course not the case, as all of these other factors are also critical considerations in determining where transit priority can and should be implemented. Therefore, the specific projects that may be included in this group will not be identified until after 2020, after Metro has identified its anticipated capacity to expand its TSP capabilities.

TRACKING & FURTHER STUDY

In addition to the physical infrastructure improvement projects proposed, five projects dealing with performance tracking and further study have also been identified (Table 10). Though less visible than the 'brick-and-mortar' running way and spot improvement projects, and less immediately impactful to transit operations than transit signal priority projects, these tracking and study projects would provide valuable opportunities for the City to ensure that its investments in transit priority are functioning as intended and providing the greatest return on investment possible.

The tracking and study projects include two targeted projects and three city-wide projects. Project L12 would track the volumes of traffic between Bellevue Transit Center and the NE 6th St direct-access ramp to I-405 to ensure that speed and reliability do not decline over time, and Project R17 would study how speed and reliability could be improved for westbound buses from SR-520 to the South Kirkland Park-and-Ride. Citywide-R1 would track the adequacy of turn pocket lengths along FTN corridors and adjust signal timing as needed. Citywide-S3 and Citywide-S4 both deal with TSP performance. The former would develop TSP performance standards and track the resulting measures to ensure that TSP systems are functional and optimized, while the latter project would conduct a before-and-after study of the benefits provided to transit by TSP at selected intersections, as well as its impacts on general purpose traffic. None of these projects have associated capital costs, and Project R17 is the lone project whose cost was identified as 'N/A' (see Table 6 on page 55).

Table 10 Tracking projects and studies.

ID	Project	Type	FTN Service		Composite Scores		Project Description	Project Need
			Routes	Frequency (Peak/Base/Night)	Short-Term	Long-Term		
L12	NE 6th St Bus Priority Corridor	Tracking	1, 2, 3, 5, 6, 11, 13	~1 / 1-2 / ~2	24–28	23	Highlight transit priority over general purpose and HOV traffic on NE 6th St from BTC to I-405 direct access ramps. Track general purpose and HOV volumes to ensure they do not result in degradation of speed and reliably below existing levels, and take steps to mitigate growing HOV volumes if needed.	Addresses very high bus volumes between BTC and I-405.
Citywide-R1	Transit Turn Priority	Tracking	NA	NA	N/A	N/A	Monitor right and left turn pockets used by Frequent Transit Network (FTN) routes for level-of-service and adequacy of pocket length. Use signal timing work to prioritize these movements to ensure fast and reliable transit service.	Turning moments at major intersections with long signal cycles can have a significant impact on the speed and reliability of routes.
R17	SR-520 and 108th Ave NE Exit Transit Priority	Study	4	8 / 10-15 / 30	30	23	Improve the speed and reliability of SR-520 westbound buses to South Kirkland Park-and-Ride through signal operations, striping, or construction of bus facilities.	Addresses 2010 and 2030 intersection LOS of E and F.
Citywide-S3	TSP Performance Tracking and Optimization	Tracking	NA	NA	N/A	N/A	Develop TSP performance standards in coordination with King County Metro. Track performance and ensure that TSP is operational and optimized.	Develop shared goals of successful TSP implementation between the City of Bellevue and King County Metro.
Citywide-S4	TSP Before and After Study	Study	NA	NA	N/A	N/A	Complete a before and after study at select intersections to assess the benefits of TSP to transit and the impacts on general purpose traffic. Use person throughput and person delay as performance measures.	Provides a local example of the benefits and impacts on TSP implementation for staff and policy makers.

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PROJECTED OUTCOMES

This section summarizes the results of initial efforts to model the impacts of implementing some of the potential projects considered in this report. The results presented here were generated using Dynameq, a dynamic traffic simulaton application that is capable of assessing traffic patterns under congested conditions. This software models vehicles of multiple modes and captures lane-based effects and explicit signal timing, making it a useful tool for considering how HOV and BAT lane projects would affect transit and automobile travel time along Frequent Transit Network (FTN) corridors. Other project types like queue jumps and TSP cannot be modeled with this application and are therefore not considered in this analysis. It should be noted that at this level of study, the modeling is done on the set of proposed HOV and BAT lane projects as a group (identified as the HOV/BAT Lane scenario; see Table 7 on page 61 for details about all of the projects included). As implementation of the Transit Master Plan progresses, more detailed modeling will be done to assess the benefits of individual projects.

This Dynameq-based assessment suggests that implementation of every HOV and BAT lane project being proposed will improve the average transit travel speed for each category of FTN service by roughly 1 mph (Table 11). Although this may sound like a small improvement, this level of speed increase represents approximately half of the total improvement needed for Frequent Local (FL) routes to achieve the operating speeds assumed in the *Transit Service Vision Report*. Frequent Rapid (FR) routes achieve about one-third of the improvement in average speed required, and Frequent Express (FX) routes about one-quarter.

Table 11 Average transit and general purpose travel speeds by FTN service category before and after HOV and BAT lane implementation.

Scenario	Avg. Speed Along FTN Corridors by Service Type (mph)		
	FX	FR	FL
Transit			
Baseline	18	12	12
HOV/BAT Lane Projects	19	13	13
2030 Targets	22	15	14
General Purpose Traffic			
Baseline	20	13	13
HOV/BAT Lane Projects	21	14	14

Source: Dynameq model D30R1.0.3, for November 14, 2013 Transportation Commission meeting.

Table 12 Transit and general purpose travel time by FTN route before and after HOV and BAT lane implementation.

FTN Route	FTN Type	From / To	Dir.	Dist. (miles)	Baseline Avg. Travel Time (min)	Baseline Avg. Speed (mph)	HOV/BAT Lane Projects Avg. Travel Time (min)	HOV/BAT Lane Projects Avg. Speed (mph)
Transit								
1	FX	Lakemond Interchange to NE 84th St	In	11.41	37.1	18.4	34.9	19.6
			Out	11.15	46.8	14.3	44.1	15.2
2	FX	NE 124th St Interchange to NE 102nd Ave	In	8.03	22.8	21.1	21.1	22.8
			Out	7.64	40.4	11.3	40.7	11.3
3	FX	Kennydale to Bellevue Transit Center	In	8.34	18.6	25.9	18.4	27.2
			Out	8.34	34.0	13.8	30.2	16.6
4	FX	Union Hill/SR520 to NE 84th Ave	In	10.05	24.2	24.9	20.8	28.9
			Out	8.91	20.5	26.1	21.4	25.0
5	FR	NE 124th St Interchange to Bellevue Transit Center	In	9.17	34.8	15.8	37.9	14.5
			Out	9.42	53.4	10.6	53.5	10.6
6	FR	Crossroads to Bellevue Way/NE 4th	In	3.62	23.3	9.3	22.5	9.6
			Out	3.55	20.8	10.2	19.5	10.7
7	FR	Town Square to Factoria Mall	In	12.55	57.3	13.1	55.8	13.5
			Out	11.97	54.5	13.2	48.8	14.6
11	FL	Newcastle Way to Bellevue Transit Center	In	7.94	34.4	13.9	35.6	13.5
			Out	7.99	47.0	10.2	41.8	11.3
12	FL	148th/Old Redmond Rd to Eastgate Park-and-Ride	In	7.20	32.3	13.4	32.5	13.3
			Out	7.20	40.0	10.8	33.0	13.1
13	FL	Bellevue Transit Center to Eastgate Park-and-Ride	In	7.89	39.4	12.0	38.3	12.4
			Out	7.95	36.3	13.1	31.5	15.1
14	FL	Eastgate Park-and-Ride to Lake Wash Blvd	In	7.91	37.2	12.7	32.9	14.4
			Out	7.88	39.6	11.9	38.4	12.3
General Purpose Traffic								
1	FX	Lakemond Interchange to NE 84th St	In	11.41	35.2	19.4	31.4	21.8
			Out	11.15	42.6	15.7	41.8	16.0
2	FX	NE 124th St Interchange to NE 102nd Ave	In	8.03	22.2	21.7	18.3	26.3
			Out	7.64	35.5	12.9	37.8	12.1
3	FX	Kennydale to Bellevue Transit Center	In	8.34	17.7	28.2	17.9	27.9
			Out	8.34	31.7	16.0	23.6	21.5
4	FX	Union Hill/SR520 to NE 84th Ave	In	10.05	22.0	27.4	20.2	29.8
			Out	8.91	18.1	29.5	18.1	29.5
5	FR	NE 124th St Interchange to Bellevue Transit Center	In	9.17	30.4	18.1	34.6	15.9
			Out	9.42	47.2	12.0	51.5	11.0
6	FR	Crossroads to Bellevue Way/NE 4th	In	3.62	21.5	10.1	17.4	12.5
			Out	3.55	20.5	10.4	21.1	10.1
7	FR	Town Square to Factoria Mall	In	12.55	51.5	14.6	51.2	14.7
			Out	11.97	53.1	13.5	46.4	15.5
11	FL	Newcastle Way to Bellevue Transit Center	In	7.94	28.6	16.6	30.2	15.8
			Out	7.99	42.2	11.4	39.7	12.1
12	FL	148th/Old Redmond Rd to Eastgate Park-and-Ride	In	7.20	28.8	15.0	29.4	14.7
			Out	7.20	40.4	10.7	31.6	13.7
13	FL	Bellevue Transit Center to Eastgate Park-and-Ride	In	7.89	39.5	12.0	39.7	11.9
			Out	7.95	37.7	12.7	33.4	14.3
14	FL	Eastgate Park-and-Ride to Lake Wash Blvd	In	7.91	29.4	16.2	30.0	15.8
			Out	7.88	33.5	14.1	32.0	14.8

Source: Dynameq model D30R1.0.3, for November 14, 2013 Transportation Commission meeting.
Notes: The above figures reflect only the length of each route operating either wholly within Bellevue or to the nearest bus stop outside of Bellevue city limits. For example, Route 3 terminates at Kennydale Park-and-Ride for the purposes of this modeling exercise. This is done to minimize the extent to which route segments outside of Bellevue's jurisdiction, which do not benefit from the HOV and BAT lane projects being considered in Bellevue, affect the average speeds and travel times realized as a result of these potential improvements.

That Frequent Express routes would realize less substantial improvements than Frequent Local routes stands to reason given the nature of these routes and the projects reflected in this analyis. Frequent Express routes operate long segments on highways, while all of the HOV and BAT lane projects assessed here are on local streets over which Bellevue has jurisdiction. To achieve additional improvement to Frequent Express travel times, some transit accommodations may be necessary on SR-520, I-90, and I-405, such as increasing HOV lane use requirements from 2+ to 3+ passengers, for example. By contrast, Frequent Local routes operate entirely on local arterial streets, so these running way projects are able to more directly target the range of issues affecting them.

Table 12 indicates that most routes would realize travel time improvements of two minutes or more in one or both travel directions, including Route 1FX, Route 3FX outbound, Route 4FX inbound, Route 5FR inbound, Route 7FR outbound, Route 11FL outbound, Route 12FL outbound, Route 13FL outbound, and Route 14FL inbound. Note that many potential HOV and BAT lane projects apply only to one direction of travel, hence the benefits are not realized equally by inbound and outbound trips. Outbound trips of Routes 7FR, 11FL, and 12FL would realize the largest improvements—roughly six minutes for each—which may suggest that Projects L1-L3, L6, L23, L24, and L26 are particularly effective in addressing the speed and reliability issues affecting transit on these corridors. However, because all projects are modeled simultaneously, as noted above, it is not clear from this analysis which of these projects has the greatest impact.

Table 13 reflects the systemwide impacts of implementing every potential HOV and BAT lane project currently being considered. Although the number of signalized intersections with an LOS of 'B' decreases and those rated 'C' increase, intersections with an LOS of 'D', 'E', and 'F' all decline, resulting in an overall improvement in citywide vehicle delay of 2 seconds.

Stated simply, time is money. In this case, this addage applies both to the value of transit users' time spent riding the bus and to the cost for transit providers to operate the service. For riders, time spent traveling could be better used to achieve more productive ends. For transit operators, minutes lost to traffic congestion can mean the difference between requiring three buses or four to operate the same route at a given frequency. The improvements in speed and travel time realized by implementing HOV and BAT lane projects can therefore be monetized to estimate the aggregate value of the time saved. As shown in Table 14, these improvements in travel time translate to societal savings of between $2.5–$4.2 million annually during the PM peak alone, depending on the rate at which riders' time spent traveling is valued relative to the region's mean hourly wage. Additional savings would also be realized during other times of day, particularly in the AM peak, but because travel demand model outputs reflect PM peak conditions, no assumptions are made here about the savings realized during other periods.

For transit operators, the calculation is somewhat more complicated for two reasons. First, the ability to remove a bus from a schedule while maintaining the same headways depends on multiple factors that

Table 13 2030 PM peak hour signalized intersection LOS before and after HOV and BAT lane implementation.

		2030 Reduced Funding w/o HOV/BAT Projects	2030 Growing Resources w/o HOV/BAT Projects	2030 Growing Resources with HOV/BAT Projects
Level of Service (LOS)	A	8	8	8
	B	27	31	28
	C	49	49	54
	D	50	53	52
	E	33	30	33
	F	28	24	20
Citywide LOS		D	D	D
Citywide Avgerage Vehicle Delay (sec)		51.8	49.9	48.3
Citywide Total Delay Hours		8,141	7,665	7,350

Source: Dynameq model D30R1.0.3, for November 14, 2013 Transportation Commission meeting.

are not reflected by this analysis. Second, the travel demand models used here to assess transit travel speed assume the service frequencies defined by the 2030 Growing Resources scenario as model inputs. However, it will only be possible to operate these frequencies within the budget defined by the *Funding Scenarios Report* if transit travel speeds meet or exceed the speeds assumed for each service type in the *Service Vision Report*. Nevertheless, it is still instructive to estimate the operating cost savings attributable to implementing these HOV and BAT lane projects, even if these savings are reinvested in prodiving service at the frequencies being proposed. To that end, Table 15 indicates that transit service providers would save between about $510,000–$780,000 annually based on the travel time savings achieved in the PM peak period alone, depending on the assumed operating cost per hour. See Appendix 9 on page A159 for additional information about how these figures for the value of travel time savings were calculated.

Given that only a portion of the proposed transit priority projects can be modeled (i.e. HOV and BAT lanes), it can be expected that implementation of the entire package of improvements would result in greater travel time savings than are reflected here. This is because HOV and BAT lanes are often paired with other improvements, such as queue jump lanes and/or TSP to help transit pass through problematic intersections more efficiently. This assessment therefore only presents part of the picture—the degree of benefit achieved by HOV and BAT lanes in isolation of any other related transit priority projects—so the results presented in Table 11 should not be understood to mean that the City will be unable to achieve the target travel speeds assumed in the *Transit Service Vision Report*. The other types of priority projects being considered will also contribute to transit travel speed improvement, but those projects' benefits will need to be assessed using more detailed applications.

Table 14 Value of Annualized PM Peak Travel Time Savings for Transit Users from Proposed HOV/BAT Projects.

FTN Service Type	Annualized PM Peak Pass Hours Saved	Value of Pass Hours Saved		
		Low	Medium	High
FX	148,592	$1,439,564	$2,056,519	$2,344,432
FR	17,414	$168,711	$241,016	$274,759
FL	99,779	$966,655	$1,380,936	$1,574,267
Annual Total:		**$2,574,930**	**$3,678,471**	**$4,193,457**

Notes: Value of travel time savings based on the May 2012 mean hourly wage for Seattle-Everett-Bellevue of $27.68, obtained from the US Department of Labor Bureau of Labor Statistics. Low, Medium, and High estimates are based on the percentage of that wage considered when valuing transit passenger time, reflecting 35%, 50%, and 57%, respectively. Higher rates of time valuation relative to the mean hourly wage correspond to reduced perceived convenience due to lower intersection LOS (e.g. High corresponds to LOS 'D') and/or standing rather than sitting. See Appendix 9 on page A159 for details.

Table 15 Value of Annualized PM Peak Travel Time Savings to Transit Operators from Proposed HOV/BAT Projects.

FTN Service Type	Annualized PM Peak Revenue Hours Saved	Value of Revenue Hours Saved	
		Low[1]	High[2]
FX	2,352	$209,285	$319,054
FR	521	$46,399	$70,736
FL	2,869	$255,322	$389,238
Annual Total:		**$511,007**	**$779,027**

1. Low estimate based on King County Metro's 2010 marginal hourly operating cost of $89.
2. High estimate based on King County Metro's 2012 'Transit Operating Cost per Vehicle Hour', as reported on the agency's website at: http://metro.kingcounty.gov/am/reports/annual-measures/financial.html#cost-per-hour. See Appendix 9 on page A159 for details.

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APPENDICES

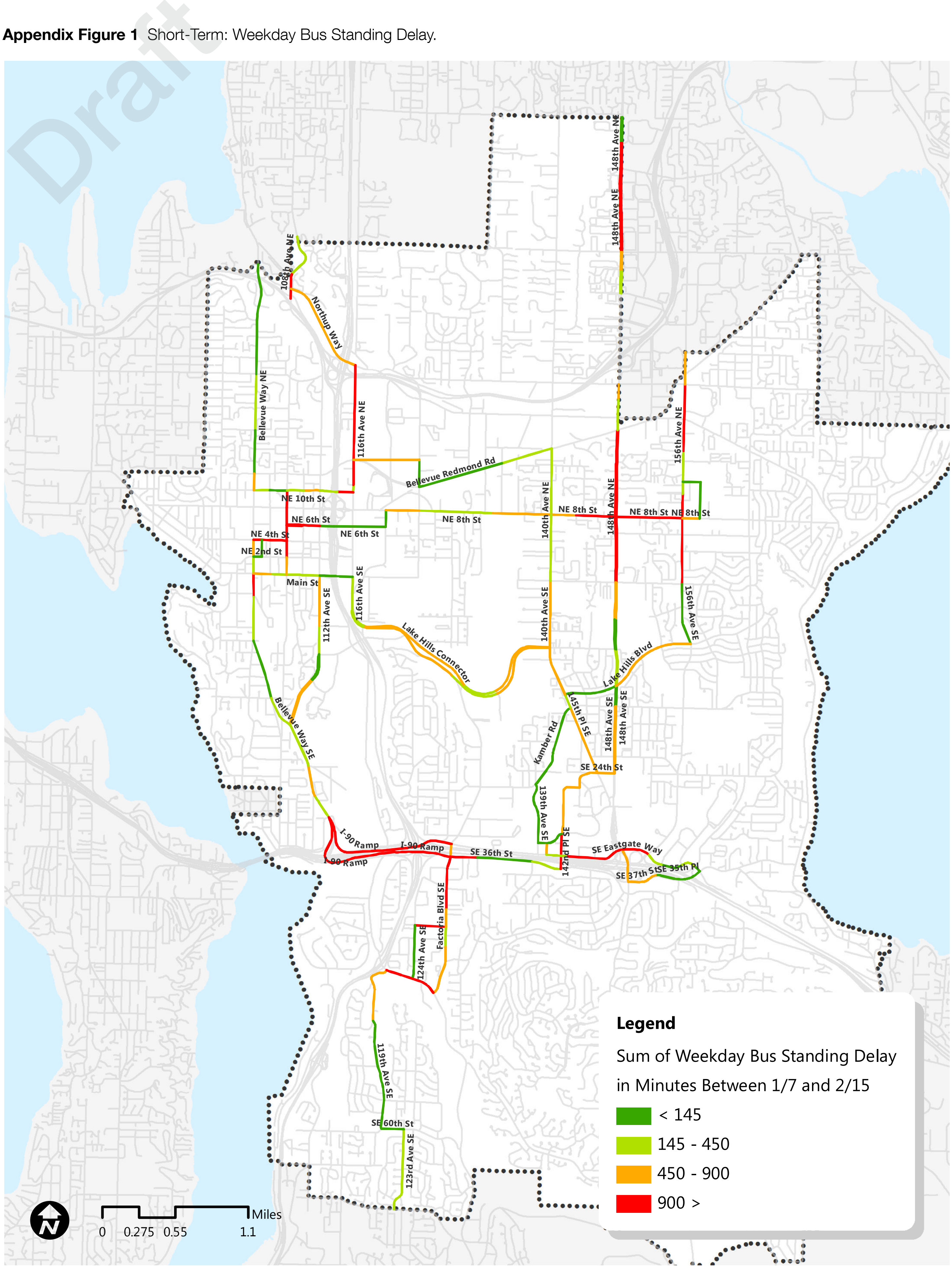
APPENDIX 1: ISSUE IDENTIFICATION MEASURE MAPS

The maps on the following pages present all of the measures used in the issue identification methodology described on pages 27-49. This includes the following measures:

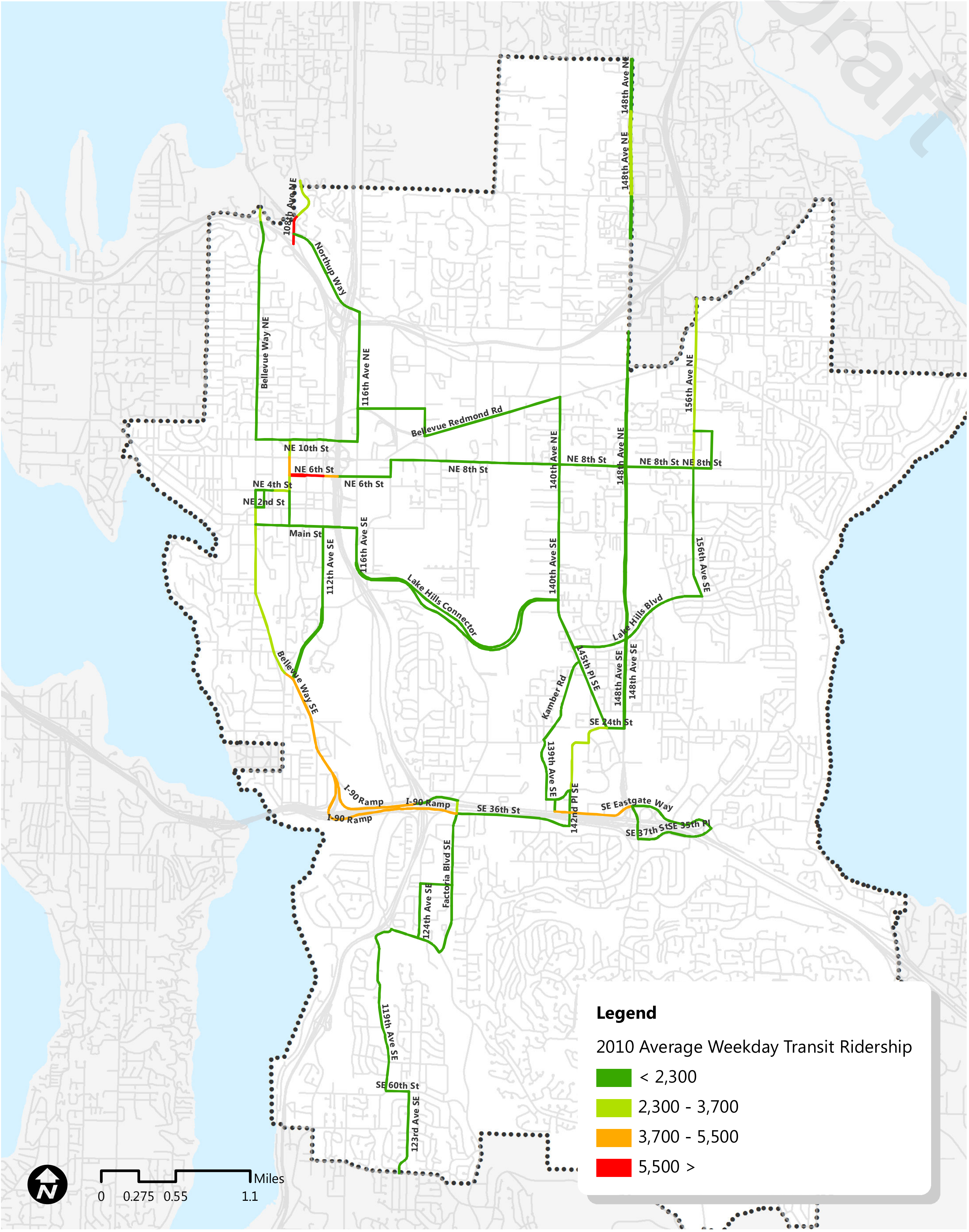
- Short Term Measures:
  - Weekday bus standing delay (in minutes)
  - 2010 average weekday transit ridership
  - 2013 weekday bus volumes
  - Coach operator survey comments

- Long-Term Measures:
  - 2030 projected average weekday transit ridership
  - 2030 planned weekday bus volumes
  - 2030 projected sum of average weekday PM peak approach delay (in seconds)
  - 2030 projected sum of average weekday PM peak approach queue length (in feet)
  - 2030 projected intersection level-of-service (LOS)

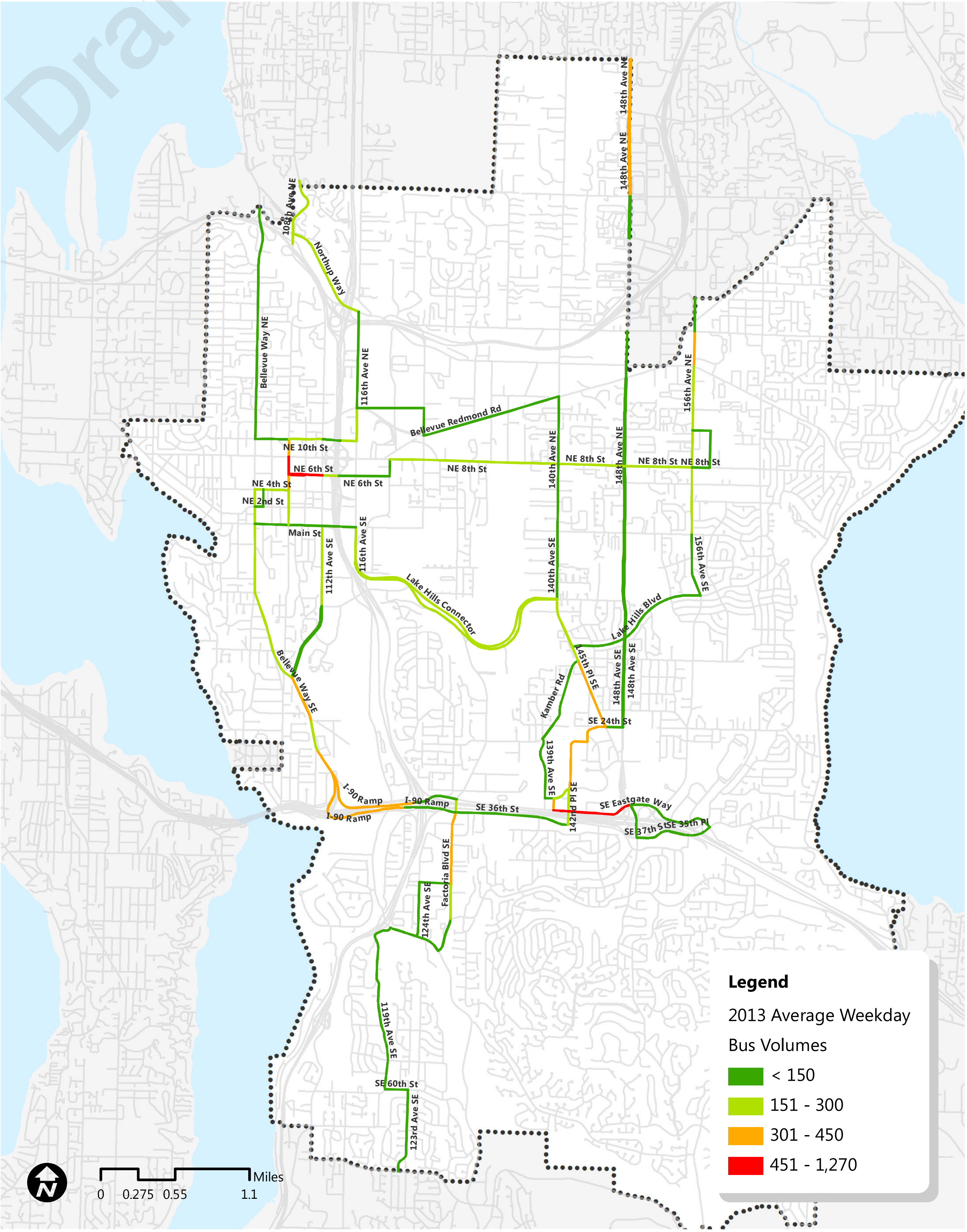
Appendix Figure 1 Short-Term: Weekday Bus Standing Delay.



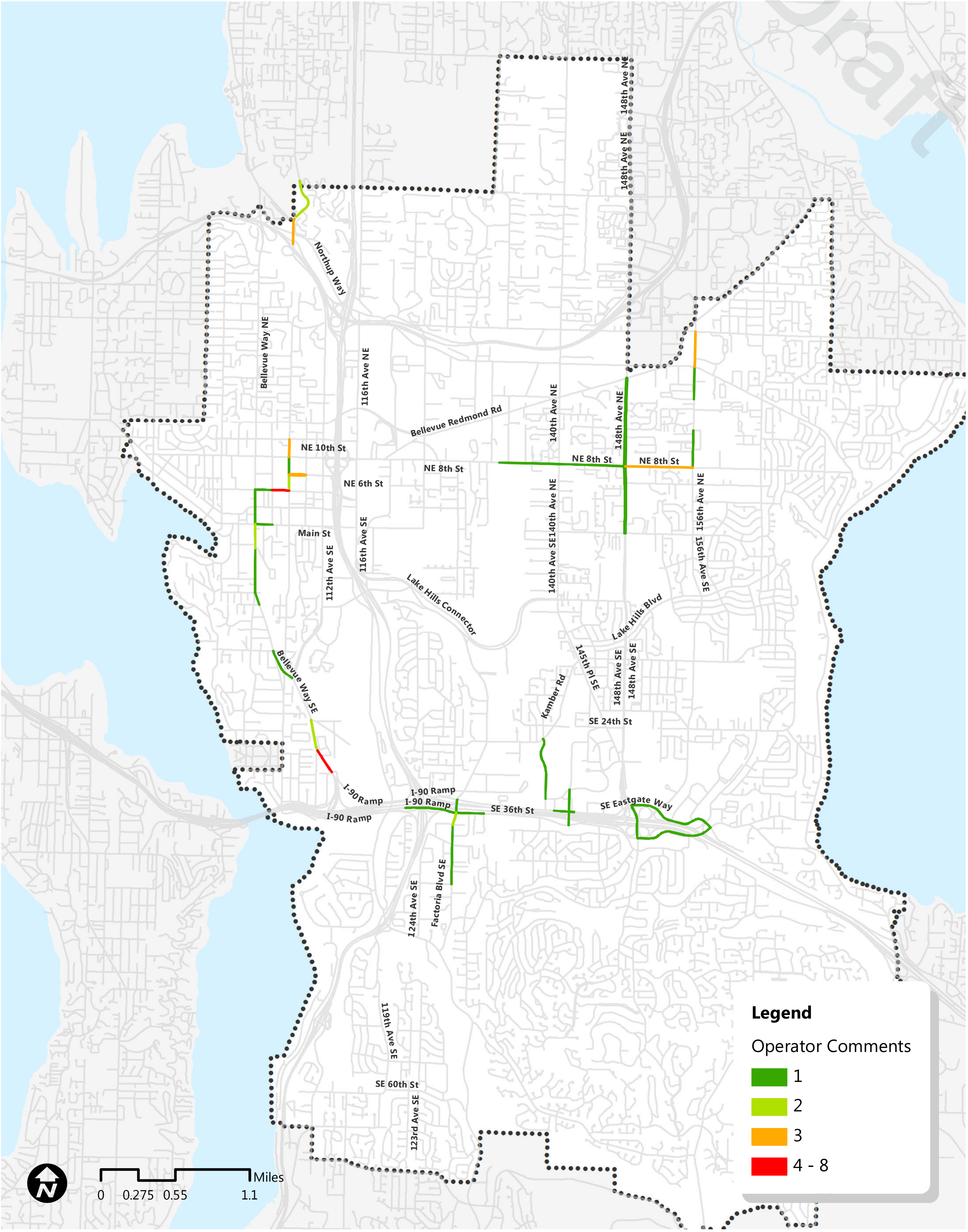
Appendix Figure 2 Short-Term: 2010 Average Weekday Transit Ridership.



