

# Puget Sound Gateway Project

SR 509, I-5 and SR 167 Funding and Phasing Study: Strategic Corridor Design Review



## Appendix K: Tolling Concept of Operations

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## 1. PURPOSE AND SCOPE

The purpose of this document is to support understanding and discussion of how the tolled aspects of the Puget Sound Gateway Project (Gateway Project) would operate, including the potential effects of tolling on drivers, in a general sense.

This Concept of Operations provides information to support project planning and outreach. It focuses on the driver experience and high-level traffic operational effects of the tolling approach for the SR 167, I-5 express toll lanes, and SR 509 corridors. The Concept of Operation provides an overview of the existing WSDOT toll projects, to provide context, and includes a discussion of the operational effects of the I-5 Express Toll Lanes (ETLs), and SR 167 and SR 509 full road tolling systems, by project phase. These operational effects are described in terms of:

- Overall road system operations
- Toll system operations, including customer service center operations
- The driver (user) experience, including for 2-person carpools (HOV2+ ), three or more person carpools (HOV 3+), and trucks

Throughout the report, any areas that require additional investigation are highlighted. This report provides detail regarding the elements of the toll systems that are identified in Appendices J – Travel Demand Methodology, and Appendix L – Revenue Projections and Methodology. The traffic and tolling models included in these appendices identify a preliminary forecast model that is being used to develop an understanding of how the Gateway Project operates as part of the highway system and preliminary toll revenue.

Finally, the Concept of Operation includes a discussion of the effects of the construction of future construction phases of the Gateway Project on Phase 1 systems and operations.

## 2. PROJECT OVERVIEW AND PHASING

The purpose of the Gateway project is to complete missing system links on SR 167 and SR 509, and improve travel on I-5 between the two new connections with a focus on freight operations. This project will provide improved connections between the ports of Seattle and Tacoma, local distribution centers, and I-5. The new travel options will relieve congestion on local roads and highways. The Project will also implement an I-5 express toll lane (ETL) system.

### *SR 167 and SR 509 – Full Road Tolling*

Operationally, the SR 167 and SR 509 extension projects will implement a tolling concept that is very similar to the tolling concept on other full road tolling facilities in Washington. The operational approach for SR 167 and SR 509 extensions is full electronic tolling, with variably priced tolling (toll rates change at pre-determined times-of-day, based on analysis of historical congestion).

The final approach to toll pricing has not been determined for either SR 167 or SR 509. In these corridors, the toll pricing may be based on a single charge or segmented charge. For a single

charge, users would pay a single rate for using the facility no matter where a vehicle enters and exits. A segmented toll is priced by segment of the corridor traveled, and would be based on how far a vehicle travels on the tolled facility, across defined segments.

The approach to toll pricing for trucks is not determined at this time. Options include pricing by axle (as is currently done on SR 520 and the Tacoma Narrow Bridge), “shape”-based pricing, which classifies trucks based on the size as evaluated using image processing cameras, or some other approach.

### *I-5 – Express Toll Lanes*

The operational approach for the I-5 express toll lane is very similar to the tolling concept for the I-405 (Bellevue to Lynnwood) ETL, and is expected to be full electronic tolling with dynamically priced toll rates based on current congestion. For the I-5 ETL, tolls are expected to be priced by segment (toll rates change based on how far a vehicle travels on the tolled facility, based on defined segments).

All vehicles will be tolled with possibilities for exemptions for HOV 3+, transit, and emergency vehicles on an active call. These specific decisions will be made as the concept of operation is refined during future project development. There is discussion that single unit trucks less than 26,000 GVW may be allowed on the I-5 ETL, and these single unit trucks will be subject to the same tolls as other users of the ETL. This will need to be resolved as part of the final operations.

## **2.1 Project Phasing**

The Gateway project will be built in phases, starting with a first phase planned for near-term implementation that includes extensions of SR 167 and SR 509, including connections to I-5, and converting the existing I-5 HOV lanes to ETLs from SR 16 to I-90. Phase 1 would be followed by future expansion that could be implemented as a single additional phase, or in multiple phases. This Concept of Operations considers the future construction as a single phase.

### **2.1.1 Phase 1**

Phase 1 envisions the following main elements:

Convert the existing I-5 HOV lanes to ETLs from SR 16 to I-90.

Construct SR 509 improvements to include:

- Full road electronic tolling
- One lane in each direction between South 188th Street and I-5
- Add a second lane in each direction between 28th/24th Avenue south and I-5
- Add truck climbing lanes to provide freight bypass in each direction as needed where steep grades exist
- Complete interchange at South 188th Street and SR 509
- New interchange to/from east at 28th/ 24th Avenue South

- New interchange at SR 509 and I-5
- New connection to South 231st Way and the Kent Valley
- Improve interchange at SR 516 to connect new I-5 collector-distributor lanes
- Build new southbound I-5 lane between SR 516 and South 272nd Street

Construct SR 167 improvements to include:

- Full road electronic tolling
- One lane in each direction between North Meridian Avenue/SR 161 and Valley Avenue East
- Add a second freight bypass lane in each direction between Valley Avenue East and 54th Avenue East
- Replace Porter Way overpass
- New interchange at SR 167 and I-5
- New interchange to/from east at 54th Avenue East
- New interchange to/from west at Valley Avenue East
- New interchange to/from east at Freeman Road East
- Complete the interchange at North Meridian Avenue/SR 161
- Replace 70th Avenue East from 20th Street East to SR 99

See Appendix A: Exhibits A-1, A-2, A-5, and A-7 for Phase 1 construction features.