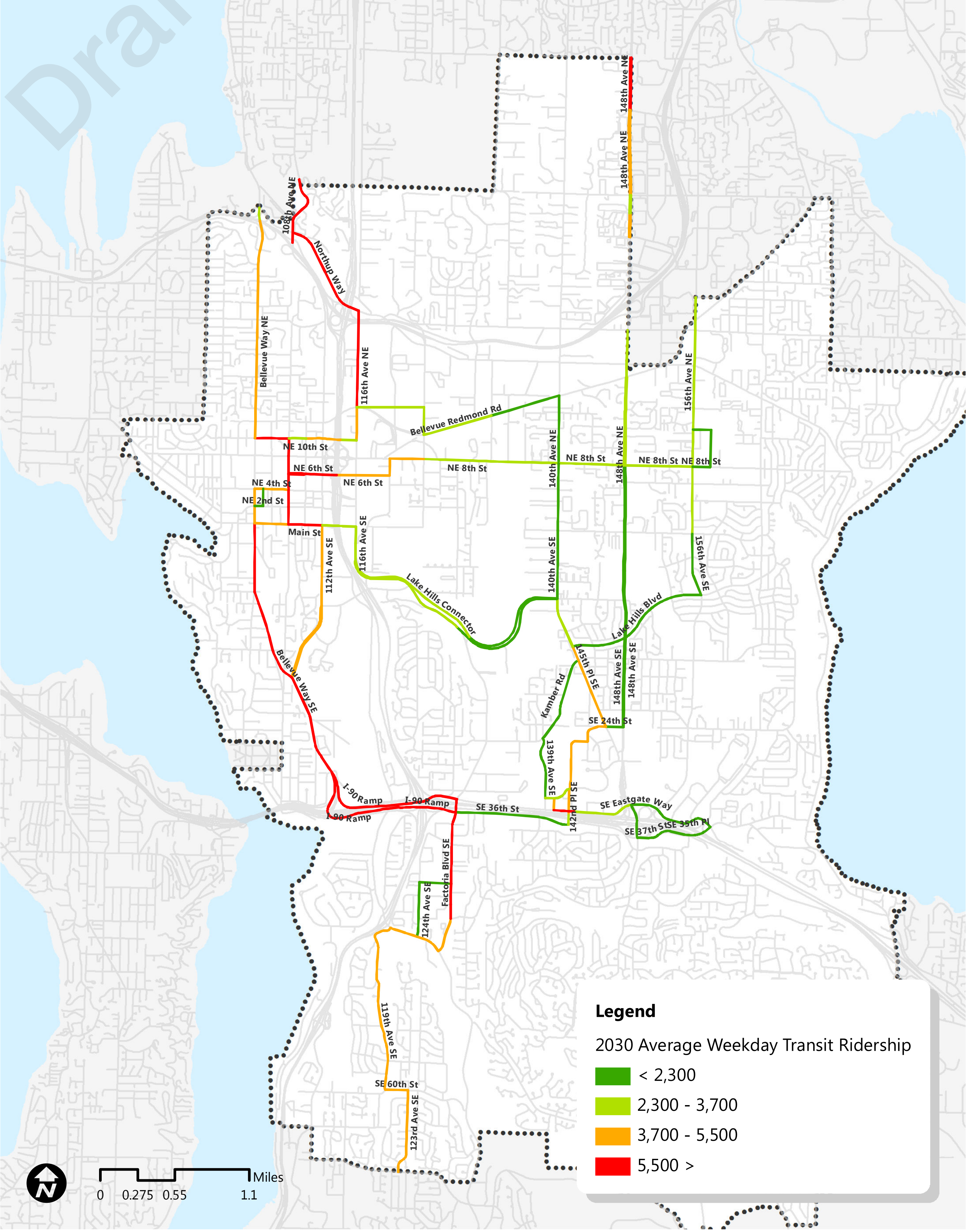
Appendix Figure 3 Short-Term: 2013 Weekday Bus Volumes.



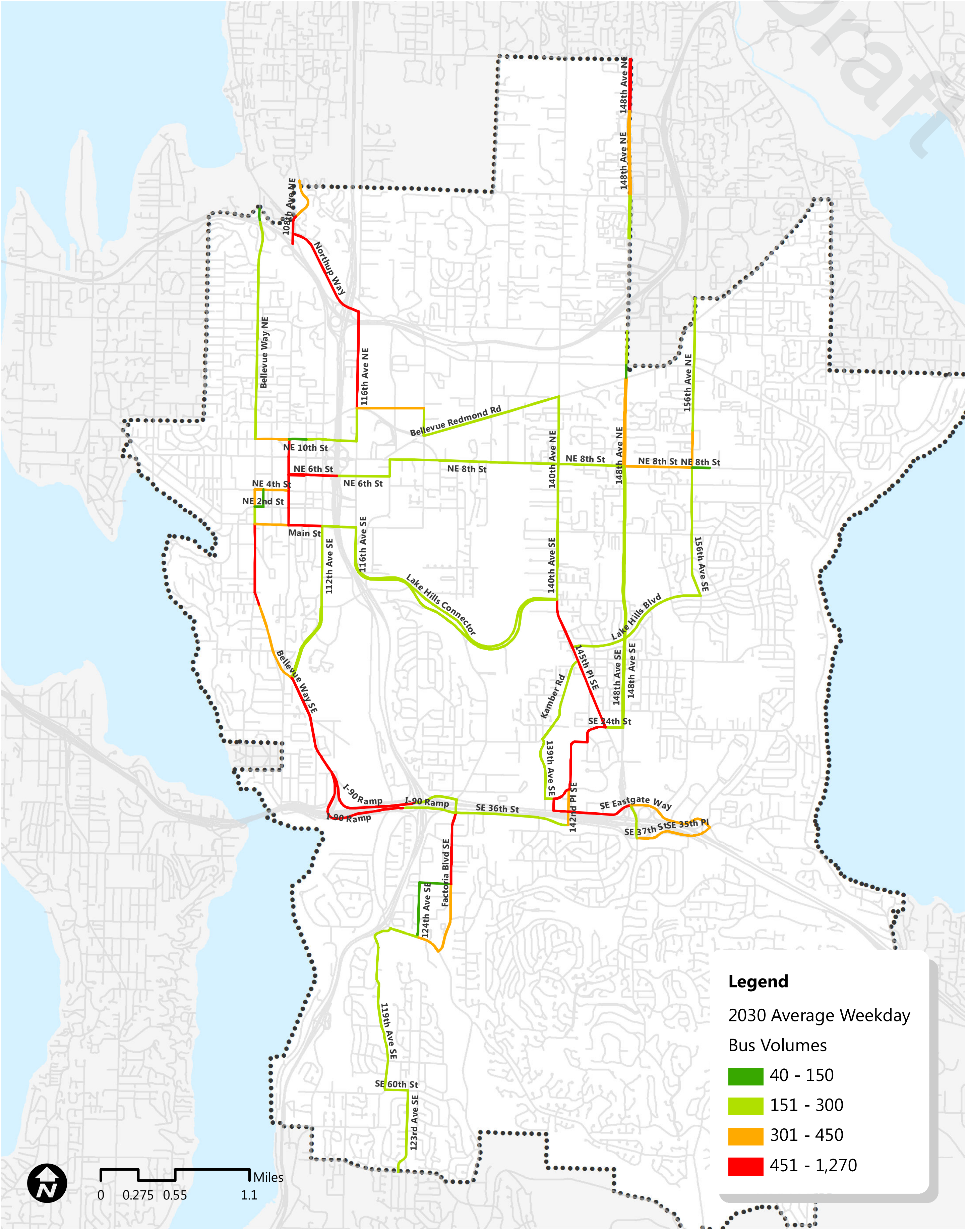
Appendix Figure 4 Short-Term: Operator Survey Comments.



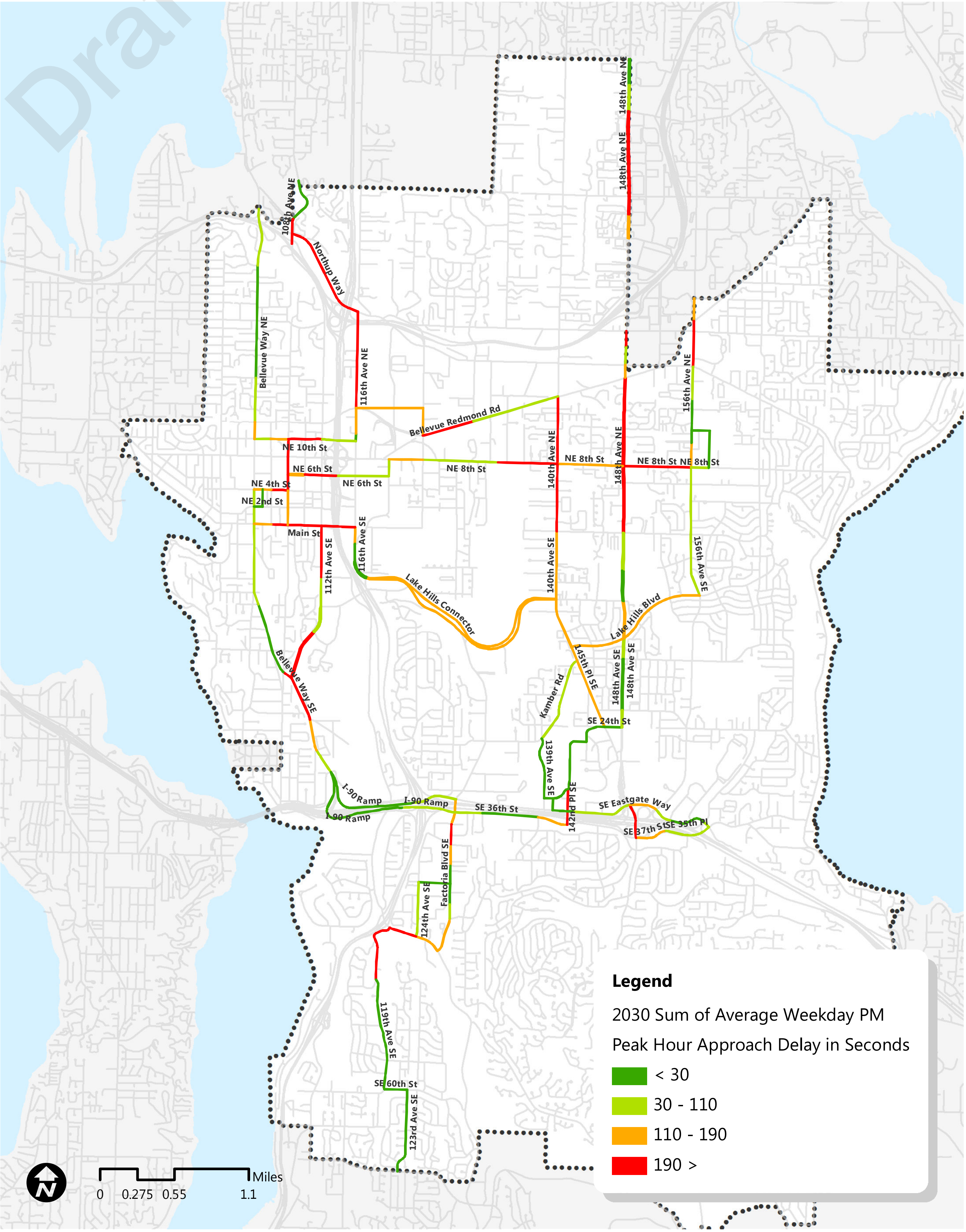
Appendix Figure 5 Long-Term: 2030 Average Weekday Transit Ridership.



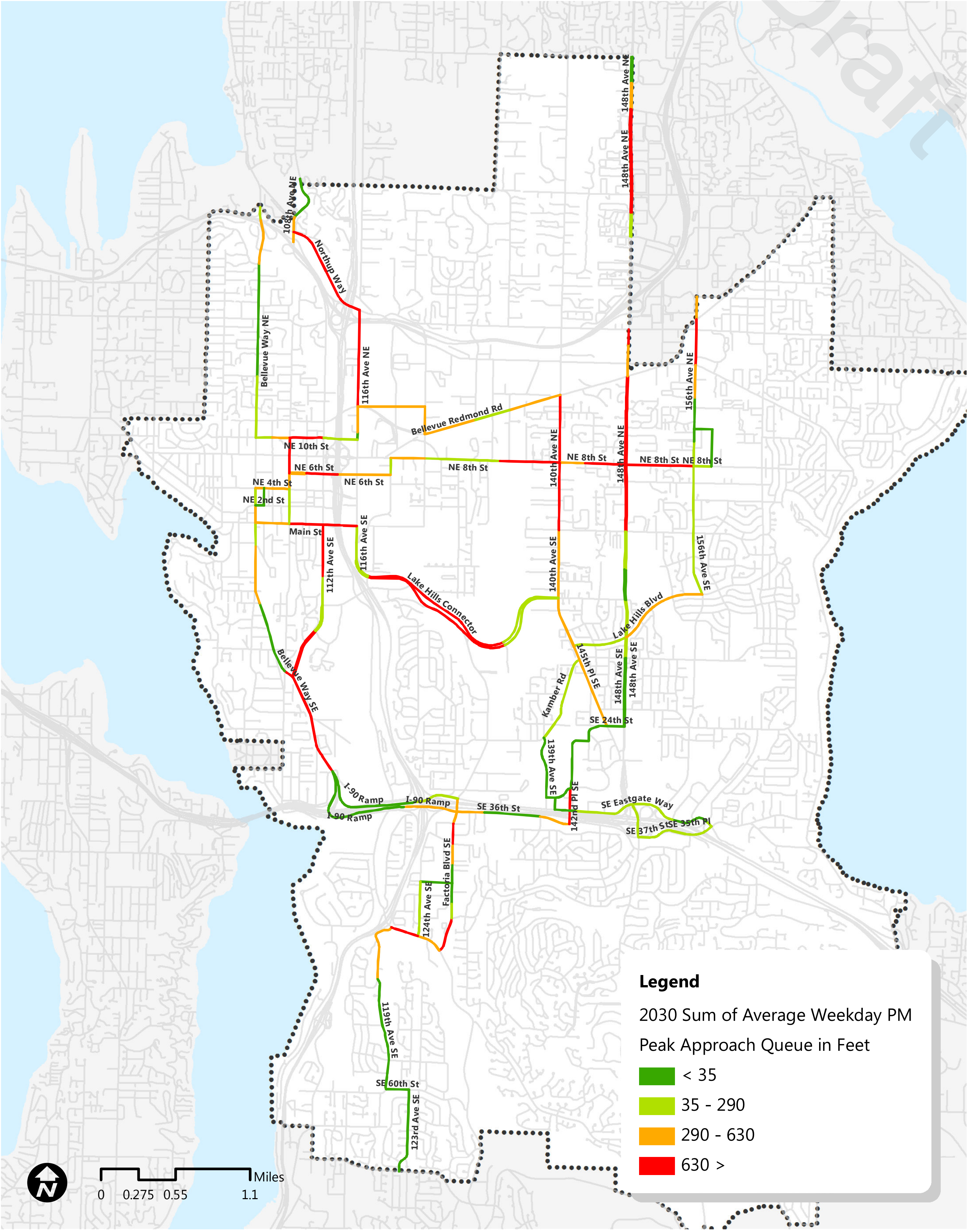
Appendix Figure 6 Long-Term: 2030 Weekday Bus Volumes.



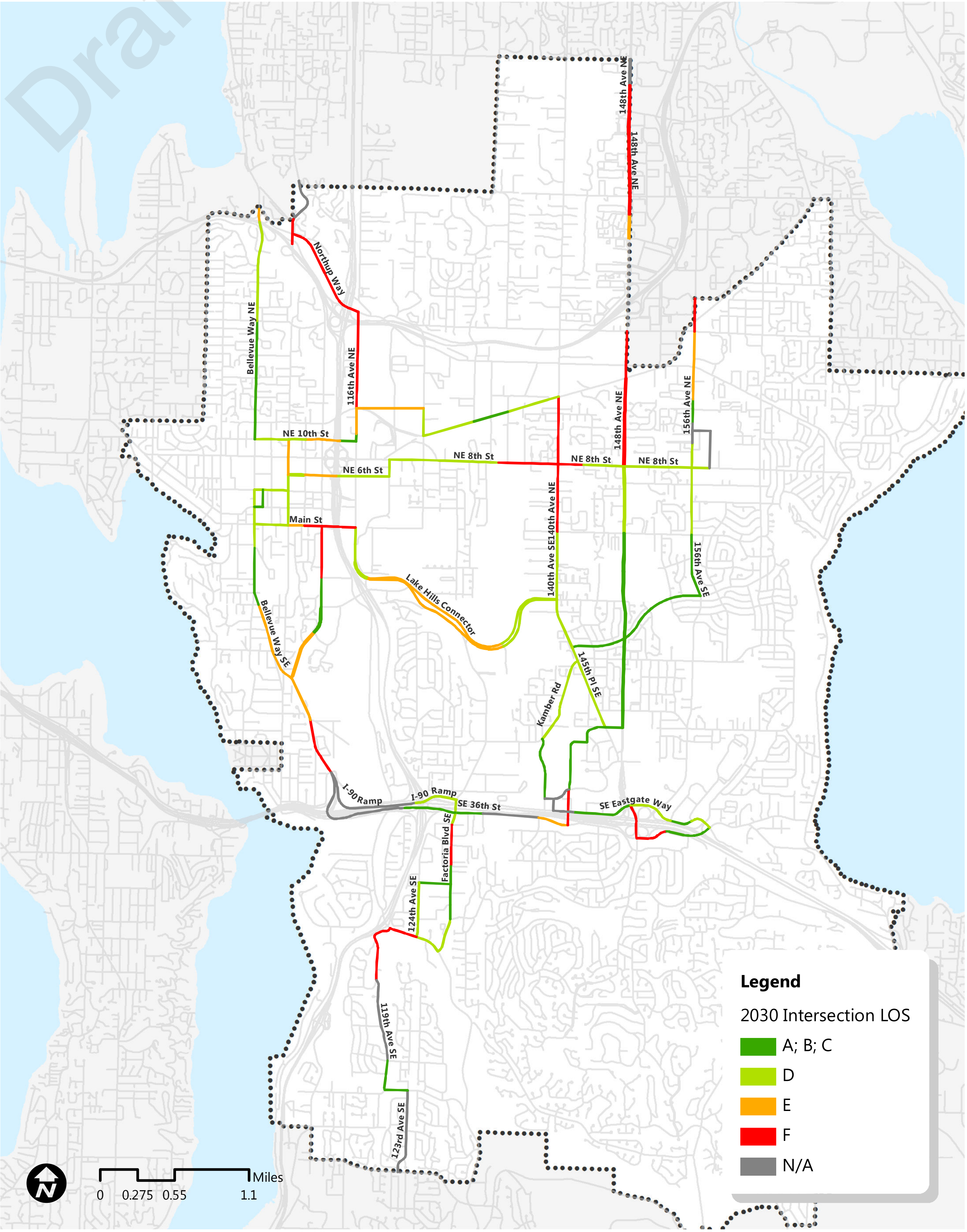
Appendix Figure 7 Long-Term: 2030 Average Weekday PM Peak Approach Delay.



Appendix Figure 8 Long-Term: 2030 Average Weekday PM Peak Approach Queue Length.



Appendix Figure 9 Long-Term: 2030 Intersection Level-of-Service (LOS).



APPENDIX 2: DATA SOURCES CONSIDERED BUT NOT USED

After additional review several data sources which were presented at the project kickoff meeting or discussed with staff will not be used. These data sources, while related to transit speed and reliability, had various issues which made them poorly fitted to the analysis, unavailable, tedious to use, or simply less useful than other similar data sources.

On-Time Performance

On-time performance is measured as the percent of trips which depart their respective time points less than two minutes early or five minutes late. For example, RapidRide B Line on-time performance is measured as the percent of trips within +/- three minute of that trip's scheduled headway. Multiple issues were identified with this data source:

1. The data is coarse, with data available only for an entire route or at some time points. Only some terminal time points can be used due to known issues with data when buses layover.
2. Delays from insufficient recovery time at route terminals can contribute to poor on-time performance.
3. On-time performance is calculated by comparing actual departure times against scheduled departure time. By adding time to a schedule, Metro planners can improve on-time performance without actually improving the speed and reliability of routes.
4. Delays occurring outside the city, especially on highways, are not directly relevant to this analysis, but their impact cannot be removed from the data.

Because of these issues and the more detailed data provided by bus GPS data, on-time performance is not used at this time.

Street Congestion

Congestion on road segments can be measured as the ratio of vehicles to roadway capacity. The closer vehicle volumes are to the capacity of the roadway, the more delay a road segment experiences. This measure was originally identified because it could help identify road segments where buses might experience delay when reentering traffic after stopping at an out-of-lane bus stop. However, because very few locations in Bellevue require buses to merge back into traffic and intersection delay is available from the more detailed Dynameq model, it was determined that this data was duplicative.

Travel Time Reliability

Reliability of travel time is highly important for transit systems. When transit travel times are unreliable the service operator must schedule extra time at the end of each trip to ensure the bus can depart on time for its next trip. This additional time, called recovery time, is necessary to operate a reliable transit system but also results in "wasted" service hours because buses are not carrying passengers during this time.

The reliability of travel time can be measured as the variation of travel time throughout the day from one time point to another. The lower the variability, the more reliable a time point interval is. While presented at the project kickoff meeting as a very important data point, further discussion with King County Metro revealed that Metro's database structure is set up in such a way that this measure could not be calculated. Alternative approaches to use this data were reviewed because of the value of this data but no good alternative was ultimately identified.

Scheduled Speed

The average scheduled travel speed between two time points can be calculated using the scheduled travel time and distance between the time points. The first reason this data was not used is due to the lack of detail with regards to time point intervals, the route between time points, which can be several miles long. The second, more practical reason, is because King County Metro doesn't have a shapefile which time point interval data can be joined to.

Mode Share

Mode share is a ratio that describes the relative use of a street by different modes of transportation such single occupant vehicles (SOVs), high occupancy vehicles (HOVs), buses, pedestrians, and bicyclists. Whereas low-density, auto-oriented areas have a high SOV mode share, areas like Downtown have a higher non-SOV mode share. The mode share of key transit corridors will be used to identify and prioritize the locations for transit priority treatments, but this data is not available for all areas served by the Frequent Transit Network (FTN).

APPENDIX 3: CORRIDOR THROUGHPUT ANALYSIS

Following the development of composite scores for all FTN analysis segments (see pages 31 through 53), twenty corridor segments of particular interest were identified for further consideration. As reflected in the tables and charts on the following pages, composite scores and their constituent parts were compiled for each corridor, and the BKR travel demand model (MP30R6.2) was leveraged to compare vehicle throughput to person throughput, consistent with guidance from the Measures of Effectiveness Report.

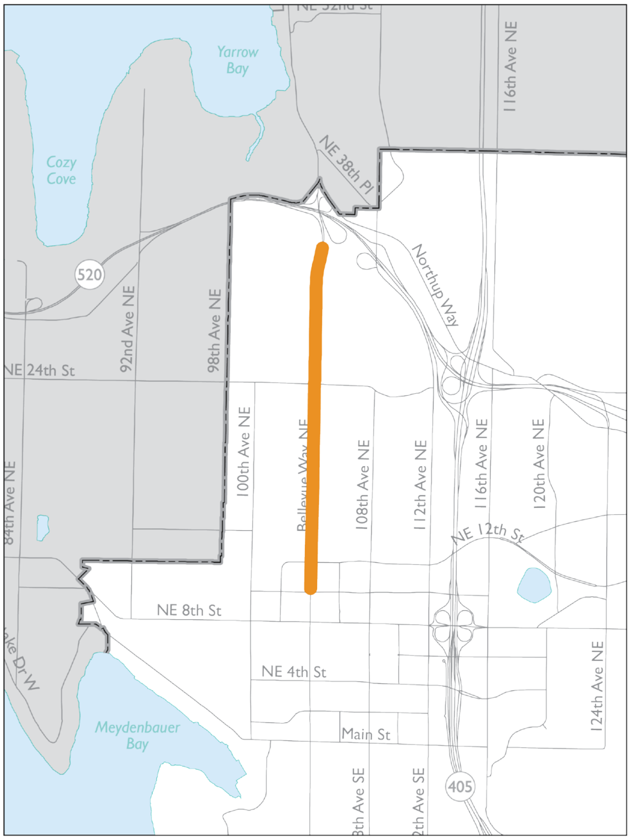
The BKR model produces Peak-Period Person Throughput (PPPT) by mode for the corridor segments that comprise the Frequent Transit Network (FTN). This takes into account average vehicle occupancy for personal vehicles and buses, thereby facilitating a comparison of vehicle and person throughput for both transit and personal vehicles along FTN corridors. For example, on Bellevue Way NE between NE 10th St and NE 32nd Pl, the 2030 projected PPPT on transit is 36 percent of all person trips, yet transit represents only 0.8 percent of all vehicle trips along this corridor. Clearly, bus service is projected to make efficient use of the roadway capacity here.

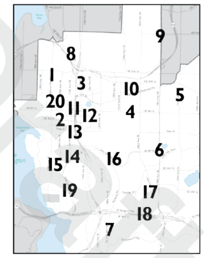
Whereas the composite scores indicate how great a particular corridor's need is for transit speed and reliability investments relative to other FTN corridors, the throughput analysis provides insight into the relative share of total person trips served by transit and private vehicles. The composite scores help to prioritize corridors for potential projects based solely on characteristics that directly affect transit operations, while throughput by mode helps to assess how reasonable it might be to allocate limited right-of-way to one mode or another based on their relative ability to move people. The larger the share of person trips served by transit along a corridor, the more appropriate it may be to consider transit priority projects.

Appendix Table 1 Legend of Long-Term Weighted Score color-coded tables.

LEGEND	Weighted Scores[2] Long-Term			
Composite Score	5-11	12-15	16-18	19-24
Weekday Ridership	0-2	4	6	8
Weekday Bus Volumes	1	2	3	4
Approach Delay (sec)	1	2	3	4
Approach Queue Length (ft)	1	2	3	4
Intersection LOS	0-1	2	3	4

2. Derived from Issue Identification Methodology; see the Capital Element Background Report for details.





1 Bellevue Way NE btw NE 10th St and NE 32nd Pl

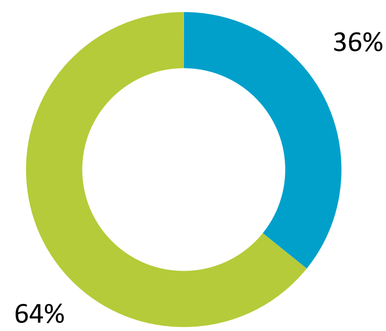
Buses[1]	16
Total Vehicles[1]	2,109
Percent Transit[1]	0.8%
Person Trips – Transit[1]	1,583
Person Trips – Total[1]	4,420
Percent Transit[1]	36%

[1] Based on City of Bellevue 2030 PM Peak Hour BKR Model (MP30R6.2).

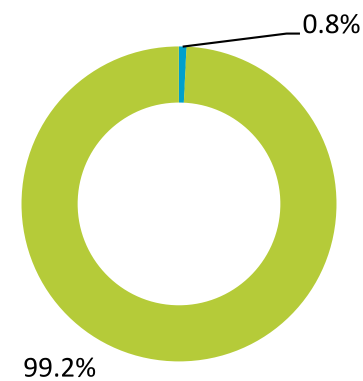
	Weighted Scores[2] Long-Term
Composite Score	11 - 15 (13.0)
Weekday Ridership	6
Weekday Bus Volumes	2
Approach Delay (sec)	1 - 3 (1.8)
Approach Queue Length (ft)	1 - 3 (1.8)
Intersection LOS	1 - 2 (1.4)

1. Based on the City of Bellevue 2030 PM Peak Hour BKR Model (MP30R6.2).
2. Derived from Issue Identification Methodology; see the Capital Element Background Report for details.

Projected Travel Demand[1]
2030 PM Peak



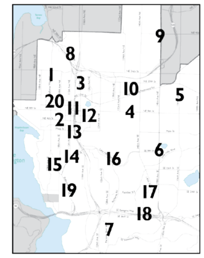
Person Throughput



Vehicle Throughput

Bus Auto

2 108th Ave NE btw Main St and NE 10th St



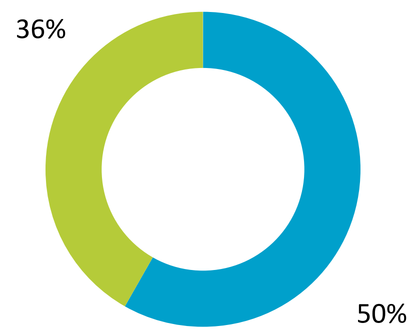
Buses[1]	62
Total Vehicles[1]	2,022
Percent Transit[1]	3.0%
Person Trips – Transit[1]	3,966
Person Trips – Total[1]	6,678
Percent Transit[1]	59%

[1] Based on City of Bellevue 2030 PM Peak Hour BKR Model (MP30R6.2).

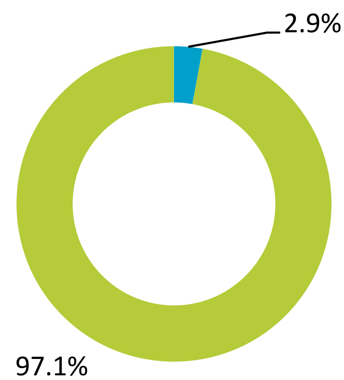
	Weighted Scores[2] Long-Term
Composite Score	19 - 23 (21.0)
Weekday Ridership	8
Weekday Bus Volumes	4
Approach Delay (sec)	3 - 4 (3.6)
Approach Queue Length (ft)	2 - 4 (3.0)
Intersection LOS	2 - 3 (2.4)

1. Based on the City of Bellevue 2030 PM Peak Hour BKR Model (MP30R6.2).
2. Derived from Issue Identification Methodology; see the Capital Element Background Report for details.

Projected Travel Demand[1]
2030 PM Peak



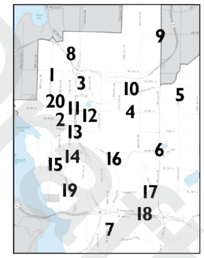
Person Throughput



Vehicle Throughput

Bus Auto

3 116th Ave NE btw NE 12th St and Northup Way



Buses[1]	23
Total Vehicles[1]	1,518
Percent Transit[1]	1.5%

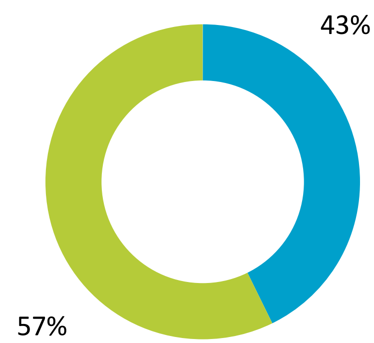
Person Trips – Transit[1]	1,480
Person Trips – Total[1]	3,465
Percent Transit[1]	43%

[1] Based on City of Bellevue 2030 PM Peak Hour BKR Model (MP30R6.2).

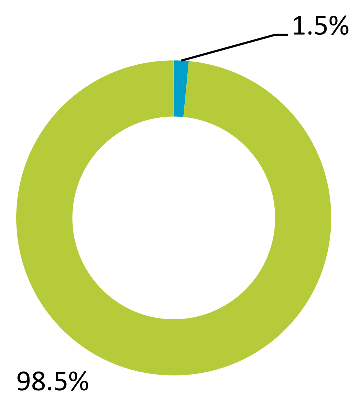
	Weighted Scores[2] Long-Term
Composite Score	24
Weekday Ridership	8
Weekday Bus Volumes	4
Approach Delay (sec)	4
Approach Queue Length (ft)	4
Intersection LOS	4

1. Based on the City of Bellevue 2030 PM Peak Hour BKR Model (MP30R6.2).
2. Derived from Issue Identification Methodology; see the Capital Element Background Report for details.

Projected Travel Demand[1]
2030 PM Peak

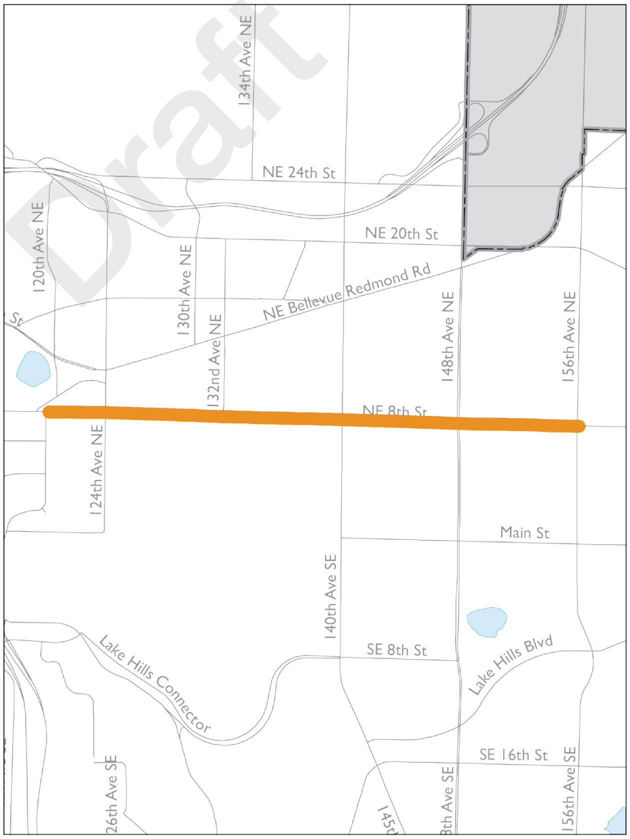


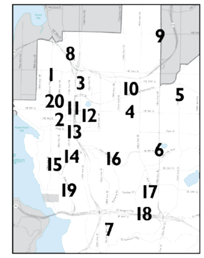
Person Throughput



Vehicle Throughput

Bus Auto





4 NE 8th St btw 120th Ave NE and 156th Ave NE

Buses[1]	17
Total Vehicles[1]	2,703
Percent Transit[1]	0.6%

Person Trips – Transit[1]	871
Person Trips – Total[1]	4,606
Percent Transit[1]	19%

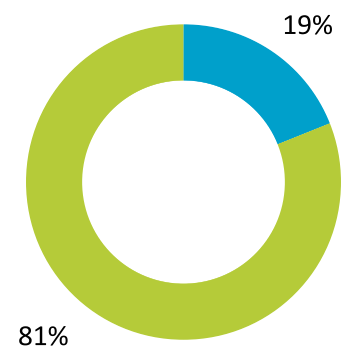
[1] Based on City of Bellevue 2030 PM Peak Hour BKR Model (MP30R6.2).