### **2.1.2 Gateway Project Future Phase**

The Future Phase, as currently planned, includes the following main elements:

Add a second ETL on I-5 from SR 167 to SR 509

- Construct NB on/SB off direct ETL access ramps from SR 167 to the I-5 ETL
- Construct NB off/SB on, direct ETL access ramps from SR 509 to the I-5 ETL

SR 509 improvements may include:

- Completing the second lane northbound and southbound, creating a four lane highway for the full length of the corridor extension
- Adding a half-interchange at S 200<sup>th</sup> St, an additional SR 509 southbound lane between Des Moines Memorial Drive and S 200<sup>th</sup> St
- Modification to accommodate the South Access Road connection from SR 509 to/from the SeaTac Airport area. The South Access Road is a project that is funded and constructed by others, but the Gateway future phases include this road being implemented.

SR 167 improvements may include:

- Completing the second lane northbound and southbound, creating a four-lane highway for the full length of the corridor extension.
- Constructing the full directional interchange at I-5.

- Removing the westbound SR 167 off ramps at Freeman Rd, and replacing them with westbound off ramps at Valley Ave.
- Modifying the southbound half-diamond interchange of SR 167 and I-5 to add additional access from northbound I-5 to eastbound SR 167, and conversely from westbound SR 167 to southbound I-5, and constructing direct merge ramps, replacing the Phase 1 signalized half-diamond configuration for I-5 south to SR 167 east and west, and SR 167 east and west to I-5 north.

See Appendix A, Exhibits A-3, A-4, A-6 and A-8 for concepts for the potential future phase(s).

### **3. OVERVIEW OF WSDOT TOLLING PROJECTS**

WSDOT currently operates full road tolling on the Tacoma Narrow Bridge (TNB) and the SR 520 Bridge. In addition, a high occupancy toll (HOT) lane system (similar to an ETL) is currently operating on SR 167. The following information is supplied to provide context for the Gateway Project.

#### **3.1 How Facilities are Selected for Tolling, and How Toll Rates are Set**

The Washington State Legislature is responsible for overall approval and authority to toll State Highways, and for selecting the corridors that will be tolled. They are supported by the Washington State Transportation Commission (WSTC). The WSTC is a seven-member body of citizens appointed by the Governor for six-year terms. The Secretary of the Washington State Department of Transportation and a representative from the Governor's Office are ex officio members of the WSTC. The WSTC is designated as the State Tolling Authority and is responsible for setting toll rates for all state highways and bridges.

The Commission has conducted two tolling studies. The first study was completed in 2006, and guided the initial statewide tolling policy that was enacted as Washington State Law. The second study was completed in 2008, and it identified 28 potential tolling projects throughout the state and established the state's candidate tolling project list for the next 20 years.

Table K- 1, below, summarizes the roles and responsibilities of the Legislature, the WSTC, and WSDOT with respect to authorizing tolls, setting toll rates, and collecting and administering toll collection.

**Table K- 1: Roles and Responsibilities for Toll Facilities in Washington**

	<b>Washington State Legislature</b>	<b>Washington State Transportation Commission</b>	<b>Washington State Department of Transportation</b>
Authority Under Current Legislation	Establish tolling and designate toll corridors	Set toll rates	Build and operate toll collection system, collect tolls
Roles and Responsibilities	<ul style="list-style-type: none"> <li>• Establish legal toll framework</li> <li>• Authorize tolling in designated corridors</li> <li>• Approve financing planes</li> <li>• Enable tolling practices</li> <li>• Appropriate toll operation budget</li> </ul>	<ul style="list-style-type: none"> <li>• Set toll rates within funding requirements</li> <li>• Set toll discounts</li> <li>• Establish advisory committees</li> <li>• Prepare the Washington Transportation Plan</li> </ul>	<ul style="list-style-type: none"> <li>• Develop toll collection systems and procedures</li> <li>• Operate tolled corridors</li> <li>• Collect tolls</li> <li>• Finance improvements</li> <li>• Assess financial feasibility of toll projects</li> </ul>

### 3.2 Tolling Approaches

The following are three approaches to toll pricing, all based on where tolls are collected:

**Single Point Tolling** – There is a single tolling point on the facility to collect tolls. For example, SR 520 and the TNB use single point tolling.

**Segmental Tolling** – Under segmental tolling, the toll facility is divided into segments. The toll paid depends on how many segments are traveled (or where the vehicle enters or exits the toll road). For example, the I-405 ETL will operate using segmental tolling.

**One Toll** – multiple tolling points, but a single toll paid regardless of the distance traveled on the facility. This allows both short and long trips to be tolled the same amount. For example, the SR 167 HOT lane operates with the same toll charge no matter how far a vehicle travels on the facility.

The following are three approaches to establishing toll rates:

**Fixed** - The toll price is same all times of the day. Different vehicle classes can have different prices. For example, the TNB operates as a fixed price toll facility.