Weighted Scores[2]
Long-Term

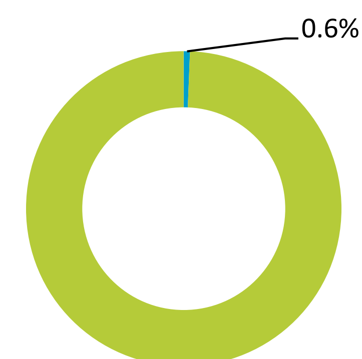
Composite Score	12 - 18 (15.8)
Weekday Ridership	4 - 6 (4.3)
Weekday Bus Volumes	2 - 3 (2.2)
Approach Delay (sec)	2 - 4 (3.3)
Approach Queue Length (ft)	2 - 4 (3.3)
Intersection LOS	2 - 4 (2.7)

1. Based on the City of Bellevue 2030 PM Peak Hour BKR Model (MP30R6.2).
2. Derived from Issue Identification Methodology; see the Capital Element Background Report for details.

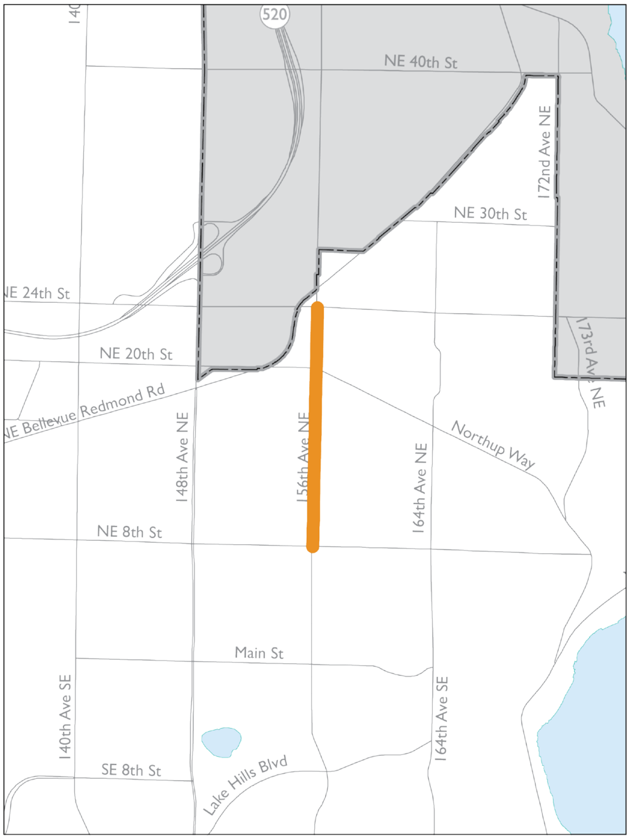
Projected Travel Demand[1]
2030 PM Peak



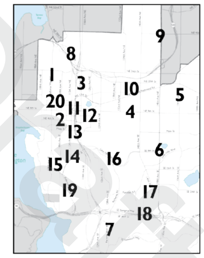
Person Throughput



Vehicle Throughput



5 156th Ave NE btw NE 8th St and Bel-Red Rd



Buses[1]	22
Total Vehicles[1]	2,799
Percent Transit[1]	0.8%

Person Trips – Transit[1]	903
Person Trips – Total[1]	4,547
Percent Transit[1]	20%

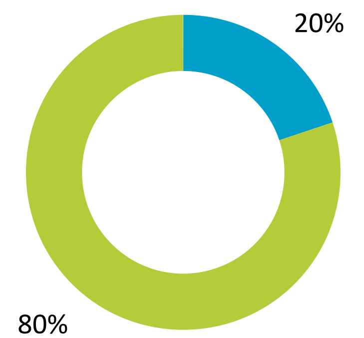
[1] Based on City of Bellevue 2030 PM Peak Hour BKR Model (MP30R6.2).

	Weighted Scores[2] Long-Term
Composite Score	8 - 17 (11.4)
Weekday Ridership	4
Weekday Bus Volumes	2 - 3 (2.3)
Approach Delay (sec)	1 - 4 (1.9)
Approach Queue Length (ft)	1 - 4 (1.9)
Intersection LOS	0 - 3 (1.4)

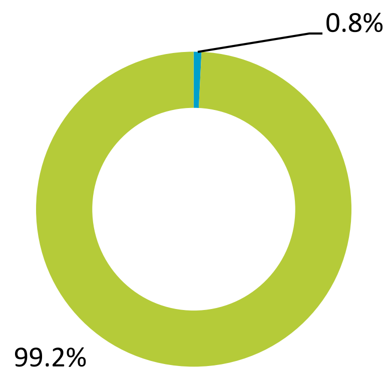
1. Based on the City of Bellevue 2030 PM Peak Hour BKR Model (MP30R6.2).
2. Derived from Issue Identification Methodology; see the Capital Element Background Report for details.

Projected Travel Demand[1]

2030 PM Peak

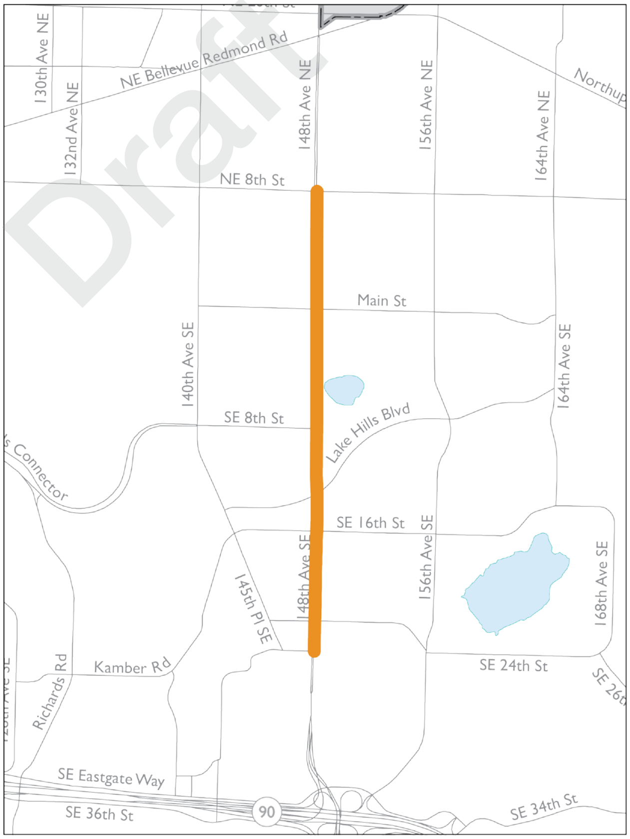


Person Throughput



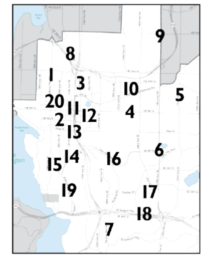
Vehicle Throughput

Bus Auto



6

148th Ave NE btw NE 8th St and SE 24th St



Buses[1]	16
Total Vehicles[1]	3,281
Percent Transit[1]	0.5%

Person Trips – Transit[1]	432
Person Trips – Total[1]	4,527
Percent Transit[1]	10%

[1] Based on City of Bellevue 2030 PM Peak Hour BKR Model (MP30R6.2).

Weighted Scores[2]

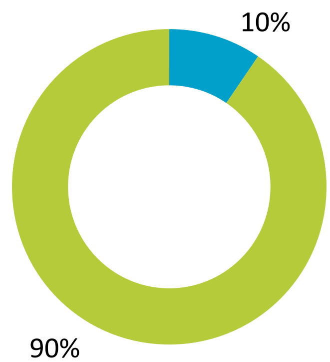
Long-Term

Composite Score	6 - 14 (9.1)
Weekday Ridership	2
Weekday Bus Volumes	2
Approach Delay (sec)	1 - 4 (2.3)
Approach Queue Length (ft)	1 - 4 (1.9)
Intersection LOS	0 - 2 (1.0)

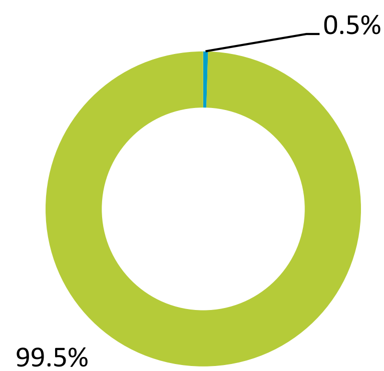
1. Based on the City of Bellevue 2030 PM Peak Hour BKR Model (MP30R6.2).
2. Derived from Issue Identification Methodology; see the Capital Element Background Report for details.

Projected Travel Demand[1]

2030 PM Peak

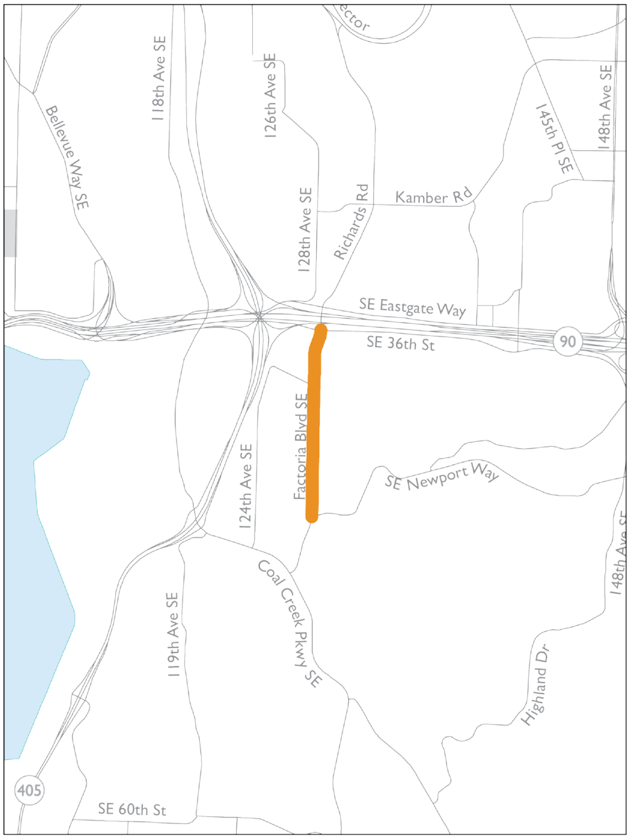


Person Throughput

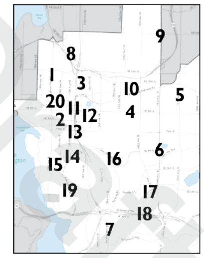


Vehicle Throughput

Bus Auto



7 Factoria Blvd SE btw SE 36th St and SE Newport Way



Buses[1]	34
Total Vehicles[1]	3,597
Percent Transit[1]	0.9%
Person Trips – Transit[1]	1,515
Person Trips – Total[1]	6,080
Percent Transit[1]	25%

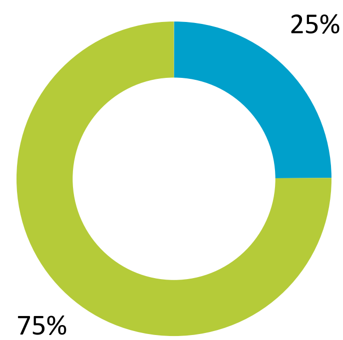
[1] Based on City of Bellevue 2030 PM Peak Hour BKR Model (MP30R6.2).

	Weighted Scores[2] Long-Term
Composite Score	13 - 24 (16.8)
Weekday Ridership	8
Weekday Bus Volumes	3 - 4 (3.6)
Approach Delay (sec)	1 - 4 (2.0)
Approach Queue Length (ft)	1 - 4 (2.0)
Intersection LOS	0 - 4 (1.2)

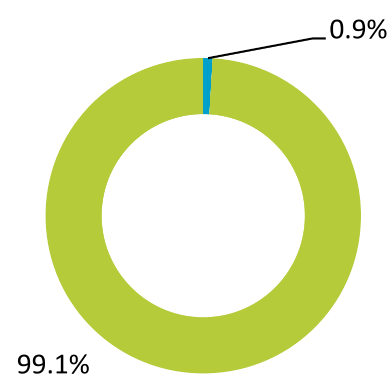
1. Based on the City of Bellevue 2030 PM Peak Hour BKR Model (MP30R6.2).
2. Derived from Issue Identification Methodology; see the Capital Element Background Report for details.

Projected Travel Demand[1]

2030 PM Peak

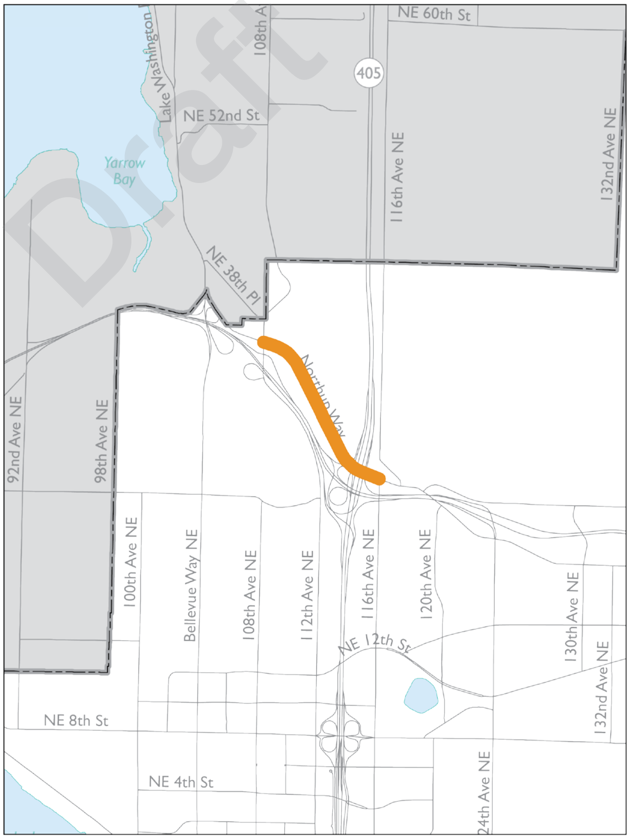


Person Throughput

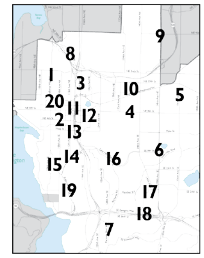


Vehicle Throughput

Bus Auto



8 Northup Way btw 108th Ave NE and 116th Ave NE



Buses[1]	30
Total Vehicles[1]	1,460
Percent Transit[1]	2.1%

Person Trips – Transit[1]	1,850
Person Trips – Total[1]	3,620
Percent Transit[1]	51%

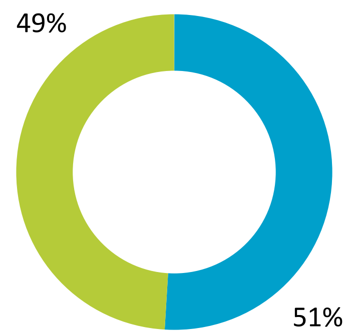
[1] Based on City of Bellevue 2030 PM Peak Hour BKR Model (MP30R6.2).

	Weighted Scores[2] Long-Term
Composite Score	24
Weekday Ridership	8
Weekday Bus Volumes	4
Approach Delay (sec)	4
Approach Queue Length (ft)	4
Intersection LOS	4

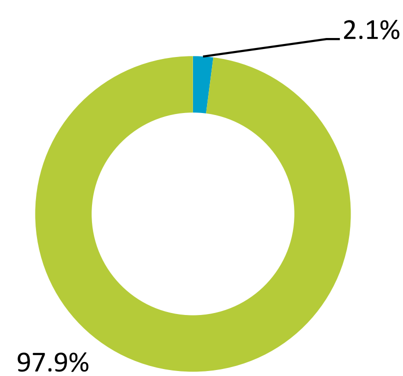
1. Based on the City of Bellevue 2030 PM Peak Hour BKR Model (MP30R6.2).
2. Derived from Issue Identification Methodology; see the Capital Element Background Report for details.

Projected Travel Demand[1]

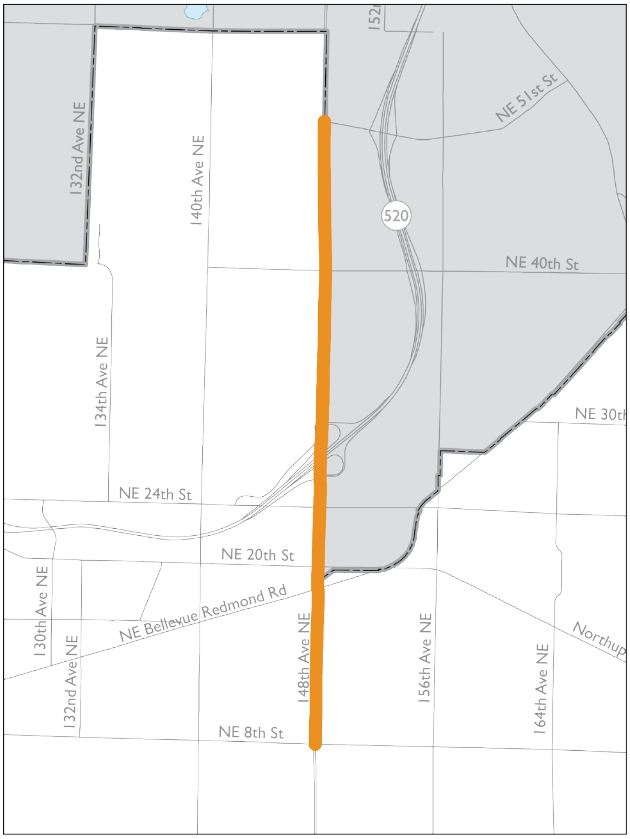
2030 PM Peak

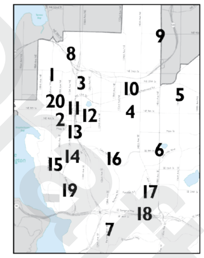


Person Throughput



Vehicle Throughput





9 148th Ave NE btw NE 8th St & NE 51st St

Buses[1]	15
Total Vehicles[1]	3,606
Percent Transit[1]	0.4%
Person Trips – Transit[1]	699
Person Trips – Total[1]	5,359
Percent Transit[1]	14%

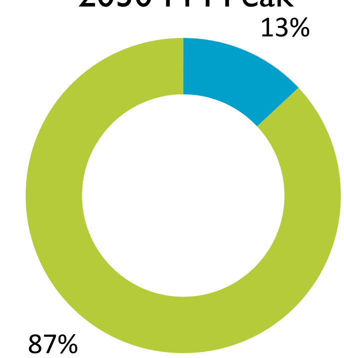
[1] Based on City of Bellevue 2030 PM Peak Hour BKR Model (MP30R6.2).

Weighted Scores[2]
Long-Term

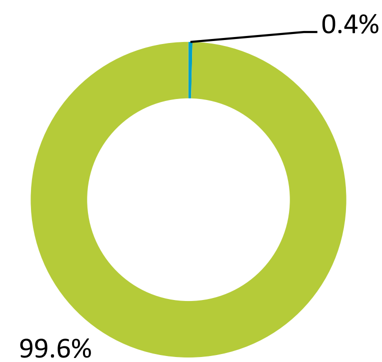
Composite Score	14 - 21 (17.8)
Weekday Ridership	4 - 8 (5.4)
Weekday Bus Volumes	1 - 4 (2.6)
Approach Delay (sec)	1 - 4 (3.1)
Approach Queue Length (ft)	1 - 4 (3.2)
Intersection LOS	0 - 4 (3.5)

1. Based on the City of Bellevue 2030 PM Peak Hour BKR Model (MP30R6.2).
2. Derived from Issue Identification Methodology; see the Capital Element Background Report for details.

Projected Travel Demand[1]
2030 PM Peak

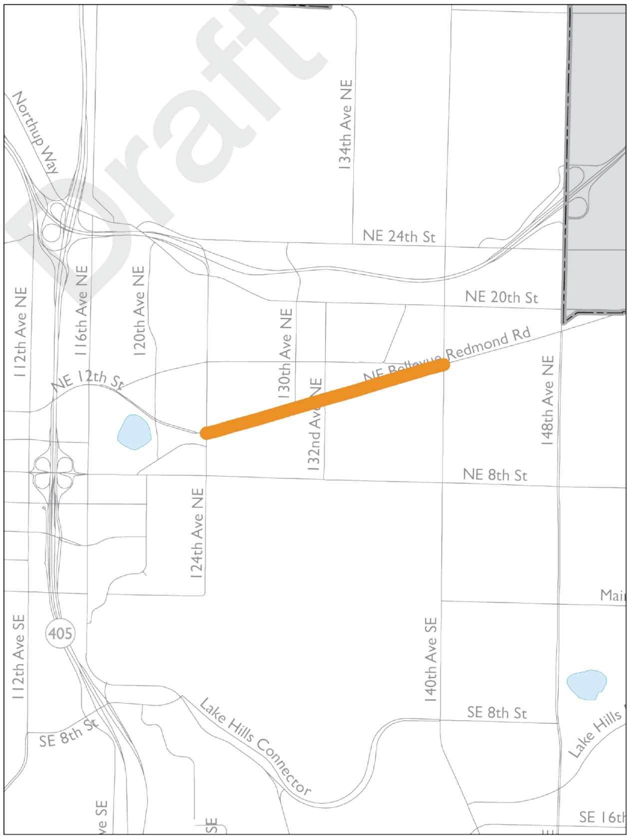


Person Throughput

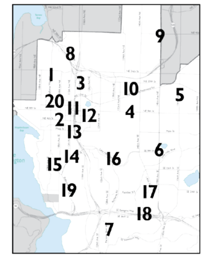


Vehicle Throughput

Bus Auto



10 Bel-Red Rd btw 124th Ave NE and 140th Ave NE



Buses[1]	16
Total Vehicles[1]	3,266
Percent Transit[1]	0.5%
Person Trips – Transit[1]	558
Person Trips – Total[1]	4,935
Percent Transit[1]	11%

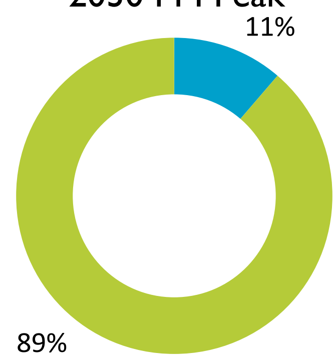
[1] Based on City of Bellevue 2030 PM Peak Hour BKR Model (MP30R6.2).

	Weighted Scores[2] Long-Term
Composite Score	8 - 15 (11.0)
Weekday Ridership	2 - 4 (3.0)
Weekday Bus Volumes	2
Approach Delay (sec)	2 - 4 (2.5)
Approach Queue Length (ft)	2 - 3 (2.5)
Intersection LOS	0 - 2 (1.0)

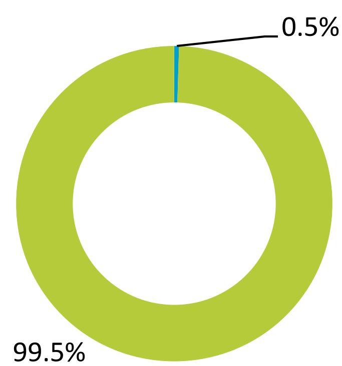
1. Based on the City of Bellevue 2030 PM Peak Hour BKR Model (MP30R6.2).
2. Derived from Issue Identification Methodology; see the Capital Element Background Report for details.

Projected Travel Demand[1]

2030 PM Peak



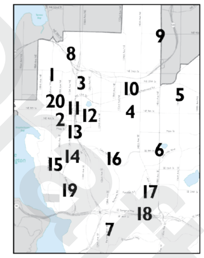
Person Throughput



Vehicle Throughput

Bus Auto

11 NE 8th St btw Bellevue Way NE and 120th Ave NE



Buses[1]	14
Total Vehicles[1]	3,412
Percent Transit[1]	0.4%

Person Trips – Transit[1]	670
Person Trips – Total[1]	5,230
Percent Transit[1]	13%

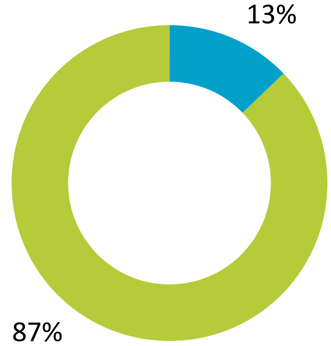
[1] Based on City of Bellevue 2030 PM Peak Hour BKR Model (MP30R6.2).

Weighted Scores[2]
Long-Term

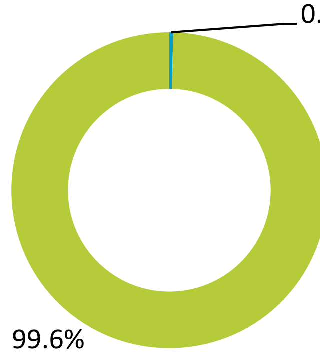
Composite Score	**N/A**
Weekday Ridership	**N/A**
Weekday Bus Volumes	**N/A**
Approach Delay (sec)	**N/A**
Approach Queue Length (ft)	**N/A**
Intersection LOS	**N/A**

1. Based on the City of Bellevue 2030 PM Peak Hour BKR Model (MP30R6.2).
2. Derived from Issue Identification Methodology; see the Capital Element Background Report for details.

Projected Travel Demand[1]
2030 PM Peak

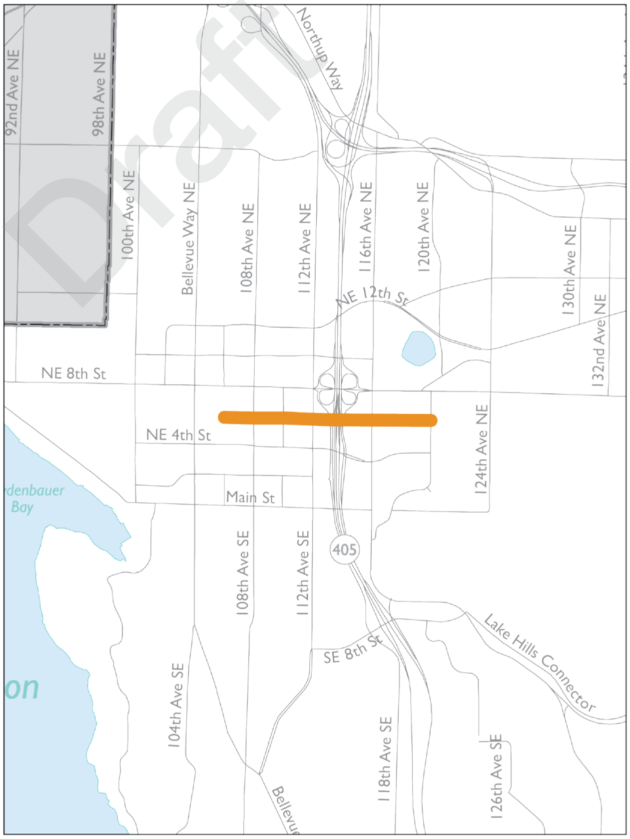


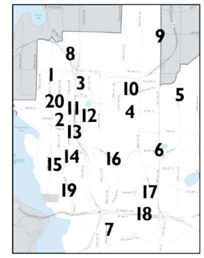
Person Throughput



Vehicle Throughput

Bus Auto





12 NE 6th St btw 106th Ave NE and 120th Ave NE

Buses[1]	71
Total Vehicles[1]	2,588
Percent Transit[1]	2.7%
Person Trips – Transit[1]	5,713
Person Trips – Total[1]	9,920
Percent Transit[1]	58%

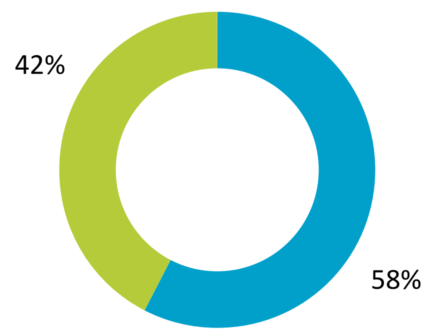
[1] Based on City of Bellevue 2030 PM Peak Hour BKR Model (MP30R6.2).

Weighted Scores[2]
Long-Term

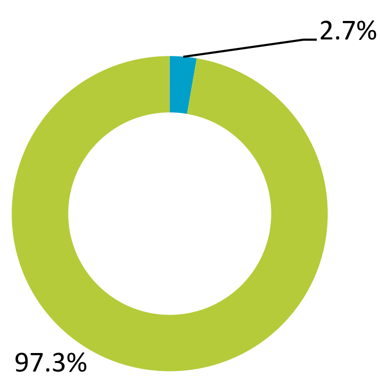
Composite Score	15 - 23 (20.3)
Weekday Ridership	6 - 8 (7.5)
Weekday Bus Volumes	2 - 4 (3.5)
Approach Delay (sec)	2 - 4 (3.3)
Approach Queue Length (ft)	3 - 4 (3.5)
Intersection LOS	2 - 3 (2.5)

1. Based on the City of Bellevue 2030 PM Peak Hour BKR Model (MP30R6.2).
2. Derived from Issue Identification Methodology; see the Capital Element Background Report for details.

Projected Travel Demand[1]
2030 PM Peak

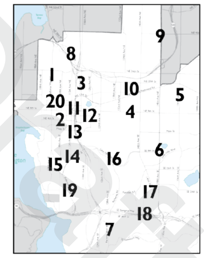


Person Throughput



Vehicle Throughput

Bus Auto



13 Main St btw Bellevue Way NE and 116th Ave NE

Buses[1]	23
Total Vehicles[1]	2,583
Percent Transit[1]	0.9%
Person Trips – Transit[1]	1,410
Person Trips – Total[1]	4,750
Percent Transit[1]	30%

[1] Based on City of Bellevue 2030 PM Peak Hour BKR Model (MP30R6.2).

Weighted Scores[2]

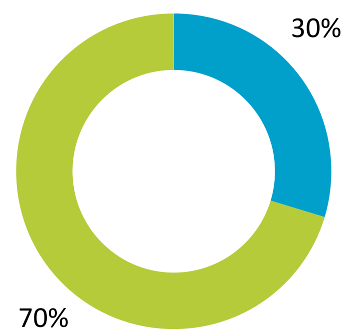
Long-Term

Composite Score	17 - 24 (20.0)
Weekday Ridership	4 - 8 (6.4)
Weekday Bus Volumes	2 - 4 (3.2)
Approach Delay (sec)	3 - 4 (3.8)
Approach Queue Length (ft)	3 - 4 (3.6)
Intersection LOS	2 - 4 (3.0)

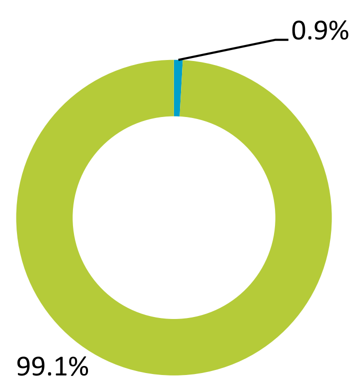
1. Based on the City of Bellevue 2030 PM Peak Hour BKR Model (MP30R6.2).
2. Derived from Issue Identification Methodology; see the Capital Element Background Report for details.

Projected Travel Demand[1]

2030 PM Peak

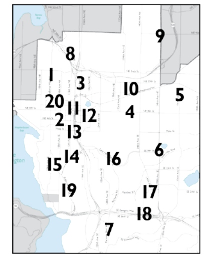


Person Throughput



Vehicle Throughput

Bus Auto



14 112th Ave SE btw Main St and Bellevue Way SE

Buses[1]	16
Total Vehicles[1]	2,311
Percent Transit[1]	0.7%
Person Trips – Transit[1]	1,370
Person Trips – Total[1]	4,450
Percent Transit[1]	31%

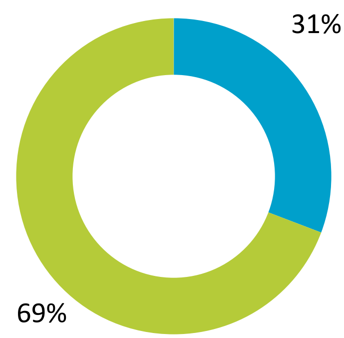
[1] Based on City of Bellevue 2030 PM Peak Hour BKR Model (MP30R6.2).

Weighted Scores[2] Long-Term

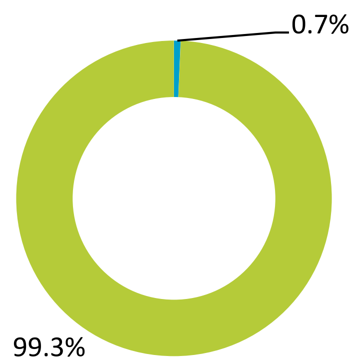
Composite Score	12 - 20 (15.8)
Weekday Ridership	6
Weekday Bus Volumes	2
Approach Delay (sec)	2 - 4 (3.0)
Approach Queue Length (ft)	2 - 4 (3.0)
Intersection LOS	0 - 4 (1.8)

1. Based on the City of Bellevue 2030 PM Peak Hour BKR Model (MP30R6.2).
2. Derived from Issue Identification Methodology; see the Capital Element Background Report for details.