**Variable** – The toll price is different depending on time of day and/or day of week. The prices are set based on historical traffic volumes, with the highest price set during the most congested periods. For example, SR 520 currently operates as a variable priced facility.

**Dynamic** – The toll price varies based on current congestion. For ETLs, the pricing will depend upon the traffic conditions in the ETL, and, for some dynamic pricing algorithms, traffic conditions in the general-purpose lane. The WSDOT Northwest Region is developing the dynamic pricing algorithm that will be used on future dynamically tolled facilities. The goal of dynamic tolling is typically to keep the tolled facility operating at a high level of service, keeping it an attractive alternative to drivers while enhancing revenue. For ETLs, the objective is generally to keep the toll lane traveling at least 45 mile per hour (mph). Drivers are provided the toll rates on overhead signs over or next to the ETL. The vehicle will be charged the price shown when it first enters the toll lane for the destinations displayed. For example, SR 167 operates as a

dynamically priced facility. The I-405 ETL is planned to operate as a dynamically priced facility, and it is planned to change SR 520 to dynamic pricing in the next several years.

### **3.3 Overview of Existing WSDOT Full Road Tolling Projects and Systems**

WSDOT currently operates full road tolling on the TNB and the SR 520 Bridge. Every lane is tolled. They are also single point tolling facilities.

#### **3.3.1 Tacoma Narrows Bridge**

To fund the capacity expansion of the TNB 30-year bonds based on toll revenues were issued. The WSTC set the toll rates to cover the capital costs of the construction debt, the on-going costs of maintenance, and the preservation and operations of the TNB. TNB tolling began in 2007. Tolls are collected from all vehicles traveling eastbound from Gig Harbor towards Tacoma. Travelers can stop at any of the six tollbooths to pay using cash or credit card, or can pay with their Good To Go! account using a Pass or Pay by Plate, or Pay by Mail (non-account holders) by driving in one of the three mainline (two General purpose and one HOV) lanes or on the 24th Street NW ramp. All vehicles, including transit, must pay the toll. Emergency responder vehicles that are on an active call are exempted from paying the toll.

Toll rates on the TNB are the same at all times every day. As of July 1, 2013, the toll ranges from \$4.25 for single-axle vehicle with a Good To Go! Pass, to \$18.75 for trucks of six or more axles using Pay By Mail. The WSTC may again modify the toll rate in the future to ensure financial viability.

#### **3.3.2 SR 520 Bridge**

In December 2011, tolling started on SR 520 to provide funds to construct a new bridge and to manage congestion (Figure K- 1). The facility uses a fully electronic toll collection method, and therefore, there are no tollbooths. Tolls are collected in both directions of travel. As a means to manage traffic congestion, the toll rate varies depending on time of day and on weekends (and certain holidays), with higher tolls charged during the most congested periods.

Tolls are charged between 5 AM and midnight daily, with no tolls charged between midnight and 5 AM. Tolls vary based on the number of vehicle axles, and the method of payment. Effective July 1, 2013, the WSTC established one-way tolls ranging from \$1.70 to \$3.70 for single axle vehicles with a Good To Go! Pass. Tolls for trucks with six or more axles and using a Short-Term Account range from \$7.70 to \$15.25. Transit vehicles, emergency responder vehicles that are on active call, tow truck authorized by WSP to respond and clear blocking vehicles, over the road transit buses on fixed schedules and diplomatic vehicles are exempted from paying the toll.



Figure K- 1: SR 520 Bridge

### 3.4 Overview of WSDOT Express Toll Lane Projects

WSDOT currently operates an ETL on the north portion of SR 167 between Auburn and Renton (the SR 167 HOT lane). WSDOT is completing construction of an ETL on I-405 (from NE 6th Street in Bellevue to I-5 in Lynnwood), scheduled for operation in 2015. On the I-405 project website, express toll lanes are defined in the following way:

Express toll lanes are carpool (HOV) lanes that also allow vehicles not meeting the occupancy requirement to use the lanes by paying a toll. Similar to SR 167 today, the express toll lanes on I-405 will operate as an expressway within a freeway, with limited access to specific entry and exit points. Dynamic tolls, or tolls that fluctuate based on available capacity in the lane, will help manage the number of vehicles in the lanes. The express toll lanes will allow toll-free trips for transit and vanpools. ETLs may also include discounts or toll-free trips for carpools, either 2+ or 3+ occupancy, depending upon what is selected for a facility by the Toll Commission.

The SR 167 HOT lanes were funded through a Federal Highway Administration (FHWA) grant. Part of the grant program establishes performance benchmarks. The intent is to ensure that congestion reduction goals are met. The I-405 ETL project is funded with traditional gas tax funds. ETL (and the HOT lane) performance is required to be maintained at an average speed of 45 mph or more 90 percent of the time.

#### 3.4.1 SR 167 – HOT Lanes Operations

The SR 167 HOT lane was implemented as a pilot project to test the concept of allowing non-HOVs to pay to use HOV lanes. HOVs do not need to register for a Good To Go account to travel in the HOT lane without charge. It will take legislative authorization to continue operation of the SR 167 HOT lanes after the pilot project ends in June 2015.

Tolls range from .50 cents – \$9.00. The toll changes in real time (dynamically) based upon the speed of vehicles moving through the lane. If traffic is free flowing, the minimum charge will

apply. If traffic slowing down, the rate will increase with the amount of congestion. The amount being charged for using the HOT lane is displayed on the overhead electronic signs. The amount shown is a one-time charge for traveling in the HOT lane, no matter how far a vehicle travels in it.

The SR 167 HOT lanes give solo drivers the option to pay a toll to drive in the HOV lane. Solo drivers who choose to use the HOT lanes must install a Good To Go! pass in their vehicle and have an active Good To Go! account. A switchable pass is well suited for HOT lanes users as it can be turned on or off depending on the number of people in the vehicle. Buses, motorcycles, vanpools, transit, and carpools of two or more use HOT lanes toll-free, and do not need a Good To Go! pass. Trucks over 10,000 lbs. gross vehicle weight are not allowed to use the SR 167 HOT lanes.

### **3.4.2 I-405 – Express Toll Lanes Planned Operations**

This project will add one new lane between NE 6th Street in Bellevue and SR 522 in Bothell and convert the existing carpool lane to an express toll lane. Together, these two lanes will form a dual express toll lane system. Farther north, the existing carpool lane between SR 522 and I-5 will be converted to a single express toll lane.

The operational policies and the toll rates for this ETL are currently being developed. However, it is planned to operate as a dynamically priced ETL, with segmental tolling over two segments – from I-5 in Lynnwood to SR 522 and from SR 522 to NE 6th Street in Bellevue. A Good To Go! account will be needed for travel in the ETL. If a user does not have a Good To Go! account, they will be charged the toll by mail, using the vehicle license plate number. Trucks over 10,000 lbs. gross vehicle weight will not be allowed in the ETLs.

## **4. GATEWAY PROJECT OPERATIONS OVERVIEW**

The following provides discussions of the operational effects of the Gateway project by phase, including a discussion of the effects of Gateway future phase construction on Phase 1 operations.

### **4.1 Phase 1 of the Gateway Project - Overview**

See section 2.1.1 of this report and Final Report for the description of the Gateway Project Phase 1.

#### **4.1.1 I-5 Express Toll Lanes**

The I-5 ETLs proposed for the Phase 1 Gateway project, from SR 16 to I-90, are part of an overall plan for various measures to ensure effective operations of I-5 in the long term (WSDOT Express Toll Lanes Pre-Design Study).

At this time, the plan is to operate the ETL as a dynamically priced, segmental tolling operation. The proposed segments are:

- SR 16 to the new SR 167 extension
- The new SR 167 extension to S 317th Street

- S 317th Street to the new SR 509 extension
- The new SR 509 extension to just south of I-405
- Just south of I-405 to I-90

Further details of the I-5 ETL operations and toll rates will be developed in the future.

### *ETL Beginnings and Terminations*

Locations where the ETL will transition to or from an HOV lane, including direct access ramps were reviewed to determine if any specific treatments are needed to maintain safe and effective operations.

- Northbound
  - ETL Beginning – The ETL would begin at the existing HOV lane just north of the SR 16 interchange. There are no anticipated operational issues with beginning the ETL at this location.

ETL Termination – The ETL would end at the existing HOV lane termination just south of the I-90 interchange (at approximately S Atlantic Street). Today, the existing HOV lane termination operates well. It is expected that, with conversion to an ETL, there could be additional merging and weaving at the termination point over what exists today. Because the performance expectations of an ETL are higher than that of an HOV lane – as users are paying to use the lane - a review should be conducted to consider the impacts of the following merges and weaves:

- ETL users merging right to access the exit at Edgar Martinez Dr.
- ETL users merging right to the I-5 collector-distributor (C-D) lanes
- ETL users merging right to the mainline lanes (those not exiting to the reversible lanes when they are open, or to Seneca Street), and the concurrent merge left (weave) for those in the mainline lanes wishing to access the reversible lanes (when they are open), or the Seneca Street exit.

Figure K- 2 shows these concurrent movements at a location just south of I-90. The review may assess the operation of the current HOV termination point as a comparison, with an additional focus on maintaining smooth ETL operations.

In addition, south of the termination point, a detailed review of the ETL will need to be done to consider how to best manage access to and from the ETL to consider the following merges and weaves:

- ETL users wishing to access the Spokane Street interchange (approximately two miles south of the I-90 interchange)
- Traffic entering I-5 from the Spokane Street interchange (approximately one mile south of the I-90 interchange)
- ETL users to access the I-90 / I-5 NB Collector-Distributor (C-D) lane exit (approximately a half mile south of the I-90 interchange).

There are several solutions to managing merges and weaves, with the principal approach being to modify the locations where access to and from the ETL is available. This is accomplished through striping and signing of the ETL lane and

potentially the mainline lanes to note where access is allowed and where access is not allowed.