Projected Travel Demand[1] 2030 PM Peak

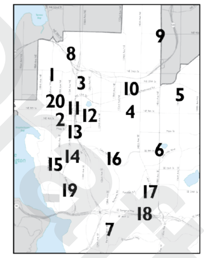


Person Throughput



Vehicle Throughput

Bus Auto



15 Bellevue Way SE btw SE 8th St and 113th Ave SE

Buses[1]	36
Total Vehicles[1]	3,230
Percent Transit[1]	1.1%
Person Trips – Transit[1]	3,363
Person Trips – Total[1]	7,705
Percent Transit[1]	44%

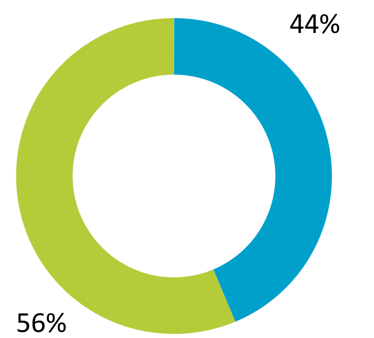
[1] Based on City of Bellevue 2030 PM Peak Hour BKR Model (MP30R6.2).

Weighted Scores[2]
Long-Term

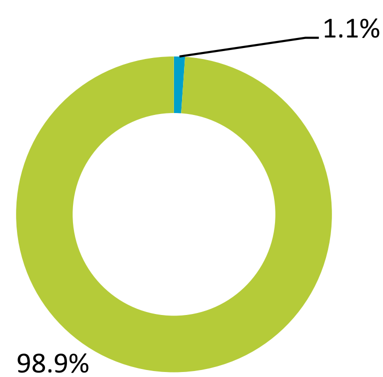
Composite Score	16 - 22 (18.0)
Weekday Ridership	8
Weekday Bus Volumes	3 - 4 (3.3)
Approach Delay (sec)	1 - 4 (2.0)
Approach Queue Length (ft)	1 - 4 (2.3)
Intersection LOS	1 - 3 (2.5)

1. Based on the City of Bellevue 2030 PM Peak Hour BKR Model (MP30R6.2).
2. Derived from Issue Identification Methodology; see the Capital Element Background Report for details.

Projected Travel Demand[1]
2030 PM Peak



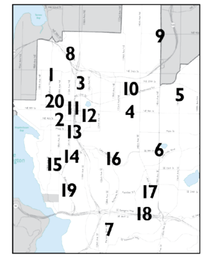
Person Throughput



Vehicle Throughput

Bus Auto

16 Lake Hills Connector btw SE 1st St and 150th Ave SE



Buses[1]	16
Total Vehicles[1]	3,081
Percent Transit[1]	0.5%
Person Trips – Transit[1]	595
Person Trips – Total[1]	4,498
Percent Transit[1]	13%

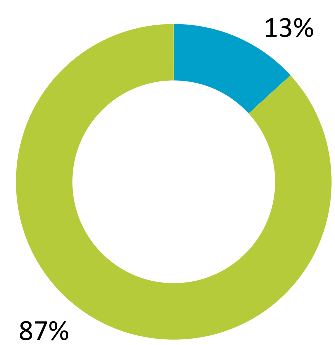
[1] Based on City of Bellevue 2030 PM Peak Hour BKR Model (MP30R6.2).

	Weighted Scores[2] Long-Term
Composite Score	11 - 16 (13.6)
Weekday Ridership	2 - 4 (3.2)
Weekday Bus Volumes	2
Approach Delay (sec)	1 - 3 (2.6)
Approach Queue Length (ft)	2 - 4 (3.2)
Intersection LOS	2 - 3 (2.6)

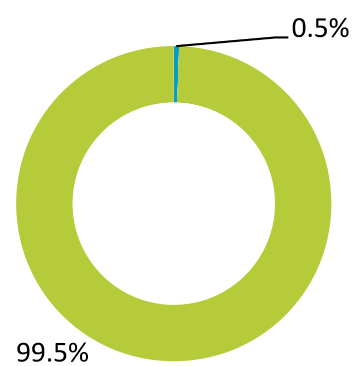
1. Based on the City of Bellevue 2030 PM Peak Hour BKR Model (MP30R6.2).
2. Derived from Issue Identification Methodology; see the Capital Element Background Report for details.

Projected Travel Demand[1]

2030 PM Peak

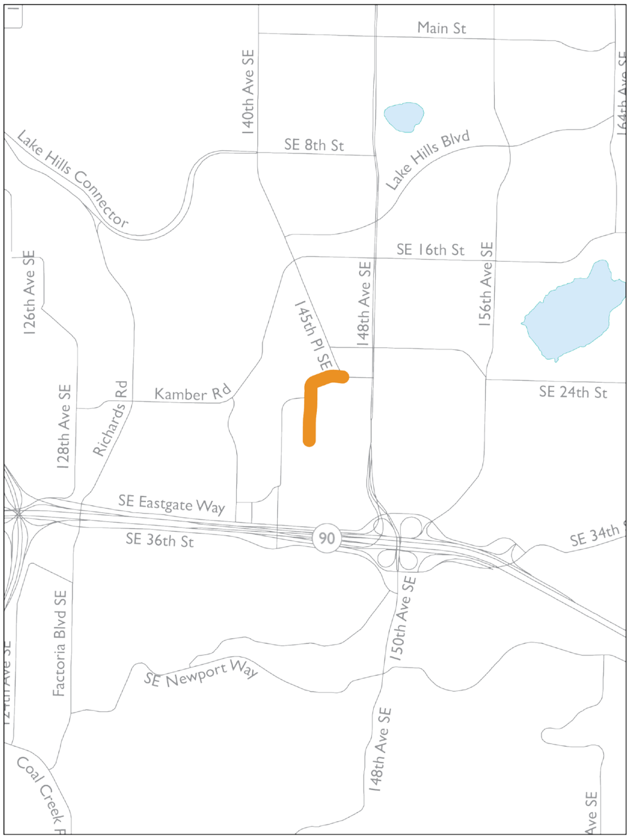


Person Throughput

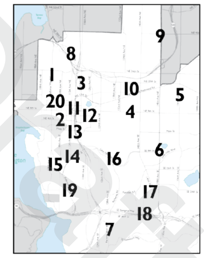


Vehicle Throughput

Bus   Auto



17 Kelsey Creek Rd btw 145th Pl SE and Tyee River Rd



Buses[1]	46
Total Vehicles[1]	276
Percent Transit[1]	17%

Person Trips – Transit[1]	1,350
Person Trips – Total[1]	1,620
Percent Transit[1]	83%

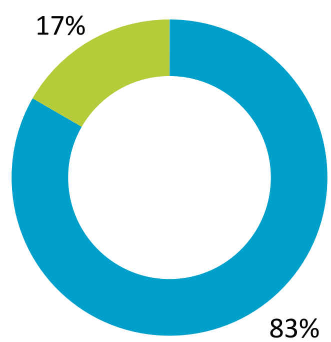
[1] Based on City of Bellevue 2030 PM Peak Hour BKR Model (MP30R6.2).

	Weighted Scores[2] Long-Term
Composite Score	12
Weekday Ridership	6
Weekday Bus Volumes	4
Approach Delay (sec)	1
Approach Queue Length (ft)	1
Intersection LOS	0

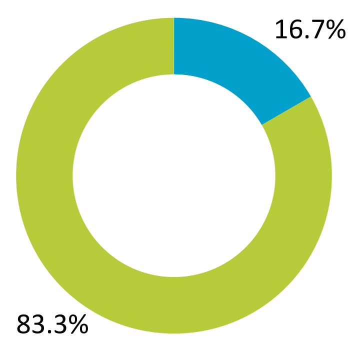
1. Based on the City of Bellevue 2030 PM Peak Hour BKR Model (MP30R6.2).
2. Derived from Issue Identification Methodology; see the Capital Element Background Report for details.

Projected Travel Demand[1]

2030 PM Peak

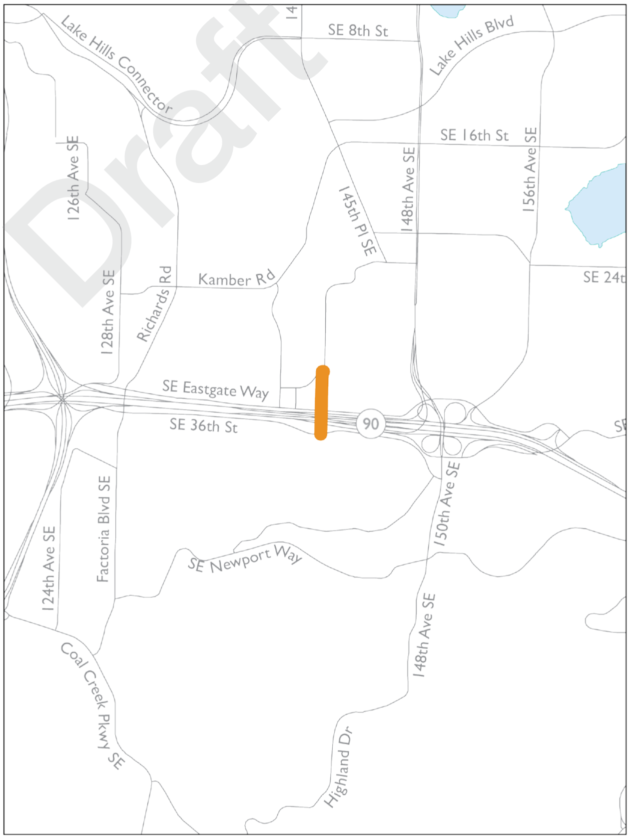


Person Throughput

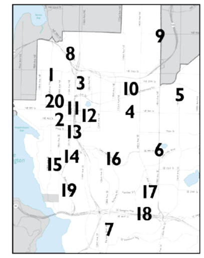


Vehicle Throughput

Bus Auto



18 142nd Pl SE btw Coal Creek Rd and SE 36th St



Buses[1]	40
Total Vehicles[1]	625
Percent Transit[1]	6%

Person Trips – Transit[1]	1,025
Person Trips – Total[1]	1,920
Percent Transit[1]	53%

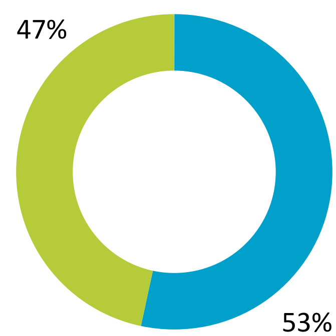
[1] Based on City of Bellevue 2030 PM Peak Hour BKR Model (MP30R6.2).

Weighted Scores[2]
Long-Term

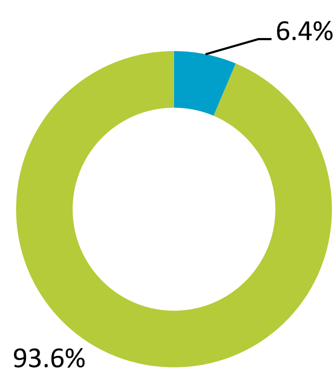
Composite Score	15 - 19 (17.0)
Weekday Ridership	0 - 4 (2.0)
Weekday Bus Volumes	3
Approach Delay (sec)	4
Approach Queue Length (ft)	4
Intersection LOS	4

1. Based on the City of Bellevue 2030 PM Peak Hour BKR Model (MP30R6.2).
2. Derived from Issue Identification Methodology; see the Capital Element Background Report for details.

Projected Travel Demand[1]
2030 PM Peak

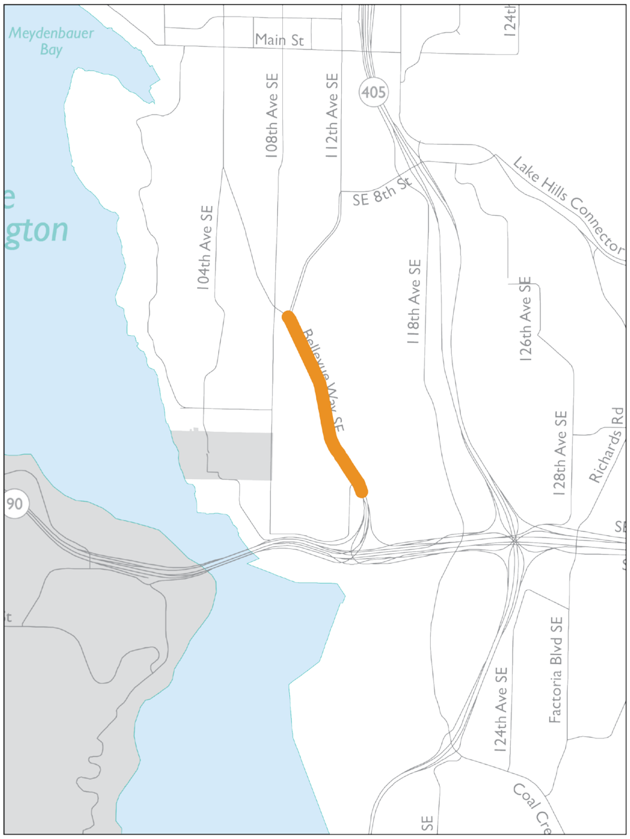


Person Throughput

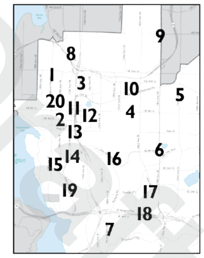


Vehicle Throughput

Bus Auto



19 Bellevue Way SE btw 113th Ave SE and I-90



Buses[1]	48
Total Vehicles[1]	4,618
Percent Transit[1]	1%

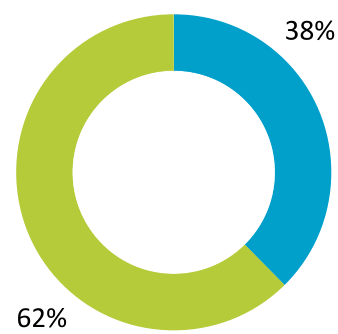
Person Trips – Transit[1]	3,830
Person Trips – Total[1]	10,330
Percent Transit[1]	37%

[1] Based on City of Bellevue 2030 PM Peak Hour BKR Model (MP30R6.2).

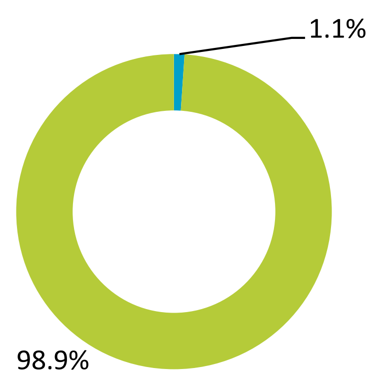
	Weighted Scores[2] Long-Term
Composite Score	22 - 23 (22.7)
Weekday Ridership	8
Weekday Bus Volumes	4
Approach Delay (sec)	2 - 4 (3.0)
Approach Queue Length (ft)	4
Intersection LOS	3 - 4 (3.7)

1. Based on the City of Bellevue 2030 PM Peak Hour BKR Model (MP30R6.2).
2. Derived from Issue Identification Methodology; see the Capital Element Background Report for details.

Projected Travel Demand[1]
2030 PM Peak

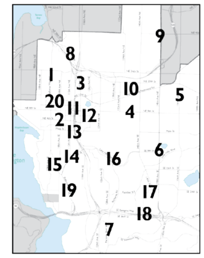


Person Throughput



Vehicle Throughput

Bus Auto



20 NE 10th St btw Bellevue Way NE and 112th Ave NE

Buses[1]	24
Total Vehicles[1]	2,349
Percent Transit[1]	1%

Person Trips – Transit[1]	1,658
Person Trips – Total[1]	4,823
Percent Transit[1]	34%

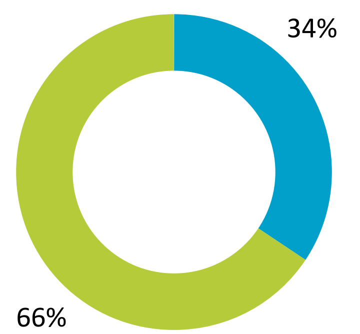
[1] Based on City of Bellevue 2030 PM Peak Hour BKR Model (MP30R6.2).

	Weighted Scores[2] Long-Term
Composite Score	17 - 19 (18.0)
Weekday Ridership	6 - 8 (7.0)
Weekday Bus Volumes	1 - 3 (2.3)
Approach Delay (sec)	2 - 4 (3.3)
Approach Queue Length (ft)	2 - 4 (3.3)
Intersection LOS	2 - 3 (2.3)

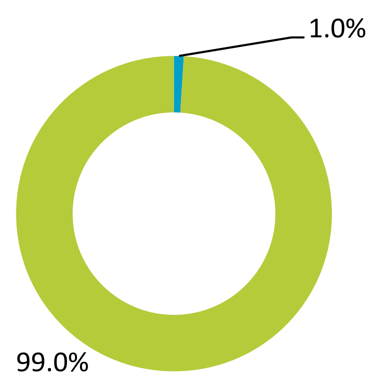
1. Based on the City of Bellevue 2030 PM Peak Hour BKR Model (MP30R6.2).
2. Derived from Issue Identification Methodology; see the Capital Element Background Report for details.

Projected Travel Demand[1]

2030 PM Peak



Person Throughput



Vehicle Throughput

Bus Auto

APPENDIX 4: BELLEVUE WAY SE TRAFFIC ANALYSIS SUMMARY

City of Bellevue

Bellevue Way SE Traffic Analysis Summary

January 24, 2013

Numerous analyses of Bellevue Way SE have been conducted during the planning and preliminary engineering stage of the East Link project. Initially, analyses were focused on the effects of the East Link project itself, with a focus on ensuring that the 900+/- stall expansion of the South Bellevue Park and Ride would be adequately mitigated. Subsequently, the City Council expressed an interest in addressing underlying corridor traffic congestion. For the purposes of this summary, the "Project" is defined as the addition of the southbound HOV lane from the "Y" to the South Bellevue Park and Ride Lot.

PM Peak Hour Indicators:

Summary: The Project would substantially reduce transit, HOV, and general purpose travel times while increasing person and vehicle throughput/volumes. At the same time it would reduce neighborhood cut-through traffic. Overall, the Project would result with a more efficient transportation system.

"Y" to Park and Ride	No Build/East Link Mitigated	Project	Change	Percent Change
Travel Time Minutes				
General purpose	3.4	2.0	-1.4	-41%
Transit	3.9	1.4	-2.5	-64%
HOV	3.4	1.2	-2.2	-65%
Volumes				
Bellevue Way SE southbound vehicles	2390	1840 GP 1160 HOV 3000 total	+610	+26%
Transit routes	9	9	0	0
Person trips – total	4440	6030	1590	+36%
Person trips – transit	1520	1690	170	+11%
Person trips – Auto-HOV	2920	1830 + 2510	1420	+49%
Southbound neighborhood vehicle volumes	470 (108th Ave SE) 300 (104th Ave SE) 770 total	210 (108th Ave SE) 190 (104th Ave SE) 400 total	-260 (108th) -110 (104th) -370 total	-55% -37% -48% total
Cost				
	$18-20m (City build independently)	$11m (City share of $22m joint project)		

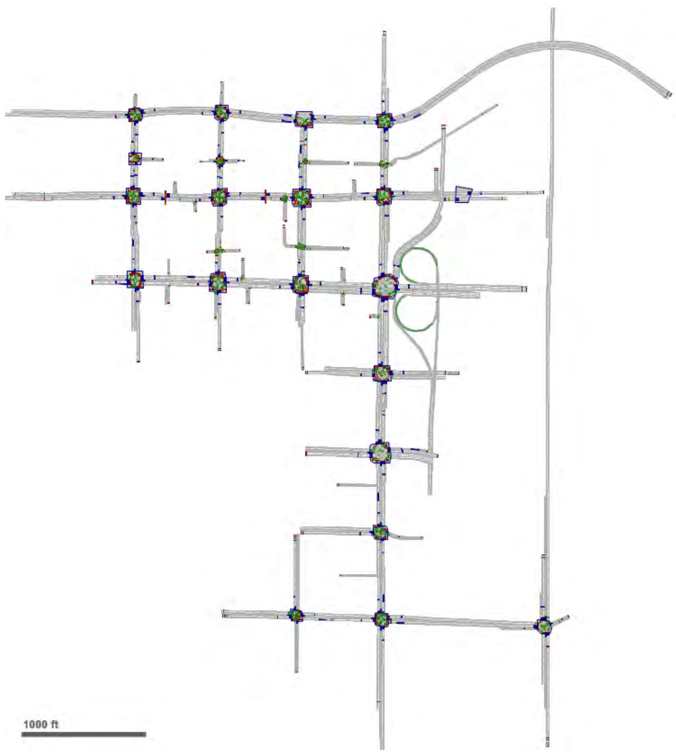
Belway HOV Summary Table For Council 1-24-13.Docx

APPENDIX 5: DOWNTOWN BELLEVUE MICRO-SIMULATION ANALYSIS

In the *Draft Speed and Reliability Project List* (November 2013), Bellevue staff brought forward a number of potential arterial High-Occupancy Vehicle (HOV) lane projects for Transportation Commission consideration. These projects are intended to support Bellevue's Frequent Transit Network (FTN) vision of enabling more people to reach more destinations in less time (see the *Transit Service Vision Report*).

At its November 14, 2013 meeting, the Commission requested additional information about Running Way Projects L11 and L13, eastbound HOV lanes between Bellevue Way and 112th Ave NE on Main Street and NE 10th St, respectively. Both projects propose converting an existing general purpose travel lane in the eastbound direction into an HOV lane. This memo summarizes the results of a VISSIM micro-simulation traffic model analysis of these Downtown Bellevue HOV alternatives.

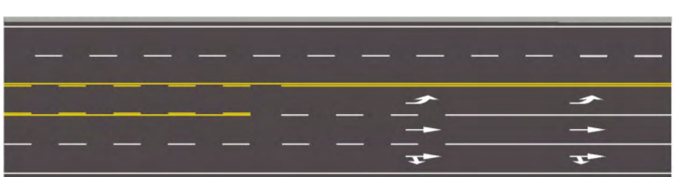
The VISSIM model used in this assessment of potential HOV lanes is based on the platform developed for the Downtown Bellevue Light Rail Alternatives Analysis (see *Documentation Report,* February 2010). VISSIM is a microscopic, time step- and behavior-based simulation developed to model urban traffic and public transit operations. The program can analyze traffic and transit operations under constraints such as lane configuration, traffic composition, traffic signals, and transit stops, thus making it a useful tool for the evaluation of various alternatives based on transportation engineering and planning measures of effectiveness. Appendix Figure 10 shows the Downtown Bellevue study area boundaries considered in this assessment.



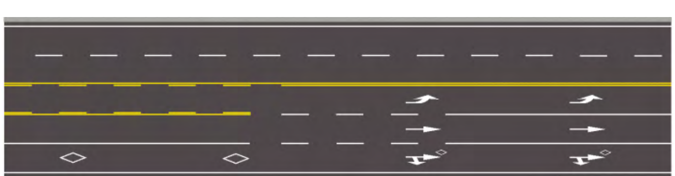
Appendix Figure 10 Downtown Bellevue study area boundaries.

Appendix Figure 11 depicts the existing configuration of the roadway and the proposed restriping for both NE 10th St and Main St. As noted, these projects

Existing Configuration



Future with Improvement



Appendix Figure 11 Existing configuration of the roadway and the proposed restriping for both NE 10th Street and Main Street.

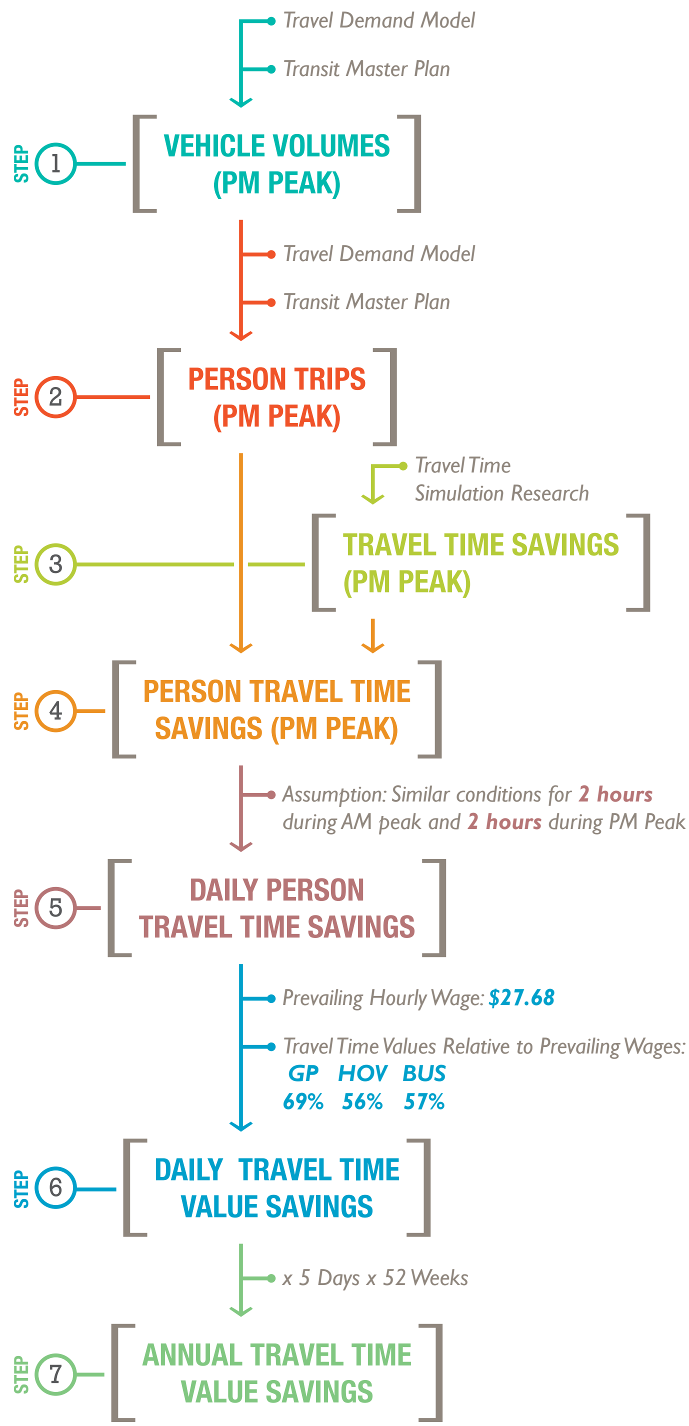
remain within existing street rights-of-way. The HOV lane alternative incorporates Transit Signal Priority (TSP) along NE 10th St at 106th Ave NE, 108th Ave NE, 110th Ave NE, and 112th Ave NE.

Traffic Analysis Methodology

VISSIM was used to assess the 2030 PM peak impacts of the HOV lane alternative on general purpose (GP), high-occupancy vehicle (HOV), and transit (Bus) travel times, as well as measurements of vehicle and person delay. Travel time is one of the largest categories of transport costs, and time savings are often claimed to be the greatest benefit of transport projects like roadway and public transit improvements. Appendix Figure 12 reflects the seven step methodology used for the travel time analysis:

1. Factor inbound volume at 108th Ave NE/ NE 10th St to route volume based on EMME travel demand model output.
2. Factor vehicle volume to person volume based on occupancy rate for each mode.
3. Vehicle travel time difference from baseline to HOV Alternative for each route/mode.
4. Multiply travel time difference with total person for each route/mode.
5. Factor PM Peak-Hour improvement to daily improvement.
6. Factor hourly wages into travel time values for each mode. Multiply person travel time savings with travel time values for each route/mode.
7. Extend travel time savings from daily to annual for each route/mode.

Appendix Figure 12 Seven step traffic analysis methodology.



Route 1:
From: Bellevue Way NE/NE 10th Street
To: 112th Avenue NE/NE 10th Street

Route 2:
From: Bellevue Way NE/NE 10th Street
To: 108th Avenue NE/NE 8th Street

Route 3:
From: 112th Avenue NE/NE 10th Street
To: Bellevue Way NE/NE 10th Street

Route 4:
From: 112th Avenue NE/NE 10th Street
To: 108th Avenue NE/NE 8th Street

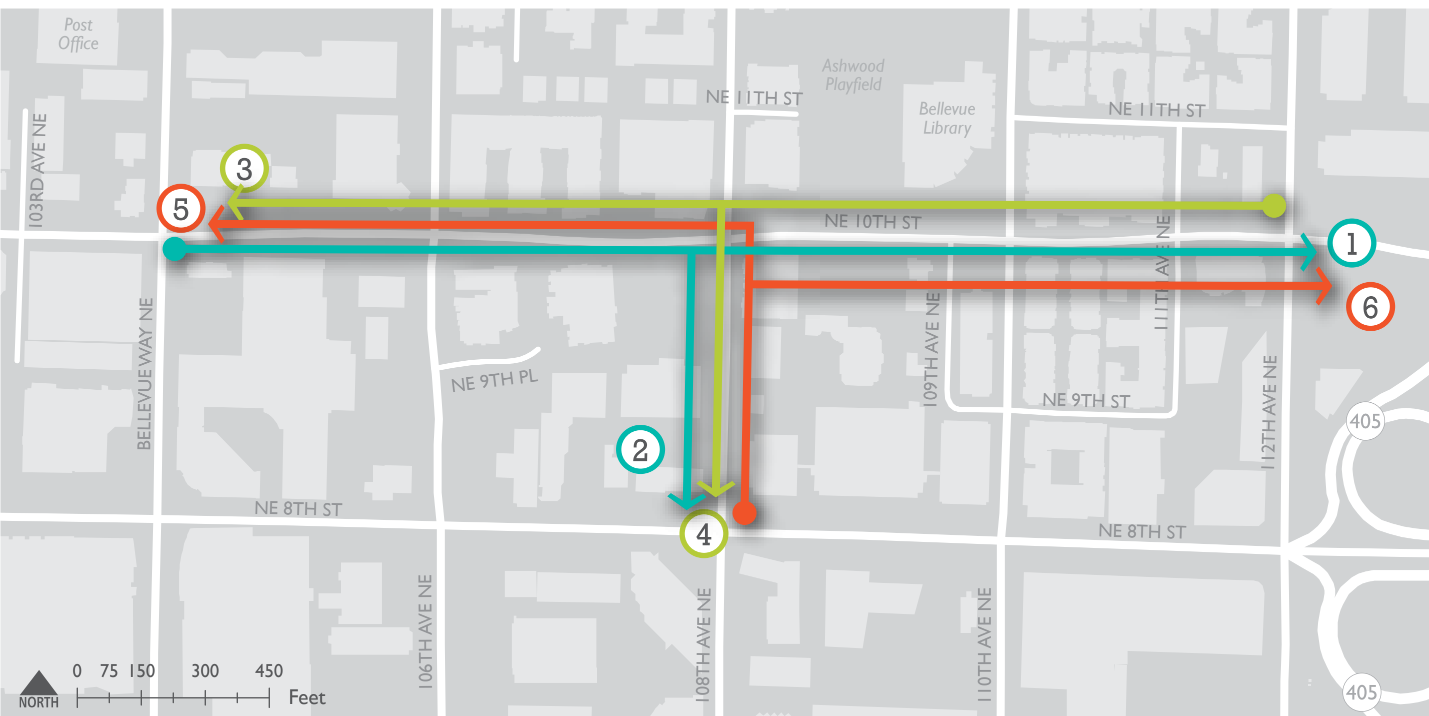
Route 5:
From: 108th Avenue NE/NE 8th Street
To: Bellevue Way NE/NE 10th Street

Route 6:
From: 108th Avenue NE/NE 8th Street
To: 112th Avenue NE/NE 10th Street

As indicated, this methodology produces PM peak vehicle travel time (in seconds) and person travel time (in hours) statistics by mode (GP, HOV, and Bus). Daily person travel time savings figures are derived from these statistics and then monetized based on the average hourly wage of workers in the Seattle-Bellevue-Everett Metropolitan Division (Source: *Bureau of Labor Statistics*, May 2012). The valuation of time is cross-referenced with adjustment factors to reflect qualitative factors such as comfort, convenience, and reliability using Level-of-Service ratings for various modes (Source: *Victoria Transport Policy Institute*, see page 5.2-10). The final step of the analysis annualizes the value of daily travel time savings.

The analysis methodology for the NE 10th St improvements considers the travel time impact on general purpose (GP), high-occupancy vehicle (HOV), and transit (Bus) for the six different routes to/from and along NE 10th Street described at left (see Appendix Figure 13).

Appendix Figure 13 Six routes to/from and along NE 10th Street.



NE 10th Street Analysis Results

Appendix Tables 2 through 9 below and on the following pages provide the results from the analysis methodology for each of the six routes identified for the NE 10th St analysis.

Appendix Table 2 Routes vehicle volume estimation (PM Peak-Hour) values derived from factoring inbound volumes at 108th Ave NE/NE 10th Street to route volume based on EMME travel demand model output.

From EMME Travel Demand Model						*In Vissim Model*			
Total Inbound Volume @ 108th & 10th		Route	Vol at Start	Vol at the End	Total Vol	Total Inbound Volume @ 108th & 10th		Route	Total Vol
Eastbound	*1,156*	*1*	*728*	*815*	*513*	*Eastbound*	*1,262*	*1*	*560*
		2	*728*	*99*	*62*			*2*	*68*
Westbound	*1,308*	*3*	*936*	*549*	*393*	*Eastbound*	*576*	*3*	*173*
		4	*936*	*355*	*254*			*4*	*112*
Northbound	*849*	*5*	*849*	*79*	*79*	*Northbound*	*574*	*5*	*53*
		6	*849*	*269*	*269*			*6*	*182*

Estimated Volumes per Route per Mode								
Mode Split				Vehicle Volume				
GP	HOV-2	HOV-3+	HV	GP	HOV-2	HOV-3+	HV	BUS
70%	*21%*	*7%*	*2%*	*392*	*118*	*39*	*11*	—
70%	*21%*	*7%*	*2%*	*48*	*14*	*5*	*1*	*8*
70%	*21%*	*7%*	*2%*	*121*	*36*	*12*	*3*	—
70%	*21%*	*7%*	*2%*	*78*	*23*	*8*	*2*	*8*
70%	*21%*	*7%*	*2%*	*37*	*11*	*4*	*1*	*8*
70%	*21%*	*7%*	*2%*	*127*	*38*	*13*	*4*	*8*

Appendix Table 3 Routes person volume estimation (PM Peak-Hour) values derived from factoring vehicle volume to person volume based on occupancy rate for each mode.