**Figure K- 2: I-5 Northbound Just South of I-90**

- Southbound
  - ETL beginning – The southbound ETL is planned to begin where the existing HOV lane begins, just north of I-90 near S King Street. The beginning of the HOV lane operates acceptably today; however, merging from the reversible roadway into the mainline in the morning has limited sight distance. The existing operation works acceptably because there is little traffic in the morning in the southbound HOV lane (far left lane) approaching the reversible roadway merge. A review of the ETL access should be done at this location, because the ETL will introduce different merge and weave movements that may make the sight distance issue an operational problem. Furthermore, the I-5 southbound C-D lanes merge approximately one mile south of the beginning of the proposed ETL, and the Spokane Street off ramp follows that merge point (approximately one-half mile south of the C-D merge). The proximity of these merge and weave movements along with the added merge and weave for the southbound ETL entrance may introduce undesirable traffic turbulence and congestion. In addition, the ability for those using the I-5 southbound C-D lanes to enter the ETL should be assessed.
  - There are several approaches to managing ETL merges and weaves at the beginning and termination points that involve signing and striping to manage access to and from the ETL.

- ETL Termination. The ETL would terminate at the existing HOV lane termination point just north of the SR 16 interchange. There are no anticipated operational issues with terminating the ETL at this location.

### *Geometric or Grade Conditions that May Affect Operations*

There are three locations on the corridor where geometry or grades may affect ETL operations.

- I-5 NB Corson Avenue Off-Ramp.

The Corson Avenue NB exit is a left-side off-ramp. Currently, the HOV lane restriction drops in advance of the exit to allow single occupant vehicles to merge over to exit. When the HOV lane converts to ETL, the exiting general-purpose vehicles will take up capacity in the lane, reducing the number of paying vehicles that are able to use it and still maintain a 45 mph or greater operation or creating operational and capacity issues if too many vehicles are in the ETL. There are two needs to be considered:

- The ETL toll system must be designed to avoid charging vehicles that are in the ETL just to use the Corson Ave exit.
- The exiting (general) traffic must be managed to minimize traffic operations degradations in the ETL, to maintain a high level of service in the ETL.

To address both of these needs, means to manage the general exiting traffic should be considered. Of key concern are merges from potentially slower moving, general-purpose lanes to the ETL. Features that may be evaluated include:

- Implementing restricted access in advance of this exit. This would prevent last minute lane changes into the ETL for traffic needing to exit at Corson. It may also be desirable to use restricted access to concentrate the merge point for Corson exiting traffic.
- The location of field toll equipment should be placed to minimize the likelihood of charging vehicles that use the ETL only to exit at Corson.

There may be non-ETL users that want to exit at Corson Avenue, and enter the ETL too soon, and are charged. This will result in additional calls to the Customer Service Center (CSC), with a peak in calls over the first several months of operations as users learn how to use the system. These users will call the CSC to dispute the charge. A policy to waive at least the first such charge could be implemented.

- I-5 SB to NB I-405 exit

The existing southbound exit from I-5 to northbound I-405 is on the left side of I-5. The HOV lane splits into two lanes: the left-most lane continuing as the SB I-5 HOV lane, and the other serving as an exclusive HOV exit lane to the I-405 NB HOV lane. Adjacent to these two lanes, the left-most general-purpose lane is an exit only lane to NB I-405 general-purpose traffic. Figure K- 3 shows the existing configuration.

The key operational question at this interchange is whether the HOV ramp should be converted to an ETL ramp, or if it should remain as an HOV ramp. As for all operational decisions related to ETL implementation, the objectives are to ensure traffic flow in the ETLs is maintained, while minimizing traffic operational impacts to all other lanes and ramps.



**Figure K- 3: I-5 Southbound, just north of I-405**

Given those objectives, a qualitative review of the traffic conditions at this interchange can support a decision on the treatment of this ramp. Key operational conditions to consider are:

- The receiving lane on I-405 NB is an HOV-only lane. SOV ETL users that would enter this lane would have to merge right to the I-405 northbound general purpose lanes at some point.
- The existing peak period conditions in the general purpose lanes on I-405 NB (just east of I-5) are highly congested, operating at or over capacity, with large merge and weave volumes contributing to the poor operational conditions. Any additional merges and weaves in this section would further reduce capacity, and could increase spillback congestion on I-5 and SR 518 significantly.
- There is minimal congestion in the existing I-5 southbound HOV lane. There is also minimal congestion in the I-405 northbound HOV lane.
- The weaving distance for the southbound I-5 HOV and general purpose ramps (upstream of the interchange) exceed one mile, allowing ample opportunity for traffic to effectively merge and weave in this area with little induced congestion.

Thus, the decision regarding the future designation of the existing HOV-only ramp should ensure that I-405 congestion is not impacted further, which could potentially result in pushing congestion upstream onto I-5 southbound, and impact ETL operations.

Converting the HOV-only ramp to ETL operations would result in a greater impact to I-405 operations rather than maintaining the ramp as an HOV-only ramp. The impact of SOVs from the ETL merging to the general-purpose lanes in this already highly congested portion of I-405 would be significantly worse than the impact on the ETL of allowing all HOVs to enter the ETL without charge to access the HOV-only ramp.

- Southcenter Hill grade

The grade of the Southcenter Hill (on southbound I-5 from approximately I-405 to S 200<sup>th</sup> Street) is significant enough to cause some traffic to slow, affecting operations. Although large trucks will not use the ETL, transit coaches will and small trucks may. Some coaches and trucks are not able to maintain speed on the Southcenter Hill. This condition is the same today for HOV lane operations. Operating an ETL introduces higher performance expectations, as users are paying for the lane. Access into and out of the ETL would need to be designed to allow traffic to move around any slower moving vehicles, or some type of climbing lane for may need to be provided in order to maintain speeds in the ETL.

#### *Operation of I-5 ATM in Conjunction with ETL Operation*

There is an Active Traffic Management (ATM) system in place on northbound I-5 from just south of Boeing Access road to just north of I-90, as shown in Figure K- 4. The system consists of 15 overhead sign locations (at approximately one-half mile spacing), and includes a network of traffic sensors supporting ATM operations.

The system uses overhead lane signs to provide advance notice of traffic conditions:

- Variable speed limit signs direct drivers to incrementally reduce their speeds. The speeds posted are the legal posted speed limit, not an advisory speed.
- The same signs used to post the speed can also post symbols to direct drivers to change lanes when a lane is blocked. The can also be used to warn drivers of heavy merging traffic affecting a particular lane.
- The dynamic message signs mounted on the upright portion of the gantries can be used to post speeds, or messages regarding slowdowns, backups and crashes ahead.

The system decreases last second avoidance maneuvers and panic braking, primary factors contributing to collisions. One of the gantries and signs is shown in Figure K- 5



Figure K- 4: Existing I-5 Northbound Active Traffic Management System



**Figure K- 5: Existing I-5 Northbound Active Traffic Management System Gantry Example**

If conditions warrant, the system will post different speeds for the HOV lane and the general-purpose lanes. The current system limits the differential in speed between the HOV and general-purpose lanes to 15 MPH. The purpose of the limit on the speed differential is to minimize crash risk for those merging into or out of the HOV lane.

#### *Operation of the Toll System in Conjunction with the ATM System*

There has been discussion that posting a reduced speed limit for the ETL may conflict with the ETL revenue generation goals, in particular in cases where the ETL speed limit is not significantly higher than the mainline speed limit. The concern is that it would discourage ETL lane usage. It may be that potential users will not perceive adequate benefit from using the ETL if the speed limit in the ETL is the same as in the mainline or only 5 mph faster than the mainline. In addition, the limit on the speed differential between the lanes may reduce the number of potential users of the system. For example, the posted speed on the mainline may be 30 mph. Under current operational rules, the ETL would be posted at 45 mph, but it could be that the lane is uncongested enough to allow for 60 mph travel. Even so, the 15 mph difference is essentially posting a significant travel time benefit for ETL users – about 5 minutes over a 7 mile segment. The ATM system thus supports ETL effectiveness, safe operation, and overall usage.

Last, the toll system field equipment and signage must be placed to ensure it does not conflict with or obscure the view of the ATM equipment.

#### **4.1.2 SR 167 and SR 509 Full Road Tolling (Phase 1)**

The SR 509 and SR 167 extensions will complete the missing highway system links to I-5. The new road sections will be tolled. This section addresses operational effects of Phase 1 of these improvements.

#### *Overview of tolling operations*

Full road tolling of the newly constructed sections of SR 509 and SR 167 will begin in Phase 1. The following aspects of the toll approach are currently known:

- The tolls will vary by time of day based on historical traffic volumes.

- The toll will likely vary based on the number of axles/vehicle size, so larger trucks will pay more (as is the case for SR 520 and TNB).
- Emergency vehicles on active call will not pay a toll.
- Toll payment options. All currently available electronic toll payment options (Good To Go! pass, pay by plate, pay by mail) will be available.

At this time, the following aspects of the toll approach are not yet determined:

- **HOV exemptions.** Some tolled facilities in the region offer exemptions to HOVs, and some allow transit to use the facility for free. It is not known if any such exemptions would be allowed for SR 167 and SR 509 tolling.
- **Motorcycles.** Motorcycles will be charged the same as passenger vehicles.
- **Per-Axle Charges.** Although the two other existing tolled facilities levy increased tolls based on the number of axles, this approach may not be aligned with the SR 509 and SR 167 facilities goals, which are highly focused on improving freight operations. The approach to per-axle tolls has not yet been determined.
- **One toll or segmental tolling.** There are two options for how tolls would be assessed for travel on the new sections:
  - One toll – Under this option, the same toll is assessed no matter where a vehicle enters or exits. The toll will vary throughout the day, either based on time of day, or based on congestion.
  - Segmental toll – Under this option, the toll is based on the number of segments that are traveled. Segments are made up of road sections that are generally defined by interchanges. The segment can include intermediate on- and off-ramps. In other words, segments do not have to be defined between each interchange. Each segment is charged a toll. The more segments driven, the greater the toll charged. The toll will vary throughout the day, based on time or day, or based on congestion.

The approach to tolling SR 167 and SR 509 as one toll rate or a segmental toll has not yet been determined for the project. A detailed traffic and revenue study testing each option would be required to assess the approaches before a decision is made. At this time, the relative effects of each option (with respect to each other) can be evaluated in a qualitative manner in terms of traffic operations, toll field infrastructure, and customer service center operations.