Benefit - HOV+TSP	*Vehicle Volume*				
Route	GP	HOV-2	HOV-3+	HV	BUS
1	*392*	*118*	*39*	*11*	—
2	*48*	*14*	*5*	*1*	*8*
3	*121*	*36*	*12*	*3*	—
4	*78*	*23*	*8*	*2*	*8*
5	*37*	*11*	*4*	*1*	*8*
6	*127*	*38*	*13*	*4*	*8*

Person Volume				
GP	HOV-2	HOV-3+	HV	BUS
1	*2*	*3.5*	*2*	*90*

Benefit - HOV+TSP	*Person Volume*				
Route	GP	HOV-2	HOV-3+	HV	BUS
1	*392*	*236*	*136.5*	*22*	—
2	*48*	*28*	*17.5*	*2*	*720*
3	*121*	*72*	*42*	*6*	—
4	*78*	*46*	*28*	*4*	*720*
5	*37*	*22*	*14*	*2*	*720*
6	*127*	*76*	*45.5*	*8*	*720*

Appendix Table 4 Travel time difference (PM Peak-Hour) values based on vehicle travel time difference from baseline to HOV Alternative for each route/mode.

Baseline (Direct output from VISSIM)

Vehicle Travel Time Measurement	TRAVTM(ALL)	TRAVTM(1)	TRAVTM(10)	TRAVTM(12)	TRAVTM(13)	TRAVTM(20)	TRAVTM(31)
1	*247.44*	*247.19*	*247.02*	*243.87*	*259.69*	*255.18*	*0*
2	*209.57*	*212.15*	*210.74*	*213.09*	*150.77*	*177.51*	*215.69*
3	*139.33*	*139.91*	*139.4*	*136.34*	*143.86*	*151.98*	*0*
4	*160*	*165.9*	*146.94*	*137.62*	*141.33*	*183.46*	*193.54*
5	*197.31*	*200.37*	*247.33*	*169.91*	*320.28*	*168.08*	*160.8*
6	*241.52*	*243.9*	*244.08*	*235.77*	*235.55*	*213*	*248.2*

HOV + TSP (Direct output from VISSIM)

Vehicle Travel Time Measurement	TRAVTM(ALL)	TRAVTM(1)	TRAVTM(10)	TRAVTM(12)	TRAVTM(13)	TRAVTM(20)	TRAVTM(31)
1	*309.88*	*343.34*	*343.48*	*231.88*	*236.82*	*333.93*	*0*
2	*245.18*	*247.69*	*277.35*	*228.69*	*217.47*	*305.72*	*188.29*
3	*142.55*	*141.21*	*141.72*	*144.01*	*148.82*	*130.95*	*0*
4	*209.9*	*211.97*	*200.59*	*186.23*	*195.1*	*109.87*	*234.45*
5	*180.19*	*173.17*	*216.77*	*216.95*	*142.46*	*70.54*	*127.4*
6	*224.9*	*227.28*	*230.79*	*217.1*	*225.03*	*214.17*	*187.67*

Vehicle Travel Time Change (in seconds) - TSP+HOV

Route	GP	HOV-2	HOV-3+	HV	BUS
1	*96.46*	*-11.99*	*-22.87*	*78.75*	*0*
2	*66.61*	*15.6*	*66.7*	*128.21*	*-27.4*
3	*2.32*	*7.67*	*4.96*	*-21.03*	*0*
4	*53.65*	*48.61*	*53.77*	*-73.59*	*40.91*
5	*-30.56*	*47.04*	*-177.82*	*-97.54*	*-33.4*
6	*-13.29*	*-18.67*	*-10.52*	*1.17*	*-60.53*

Appendix Table 5 Person travel time savings (PM Peak-Hour) values derived from multiplying the travel time difference with total person for each route/mode.

Route	GP	HOV-2	HOV-3+	HV	BUS	Total by Route
1	*10.50*	*-0.79*	*-0.87*	*0.48*	*—*	*9.33*
2	*0.89*	*0.12*	*0.32*	*0.07*	*-5.48*	*-4.08*
3	*0.08*	*0.15*	*0.06*	*-0.04*	*—*	*0.25*
4	*1.16*	*0.62*	*0.42*	*-0.08*	*8.18*	*10.30*
5	*-0.31*	*0.29*	*-0.69*	*-0.05*	*-6.68*	*-7.45*
6	*-0.47*	*-0.39*	*-0.13*	*0.00*	*-12.11*	*-13.10*
Total by Mode	**11.85**	**0.00**	**-0.89**	**0.38**	**-16.08**	**-4.74**

Appendix Table 6 Person travel time savings (daily) values derived from factoring PM Peak-Hour improvement to daily improvement.

PM Peak-Hour to Daily Rate

GP	HOV-2	HOV-3+	HV	BUS
4	4	4	4	4

*** Assumes 2 hours during PM and same benefitial impact during AM 2 hour period*

Person Travel Time Change (in hours) - TSP+HOV (Daily)

Route	GP	HOV-2	HOV-3+	HV	BUS	Total by Route
1	*42.01*	*-3.14*	*-3.47*	*1.93*	*—*	*37.33*
2	*3.55*	*0.49*	*1.30*	*0.28*	*-21.92*	*-16.30*
3	*0.31*	*0.61*	*0.23*	*-0.14*	*—*	*1.02*
4	*4.65*	*2.48*	*1.67*	*-0.33*	*32.73*	*41.21*
5	*-1.26*	*1.15*	*-2.77*	*-0.22*	*-26.72*	*-29.81*
6	*-1.88*	*-1.58*	*-0.53*	*0.01*	*-48.42*	*-52.40*
Total by Mode	**47.40**	**0.01**	**-3.57**	**1.54**	**-64.34**	**-18.96**

Appendix Table 7 Travel time values derived from factoring hourly wages into travel time values for each mode.

Average Hourly Wage: $27.68

	GP	HOV-2	HOV-3+	HV	BUS
Relative to Prevailing Wages	*67%*	*57%*	*53%*	*135%*	*57%*
Travel Time Values	*$18.55*	*$15.78*	*$14.67*	*$37.37*	*$15.78*

Appendix Table 8 Total travel time savings (daily) values derived from multiplying travel time savings with travel time values for each route/mode.

Daily Travel Time Savings - TSP+HOV

Route	GP	HOV-2	HOV-3+	HV	BUS	Total by Route
1	*$779.10*	*($49.54)*	*($50.91)*	*$72.12*	—	*$750.77*
2	*$65.84*	*$7.73*	*$19.07*	*$10.46*	*($345.84)*	*($242.74)*
3	*$5.75*	*$9.62*	*$3.37*	*($5.23)*	—	*$13.52*
4	*$86.24*	*$39.13*	*$24.50*	*($12.33)*	*$516.40*	*$653.93*
5	*($23.37)*	*$18.14*	*($40.64)*	*($8.22)*	*($421.58)*	*($475.66)*
6	*($34.87)*	*($24.93)*	*($7.78)*	*$0.37*	*($763.95)*	*($831.15)*
Total by Mode	**$878.69**	**$0.16**	**($52.37)**	**$57.17**	**($1,014.97)**	**($131.32)**

Appendix Table 9 Total travel time savings (annual) values derived from extending travel time savings from daily to annual for each route/mode.

Workdays per Week: 5
Weeks per Year: 52

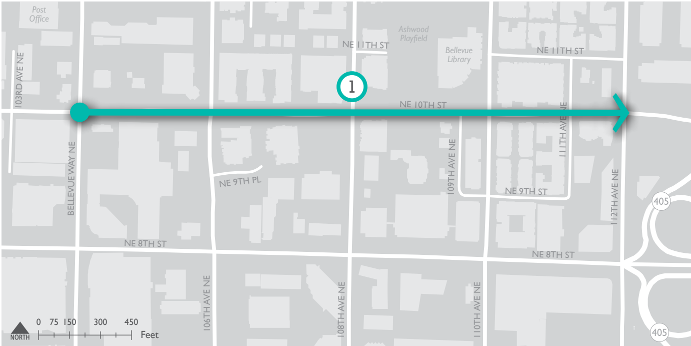
Annual Travel Time Savings - TSP+HOV (in thousands)

Route	GP	HOV-2	HOV-3+	HV	BUS	Total by Route
1	*$202.57*	*($12.88)*	*($13.24)*	*$18.75*	—	*$195.20*
2	*$17.12*	*$2.01*	*$4.96*	*$2.72*	*($89.92)*	*($63.11)*
3	*$1.49*	*$2.50*	*$0.88*	*($1.36)*	—	*$3.51*
4	*$22.42*	*$10.17*	*$6.37*	*($3.21)*	*$134.26*	*$170.02*
5	*($6.08)*	*$4.72*	*($10.57)*	*($2.14)*	*($109.61)*	*($123.67)*
6	*($9.07)*	*($6.48)*	*($2.02)*	*$0.10*	*($198.63)*	*($216.10)*
Total by Mode	**$228.46**	**$0.04**	**($13.62)**	**$14.86**	**($263.89)**	**($34.14)**

NE 10th Street Summary

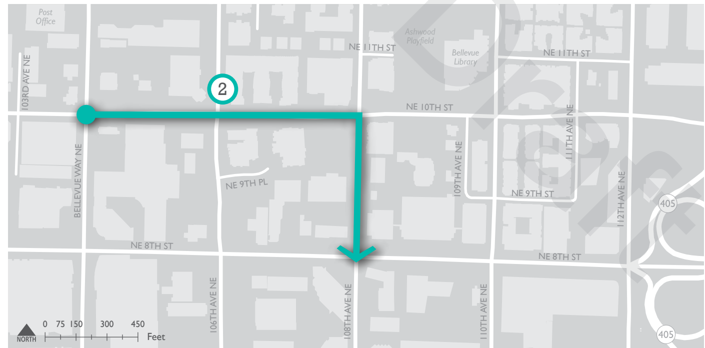
Appendix Figure 14 on page A127 provides a summary of the travel time impact on general purpose (GP), high-occupancy vehicle (HOV), and transit (Bus) for the six different routes to/from and along NE 10th St described above. Some routes experience travel time penalties while others experience travel time benefits. When all of the various routes to/from and along NE 10th St are taken into account, the HOV lane alternative results in an annual travel time savings of $34,140. After considering these impacts at two meetings (on January 22, 2014 and January 23, 2014), the Transportation Commission was in unanimous agreement that these Downtown Bellevue HOV lane projects should remain in the Transit Master Plan for consideration when bus frequencies along these corridors justify this lane conversion.

Appendix Figure 14 Travel time impacts to the six routes to/from and along NE 10th St.



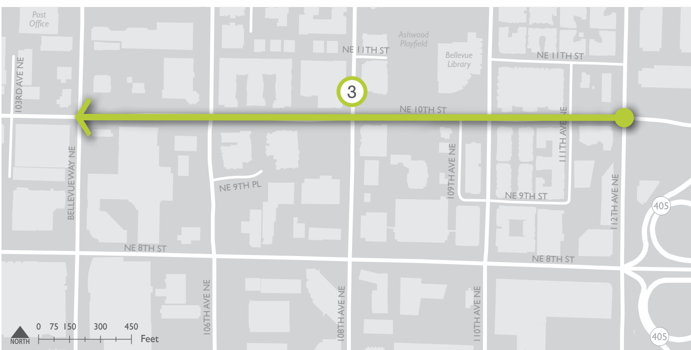
Route 1

Vehicle Travel Time Change (in seconds)			*Person Travel Time Change (in hours)*			*Travel Time Savings (PM Peak)*
GP	HOV	BUS	GP	HOV	BUS	*$173.56 +19.7%*
95.97	-14.71	—	10.98	-1.65	—	



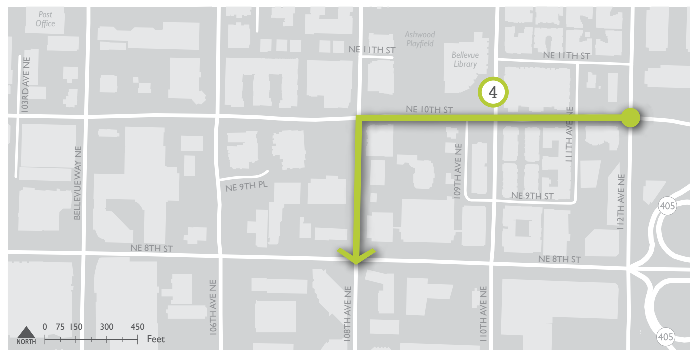
Route 2

Vehicle Travel Time Change (in seconds)			*Person Travel Time Change (in hours)*			*Travel Time Savings (PM Peak)*
GP	HOV	BUS	GP	HOV	BUS	*$56.10 -7.8%*
68.32	28.38	-27.40	0.96	0.44	-5.48	



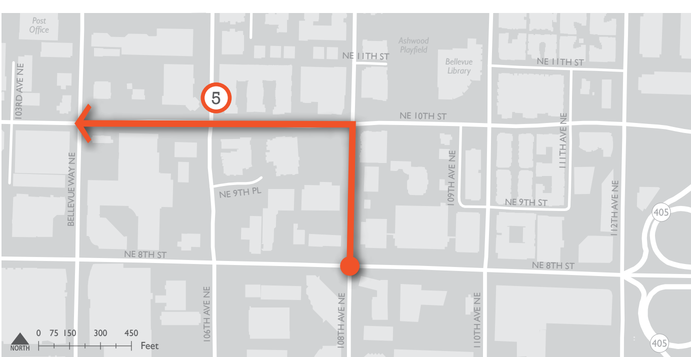
Route 3

Vehicle Travel Time Change (in seconds)			*Person Travel Time Change (in hours)*			*Travel Time Savings (PM Peak)*
GP	HOV	BUS	GP	HOV	BUS	*$3.15 +2.1%*
1.67	6.99	—	0.04	0.21	—	



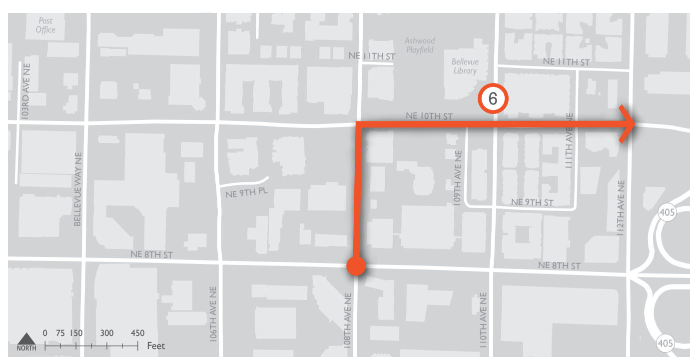
Route 4

Vehicle Travel Time Change (in seconds)			*Person Travel Time Change (in hours)*			*Travel Time Savings (PM Peak)*
GP	HOV	BUS	GP	HOV	BUS	*$151.24 +22.7%*
50.12	49.90	40.91	1.08	1.04	8.18	



Route 5

Vehicle Travel Time Change (in seconds)			*Person Travel Time Change (in hours)*			*Travel Time Savings (PM Peak)*
GP	HOV	BUS	GP	HOV	BUS	*$109.92 -20.1%*
-32.42	-9.18	-33.40	-0.36	-0.40	-6.68	



Route 6

Vehicle Travel Time Change (in seconds)			*Person Travel Time Change (in hours)*			*Travel Time Savings (PM Peak)*
GP	HOV	BUS	GP	HOV	BUS	*$192.16 -19.2%*
-12.89	-16.63	-60.53	-0.47	-0.52	-12.11	

Main Street Analysis

The improvement evaluated at the Main Street/112th Avenue intersection included the conversion of the eastbound general purpose curb lane to an HOV lane (Project L11) and the widening of Main Street to provide a dedicated eastbound right-turn lane. The analysis assumed that right-turns for HOV traffic would be permitted from the HOV lane.

Similar to the analysis of NE 10th St, the impacts of the Main St project were also measured using VISSIM. The VISSIM model used for this analysis is consistent with that described for the NE 10th St; however, unlike the analysis of the NE 10th project, this analysis focused on intersection delay, both from a vehicle perspective and person delay perspective. Since this improvement is limited to the subject intersection only, the analysis focuses primarily on the intersection operations. The impact of the use restriction of the curb lane is reflected in the intersection operations summary, the results of which are shown in Appendix Table 10.

Appendix Table 10 Impacts to vehicle and person delay at Main Street/112th Ave NE resulting from Running Way Project L11.

Main St / 112th Ave NE	Baseline		HOV + TSP	
	LOS	Delay (sec)	LOS	Delay (sec)
Vehicle Delay	E	62.0	D	54.5
Person Delay	E	66.8	D	53.7

Assumed Vehicle Occupancy:

SOV: 1

Buses: 90

Main Street Summary

The analysis shows that the average vehicle delay at the intersection is reduced from 62.0 seconds to 54.5 seconds, and person delay is reduced from 66.8 seconds to 53.7 seconds with the improvement. Although the curb lane is restricted to HOV traffic, the right-turn lane provides additional intersection capacity that results in the improvements in both vehicle and personal delay shown in Appendix Table 10. As part of the next level of analysis, further evaluation of the length of the right turn lane and its impact on the corridor performance should be conducted.

APPENDIX 6: BELLEVUE COLLEGE CONNECTION – 142ND PL SE / SNOQUALMIE RIVER RD MULTIMODAL TRANSPORTATION CORRIDOR

One of the more significant projects included in this report is the Bellevue College Connection Multimodal Transportation Corridor (Running Way Project L27), which is located between the intersection of 142nd Pl SE and SE 36th St on the south end and SE 24th St and Kelsey Creek Rd on the north end. The corridor spans the length of the 142nd Pl SE Bridge from SE 36th St to SE 32nd St, continues north along Snoqualmie River Rd to its intersection with Kelsey Creek Rd, and proceeds north to SE 24th St (see Appendix Figure 16 on page A130). This multimodal corridor as proposed and reflected in the preliminary designs presented here is intended to support pedestrians, bicyclists, and transit users.

This project was previously highlighted in the *Transportation Strategies Report*, part of the *Eastgate/I-90 Lane Use and Transportation Project* completed in 2012 (see Appendix Figure 15). That report outines a vision that will guide public and private actions, investments, and capital project priorities to improve mobility for all travel modes in the Eastgate/I-90 corridor. Potential improvements advanced by the plan are oriented toward finding the best transportation solutions for the area that are affordable, supported by the community, and can be implemented in a reasonable time frame. The list includes projects that would improve traffic flow at critical intersections, enhance the pedestrian/bicycle environment, and increase the attractiveness of transit as a travel option. One of the transit improvements proposed is the development of 142nd Pl SE as a transit emphasis corridor, including upgrading Snoqualmie River Rd to support buses and accessible bus stops. This project has since been adopted into the *2013-2024 Transportation Facilities Plan* (TFP-252).


Transportation Strategies Report

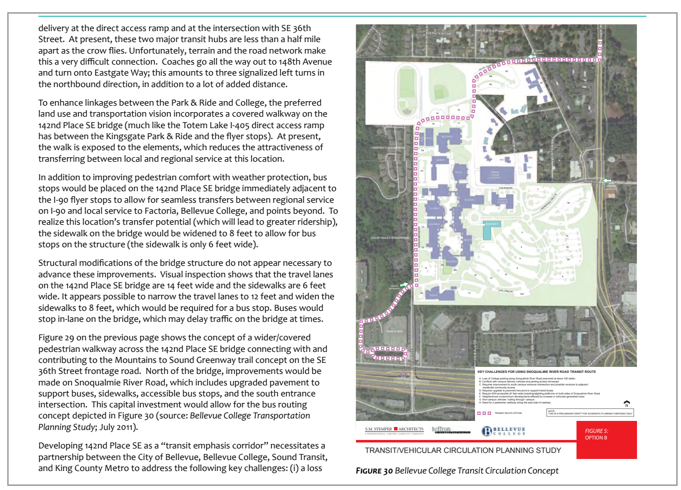
Eastgate/I-90 Land Use & Transportation Project

CITY OF BELLEVUE

January 2012

Department of Transportation

Department of Planning and Community Development


delivery at the direct access ramp and at the intersection with SE 36th Street. At present, these two major transit hubs are less than a half mile apart as the crow flies. Unfortunately, terrain and the road network make this a very difficult connection. Coaches go all the way out to 148th Avenue and turn onto Eastgate Way; this amounts to three signalized left turns in the northbound direction, in addition to a lot of added distance.

To enhance linkages between the Park & Ride and College, the preferred land use and transportation vision incorporates a covered walkway on the 142nd Place SE bridge (much like the Totem Lake I-405 direct access ramp has between the Kingsgate Park & Ride and the flyer stops). At present, the walk is exposed to the elements, which reduces the attractiveness of transferring between local and regional service at this location.

In addition to improving pedestrian comfort with weather protection, bus stops would be placed on the 142nd Place SE bridge immediately adjacent to the I-90 flyer stops to allow for seamless transfers between regional service on I-90 and local service to Factoria, Bellevue College, and points beyond. To realize this location's transfer potential (which will lead to greater ridership), the sidewalk on the bridge would be widened to 8 feet to allow for bus stops on the structure (the sidewalk is only 6 feet wide).

Structural modifications of the bridge structure do not appear necessary to advance these improvements. Visual inspection shows that the travel lanes on the 142nd Place SE bridge are 14 feet wide and the sidewalks are 6 feet wide. It appears possible to narrow the travel lanes to 12 feet and widen the sidewalks to 8 feet, which would be required for a bus stop. Buses would stop in-lane on the bridge, which may delay traffic on the bridge at times.

Figure 29 on the previous page shows the concept of a wider/covered pedestrian walkway across the 142nd Place SE bridge connecting with and contributing to the Mountains to Sound Greenway trail concept on the SE 36th Street frontage road. North of the bridge, improvements would be made on Snoqualmie River Road, which includes upgraded pavement to support buses, sidewalks, accessible bus stops, and the south entrance intersection. This capital investment would allow for the bus routing concept depicted in Figure 30 (source: *Bellevue College Transportation Planning Study*; July 2011).

Developing 142nd Place SE as a "transit emphasis corridor" necessitates a partnership between the City of Bellevue, Bellevue College, Sound Transit, and King County Metro to address the following key challenges: (i) a loss

Figure 30 *Bellevue College Transit Circulation Concept*

Appendix Figure 15 Revised transit routing around Bellevue College along Snoqualmie River Rd, as presented in the *Eastgate/I-90 Transportation Strategies Report*, adopted in January 2012.

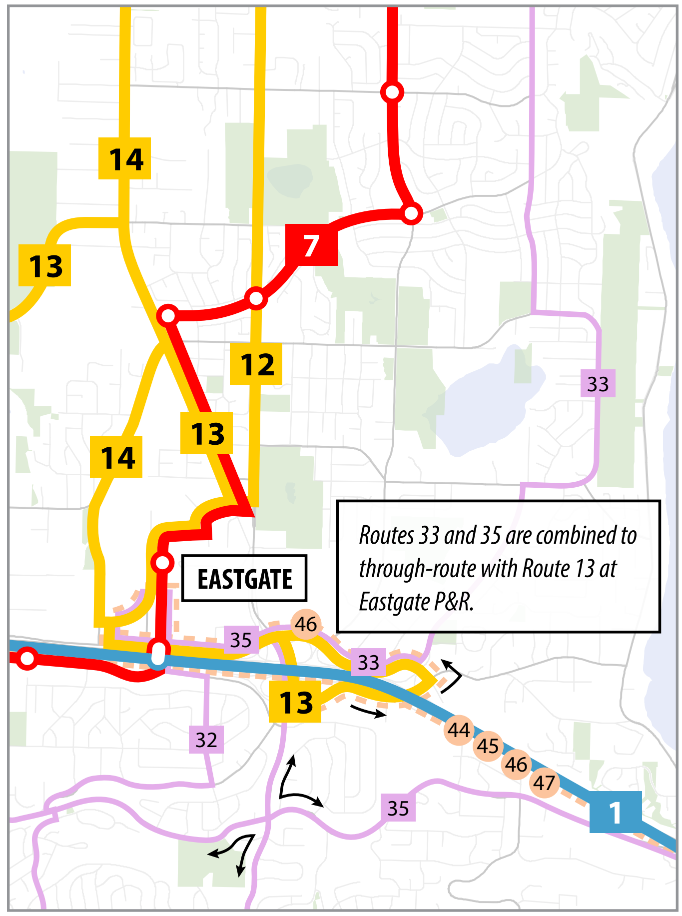
Appendix Figure 16 Full extents of the Bellevue College Connection: 142nd Pl SE / Snoqualmie River Rd Multimodal Transportation Corridor.

This corridor is especially significant to the Transit Master Plan because it improves the efficiency of transit operations to the Eastgate Park-and-Ride while maintaining direct frequent service to the Bellevue College campus. As described in the *Transit Service Vision Report*, the layout of Bellevue College currently presents a major obstacle to efficient service, and it also creates a conflict between the goal of serving the college well and the goal of providing efficient north-south service connecting Crossroads and Overlake to Eastgate and Factoria. The key is to put Bellevue College "on the way" between Eastgate and Crossroads; currently, Bellevue College is a time-consuming cul-de-sac that discourages all north-south ridership across the eastside of Bellevue. Eastgate will continue to grow more important as a regional connection site, so it must be possible to serve both the campus and Eastgate with a minimal amount of deviation.

As shown in Appendix Figure 17, the 2030 Growing Resources scenario envisions three FTN routes operating along the 142nd Pl SE/Snoqualmie River Rd Multimodal Transportation Corridor: Frequent Rapid Route 7 and Frequent Local Routes 12 and 13. The design of the Bellevue College Connection thus suggests two main types of linear segments along the corridor based on the location of transit, pedestrian, and bicycle traffic flows and the width of travel lanes:

- Snoqualmie River Rd/Kelsey Creek Rd
- 142nd Pl SE Bridge

All three FTN routes traverse the Snoqualmie River Rd/Kelsey Creek Rd segment. At the SE 32nd St intersection, Routes 12FL and 13FL continue southwest to the Eastgate Park-and-Ride, providing connections to Frequent Local Route 14, Coverage Routes 32, 33, and 35, and Peak-Only Route 46. Route 7FR continues south to the Eastgate Freeway Station, providing connections to Frequent Express Route 1, Coverage Route 32, and several Peak-Only routes serving Downtown Seattle and Issaquah (see Appendix Figure 18 on page A133).



WEEKDAY ALL-DAY SERVICE FREQUENCIES (in minutes)

	Peak	Base	Night
Frequent Express	8	10 - 15	30
Frequent Rapid	8	10	15
Frequent Local	8	10	15
Coverage	30	30	30
Peak-Only* (Express & Local)	*Peak frequencies vary by route		

Appendix Figure 17 Routes operating along the 142nd Pl SE/Snoqualmie River Rd Multimodal Transportation Corridor and in Eastgate and vicinity, as proposed by the 2030 Growing Resources scenario in the *Transit Service Vision Report*.

Snoqualmie River Rd / Kelsey Creek Rd

Pedestrian flow is logically oriented on the north and east sides of Snoqualmie River Rd around campus structures. A sidewalk is recommended to provide direct access to campus, with widths varying from 6-10 feet depending on the volume of pedestrian flow and the locations of the bus zones. To minimize conflict points between pedestrians and driveways, bicycle traffic is moved west of the road to a 10-foot-wide two-way path, with multiple points of access to the college provided. Two 12-foot-wide travel lanes are provided, one for each direction. General purpose vehicular traffic may be restricted along Snoqualmie River Rd to facilitate better transit operation and access for delivery trucks. A sound wall along Snoqualmie River Rd west of the bicycle facility is designed to minimize noise generated by traffic for the neighboring condominium developments.

142nd Pl SE Bridge

The 142nd Pl SE Bridge currently has two 14-foot-wide travel lanes (one for each direction) and 6-foot-wide sidewalks on both sides. No bicycle facility is provided, making riding over the bridge uncomfortable for most riders. There is significant pedestrian traffic on the west side of the 142nd Pl SE Bridge, mainly to/from the Eastgate Park-and-Ride and Eastgate Freeway Station. Due to pedestrian volumes, an 8-foot-wide sidewalk is recommended on the west side of the road. The east side of the road is identified as a suitable location for an independent bicycle facility, providing a direct connection to the Mountains to Sound Greenway at the northeast corner of SE 36th St and 142nd Pl SE. A 10-foot-wide, two-way, elevated bicycle facility is thus recommended on the east side of the road. These non-motorized facilities leave 22 feet for general purpose travel lanes, which at 11-feet per lane satisfies the minimum width criteria to support transit operations.

Corridor Sub-segments

Within these two main linear segments, multiple sub-segments warrant specific design consideration:

Segment 1: Kelsey Creek Rd/SE 24th St to Kelsey Creek Rd/Snoqualmie River Rd

Segment 2: Snoqualmie River Rd/Kelsey Creek Rd to Delivery Zone

Segment 3: Delivery Zone to Greenhouse

Segment 4: Bellevue College Transit Center on Snoqualmie River Road

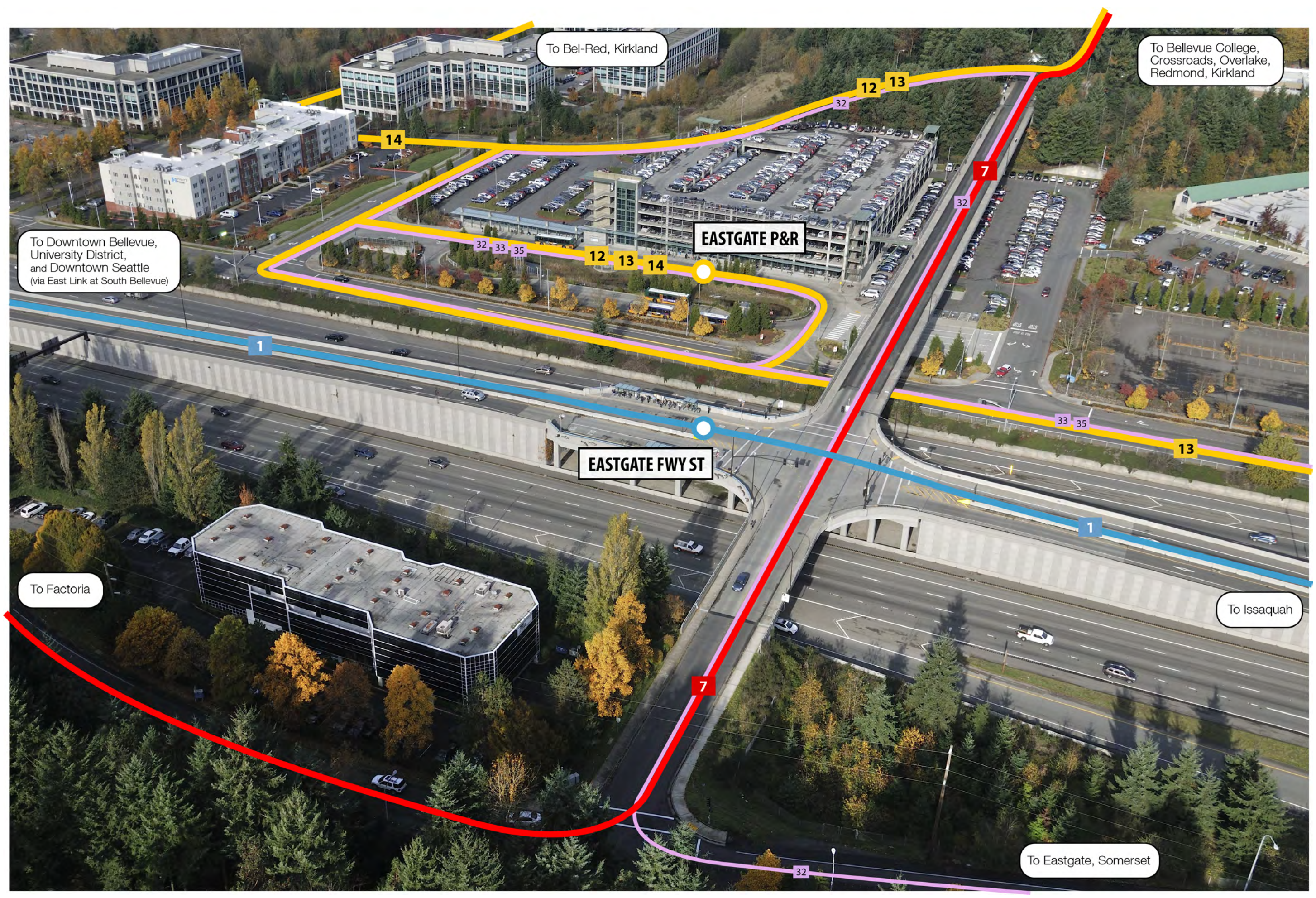
Segment 5: 142nd Pl SE/SE 32nd St

Segment 6: South of 142nd Pl SE/SE 32nd St to 142nd Pl SE north of I-90 Direct Access Ramp

Segment 7: 142nd Pl SE/I-90 Direct Access Ramp to 142nd Pl SE/SE 36th St

Each of these corridor sub-segments is addressed individually on the following pages.

Appendix Figure 18 Transit services at the Eastgate Park-and-Ride and Eastgate Freeway Station in 2030 based on the Growing Resources network. Frequent connections are available to Bellevue College, Crossroads, Downtown Bellevue, Factoria, Issaquah, Overlake, Redmond, and Kirkland.



Segment 1

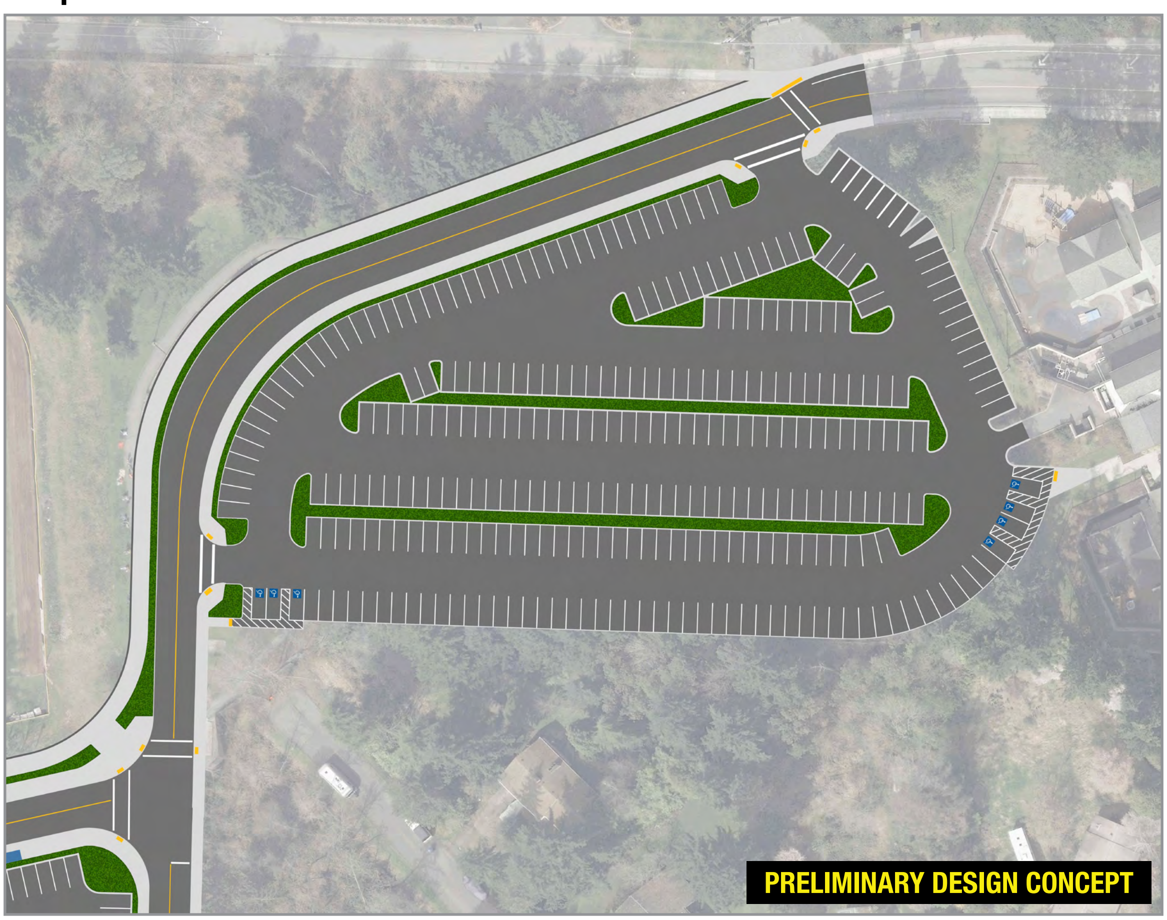
Kelsey Creek Rd/SE 24th St to Kelsey Creek Rd/Snoqualmie River Rd

A 6-foot wide sidewalk is proposed for the south and southeast side of the road. The parking lot is redesigned with only two driveways to reduce the number of the conflict points between pedestrians, transit, and general purpose traffic. The new parking lot design increases the number of stalls by 74, from 227 to 301 stalls (see Appendix Table 11 on page A151).

West of the intersection of Kelsey Creek Rd and SE 24th St, a two-way bicycle facility will be constructed on the north side of the road. East of this intersection, bicycle lanes will be provided in the shoulders of both sides of the road. Bicycle users will transition between these facilities at the SE 24th St intersection, such that bicyclists traveling westbound on SE 24th St would continue directly onto the two-way bicycle facility, while those traveling northeastbound from the campus would cross the street from the new bicycle path and continue along SE 24th St on the south side of the road. Bicyclists also have access to campus at the northwest corner of Snoqualmie River Rd and Kelsey Creek Rd.

Existing:

Proposed:



Segment 2

Snoqualmie River Rd/Kelsey Creek Rd to Delivery Zone

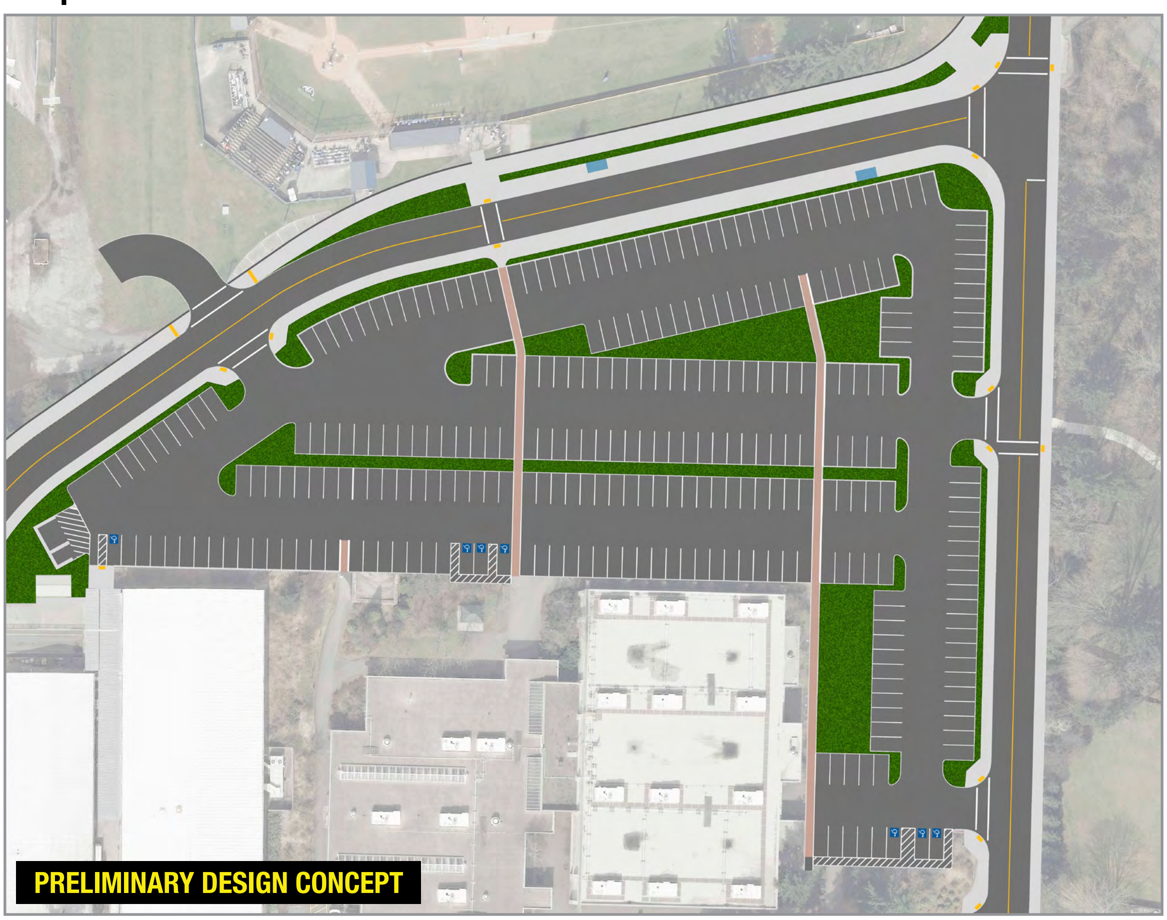
This segment is realigned and shifted north next to the athletic fields to reduce the number of potential conflicts between pedestrians, bicyclists, transit, general purpose traffic, and parking lot users. Parking lot traffic is focused on one side of Kelsey Creek Rd, compared to the current configuration that includes driveways on both sides. This also creates a single parking lot that is larger than the multiple separate existing lots, which allows for a design that maximizes parking capacity. This redesign adds 93 more stalls, increasing the number of stalls in this segment from 203 to 296 (see Appendix Table 11 on page A151).

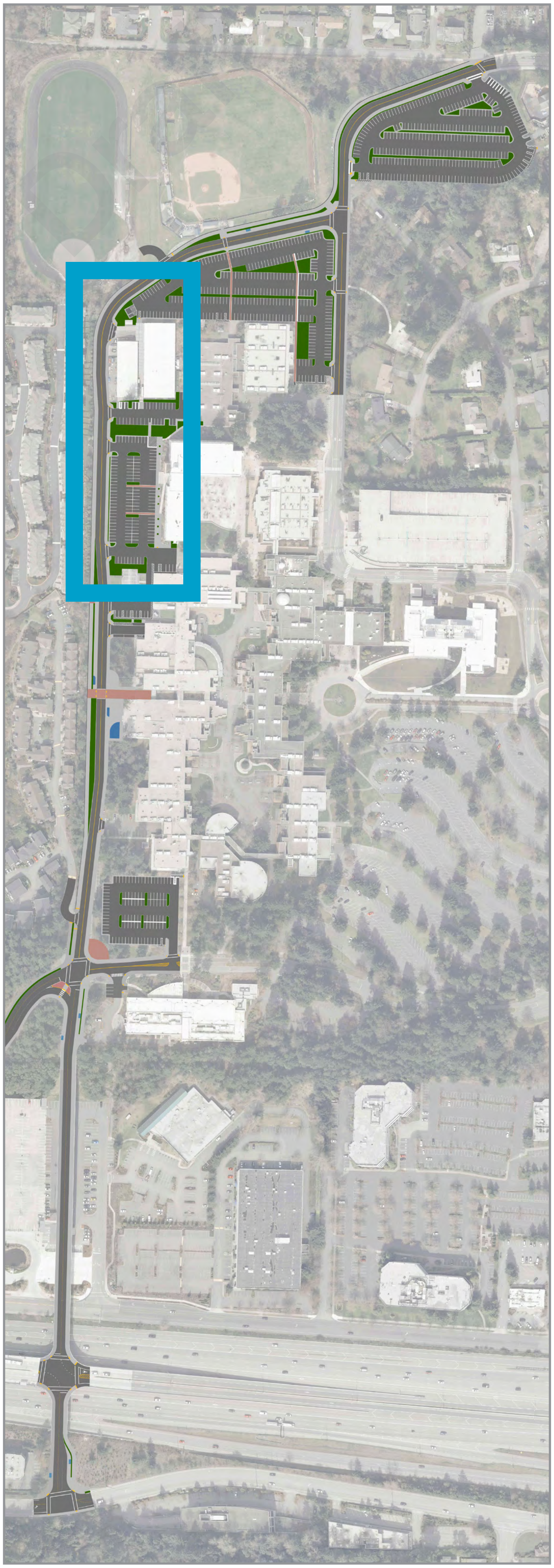
Another advantage of moving the road north is that it increases the turning radius between Snoqualmie River Rd and Kelsey Creek Rd, which will improve transit operations. Bus zones are located between the intersection of Snoqualmie River Rd/Kelsey Creek Rd and the pedestrian crossing to the athletic fields, as this is the longest distance without driveways or pedestrian crossings (about 300 feet). Ten-foot-wide sidewalks are provided on the north and south sides of Snoqualmie River Rd for the westbound (southbound) and eastbound (northbound) bus zones, respectively.

Two pedestrian crossing corridors are provided through the parking lot to facilitate pedestrian movement perpendicular to the parking aisles. Pedestrian access from the gymnasium buildings to the baseball fields remains at almost the same place as its current location. Ideally, to minimize the number of conflicts with bicyclists, it would be combined with the athletic fields' driveway, and the driveway would be moved slightly north from its current location. The bicycle facility is separated from the westbound (southbound) bus zone by a 4-foot-wide planter strip to avoid conflicts with pedestrians. Bicyclists have access to campus and to transit at that bus platform.

Existing:

Proposed:





Segment 3

Delivery Zone to Greenhouse

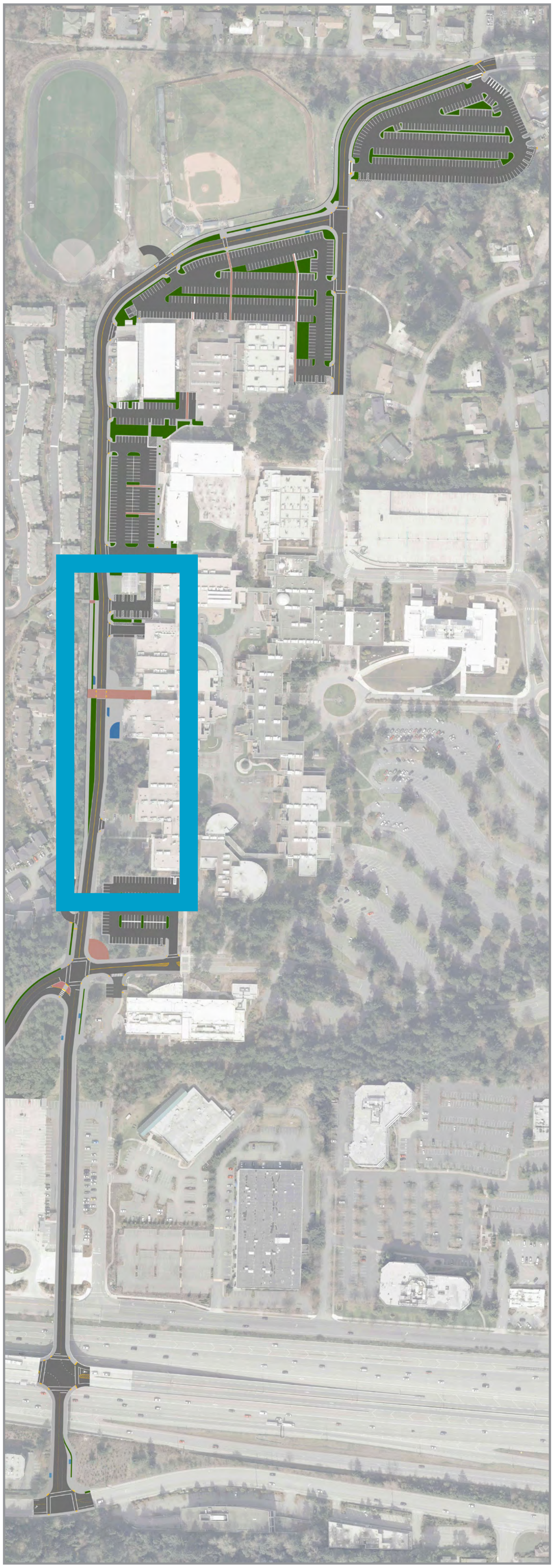
The primary consideration for the Bellevue College delivery zone is preserving the road width to accommodate delivery truck operations. Study of this area resulted in two options for preserving the road width: (1) moving the bicycle facility west of the roadway, or (2) using a mountable curb. While both scenarios have advantages and disadvantages, this design gives preference to the independent bicycle facility west of the roadway. Although this is a more expensive design due to easement and topology, it is much safer and more comfortable for bicyclists, and they would not be required to stop and wait while deliveries take place.

A 6-foot-wide sidewalk provided on the east side of the road, east of the current travel lanes, would be sufficient to support the light pedestrian traffic in this area. Transit vehicles will need to stop and wait for delivery trucks to enter or exit the delivery zone.

With these changes to the roadway and non-motorized facilities, the redesigned parking lot cannot maintain all of the existing stalls in this segment. The number of stalls decreases from 173 to 156, a loss of 17 stalls. However, the parking lot just north of this location (see Segment 2) is close and gains 93 additional stalls, which compensates for the loss realized in this segment (see Appendix Table 11 on page A151).

Existing:

Proposed:



Segment 4

Bellevue College Transit Center on Snoqualmie River Road

This segment includes the primary transit access point to the Bellevue College campus. Bus zones for the Bellevue College Transit Center will be aligned with the campus' main east-west axis, as requested by Bellevue College staff. The pedestrian plaza on the east side of the road may be designed to include a café and magazine kiosk, and a covered area could be provided for tables and chairs.

A 10-foot-wide (minimum requirement) platform area is recommended to accommodate both bus shelters and ADA requirements. Pedestrians cross Snoqualmie River Rd to/from the southbound bus zone at a 24-foot-wide pedestrian crossing area. This design scenario recommends locating bus zones on the near-side of the pedestrian crossing. Although far-side zones would allow buses to leave sooner and reduce dwell times, such a configuration would ultimately encourage unsafe passing, and there are other factors that also support near-side zones. For example, if far-side zones are pursued, two driveways will need to be eliminated—one for the existing handicap parking and one used by delivery trucks. This design preserves the location of the pedestrian access from the neighboring condominium complexes at the north end of the southbound platform. Ideally, it would align with the pedestrian crossing area to reduce the number of conflict points bewteen pedestrians and bicyclists. The bicycle facility west of the southbound zone is separated from the bus platform by a 4-foot-wide planter strip to avoid conflicts with pedestrians. The 24-foot-wide pedestrian crossing extends to the bicycle facility to provide bicyclists access to transit and the campus.

This redesigned roadway eliminates 92 parking stalls along Snoqualmie River Rd (see Appendix Table 11 on page A151). A new parking lot could not be built without significant tree canopy loss.

Existing:

Proposed:

Segment 5

142nd Pl SE/SE 32nd St

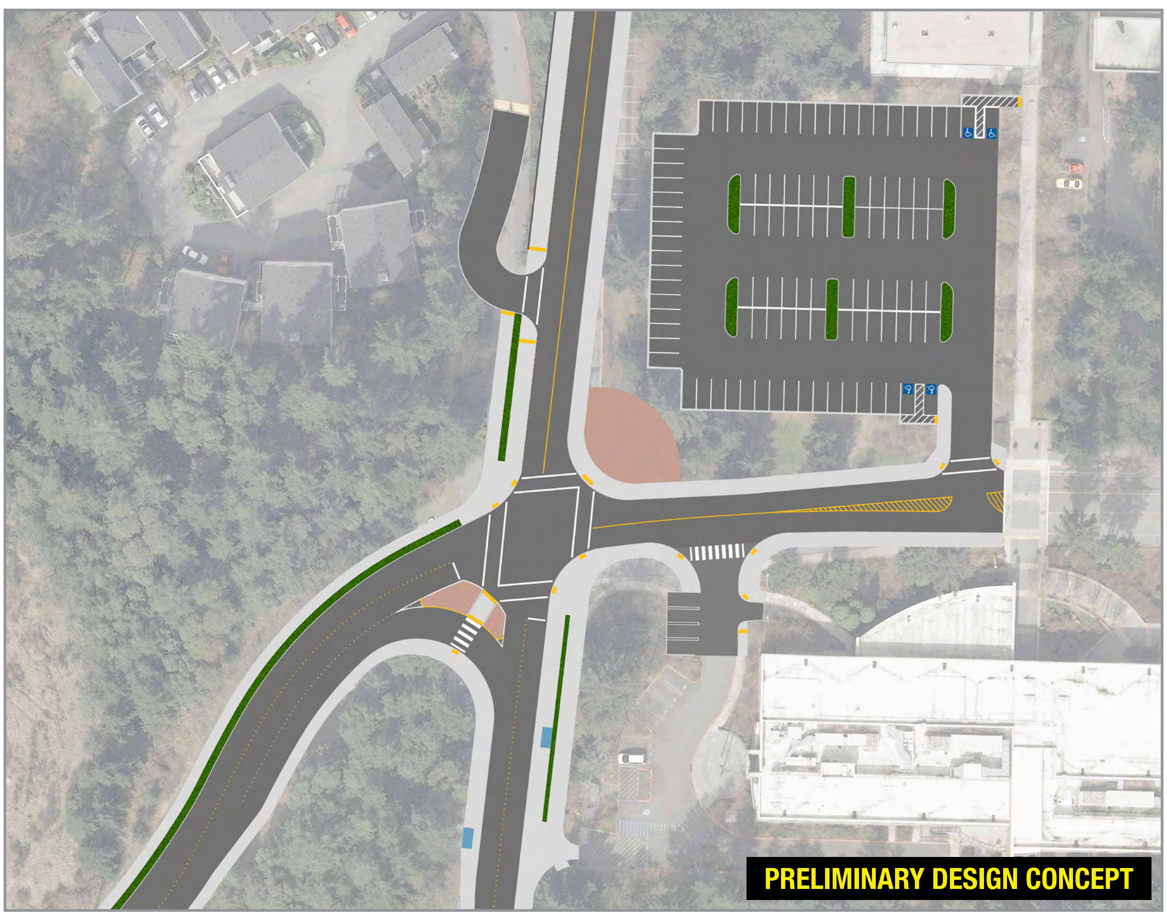
This intersection would undergo significant changes under this preliminary proposed design concept. Currently effectively a five-leg intersection, the realignment of Snoqualmie River Rd would result in a four-leg intersection. Access to the condominium developments along 142nd Pl SE north of SE 32nd St would be provided from Snoqualmie River Rd, instead of directly from the primary intersection. The alignment of Coal Creek Rd would be moved slightly to the north to accommodate a 45-foot turn radius for buses traveling northbound on 142nd Pl SE and continuing westbound on SE 32nd St.

Several bus routes will pass through this intersection, including Routes 7FR, 12FL, and 13FL, and Coverage Route 32. Transit movements will thus consist of north-south travel from 142nd Pl SE to Snoqualmie River Rd (Route 7FR), northbound-to-westbound and eastbound-to-southbound turns between 142nd Pl SE and SE 32nd St (Route 32), and eastbound-to-northbound and southbound-to-westbound turns between SE 32nd St and Snoqualmie River Rd (Routes 12FL and 13FL). The rest of the vehicular traffic consists of private vehicles and delivery trucks to and from the condominium complexes and college campus.

Pedestrian traffic at the intersection comes from Bellevue College (sidewalks on the east side of Snoqualmie River Rd and on the north and south sides of Coal Creek Rd), 142nd Pl SE (sidewalks on the east and west sides of 142nd Pl SE, connecting to the Eastgate Park-and-Ride and northbound bus zone platform), the condominium complex (northwest of the intersection), SE 32nd St, and from the bus zones. Transit shares the road with other traffic west and south of the intersection, but a restriction may be necessary on general purpose traffic along Snoqualmie River Rd north of the condominium complex access road.

Existing:

Proposed:



A pair of bus zones already exists on the south leg of the intersection of 142nd Pl SE and SE 32nd St. To better align with the modified intersection, and to facilitate two-door operation, the northbound zone is moved slightly further north. This eliminates transit conflicts with bicyclists using the bicycle facility on the east side of 142nd Pl SE and pedestrians using the pedestrian trail from the lower elevation.

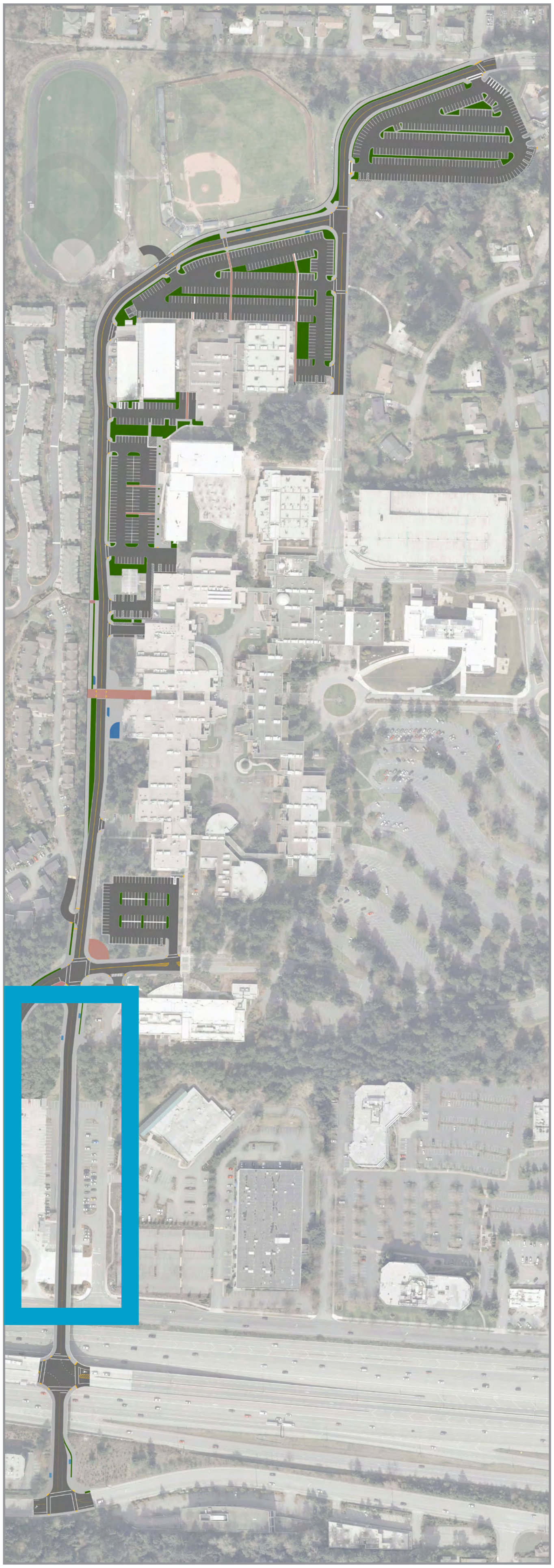
To balance transit access and speed, and to limit the number of potential conflicts between modes, King County Metro recommends only a pair of bus zones on the south leg of the intersection—one for north- and westbound buses and a second for southbound buses. That would mean that buses traveling eastbound on SE 32nd St and continuing northbound on Snoqualmie River Rd (Routes 12FL and 13FL) would not make a stop at the intersection, instead continuing to the Bellevue College Transit Center. Limiting bus zones to only the south leg of the intersection offers more flexibility in addressing access to the condominium complex and the crossing of the bicycle path. The pair of zones on the south leg of 142nd Pl SE can and should remain in-lane stops. Traffic coming from the Bellevue College campus should be minor, as should the LOS for the intersection's west approach. Dwell times are expected to be nominal. King County Metro does not recommend construction of an additional general purpose travel lane. North of the 142nd Pl SE bridge structure, the width of travel lanes would be increased from 11 to 12 feet to facilitate bus operations.

Pedestrian traffic changes sides at the intersection, from the west side of the road on 142nd Pl SE to the east side of the road on Snoqualmie River Rd. Sidewalks remain 8-feet wide except for at the bus zones, where the sidewalk width increases to 10 feet. A new 8-foot-wide sidewalk is designed on the north side of Coal Creek Rd between the intersection and the pedestrian crossing on Coal Creek Rd, approximately 250 feet east of the intersection.

Pedestrian access to the condominium development consists of an 8-foot-wide sidewalk to the west of and separated from the new bicycle facility by a 4-foot-wide planter strip.

Bicycle traffic also changes sides at the intersection. South of the intersection, it runs along the west side of 142nd Pl SE, has a direct access to the northbound bus zone, and then shifts east of the zone, separated by a 2.5-foot-wide planter strip. A 4-foot-wide planter strip is recommended and may be found to be feasible in later design stages. Bicycle traffic using this intersection will come mainly from the new bicycle facility proposed for the east side of 142nd Pl SE, which connects to the Mountains to Sound Greenway Trail, and from the new bicycle facility proposed for the west side of Snoqualmie River Rd.

The northeast corner of this intersection would be designed as a campus gateway that includes the Bellevue College logo. Landscaping could include a water element and/or a cut-thru crossing, which would benefit pedestrians traveling between Snoqualmie River Rd and Coal Creek Rd. The parking lot northeast of the intersection helps to compensate for the 28 parking stalls lost along Snoqualmie River Rd, increasing the number of stalls in this segment from 77 to 105 (see Appendix Table 11 on page A151).

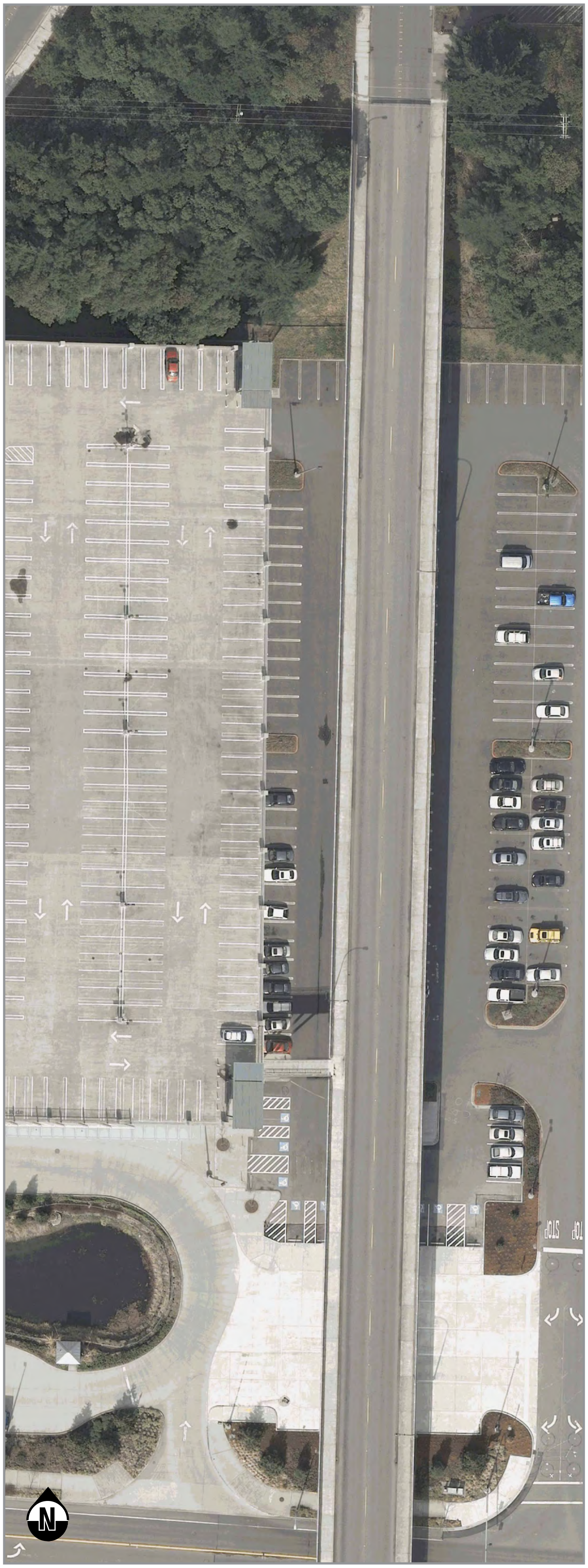


Segment 6

South of 142nd Pl SE/SE 32nd St to North of 142nd Pl SE/I-90 Direct Access Ramp

Consistent with recommendations in the *Eastgate/I-90 Transportation Strategies Report*, this preliminary design concept proposes modifications to the 142nd Pl SE Bridge that would improve the walking and bicycling experience there. There is significant pedestrian traffic on the west side of 142nd Pl SE Bridge, mainly to/from the Eastgate Park-and-Ride and Eastgate Freeway Station. Due to pedestrian volumes, an 8-foot-wide sidewalk is recommended on the west side of the road. The east side of the road is identified as a suitable location for an independent bicycle facility, providing a direct connection to the Mountains to Sound Greenway at the northeast corner of SE 36th St and 142nd Pl SE. A 10-foot-wide, two-way, elevated bicycle facility is thus recommended on the east side of the road. These non-motorized facilities leave 22 feet for general purpose travel lanes, which at 11-feet per lane satisfies the minimum width criteria to support transit operations.