### *Traffic Operations*

The traffic operations effects of the tolling approach will depend on the difference in toll to an individual user under the one toll or segmental tolling approach. It also depends on the total time savings from using the tolled facility, and the value that users assign to that time savings. However, it can be assumed that under one toll, shorter trips would typically pay somewhat more than under segmental tolling. Therefore, one toll would tend to result in some reduction in shorter trips, with a lesser reduction when the alternative routes become more congested. As noted above, a detailed analysis of traffic and toll rates is needed to estimate the actual effects.

### *Freight User Operations*

Both the new SR 167 and new SR 509 links are expected to be attractive to freight users due to the travel time and connectivity benefits. Freight users' cost sensitivity differs from other users in that it is based upon the ability to improve overall profitability, rather than simply based on travel time savings. The result is that freight users are more sensitive to cost than other users, until the profitability improvement threshold is reached. Overall, as for all other users, a one toll operation would result in relatively fewer shorter trips than segmental tolling.

### *Toll Field Infrastructure*

The same toll field equipment will be required under either toll approach. There would be a difference in the type of signing required at on-ramps and on the main line before the toll facility begins. Signing at these locations under single point tolling would be designed with a single dynamic element for displaying the current toll rate. Signing under segmental tolling would need to indicate the different tolls to different destinations along the roadway. Signs would be larger with two or three dynamic elements for displaying current toll rates to different destinations.

### *Customer Service Center Operations*

The potential effect of one toll and segmental toll operations on Customer Service Center (CSC) operations need to be evaluated in the context of the WSDOT toll system operations that will be in place. Segmental tolling will have been implemented on the I-405 ETL, so users (at least of that facility) will understand that they pay based on the segments they travel. Single point tolling is in place on SR 520 and the TNB. I-90 may be tolled by that time, and either single point or segmental tolling will be used. Therefore, a base understanding of both single point toll and segmental toll will be in place among users in the region. However, many of the users of SR 167 and SR 509 may not be familiar with how tolled facilities in other parts of the region operate.

In general, the more complex a toll operation, the more calls are placed to the Customer Service Center. Segmental tolling is more complex than single toll, and it would be expected that it would result in additional calls to the CSC to help users understand their toll bill, and for users to dispute tolls (e.g. a user believes that they were charged for more segments than they travelled).

Both one toll and segmental tolling require software be provided to ensure proper charging, with relatively minor differences between each in terms of software requirements. Because segmental tolling is planned to be introduced on the north I-405 ETL many of the processes required would have been implemented in the back office software before the Gateway project is implemented. These processes will support both single point and segmental tolling of SR 509 and SR 167.

The opening of the Gateway project will result in an increase in user activity to open toll accounts and to ask questions about toll operations. This activity will subside some months after opening. A temporary walk-in customer service center may be considered to support the peak in demand over the first several months of operations. Opening of the Gateway project will also require additional training of customer service representatives on how the facilities operate, and how to respond to customer inquiries.

## 4.2 Gateway Project Future Phase

See Appendix A, Exhibits A-3, A-4, A-6 and A-8 for concepts for the potential future phase(s).

Future phases of the Gateway project could include some or all of the following:

- The addition of a second ETL on I-5 between SR 167 and SR 509. This added ETL would be accompanied by the addition of ETL direct access on and off ramps at both SR 167 (to and from the east only) and SR 509 (to and from the north only).
- SR 167 future phase improvements may include:
  - Removing the westbound SR 167 off ramps at Freeman Rd, and replacing them with westbound off ramps at Valley Ave.
  - Adding a second lane between Valley Ave and North Meridian Ave/SR 161 each direction, for a total of two-lanes in each direction.
  - Modifying the southbound half-diamond interchange of SR 167 and I-5 to add additional access from northbound I-5 to eastbound SR 167, and conversely from westbound SR 167 to southbound I-5, and constructing direct merge ramps, replacing the Phase 1 signalized half-diamond configuration for I-5 south to SR 167 east and west, and SR 167 east and west to I-5 north.
- SR 509 future phase improvements may include:
  - The addition of on- and off-ramps from S 200<sup>th</sup> Street to SR 509 (for movements from SR 509 south to S 200<sup>th</sup> and from S 200<sup>th</sup> to SR 509 north). This would be accompanied by the addition of a through lane on SR 509 south between Des Moines Memorial Drive and S 200<sup>th</sup> Street, for a total of two southbound lanes in that section.
  - The South Access Road to the SeaTac airport area is anticipated to be constructed by others, not as part of the Gateway project itself. This road is being planned for in future phases of the Gateway project, and will modify the Phase 1 interchange at 24<sup>th</sup>/28<sup>th</sup> Ave S with the addition of ramps on SR 509 to and from the north, connecting to the new South Access Road.

### 4.2.1 Second I-5 ETL and Direct Access Ramps at SR 167 and SR 509

A second ETL on I-5 between SR 167 and SR 509 would be constructed with the addition of direct access ramps to facilitate termination of the second ETL. There are no specific geometric concerns with the introduction of a second ETL in this section. The following operational effects, as compared to Phase 1, can be expected:

- Beginning and termination of the second ETL.
  - The direct access ramps at SR 167 (to and from the east only) and SR 509 (to and from the north only) will support termination of the second ETL. At the north end of the project, the termination of the northbound I-5 second ETL should be evaluated to determine whether additional transition space is required to smoothly merge traffic to the single ETL continuing north on I-5, to ensure that the ETL operates without

undue congestion. Pricing approaches may be used to control the volume in the ETLs to support the smooth transition from two to one ETL.