Existing:



Proposed:

Segment 7

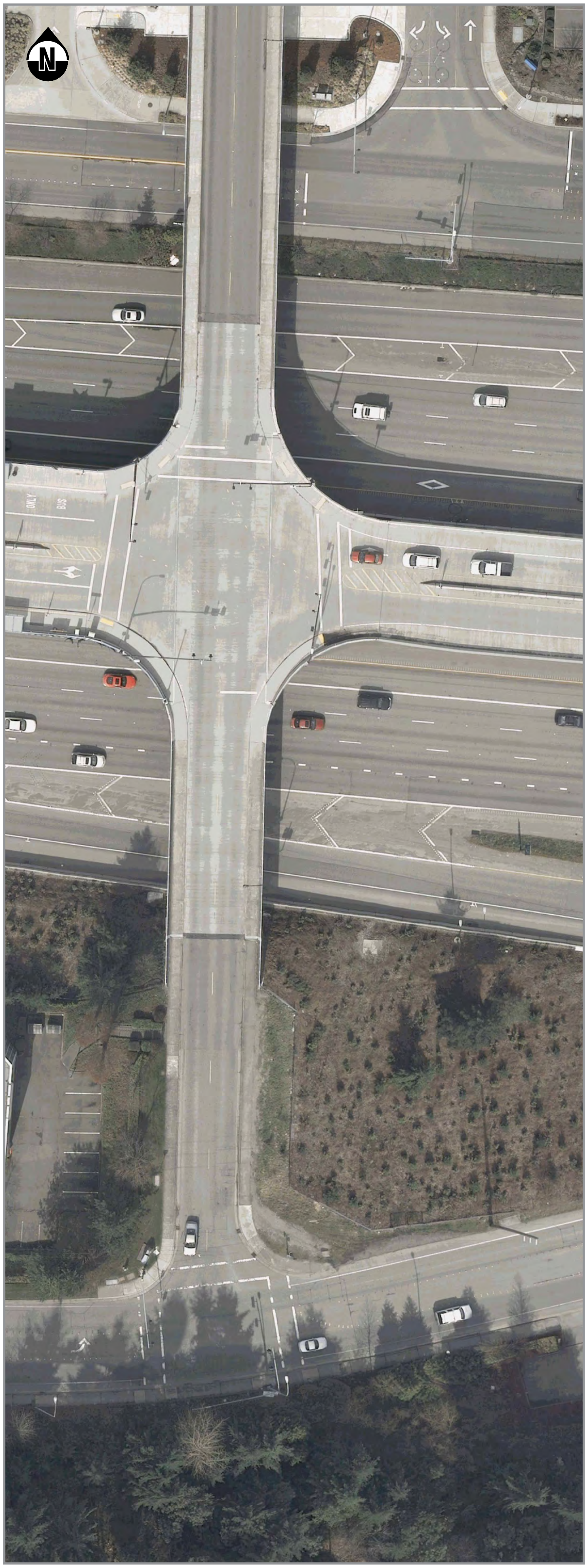
142nd Pl SE/I-90 Direct Access Ramp to 142nd Pl SE/SE 36th St

Users of the 142nd Pl SE/SE 36th St intersection include pedestrians, bicyclists, transit, and general purpose traffic. Bus movements through the intersection include Route 7FR, which travels southbound-to-westbound and eastbound-to-northbound, and Coverage Route 32, which travels southbound-to-eastbound and westbound-to-northbound. South of the 142nd Pl bridge structure, the travel lane width increases from 11 to 12 feet to facilitate bus operations.

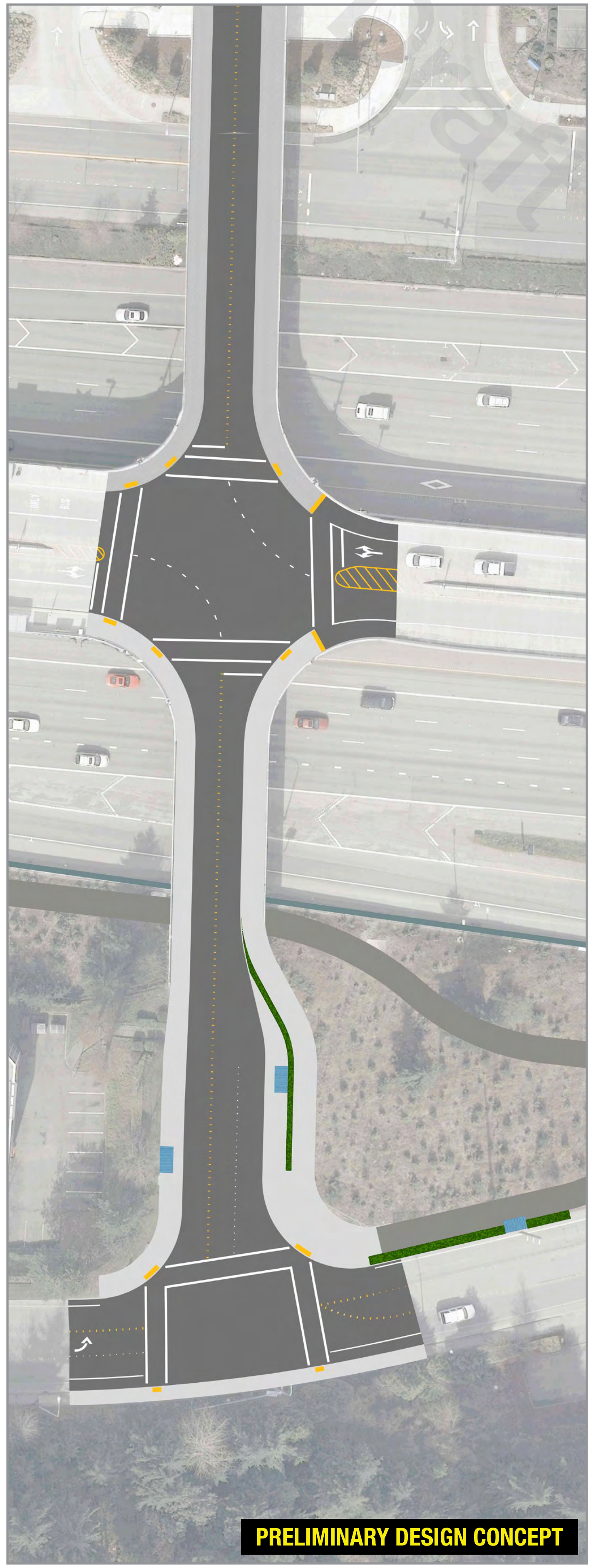
A pair of bus zones is recommended on both sides of 142nd Pl SE just north of SE 36th St—one for northbound and one for southbound buses. These stops serve as a transfer point for transit users connecting from Route 7FR or 32 to routes serving the Eastgate Freeway Station, located 300 feet north of the intersection. The southbound bus zone is in the only southbound lane of travel, so a bus pullout is not practical at this location, as buses turning eastbound onto SE 36th St would not be allowed to make the turn. A pullout lane is designed for the northbound bus zone, allowing other traffic to pass while a bus is stopped at the zone. Additionally, the improved 40-foot turn radius will allow a bus to start from its own lane of travel and finish within the receiving lane without encroaching on opposing traffic.

Because bus zones are located on both sides of 142nd Pl SE just north of SE 36th St, 10-foot-wide sidewalks are provided to comply with criteria for bus zone platform width. Transit users going to the northbound bus zone would cross to the west side of 142nd Pl SE at SE 36th St, not at the I-90 Direct Access Ramp intersection. Pedestrians and bicyclists using the intersection come from the Mountains to Sound Greenway Trail, SE 36th St, 142nd Pl SE, and from the bus zones.

Existing:



Proposed:



A 10-foot-wide two-way bicycle facility begins at the Mountains to Sound Greenway Trail on the east side of 142nd Pl SE, east of the northbound bus zone, separated from the zone by a 2.5-foot-wide planter strip. A 4-foot-wide horizontal separation between the bicycle facility and the bus zone is recommended; however, a wider planter strip would require a wider and thus more expensive bridge structure, especially given the existing slope of the site. Later design stages may consider a wider planter strip or a vertical separation instead. Bicyclists would cross to the west side of 142nd Pl SE at SE 36th St or at the I-90 Direct Access Ramp.

Next Steps

The preliminary design concept for the Bellevue College Connection: 142nd Pl SE/Snoqualmie River Rd Multimodal Transportation Corridor presented here represents the result of several months of coordination between the staffs at the City of Bellevue, Bellevue College, and King County Metro. This design was developed to account for the facility dimension requirements for each of the various modes and to comply with ADA requirements, but it should not be construed as a final engineering-level design, nor have the various stakeholders officially endorsed this proposal at the time of this report's publication.

Discussion with Bellevue College is ongoing and will continue, and final design decisions will be made in close coordination with the College in the coming months and years. The *Transit Service Vision Report* assumes the completion of this project prior to 2022, as the mid-term transit networks are designed to utilize this facility. However, the implementation timeline for this project will be determined as the process advances into later design stages.

Appendix Table 11 Impacts of the Multimodal Transportation Corridor preliminary design concept on parking stalls by segment.

	Segment 1 Kelsey Creek Rd/ SE 24th St to Kelsey Creek Rd/Snoqualmie River Rd	Segment 2 Snoqualmie River Rd/ Kelsey Creek Rd to Delivery Zone	Segment 3 Delivery Zone to Greenhouse	Segment 4 Bellevue College Transit Center on Snoqualmie River Road	Segment 5 142nd Pl SE/SE 32nd St	Total
Proposed	301	296	156	16	105	**874**
Current	227	203	173	108	77	**788**
Difference	+74	+93	-17	-92	+28	**+86**

Note: Segments 6 and 7 correspond to the 142nd Pl SE Bridge, which currently does not and will not include any parking.

APPENDIX 7: PROJECTS NO LONGER UNDER CONSIDERATION

Appendix Figure 19 Running Way Improvement Project L10: A shoulder transit-only bypass lane would eliminate signal and queuing delay for northwest-bound buses on this segment of Lake Hills Connector. It is no longer being considered because adjacent wetland easements limit the available right-of-way. Also pictured is Spot Improvement Project Q11, a queue jump lane that would assist southeast-bound buses. The latter project is still being considered and would require a new lane to be constructed if implemented as shown, but all existing general purpose travel lanes would be maintained.

Over the course of the Capital Element planning process, several potential projects were eliminated from further consideration due to one or more limitations that render the projects 'fatally flawed'. Appendix Table 12 documents the potential transit running way, queue jump, intersection, roadway, and signalization projects that are no longer being considered for advancement by the Transit Master Plan. The transit signal priority projects that have been eliminated from further consideration are listed in Appendix Table 13 on page A154.

Determining what constitutes a 'fatal flaw' is highly contextual, and there is no single characteristic that uniformly resulted in designation of a potential project as 'fatally flawed'. Generally, the potential projects identified as such are those for which limited right-of-way precludes required roadway expansion, ongoing or planned projects cannot accommodate the proposed changes or any similarly beneficial substitute, or the proposed projects lie entirely outside of Bellevue's jurisdiction. In the case of TSP projects, those eliminated from further consideration were primarily those for which Traffic Engineering staff identified significant conflicts with traffic patterns, signal phasing limitations, or other related issues.

The elimination of these projects from further consideration should not be construed to suggest that the projects are without merit, nor that the needs these projects address are inconsequential. In fact, the composite scores for projects Q4, Q20, and L21 are all in the highest tier, indicating significant LOS and queuing issues. Nevertheless, transit priority projects cannot be accommodated at these locations. It is therefore all the more important that other transit priority projects are implemented so that transit

Appendix Table 12 Potential transit running way, queue jump, intersection, roadway, and signalization projects eliminated from further consideration.

ID	Project	Type	FTN Service Routes	FTN Service Frequency (Peak/Base/Night)	Project Description	Composite Scores Short-Term	Composite Scores Long-Term	Project Need	Reason for Project Elimination
Deleted HOV, BAT or General Purpose Lanes									
L10	Lake Hills Connector Tee Intersection Bypass	Lane Construction	13	8 / 10 / 15	Construct westbound transit bypass lanes at T-intersections with Richards Rd.	12–14	14–16	Addresses 2030 intersection LOS of E and queuing issues.	Wetland easements surround the intersection of Lake Hills Connector and Richards Rd, limiting the available space for construction of additional lanes. A sidewalk currently exists on the north side of the roadway, and a 10-14 foot-wide off-street path (O-123-N) is planned for this location as part of the Lake to Lake Trail priority bicycle corridor (EW-3). Construction of the proposed bypass lane would require removal of the existing pedestrian facility and preclude construction of the planned facility.
L15	Northup Way BAT Lane	Lane Restrictions	5, 14	4 / 5 / ~8	Implement BAT on Northup Way from 108th Ave NE to N 33rd Pl and add protected turn phase to improve LOS for turn.	16	24	Addresses current and future LOS issues (E and F, respectively) and queuing issues. Very frequent service on corridor.	Construction of the WSDOT SR-520 Eastside Transit and HOV Project had already commenced before TMP Capital Element planning began. That WSDOT project includes reconstruction of the intersection of Northup Way and 108th Ave NE, and the channelization being implemented was established based on the needs projected by WSDOT models of travel demand. Barring a substantial shift in mode split in favor of transit compared to the conditions projected by WSDOT, it is therefore considered highly unlikely that sufficient capacity will exist to convert a general purpose travel lane into a BAT lane without significant negative impacts to intersection LOS and queue lengths.
L16	Bellevue Way HOV Lane	Lane Construction	1	8 / 10-15 / 30	Construct northbound HOV lane for SR-520 westbound on-ramp to allow HOV traffic to bypass ramp meter and traffic queue.	7–9	12–15	Allows buses/HOV to bypass ramp queues.	Construction of the WSDOT SR-520 Eastside Transit and HOV Project had already commenced before TMP Capital Element planning began. Modifications to highway on-ramps and overpasses were therefore deemed to be highly unlikely if not impossible during the TMP planning horizon.
L21	148th Ave NE BAT Lane	Lane Construction	12	8 / 10 / 15	Construct northbound BAT lane on 148th Ave NE from approximately NE 40th St to NE 51st St.	21–23	21	Addresses current queuing issues as well as future LOS of F and very long queue.	Project extents lie entirely outside of Bellevue, in the jurisdiction of the City of Redmond.
Deleted Queue Jumps									
Q1	Bellevue Way to SR-520 Westbound HOV	Queue Jump	1	8 / 10-15 / 30	Construct HOV queue jump lane for transit and HOV to bypass general purpose traffic at onramp meter.	7-9	12-15	Allows buses/HOV to bypass ramp queues.	Construction of the WSDOT SR-520 Eastside Transit and HOV Project had already commenced before TMP Capital Element planning began. Modifications to highway on-ramps and overpasses were therefore deemed to be highly unlikely if not impossible during the TMP planning horizon.
Q4	108th Ave NE and Northup Way Northbound	Queue Jump	4, 5, 14	~3 / 3-4 / 5-6	Add queue jump to northbound right turn lane.	30	23	Addresses operator comments, existing and future LOS and queuing issue, and very high bus volumes	Construction of the WSDOT SR-520 Eastside Transit and HOV Project had already commenced before TMP Capital Element planning began. That WSDOT project includes reconstruction of the intersection of Northup Way and 108th Ave NE, which includes the addition of one general purpose travel lane to southbound 108th Ave NE and the inclusion of a bicycle lane in the northbound direction. Given the design of the intersection being implemented, it would not be possible to incorporate a queue jump lane in the northbound right turn lane.
Q11	Lake Hills Connector and Richards Rd - Eastbound	Queue Jump	13	8 / 10 / 15	Add queue jump to eastbound approach partially in of right turn lane and partially in new queue jump lane.	14	16	Addresses future intersection LOS of E and significant queuing.	Wetland easements surround the intersection of Lake Hills Connector and Richards Rd, limiting the available space for construction of additional lanes.
Q20	148th Ave NE and NE 51st St - Northbound	Queue Jump	7, 12	4 / 5 / ~8	Add queue jump to northbound approach in new right turn only lane.	21	21	Addresses existing queuing and future LOS of F and significant queuing	Project extents lie entirely outside of Bellevue, in the jurisdiction of the City of Redmond.

Note: These projects are conceptual and the final details of design would be developed if the projects were reconsidered and advanced further along in the implementation process.

Appendix Table 13 Potential transit signal priority (TSP) projects eliminated from further consideration.

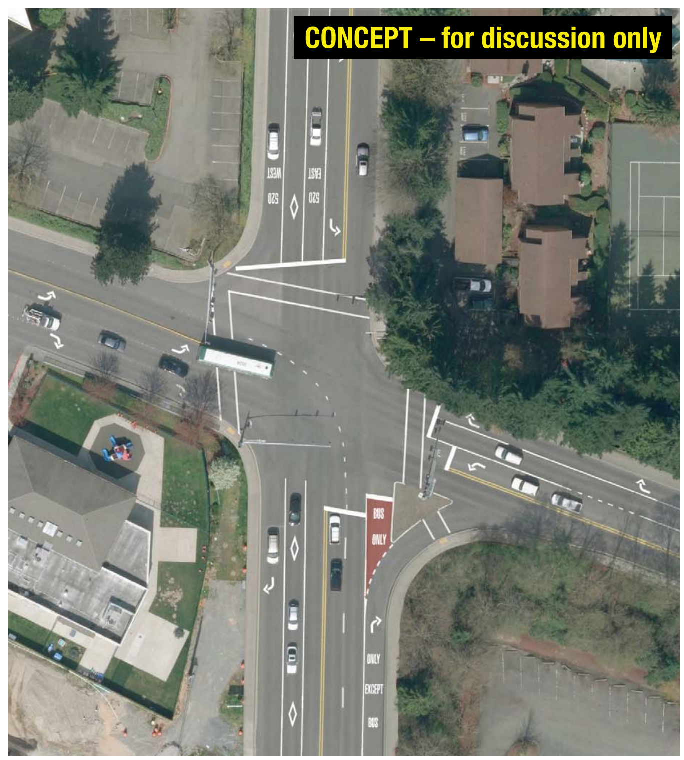
Intersection ID	Cross Streets	Direction(s)	Approach Composite Scores Short-Term	Approach Composite Scores Long-Term	FTN Route(s)	Reason for Project Elimination
8	Bellevue Way NE and NE 4th St	Northbound, Westbound	15–21	15–17	3, 6	Eliminated during the initial 'fatal flaw' screening per the direction of Traffic Engineering staff due to significant conflicts with traffic patterns, signal phasing limitations, and other related issues.
9	Main St and Bellevue Way	Northbound, Southbound, Westbound	16–24	15–18	3, 11	Eliminated during the initial 'fatal flaw' screening per the direction of Traffic Engineering staff due to significant conflicts with traffic patterns, signal phasing limitations, and other related issues.
47	148th Ave NE and NE 20th St	Northbound, Southbound	11	15	12	Eliminated during the initial 'fatal flaw' screening per the direction of Traffic Engineering staff due to significant conflicts with traffic patterns, signal phasing limitations, and other related issues.
51	Lake Hills Blvd and 148th Ave SE	Northbound, Southbound, Westbound, Eastbound	3–15	9–13	7, 12	Eliminated during the initial 'fatal flaw' screening per the direction of Traffic Engineering staff due to significant conflicts with traffic patterns, signal phasing limitations, and other related issues.
61	156th Ave NE and NE 24th St	Northbound, Southbound	12–16	17–18	7	Eliminated during the initial 'fatal flaw' screening per the direction of Traffic Engineering staff due to significant conflicts with traffic patterns, signal phasing limitations, and other related issues.
81	148th Ave NE and NE 24th St	Northbound, Westbound	13	18	12	Eliminated during the initial 'fatal flaw' screening per the direction of Traffic Engineering staff due to significant conflicts with traffic patterns, signal phasing limitations, and other related issues.
86	SE Eastgate Way and 156th Ave SE	Westbound, Eastbound	15–21	15–17	3, 6	Intersection no longer included on the most recent revision of the TSP project list submitted by consultant. No explanation was provided for its elimination.
90	SE Eastgate Way and 158th Ave SE	Westbound, Eastbound	15–21	15–17	3, 6	Intersection no longer included on the most recent revision of the TSP project list submitted by consultant. No explanation was provided for its elimination.
101	SE Eastgate Way and 150th Ave SE	Northbound, Westbound, Eastbound	14–26	12–14	13	Eliminated during the initial 'fatal flaw' screening per the direction of Traffic Engineering staff due to significant conflicts with traffic patterns, signal phasing limitations, and other related issues.
204	Factoria Blvd and SE 36th St	Northbound, Westbound, Eastbound	20–23	11–20	7, 11	Eliminated during the initial 'fatal flaw' screening per the direction of Traffic Engineering staff due to significant conflicts with traffic patterns, signal phasing limitations, and other related issues.
222	Factoria Blvd and SE 38th St	Northbound, Southbound	20–22	22–24	7, 11	Eliminated during the initial 'fatal flaw' screening per the direction of Traffic Engineering staff due to significant conflicts with traffic patterns, signal phasing limitations, and other related issues.
223	Coal Creek Pkwy SE and 119th Ave SE	Northbound, Westbound	13–17	19–20	11	Eliminated during the initial 'fatal flaw' screening per the direction of Traffic Engineering staff due to significant conflicts with traffic patterns, signal phasing limitations, and other related issues.
NA_10	NE 8th St and 148th Ave NE	Northbound, Southbound, Westbound, Eastbound	19–24	14–19	6, 12	Eliminated during the initial 'fatal flaw' screening per the direction of Traffic Engineering staff due to significant conflicts with traffic patterns, signal phasing limitations, and other related issues.
NA_11	148th Ave NE and Bel-Red Rd	Northbound, Southbound	11–20	15–19	12	Eliminated during the initial 'fatal flaw' screening per the direction of Traffic Engineering staff due to significant conflicts with traffic patterns, signal phasing limitations, and other related issues.

Note: These projects are conceptual and the final details of design would be developed if the projects were reconsidered and advanced further along in the implementation process.

services can travel quickly and efficiently, with minimal delay due to congestion, along other portions of the Frequent Transit Network to compensate for these locations where reduced speed and reliability is likely.

Running Way Improvement Project L10 and Spot Improvement Project Q4 provide representative examples of the kinds of projects no longer being considered because of 'fatal flaws' identified during the Capital Element planning process. Project L10 is a transit-only bypass lane that would be constructed in the shoulder on the north side of Lake Hills Connector. This lane would bypass long queuing delay and lengthy queues for northwest-bound buses on this segment, which in the 2030 PM peak are projected to average over 2 minutes and stretch nearly 1,000 feet. The intersection being bypassed is also projected to have an LOS of E in 2030. However, the project is no longer being considered because adjacent wetland easements limit the right-of-way available for construction of an additional lane, and a 10-14 foot-wide off-street path (O-123-N) planned for this location as part of the Lake to Lake Trail priority bicycle corridor (EW-3) precludes the bypass lane.

Project Q4 would have restructured the south approach of 108th Ave NE at Northup Way to incorporate the queue jump into a modified right turn lane. This would address 2030 average queuing delays of 4 minutes, average queue lengths of nearly 500 feet, and an LOS of F—all issues that are compounded by very high bus volumes of 675 daily trips. The project is no longer being considered because it cannot be accommodated by the WSDOT plans that are currently being implemented as part of the SR-520 Bridge Replacement and HOV Program. However, because the intersection configuration currently being constructed by WSDOT includes a northbound curbside bicycle lane, it would not be possible to modify the right turn lane as proposed without putting buses and bicycles in direct conflict with one another.



Appendix Figure 20 Spot Improvement Project Q4: Queue jump lane on 108th Ave NE for northbound buses at Northup Way. This project is no longer being considered because it cannot be accommodated by WSDOT plans currently being implemented. Also pictured is Running Way Improvement Project L17 along 108th Ave NE, a southbound HOV lane between South Kirkland Park-and-Ride and SR-520. Aerial images depict roadway striping before and after lane reconfiguration. Running Way Improvement Project L15, a BAT lane on Northup Way, is no pictured.

APPENDIX 8: POTENTIAL LONG-TERM TSP LOCATIONS

As noted in the section about transit signal priority projects (see page 71), potential TSP projects have been organized into three groups: near-term projects, deleted projects, and long-term projects. Appendix Table 14 lists all intersection approaches served by the 2030 Frequent Transit Network (FTN) that are not among the near-term or deleted projects. This should not be construed as a list of all long-term projects; rather, these are all of the signals that have not yet been eliminated from further consideration. King County Metro is expected to provide guidance by 2018 about its anticipated capacity to expand its TSP capabilities. The City will then consider that information when reviewing this list of intersection approaches to determine which should have long-term TSP projects pursued between 2020–2030.

If transit efficiency and reliability were the only two considerations necessary in determining where TSP should be deployed—that is, if cost were no object, impacts to other travel modes were deemed insignificant, and no technical limitations existed on where TSP could be deployed—then TSP might reasonably be pursued at all or most of these signals. However, this is of course not the case, as all of these other factors are also critical considerations in determining where transit priority can and should be implemented. Therefore, the specific projects that may be included in this group will not be identified until after 2020 when more information is available.

Appendix Table 14 Intersection approaches potentially eligible for long-term transit signal priority (TSP) projects.

Intersection ID	Cross Streets	Direction (Approach)	Long-Term Approach Composite Scores	FTN Route(s)	Previous TSP Priority	Related TMP Project	Related TFP Project
10	Bellevue Way SE & SE Wolverine Way	Northbound, Southbound	18	3, 11			
11	Bellevue Way SE & SE 8th St	Northbound, Southbound	18	3, 11			
12	Bellevue Way SE & SE 10th St	Northbound, Southbound	16–18	3, 11			
13	Bellevue Way SE & 108th Ave SE	Eastbound, Westbound, Northbound, Southbound	16–22	3, 11	X	X	
14	Bellevue Way SE & 112th Ave SE	Eastbound, Westbound, Northbound, Southbound	19–23	1, 3, 11	X	X	X
17	NE 4th St & 106th Ave NE	Eastbound, Westbound	17–19	3, 5, 6			
19	Main St & 106th Ave	Eastbound, Westbound	17–18	11			
22	NE 4th St & 108th Ave NE	Eastbound, Northbound, Southbound	18–19	1, 3, 5, 6, 11, 13		X	X
23	108th Ave NE & NE 2nd St	Northbound, Southbound	18–19	1, 2, 3, 5, 6, 11, 13		X	X
24	Main St & 108th Ave	Eastbound, Westbound, Southbound	18–24	1, 11, 13		X	X
29	116th Ave NE & NE 12th St	Northbound, Southbound, Westbound	16–24	5, 14			
31	Bellevue Way NE & NE 2nd St	Eastbound, Westbound, Northbound, Southbound	6–18	3. 5, 6	X	X	X
36	Main St & 112th Ave	Eastbound, Westbound, Northbound	18–24	1, 13		X	
37	Bel-Red Rd & 130th Ave NE	Eastbound, Westbound	10–15	14			
38	Bel-Red Rd & 132th Ave NE	Eastbound, Westbound	8–10	14			
40	Bel-Red Rd & 140th Ave NE	Northbound, Westbound	11–16	14		X	
50	Main St & 148th Ave	Northbound, Southbound	9–14	12			
52	148th Ave SE & SE 16th St	Northbound, Southbound	20	12			
53	148th Ave SE & SE 22nd St	Northbound, Southbound	8	12		X	
55	148th Ave SE & SE 24th St	Eastbound, Southbound	15	12		X	
60	156th Ave NE & Bel-Red Rd	Northbound, Southbound	16–18	7		X	
65	148th Ave SE & SE 8th St	Northbound, Southbound	6–10	12			
78	Northup Way & 108th Ave NE	Eastbound, Northbound, Southbound	23–24	4, 5, 14		X	
83	Main St & 156th Ave	Northbound, Southbound	8–12	7			
84	Lake Hills Blvd & 156th Ave SE	Eastbound, Southbound	9–13	7			
89	112th Ave SE & SE 8th St	Northbound, Southbound	12	1			
105	SE Eastgate Way & Richards Rd	Northbound	19	11			
108	Bellevue Way SE & Bellevue P&R Entrance	Eastbound, Westbound, Northbound, Southbound	14–22	1, 3, 11	X	X	X
114	Northup Way & NE 116th Ave	Eastbound, Northbound	24	5, 14		X	
135	Bellevue Way SE & SE 16th St	Northbound, Southbound	16	3, 11			
157	Main St & 110th Ave	Eastbound, Westbound	19–24	13		X	
165	NE 10th St & 116th Ave NE	Eastbound, Southbound	11–13	5		X	
171	SE 36th St & 142nd Pl SE	Eastbound, Westbound, Southbound	13–19	7		X	
175	Bel-Red Rd & 134th Ave NE	Eastbound, Westbound	8–11	14			
180	116th Ave SE & Overlake Hospital	Northbound, Southbound	11–17	5		X	
191	NE 6th St & I-405 Direct Access Ramp	Eastbound, Westbound, Northbound, Southbound	15–23	2, 6		X	X
202	Factoria Blvd & SE Newport Way	Northbound, Southbound	15–18	7, 11			
203	Coal Creek Pkwy & Factoria Blvd	Eastbound, Southbound	17–18	7, 11			
214	108th Ave NE & SR-520 Direct Access Ramp	Eastbound, Westbound, Southbound	23	4, 5, 14		X	
234	NE 10th St & 112th Ave NE	Eastbound, Westbound	15–17	5		X	
259	NE 10th St & I-405 on-ramp	Eastbound, Westbound	13–15	5			
263	156th Ave NE & NE 28th St	Northbound, Southbound	16–18	7		X	

Note: These projects are conceptual and the final details of design will be developed as the projects proceed further along in the implementation process.

Appendix Table 14 continued.

Intersection ID	Cross Streets	Direction (Approach)	Long-Term Approach Composite Scores	FTN Route(s)	Previous TSP Priority	Related TMP Project	Related TFP Project
268	148th Ave NE & NE 22nd St	Northbound, Southbound	19	12		X	X
280	Kamber Rd & 139th Ave SE	Northbound, Southwestbound	7–10	14			
282	Factoria Blvd & SE 41st St	Eastbound, Northbound, Southbound	5–14	7, 11			
284	Coal Creek Pkwy & 124th Ave SE	Eastbound, Westbound, Southbound	9–20	7			
285	Factoria Blvd & 3600 Block	Northbound, Southbound	19–20	7, 11		X	
291	SE 36th St & 132nd Ave SE	Westbound, Eastbound	6–20	7			
298	112th Ave SE & SE 6th St	Northbound, Southbound	12–20	1			
301	Factoria Blvd & Newport High School Entrance	Northbound, Southbound	13–15	7, 11			
304	148th Ave SE & Lake Hills Greenbelt Trail Crosswalk	Northbound, Southbound	16	12			
305	SE 36th St & 136th Pl SE	Eastbound, Westbound	6–13	7			
318	Factoria Blvd & SE 40th Ln	Northbound, Southbound	14–22	7, 11			
332	NE 10th St & Bellevue Library Crosswalk	Eastbound, Westbound	15–17	5		X	
332	NE 10th St & 110th Ave NE	Eastbound, Westbound	17–23	5		X	
NA_5	Bel-Red Rd & 124th Ave NE	Northbound, Southbound	14–15	14		X	X
NA_6	148th Ave NE & NE 36th St	Southbound, Westbound	16–18	12			
NA_7	NE 15th st & 120th Ave NE	Eastbound, Westbound	16	14			
NA_8	NE 15th st & 124th Ave NE	Eastbound, Northbound	14–15	14			
NA_9	NE 6th St & 120th Ave NE	Eastbound, Southbound	14–15	6		X	X

Note: These projects are conceptual and the final details of design will be developed as the projects proceed further along in the implementation process.

APPENDIX 9: VALUE OF TRAVEL TIME SAVINGS

To better understand the value of the projected improvements to travel speed realized by implementing all of the proposed HOV and BAT lane projects, an analysis was conducted to determine the aggregate number of revenue and passenger hours saved and the monetized value of these travel time savings to both transit users and operators. This appendix explains how the figures presented in the Potential Outcomes section (see page 80) were calculated .

Data from two separate travel demand models was used to complete this analysis, both of which assessed PM peak conditions based on the 2030 Growing Resources scenario. The first was Dynameq model D30R1.0.3, which was used to obtain transit travel speeds with and without implementation of all proposed HOV and BAT lane projects, as described on page 77 (see Table 12 on page 78 for results). Travel speeds were aggregated by FTN service type (i.e. FX, FR, and FL), and these were multiplied by the total annualized PM peak revenue miles operated by the routes in each category to obtain the estimated number of PM peak revenue hours operated. The number of hours operated in the HOV/BAT Lane Scenario was subtracted from the Baseline hours to obtain the estimated number of PM peak revenue hours saved, as shown in Appendix Table 15 below.

Appendix Table 15 2030 projected difference in PM peak speed and travel time by FTN service type - Baseline vs. HOV/BAT Scenarios.

FTN Service Type	PM Peak Rev Miles	PM Peak Avg Speed (mph)		Est. PM Peak Rev Hours		Est. PM Peak Rev Hours Saved		PM Peak Pass Hr / Rev Hr	Annualized PM Peak Pass Hours Saved
		Baseline	HOV/BAT	Est. Baseline	Est. HOV/ BAT	Baseline - HOV/BAT	% Diff		
Data Source:	Planned	Dynameq Model		Calculated		Calculated		BKR Model	Calculated
FX	816,446	18.1	19.1	45,008	42,657	2,352	5.2%	63.2	148,592
FR	290,891	12.4	12.6	23,535	23,014	521	2.2%	33.4	17,414
FL	474,491	12.1	13.1	39,117	36,248	2,869	7.3%	34.8	99,779
								Annual Total:	**265,786**

Appendix Table 16 2030 projected value of PM peak travel time savings for passengers from proposed HOV/BAT projects by service type.

FTN Service Type	Annualized PM Peak Pass Hours Saved	Mean Hourly Wage (Seattle-Bellevue-Everett)	Travel Time Value (Relative to Wage)			Value of Time ($/person hr)			Value of Pass Hrs Saved		
			Low: LOS A-C (Seated) / Urban Peak	Medium: LOS A-C (Standing)	High: LOS D (Seating/ Standing Average)	Low	Medium	High	Low	Medium	High
Data Source:	Calculated	Bureau of Labor Statistics	Victoria Transport Policy Institute			Calculated			Calculated		
FX	148,592								$1,439,564	$2,056,519	$2,344,432
FR	17,414	$27.68	35%	50%	57%	$9.69	$13.84	$15.78	$168,711	$241,016	$274,759
FL	99,779								$966,655	$1,380,936	$1,574,267
								Annual Total:	**$2,574,930**	**$3,678,471**	**$4,193,457**

Notes: Value of travel time savings based on the May 2012 mean hourly wage for Seattle-Everett-Bellevue of $27.68, obtained from the US Department of Labor Bureau of Labor Statistics. Low, Medium, and High estimates are based on the percentage of that wage considered when valuing transit passenger time, reflecting 35%, 50%, and 57%, respectively. Higher rates of time valuation relative to the mean hourly wage correspond to reduced perceived convenience due to lower intersection LOS (e.g. High corresponds to LOS 'D') and/or standing rather than sitting.