- Similar analysis of transition space and pricing approaches should be conducted for the southern termination of the second southbound I-5 ETL at SR 167.
- The beginning of the ETLs will be via the direct access ramps, and there are no operational concerns anticipated.
- SR 167 operations changes with direct access ramps added
  - The addition of direct access ramps to the second I-5 ETL will likely result in additional demand attracted to SR 167 east and westbound, on the east side of the facility, based on time savings over Phase 1 operations with the removal of the requirement to weave across all general purpose lanes to access the ETL. Users could choose to avoid the direct access ramp, and any additional toll, and access the ETL as in Phase 1 by merging onto the I-5 mainline and then weaving across all general purpose lanes. The direct access ramps will be left-hand ramps, and some additional merging will occur on the facility. However, no operational concerns are anticipated that cannot be accommodated via pricing and signing/stripping applications.
  - The placement of the toll points in Phase 1 should consider the addition of the direct access ramps, such that relocation is not required, and that all SR 167 users are tolled, including those using the direct access ramps. Additional toll infrastructure would need to be implemented on the direct access ramps.
- SR 509 operations
  - The addition of direct access ramps to the second I-5 ETL will likely result in additional demand attracted to SR 509 north and southbound, based on time savings over Phase 1 operations with the removal of the requirement to weave across all general purpose lanes to access the ETL. Users could choose to avoid the direct access ramp, and any additional toll, and access the ETL as in Phase 1 by merging onto the I-5 mainline and then weaving across all general purpose lanes. The direct access ramps will be left-hand ramps, and some additional merging will occur on the facility. However, no operational concerns are anticipated that cannot be accommodated via pricing and signing/stripping applications.
  - The placement of the toll points in Phase 1 should consider the addition of the direct access ramps, such that relocation is not required, and that all SR 509 users are tolled, including those using the direct access ramps. Additional toll infrastructure would need to be implemented on the direct access ramps.
- Direct Access Ramp Pricing
  - The pricing approach to the direct access ramps has not been determined. Pricing options include pricing the direct access ramp with the user's origin (for on-ramps) or destination (for off-ramps) as part of the segment pricing, and pricing the direct access ramp separately.

- When the direct access ramp is priced with the origin or destination, all users of that segment will be charged the same toll whether they use the ramp or not. This approach will encourage ramp usage, and improve operations of the mainline as traffic merging/weaving is reduced with use of the direct access ramp. Pricing the ramps separately will increase merging and weaving on the mainline facilities, but may be perceived as an equitable approach, especially when, as in the case of the Gateway project, direct access is not provided to and from all directions. A detailed assessment is required before determining the direct access ramp pricing approach, including the potential effects regionally of possible different ramp pricing approaches at different locations.

#### **4.2.2 SR 167 and SR 509 Future Phase Improvement Operations**

The proposed improvements to SR 167 and SR 509 will improve operations of these facilities. The only operational concern is the location of the toll points, which would need to be modified from Phase 1 to ensure all users are tolled.

### **4.3 Future Phase Construction Period Operations**

Construction of a future phase or phases will disrupt operations of Phase 1 field toll systems. The construction activities that may affect operations include lane shifts to accommodate construction, and the installation and testing of the field toll systems for the new configurations, in particular the systems to accommodate the second ETL on I-5. The result could be that the field toll infrastructure is not operable, or is unreliable. In addition, construction activities (for example, lane closures on SR 167 or SR 509) could degrade performance of the affected freeway segments, and users may feel that tolls levied during those periods are unfair.

All of these construction-based disruptions may result in periods when tolls either cannot be collected at certain locations or segments, or WSDOT determines it is not in the public's interest to collect tolls.

In addition to designing Phase 1 toll field infrastructure to accommodate future phase construction with minimal disruption, WSDOT could consider either pre-developing construction approaches and phasing to minimize disruptions to toll operations, and/or requesting approaches from contractors as part of the bid documents that will minimize toll facility disruptions while minimizing construction costs.

Installing overhead gantries for the field toll infrastructure in Phase 1 to accommodate a future phase may be useful. However, there will be a 60 to 90 day period when the full future phase second ETL infrastructure must be tested. The ability for Phase 1 toll tag readers and license plate readers (LPRs) to operate concurrently with future phase readers and LPRs will need to be tested. An approach to minimize the period when tolls cannot be collected during that testing period must be developed. It may be better to install separate, complete future phase infrastructure (as is being done for SR 520), so it can be tested without affecting Phase 1 toll operations.

#### **4.4 Customer Service Center Operations Effects**

The effect of future phase construction on CSC operations is based upon the complexity of construction phasing and the approach taken to disruptions or degradation in field toll infrastructure operations.

### **5. REFERENCED DOCUMENTS**

1. Washington State Department of Transportation (WSDOT), WSDOT Express Lane System Pre-design Studies Project, July 2012, Work Element 4, Interstate 5 Express Toll Lane Pre-Design Studies, Technical Memorandum, Conceptual Design, Preferred Alternatives