The second model that provided data for this analysis was the BKR travel demand model (EMME version MP30R6.2), which was used to project ridership by route. These ridership figures were multiplied by three (to convert from the single-hour projection to the full length of the PM peak period), then multiplied by 255 to provide an annualized weekday total. These were divided by the number of revenue hours planned for each route to estimate the number of passengers per revenue hour, which were then averaged by FTN service type, as shown in the second to last column in Appendix Table 15. Estimated PM peak revenue hours saved were multiplied by the number of passenger hours per revenue hour to obtain the total number of passenger hours saved by FTN service type, which when summed equals 265,786 hours annually. This figure is an estimate of the passenger-weighted hours saved during the PM peak period—that is, an aggregation of the couple of minutes each passenger would save each day during their evening commute over the course of a year.

A literature review was conducted to determine how to most appropriately value passenger travel time when monetizing these figures, and different sources provided different recommendations. Ultimately, figures recommended by the Victoria Transport Policy Institute (VTPI) were selected for this analysis, both because they are provided in the form of rates, which allow results to be calibrated to reflect the local average wage, and because different rates are provided for different travel modes, each with adjustments to reflect qualitative factors like comfort, convenience, and reliability (see Appendix Table 17). In Appendix Table 16, the Low, Medium, and High rates are 35%, 50%, and 57%, respectively. The Low rate is consistent with both that for seated transit passengers in LOS A-C conditions, and also with that cited by the VTPI for transit passengers under urban peak conditions (see VTPI 2009 page 5.2-20).

Appendix Table 17 Recommended travel time values relative to prevailing wages by travel mode and level-of-service (LOS).

Travel Mode	LOS A-C	LOS D	LOS E	LOS F
Personal Vehicle Driver	50%	67%	84%	100%
Adult Car Passenger	35%	47%	58%	70%
Adult Transit Passenger – Seated	35%	47%	58%	70%
Adult Transit Passenger – Standing	50%	67%	83%	100%
Pedestrians and Bicyclists	50%	67%	84%	100%

Adapted from "Transportation Cost and Benefit Analysis: Techniques, Estimates and Implications, Second Edition" by VTPI (2009), page 5.2-10.

The Medium rate is consistent with that for standing transit passengers in LOS A-C conditions, and the High rate reflects the average of the rates for seated and standing passengers in LOS D conditions. Given that the citywide average LOS is projected to be LOS D in 2030 whether or not HOV/BAT lane projects are implemented (see Table 13 on page 80), the High rate may be the most appropriate to consider, but a range is nevertheless provided to reflect the uncertainty inherent in such an analysis.

The wage by which all travel time valuation calculations are multipied in this analysis is $27.68. This is consistent with the May 2012 mean hourly wage estimate for the Seattle-Bellevue-Everett Metropolitan Division, as published by the US Bureau of Labor Statistics. Multiplying this wage by each of the rates noted above provides a range for the value of time per person hour, by which the total PM peak passenger hours saved were then multiplied for each FTN service type. This assessment suggests that transit passengers in Bellevue in 2030 will save between $2.5–$4.2 million worth of travel time annually in the PM peak period alone if the proposed HOV/BAT lanes are implemented.

As noted in the Potential Outcomes section, assessing the value of travel time savings for transit operators is somewhat more complicated. This is both because the ability to remove a bus from a schedule while maintaining the same headways depends on multiple factors that could not be reflected by this analysis, and because the travel demand models

Appendix Table 18 2030 projected value of PM peak travel time savings for transit operators from proposed HOV/BAT projects by FTN service type.

FTN Service Type	PM Peak Rev Miles	PM Peak Avg Speed (mph)		Est. PM Peak Rev Hours		Operating Cost per Hour		Annualized PM Peak Pass Hours Saved	
		Baseline	HOV/BAT	Est. Baseline	Est. HOV/BAT	Low[1]	High[2]	Low[1]	High[2]
Data Source:	Planned	Dynameq Model		Calculated		King County Metro		Calculated	
FX	816,446	18.1	19.1	2,352	5.2%	$89.00	$135.68	$209,285	$319,054
FR	290,891	12.4	12.6	521	2.2%			$46,399	$70,736
FL	474,491	12.1	13.1	2,869	7.3%			$255,322	$389,238
							Annual Total:	**$511,007**	**$779,027**

1. Low estimate based on King County Metro's 2010 marginal hourly operating cost of $89.
2. High estimate based on King County Metro's 2012 'Transit Operating Cost per Vehicle Hour', as reported on the agency's website at: http://metro.kingcounty.gov/am/reports/annual-measures/financial.html#cost-per-hour

used here to assess transit travel speed use the service frequencies defined by the 2030 Growing Resources scenario as model inputs, but operating these frequencies will only be possible if transit travel speeds meet or exceed the targets established in the *Service Vision Report*. Even so, it remains instructive to estimate the operating cost savings attributable to implementing these HOV and BAT lane projects, even if these savings are effectively reinvested in prodiving service at the frequencies being proposed.

As shown in Appendix Table 18, two values are considered in this analysis for operating cost per hour. The Low estimate ($89) is based on King County Metro's 2010 marginal hourly operating cost, while the High estimate ($135.68) is based on King County Metro's 2012 transit operating cost per vehicle hour, as reported on the agency's website. Both values are considered here because each represents a different way of assessing the cost of operating service. The marginal hourly operating cost (Low estimate) is the rate that is typically used when estimating the cost of revising existing services (e.g. adding or removing trips to an existing route), whereas the operating cost per vehicle hour (High estimate) is a more holistic cost estimate that also considers the planning, implementation, marketing, and other costs associated with operating transit service (e.g. the costs of fuel, operator wages). Multiplying the total travel time savings realized by HOV/BAT lane implementation by these operating costs per hour suggests that transit service providers would save between about $510,000–$780,000 annually in the PM peak period alone.

APPENDIX 10: 2030 CITYWIDE LEVEL OF SERVICE (LOS)

Appendix Table 19 Dynameq Model Output for 2030 Citywide Level of Service (LOS) by Intersection.

#	Node ID	Intersection	2030 Reduced Funding w/o HOV/BAT Projects				2030 Growing Resources w/o HOV/BAT Projects				2030 Growing Resources with HOV/BAT Projects			
			Hourly Volume	Avg Intersec-tion Delay (sec)	LOS	Total Delay Hours in Peak Hour	Hourly Volume	Avg Intersec-tion Delay (sec)	LOS	Total Delay Hours in Peak Hour	Hourly Volume	Avg Intersec-tion Delay (sec)	LOS	Total Delay Hours in Peak Hour
1	981	100th Ave/Main Street	1,637	25	C	11	1,883	24	C	13	1,726	24	C	12
2	5455	102nd Ave/Main Street	1,619	20	C	9	1,417	19	B	8	1,360	19	B	7
3	979	100th Ave NE/NE 8th Street	1,799	33	C	17	2,077	26	C	15	2,040	23	C	13
4	5097	102nd Ave NE/NE 8th Street	1,900	25	C	13	1,893	22	C	12	1,938	23	C	12
5	1750	Bellevue Way NE/NE 12th Street	3,159	32	C	28	3,526	34	C	33	3,134	33	C	28
6	5017	Bellevue Way NE/NE 10th Street	3,535	23	C	22	3,491	23	C	22	3,032	26	C	22
7	1738	Bellevue Way NE/NE 8th Street	4,463	55	D	68	4,236	52	D	61	4,335	51	D	61
8	2640	Bellevue Way NE/NE 4th Street	3,589	37	D	37	3,467	40	D	39	3,328	39	D	36
9	1736	Bellevue Way/Main Street	2,577	66	E	48	2,572	37	D	26	2,407	39	D	26
11	5105	Bellevue Way SE/SE 8th Street	3,827	44	D	47	3,609	30	C	30	3,338	24	C	22
12	5106	Bellevue Way SE/SE 10th Street	3,106	10	A	8	2,939	4	A	4	2,840	5	A	4
13	1717	108th Ave SE/Bellevue Way SE	3,634	62	E	62	2,954	65	E	53	2,905	18	B	15
14	1716	112th Ave SE/Bellevue Way SE	4,260	119	F	141	3,531	78	E	77	3,588	36	D	35
15	5020	106th Ave NE/NE 12th Street	2,621	26	C	19	2,622	28	C	21	2,472	32	C	22
16	5021	106th Ave NE/NE 8th Street	4,466	61	E	76	4,360	66	E	80	4,348	69	E	83
17	5022	106th Ave NE/NE 4th Street	3,713	46	D	47	3,582	49	D	49	3,534	61	E	60
18	5025	106th Ave NE/NE 2nd Street	3,097	27	C	23	3,059	25	C	21	2,684	63	E	47
19	1735	106th Ave/Main Street	2,184	24	C	14	2,196	38	D	23	2,028	85	F	48
20	1749	108th Ave NE/NE 12th Street	3,563	17	B	17	3,499	21	C	21	3,400	43	D	41
21	1739	108th Ave NE/NE 8th Street	4,988	69	E	95	4,786	64	E	85	4,208	76	E	88
22	2641	108th Ave NE/NE 4th Street	2,659	34	C	25	2,653	29	C	21	2,944	47	D	38
23	5027	108th Ave NE/NE 2nd Street	1,565	68	E	30	1,621	46	D	21	1,829	73	E	37
24	1734	108th Ave/Main Street	2,856	24	C	19	2,624	53	D	39	2,764	91	F	70
25	1748	112th Ave NE/NE 12th Street	5,129	51	D	73	4,709	50	D	65	4,570	59	E	75
26	1740	112th Ave NE/NE 8th Street	7,310	71	E	145	7,571	71	E	150	6,853	91	F	174
27	5031	110th Ave NE/NE 8th Street	5,684	65	E	102	5,636	75	E	118	4,832	96	F	129
28	5018	Bellevue Way NE/NE 6th Street	2,469	5	A	3	2,160	4	A	3	1,898	4	A	2
29	1747	116th Ave NE/NE 12th Street	5,507	68	E	104	5,506	56	E	85	5,283	58	E	84
30	1741	116th Ave NE/NE 8th Street	7,375	55	E	113	7,452	53	D	110	6,657	58	E	108
31	5019	Bellevue Way NE/NE 2nd Street	3,261	32	C	29	3,111	22	C	19	2,803	23	C	18
32	5509	120th Ave NE/NE 12th Street	3,876	39	D	42	4,124	36	D	41	4,254	35	D	41
34	1745	124th Ave NE/Bellevue-Redmond Rd	3,174	51	D	45	3,260	55	D	50	3,338	53	D	49
35	1743	124th Ave NE/NE 8th Street	4,907	43	D	59	4,790	51	D	67	4,650	40	D	52
36	1733	112th Ave/Main Street	5,177	67	E	96	5,049	90	F	127	5,182	66	E	95
37	5036	130th Ave NE/Bellevue-Redmond Rd	2,026	13	B	7	2,047	13	B	7	2,118	14	B	9
38	5037	132nd Ave NE/Bellevue-Redmond Rd	2,388	18	B	12	2,375	16	B	11	2,439	17	B	12
39	1754	140th Ave NE/NE 20th Street	4,471	34	C	42	4,346	34	C	41	4,338	36	D	43
40	1755	140th Ave NE/Bellevue-Redmond Rd	4,165	41	D	48	4,047	44	D	50	3,959	48	D	53
41	1731	140th Ave NE/NE 8th Street	4,140	93	F	107	4,031	80	F	90	4,004	55	E	62

Appendix Table 19 continued.

#	Node ID	Intersection	2030 Reduced Funding w/o HOV/BAT Projects				2030 Growing Resources w/o HOV/BAT Projects				2030 Growing Resources with HOV/BAT Projects			
			Hourly Volume	Avg Intersection Delay (sec)	LOS	Total Delay Hours in Peak Hour	Hourly Volume	Avg Intersection Delay (sec)	LOS	Total Delay Hours in Peak Hour	Hourly Volume	Avg Intersection Delay (sec)	LOS	Total Delay Hours in Peak Hour
42	5073	140th Ave/Main Street	2,032	14	B	8	1,944	14	B	7	1,862	14	B	7
43	1721	140th Ave SE/SE 8th Street	2,549	46	D	33	2,385	39	D	26	2,326	37	D	24
44	5078	145th Place SE/Lake Hills Blvd	1,647	31	C	14	1,451	13	B	5	1,450	10	B	4
45	1715	145th Place SE/SE 16th Street	2,301	50	D	32	2,052	45	D	26	1,976	40	D	22
47	1763	148th Ave NE/NE 20th Street	5,042	103	F	144	4,959	104	F	143	5,723	83	F	132
48	1756	148th Ave NE/Bellevue-Redmond Rd	5,371	75	E	112	5,195	83	F	119	5,497	59	E	89
49	1730	148th Ave NE/NE 8th Street	5,485	42	D	64	4,987	45	D	62	4,874	45	D	60
50	5074	148th Ave/Main Street	3,737	29	C	30	3,350	28	C	26	3,333	27	C	25
51	1714	148th Ave SE/Lake Hills Blvd	3,081	30	C	26	2,885	32	C	25	2,902	31	C	25
52	1713	148th Ave SE/SE 16th Street	3,372	41	D	38	3,166	33	C	29	3,181	40	D	36
53	1700	148th Ave SE/SE 22nd Street	2,686	44	D	33	2,532	25	C	18	2,679	21	C	16
54	6122	145th Place SE/SE 24th Street	1,132	18	B	6	957	12	B	3	1,006	12	B	3
55	6123	148th Ave SE/SE 24th Street	2,770	36	D	28	2,460	22	C	15	2,464	17	B	12
57	6166	148th Ave SE/SE 28th Street	3,990	135	F	150	3,684	130	F	133	3,710	118	F	122
58	1757	Bellevue-Redmond Rd/NE 20th Street	4,491	44	D	55	4,588	46	D	58	4,764	41	D	54
59	1762	Bellevue-Redmond Rd/NE 24th Street	4,219	53	D	62	4,095	46	D	53	4,055	51	D	57
60	5099	156th Ave NE/Bellevue-Redmond Rd	4,171	93	F	108	4,171	85	F	98	4,635	50	D	64
61	1761	156th Ave NE/NE 24th Street	4,008	62	E	69	3,930	59	E	65	4,517	46	D	58
62	1758	156th Ave NE/Northup Way	4,383	85	F	103	4,460	62	E	77	4,576	65	E	83
63	1729	156th Ave NE/NE 8th Street	3,285	39	D	35	3,157	38	D	34	2,786	40	D	31
64	1765	140th Ave NE/NE 24th Street	3,385	78	E	74	3,368	98	F	92	3,151	73	E	64
65	1722	148th Ave SE/SE 8th Street	2,869	6	A	4	2,642	5	A	3	2,657	6	A	5
67	6131	156th Ave NE/NE 10th Street	2,083	22	C	13	1,901	23	C	12	1,751	21	C	10
68	1753	130th Ave NE/NE 20th Street	2,803	35	C	27	2,854	28	C	22	2,863	33	C	27
69	5003	Bellevue Way NE/NE 24th Street	2,440	30	C	20	2,738	29	C	22	2,562	32	C	23
70	5551	156th Ave NE/NE 13th Street	2,547	22	C	15	2,461	25	C	17	2,504	25	C	17
71	1719	Lk Hills Connector/SE 8th St/7th Pl	3,552	112	F	110	3,491	72	E	69	3,252	79	E	72
72	2642	112th Ave NE/NE 4th Street	4,500	135	F	169	4,540	105	F	132	4,845	102	F	138
73	1732	116th Ave/Main Street	3,628	34	C	34	3,409	32	C	31	3,463	38	D	37
74	1769	Bellevue Way NE/Northup Way NE	2,404	90	F	60	2,621	71	E	52	2,603	110	F	79
75	5057	164th Ave NE/NE 24th Street	2,732	35	D	27	2,528	49	D	34	2,443	33	C	23
76	1637	164th Ave NE/Northup Way	3,274	32	C	29	3,176	23	C	21	3,080	25	C	22
77	5066	130th Ave NE/NE 24th Street	2,201	38	D	23	2,175	39	D	24	2,293	56	E	35
78	1768	108th Ave NE/Northup Way NE	3,137	122	F	106	3,300	125	F	114	3,221	116	F	103
79	5058	148th Ave NE/NE 40th Street	3,093	71	E	61	2,663	152	F	112	2,908	59	E	48
81	1764	148th Ave NE/NE 24th Street	4,890	92	F	125	4,736	85	F	112	4,666	78	E	101
82	1698	Richards Rd/Kamber Rd	2,960	54	D	45	2,956	49	D	40	2,751	36	D	28
83	5075	156th Ave/Main Street	2,064	15	B	9	1,916	16	B	9	1,771	16	B	8
84	1724	156th Ave SE/Lake Hills Blvd	1,946	24	C	13	1,797	23	C	12	1,697	21	C	10
85	6054	Richards Rd/SE 32nd Street	2,626	69	E	50	2,600	52	D	37	2,569	37	D	27
86	1770	156th Ave SE/SE Eastgate Way	2,925	44	D	36	2,758	49	D	38	2,572	43	D	30
87	1728	164th Ave NE/NE 8th Street	2,832	45	D	36	2,780	32	C	25	2,689	34	C	26
88	1766	124th Ave NE/Northup Way NE	2,798	86	F	67	2,927	64	E	52	3,005	107	F	90
89	1718	112th Ave SE/SE 8th Street	1,532	26	C	11	1,237	18	B	6	1,148	23	C	7
90	6124	158th Ave SE/SE Eastgate Way	1,390	15	B	6	1,287	15	B	5	1,205	14	B	5

Appendix Table 19 continued.

#	Node ID	Intersection	2030 Reduced Funding w/o HOV/BAT Projects				2030 Growing Resources w/o HOV/BAT Projects				2030 Growing Resources with HOV/BAT Projects			
			Hourly Volume	Avg Intersection Delay (sec)	LOS	Total Delay Hours in Peak Hour	Hourly Volume	Avg Intersection Delay (sec)	LOS	Total Delay Hours in Peak Hour	Hourly Volume	Avg Intersection Delay (sec)	LOS	Total Delay Hours in Peak Hour
91	1776	160th Ave SE/SE Eastgate Way	1,188	19	B	6	1,179	20	B	6	1,190	20	C	7
92	5101	161st Ave SE/SE Eastgate Way	1,770	37	D	18	1,697	40	D	19	1,624	34	C	15
93	6156	Lk Washington Blvd/NE 1st/NE 10th St	679	32	C	6	1,488	32	C	13	1,404	32	C	13
94	1737	92nd Ave NE/NE 8th Street	1,432	16	B	6	1,548	27	C	12	1,510	27	C	11
96	980	100th Ave NE/NE 4th Street	1,711	18	B	9	1,580	16	B	7	1,494	16	B	6
97	5080	156th Ave SE/SE 24th St/22nd Pl	1,796	60	E	30	1,599	67	E	30	1,570	56	E	25
98	5104	Coal Creek Parkway/Forest Drive	3,362	37	D	34	3,357	40	D	37	3,447	29	C	28
99	5895	Somerset Blvd/SE Newport Way	844	21	C	5	687	24	C	4	692	20	C	4
100	2540	92nd Ave NE/Lk Washington Blvd	893	11	B	3	1,537	37	D	16	1,513	53	D	22
101	5331	150th Ave SE/SE Eastgate Way	3,378	35	D	33	3,169	33	C	29	3,132	32	C	28
102	5087	118th Ave SE/SE 8th Street	2,742	95	F	72	2,747	60	E	45	2,641	75	E	55
104	6125	SE Allen Rd/SE Newport Way	1,203	22	C	7	969	17	B	5	907	19	B	5
105	5083	Richards Rd/SE Eastgate Way	3,453	83	F	80	3,569	48	D	48	3,717	85	F	88
106	2900	121st Ave SE/SE 8th Street	2,277	29	C	19	2,152	40	D	24	2,036	22	C	12
107	5033	112th Ave NE/NE 6th Street	3,251	87	F	79	3,525	66	E	64	3,627	62	E	63
108	5109	Bellevue Way SE/P&R/112th Ave SE	4,890	158	F	214	4,028	185	F	207	3,957	147	F	162
111	1726	Northup Way/NE 8th Street	1,536	40	D	17	1,609	49	D	22	1,656	56	E	26
114	1767	116th Ave NE/Northup Way NE	1,821	86	F	44	1,810	108	F	54	1,457	81	F	33
116	6210	115th Place NE/Northup Way	2,133	91	F	54	2,389	83	F	55	2,381	56	E	37
117	5510	120th Ave NE/NE 20th Street	1,373	28	C	11	1,811	31	C	16	2,058	54	D	31
118	5067	Northup Way/NE 24th Street	1,836	48	D	25	2,363	36	D	23	2,619	42	D	31
119	5004	108th Ave NE/NE 24th Street	1,082	18	B	5	1,110	19	B	6	1,068	22	C	6
123	5059	140th Ave NE/NE 40th Street	1,940	101	F	54	1,836	108	F	55	1,880	102	F	53
124	5030	110th Ave NE/NE 6th Street	1,779	41	D	20	1,851	41	D	21	1,717	61	E	29
126	5026	108th Ave NE/NE 6th Street	1,161	36	D	12	870	47	D	11	999	29	C	8
128	5032	112th Ave NE/NE 2nd Street	3,425	62	E	59	3,426	54	D	51	3,154	60	E	52
129	5096	102nd Ave NE/NE 10th Street	1,908	15	B	8	2,056	15	B	8	1,793	15	B	8
130	5012	100th Ave NE/NE 10th Street	1,106	11	B	3	1,248	14	B	5	1,205	13	B	4
131	5086	116th Ave SE/SE 1st Street	2,813	46	D	36	2,585	36	D	26	2,273	31	C	19
132	2901	Richards Rd/SE 30th Street	2,061	48	D	27	2,081	24	C	14	1,964	16	B	9
133	1692	150th Ave SE/SE Newport Way	2,690	37	D	27	2,818	47	D	37	2,795	39	D	30
134	1720	Richards Rd/Lk Hills Connector	1,818	69	E	35	1,765	57	E	28	1,794	47	D	24
135	5107	Bellevue Way SE/SE 16th Street	3,335	43	D	40	3,004	61	E	51	3,190	27	C	24
136	5604	Bellevue Way NE/NE 30th Street	2,184	21	C	13	2,538	38	D	27	2,317	52	D	34
138	5053	Bellevue-Redmond Rd/NE 40th Street	2,977	37	D	31	2,829	42	D	33	3,015	29	C	24
139	5506	116th Ave NE/NE 4th Street	3,989	81	F	90	3,637	71	E	72	3,716	52	D	53
141	5010	100th Ave NE/NE 1st Street	2,253	22	C	13	2,176	21	C	12	2,012	16	B	9
143	5894	Coal Creek Parkway/SE 60th Street	2,943	28	C	23	2,810	24	C	19	2,910	23	C	18
144	5463	102nd Ave NE/NE 1st Street	1,385	18	B	7	1,306	20	C	7	1,235	19	B	6
145	5426	102nd Ave NE/NE 4th Street	1,849	14	B	7	1,733	12	B	6	1,646	14	B	6
146	5326	SE Eastgate Way/SE 35th Place	1,406	19	B	7	1,373	21	C	8	1,290	18	B	6
152	5436	105th Ave NE/NE 4th Street	2,194	19	B	12	2,128	15	B	9	2,123	19	B	11
153	3387	114th Ave SE/SE 8th St (Bellfield Office	1,135	30	C	9	1,130	17	B	5	1,082	16	B	5
154	5023	106th Ave NE/NE 10th Street	3,137	33	C	29	3,193	36	D	32	2,663	58	E	43
157	5028	110th Ave/Main Street	2,325	24	C	16	2,289	70	E	44	2,835	34	C	27

Appendix Table 19 continued.

#	Node ID	Intersection	2030 Reduced Funding w/o HOV/BAT Projects				2030 Growing Resources w/o HOV/BAT Projects				2030 Growing Resources with HOV/BAT Projects			
			Hourly Volume	Avg Intersection Delay (sec)	LOS	Total Delay Hours in Peak Hour	Hourly Volume	Avg Intersection Delay (sec)	LOS	Total Delay Hours in Peak Hour	Hourly Volume	Avg Intersection Delay (sec)	LOS	Total Delay Hours in Peak Hour
158	5029	110th Ave NE/NE 2nd Street	2,036	95	F	54	2,136	100	F	59	2,238	95	F	59
159	5641	110th Ave NE/NE 4th Street	3,428	116	F	110	3,437	63	E	60	3,780	108	F	114
162	5401	110th Ave NE/NE 12th Street	3,738	22	C	23	3,633	24	C	25	3,484	37	D	36
164	5708	OHCM Internal Rd/NE 10th St Extension	2,338	29	C	19	2,248	25	C	16	2,218	31	C	19
165	5505	116th Ave NE/NE 10th St Extension	3,716	22	C	23	3,746	18	B	19	3,465	37	D	35
171	5088	142nd PL SE/SE 36th Street	1,674	47	D	22	1,576	57	E	25	1,626	43	D	20
173	1712	156th Ave SE/SE 16th Street	2,233	6	A	3	2,095	5	A	3	2,069	5	A	3
174	5595	150th Ave SE/SE 38th Street	3,123	70	E	61	3,122	66	E	58	3,128	72	E	62
175	6252	134th Ave NE/Bellevue-Redmond Rd	2,916	17	B	14	2,938	20	B	16	2,971	19	B	16
179	5024	106th Ave NE/NE 6th Street	2,312	15	B	10	2,199	14	B	9	2,112	20	C	12
180	7077	116th Ave NE/OHMC Entrance	2,180	14	B	8	2,264	14	B	9	1,995	20	C	11
181	5046	SE 1st St/120th Ave/Main Street	1,610	29	C	13	1,468	19	B	8	1,394	21	C	8
185	6032	136th Place NE/Northup Way	2,651	22	C	16	2,532	21	C	15	2,637	21	C	15
186	3109	120th Ave NE/NE 6th Street	2,673	23	C	17	2,273	23	C	15	2,149	20	C	12
188	6006	148th Ave NE/NE 29th Place	3,494	103	F	100	3,400	107	F	101	3,383	72	E	68
189	5803	NE 29th Place/NE 24th Street	2,009	14	B	8	1,847	20	B	10	1,683	11	B	5
190	6200	108th Ave NE/NE 10th Street	2,839	39	D	31	2,964	45	D	37	2,677	58	E	43
195	2321	148th Ave NE/NE 36th Street	2,777	36	D	28	2,584	62	E	45	2,754	34	C	26
198	5050	W Lk Sammamish Parkway/NE 40th Street	1,119	12	B	4	1,013	11	B	3	959	10	B	3
202	1693	128th Ave SE/Newport/SE Newport Way	2,406	29	C	19	2,325	16	B	10	2,274	16	B	10
203	1694	Factoria BLVD/Coal Creek Pkwy	3,075	81	F	69	3,162	52	D	45	3,159	44	D	39
204	5084	128th Ave SE/SE 36th Street	4,075	41	D	46	4,102	33	C	38	4,275	35	C	41
219	5286	I-405 NB Ramps/SE 8th Street	2,450	48	D	33	2,249	54	D	34	2,354	48	D	32
220	6110	I-405 NB Ramps/Coal Creek Parkway	3,572	55	E	55	3,718	38	D	39	3,705	42	D	43
221	6114	I-405 SB Ramps/Coal Creek Parkway	2,220	169	F	104	2,249	168	F	105	2,088	171	F	99
222	6065	128th Ave SE/SE 38th Place	3,077	78	E	66	2,936	88	F	72	3,020	82	F	69
223	6109	119th Ave SE/Coal Creek Parkway	3,667	103	F	105	3,702	81	F	84	3,725	69	E	71
224	5652	I-405 SB Ramps/NE 4th Street	3,712	48	D	50	3,689	48	D	49	3,942	48	D	53
225	5653	I-405 NB Ramps/NE 4th Street	3,182	59	E	52	3,367	56	E	52	3,324	42	D	39
226	5277	I-405 SB Ramps/SE 8th Street	1,221	51	D	17	1,068	28	C	8	1,378	37	D	14
227	2902	150th Ave SE/I-90 EB Off-Ramp/SE 36th St	3,026	80	E	67	3,024	92	F	77	3,037	75	E	64
228	1690	Lakemont Blvd (SR-901)/SE Newport Way	3,023	59	E	50	3,132	46	D	40	3,152	46	D	40
233	5091	120th Ave NE/NE 8th Street	5,303	53	D	78	5,001	46	D	63	4,792	42	D	56
234	5393	112th Ave NE/NE 10th Street	4,379	56	E	68	4,271	55	E	66	4,170	54	D	62
235	6201	110th Ave NE/NE 10th Street	2,919	49	D	40	2,913	50	D	40	2,760	31	C	24
238	1682	Coal Creek Parkway/SE 72nd Place	3,000	24	C	20	2,831	23	C	18	2,958	26	C	21
239	5098	156th Ave NE/NE 40th Street	5,165	72	E	103	4,903	62	E	84	4,873	51	D	69
245	6104	119th Ave SE/SE 60th Street	1,695	8	A	4	1,360	3	A	1	1,375	3	A	1
248	6078	148th Ave SE/SE 46th Street	1,490	3	A	1	1,531	4	A	2	1,518	4	A	2
249	2214	148th Ave NE/NE 51st Street	3,765	107	F	112	3,599	125	F	125	3,626	123	F	124
250	5383	SR-520 SB Ramps/NE 51st Street	2,610	29	C	21	2,585	28	C	20	2,549	29	C	20
251	5387	SR-520 NB Ramps/NE 51st Street	2,501	57	E	39	2,422	45	D	30	2,351	48	D	31
252	5038	132nd Ave NE/NE 20th Street	2,339	31	C	20	2,400	31	C	21	2,429	28	C	19
255	5229	156th Ave NE/NE 51st Street	3,573	111	F	110	3,429	111	F	105	3,508	95	F	92
260	6220	I-90 EB On-Ramp/SE Newport Way	1,739	5	A	2	1,906	5	A	2	1,920	4	A	2

Appendix Table 19 continued.

#	Node ID	Intersection	2030 Reduced Funding w/o HOV/BAT Projects				2030 Growing Resources w/o HOV/BAT Projects				2030 Growing Resources with HOV/BAT Projects			
			Hourly Volume	Avg Intersec-tion Delay (sec)	LOS	Total Delay Hours in Peak Hour	Hourly Volume	Avg Intersec-tion Delay (sec)	LOS	Total Delay Hours in Peak Hour	Hourly Volume	Avg Intersec-tion Delay (sec)	LOS	Total Delay Hours in Peak Hour
262	7766	W Lk Sammamish Parkway/SR-520 EB Off-Ramp	3,356	65	E	60	3,286	70	E	64	3,375	67	E	63
263	6016	156th Ave NE/NE 28th Street	2,580	57	E	41	2,672	37	D	28	2,996	41	D	34
264	6132	156th Ave NE/NE 31st Street	2,838	38	D	30	3,094	34	C	29	3,037	48	D	40
265	5061	148th Ave NE/Old Redmond Road	4,326	42	D	51	4,189	46	D	54	4,204	52	D	61
266	6170	151st Ave NE/NE 24th Street	2,047	39	D	22	1,922	45	D	24	2,021	20	C	11
267	6018	152st Ave NE/NE 24th Street	3,446	61	E	58	3,154	74	E	65	3,498	52	D	51
268	5539	148th Ave NE/NE 22nd Street (Sears)	2,967	23	C	19	2,956	26	C	21	3,349	25	C	24
269	5516	132th Ave NE/NE 16th Street	1,725	21	C	10	1,453	19	B	8	1,700	21	C	10
270	6039	140th Ave NE/NE 18th St (Evergreen Mall)	2,017	3	A	2	1,829	3	A	2	1,565	4	A	2
272	5573	139th Ave SE/SE Eastgate Way	1,497	14	B	6	1,542	14	B	6	1,573	14	B	6
275	2215	W Lk Sammamish Parkway/NE 51st Street	3,356	46	D	43	3,251	58	E	52	3,319	65	E	60
276	1760	Bellevue-Redmond Rd/W Lk Sammamish Parkway	2,634	69	E	51	2,609	70	E	51	2,743	53	D	41
277	7078	156th Ave NE/NE 36th Street	3,558	34	C	34	3,554	31	C	31	3,650	31	C	32
279	5247	148th Ave NE/SR-520 EB Off-Ramp	4,095	15	B	18	4,044	15	B	17	3,917	16	B	18
280	5578	139th Ave SE/Kamber Road	2,005	41	D	23	2,100	30	C	17	1,993	21	C	12
282	1141	128th Ave SE/SE 41st Street	2,120	15	B	9	1,934	18	B	10	1,922	21	C	11
284	6068	124th Ave SE/Coal Creek Parkway	3,108	57	E	49	3,190	53	D	47	3,184	50	D	44
285	6064	128th Ave SE/3600 Block	3,421	44	D	42	3,417	44	D	42	3,530	40	D	39
294	5508	124th Ave NE/NE 16th Street	2,016	29	C	16	1,727	31	C	15	1,849	34	C	17
295	1121	120th Ave NE/NE 4th Street	2,815	12	B	9	2,109	11	B	7	2,161	11	B	7
300	7671	W Lk Sammamish Parkway/Marymoor Park	2,993	64	E	53	2,889	83	F	67	2,963	78	E	64
		Subtotal	565,672			8,141	552,955			7,665	548,186			7,350
		Citywide Average Vehicle Delay (sec)	51.8				49.9				48.3			
		Citywide Total Delay Hours	8,141				7,665				7,350			
		Citywide Average LOS	D				D				D			