Opening Letter

Dear Joint Transportation Committee Members:

In Spring 2022, the Washington State Legislature passed the historic Move Ahead Washington transportation package, which included $40 million intended for a comprehensive I-5 Master Plan that develops a modern vision for a safe, sound, and smart north-south transportation corridor.

As directed by **Senate Substitute Bill (SSB) 5975, Section 209,** in December 2022, the Washington State Department of Transportation (WSDOT) submitted an interim report presenting a recommended approach for future seismic mitigation for over 150 structures between Boeing Field and Lake City Way, in the Puget Sound region.

WSDOT is pleased to submit the two additional interim reports directed by **SSB 5975, Section 209 (3) & (4),** which requested high-occupancy vehicle (HOV) statewide performance and Interstate 5 (I-5) corridor planning studies:

- **Interim Report: I-5 Near-Term and Longer-Term HOV Lane Recommendations, Section 209 (4)**: The legislature directed WSDOT to identify and prepare recommendations for near- and longer-term actions to improve HOV lane system-wide performance. In addition to near-term solutions, the attached report identifies steps required to convert HOV lanes to a different managed lane operating concept, such as express toll lanes, and include a detailed analysis and the environmental process. The recommendations include the planning, design, environmental review, equity considerations, community engagement, traffic and revenue analysis, rate setting, and related engineering considerations necessary for a full I-5 HOV system conversion.
- **Interim Report for the I-5 Master Plan, Section 209 (3):** The legislature directed WSDOT to conduct initial partner listening sessions and submit an interim report that makes recommendations for an I-5 Master Plan. The attached report recommends study limits, management approach, equitable engagement approach and other key elements of the plan, subsequent phases of the study and next steps to determine milestones, final scope and deliverables, budget, and workforce needs.

Coordination Efforts

Western Washington has welcomed considerable growth in recent decades and is poised for a prosperous future. To meet current needs and plan for this growth, WSDOT is investing in significant planning efforts, including Cascadia UHSGT and Interstate 5 planning, that will lead to a more connected, multimodal system. In 2023, WSDOT is integrating both UHSGT and I-5 planning efforts and closely coordinate with air mobility and other related work. These other efforts include transportation planning for state and local roadways, transit, active transportation, freight, port, and Amtrak Cascades systems along the I-5 corridor. The integrated approach to multimodal system planning will foster long-term success, the strategic use of resources and a comprehensive understanding of area communities, their needs, and opportunities in the region.

In addition, this planning integration is responsive to direction WSDOT received from the legislature in **Section 219 of the 2023-2025** budget proviso:

*The department shall continue to **coordinate** planning work focused on the transportation system in western Washington across modes with the goal of maximizing system performance toward the policy goals in RCW 47.04.280 in the most cost-effective manner. This coordination must include but is not limited to: The Interstate 5 highway corridor, existing rail infrastructure and future high-speed rail alignment, and commercial aviation capacity. The department must report to the transportation committees of the legislature through existing reporting mechanisms on the status of these planning efforts including, but not limited to, a long-term strategy for addressing resilience of the transportation system in western Washington through consideration of changing demand, modal integration, and preservation needs. The coordinated work must include an analysis of different alternatives to promote system resilience, including performance and cost of each scenario.*

Next Steps

We thank the Legislature for their support in developing a modern vision for the I-5 system, which is vital to the state of Washington's economy as well as the economy of the entire West Coast. The 2023-2025 biennial transportation budget provides $11.9 million for WSDOT to launch I-5 system planning and accomplish additional early actions:

- **Begin I-5 Master Plan:** Building on the 2022-2023 listening sessions and legislative recommendations, WSDOT will develop a framework, coordinate corridor needs, and develop core evaluation criteria and a prioritization process for an overall I-5 Master Plan while developing a vision for a resilient statewide transportation system that is safe, sound, and smart. This work will explore emerging technologies, including an equitable and transparent decision-making process and a community and partner engagement program.
- **Determine Lifeline Designation**: Determine if the study corridor will be included as part of a designated lifeline route and pursue the next steps based on the designation.
- **Conduct I-5 Ramp Reconfiguration Study**: Work with the City of Seattle and the I-5 lid representatives to identify opportunities to reconfigure, relocate, or remove ramps between Chinatown-International District and the University District.
- **Advance Seismic Work**: Develop and recommend packages of structures and phasing sequences to conduct the Seismic Vulnerability Analysis. Advance priority package(s) into the analysis.
- **Develop HOV Efficiency Implementation Plan:** Building on the 2023 legislative HOV performance recommendations, identify a pilot project to improve near-term system efficiency that progresses innovative and emerging technologies. Develop a project implementation plan and cost estimate, and advance initial steps to launch the pilot project.
- **Collaborate with Cascadia UHSGT:** Integrate engagement and scenario analysis efforts.
- **Coordinate with existing rail infrastructure** and other related efforts.

We look forward to continuing to work with the Governor's Office and the Legislature on the next steps to deliver this vision.

Sincerely,

Julie Meredith, PE

Assistant Secretary, UMA and Megaprograms, Washington State Department of Transportation

Interim Report: I-5 Near-Term and Longer-Term HOV Lane Recommendations

June 2023

WSDOT

Americans with Disabilities Act (ADA) Information: This material can be made available in an alternate format by emailing the Office of Equal and Civil Rights at wsdotada@wsdot.wa.gov or by calling toll free, 855-362-4ADA (4232). Persons who are deaf or hard of hearing may make a request by calling the Washington State Relay at 711.

Title VI Notice to Public: It is the Washington State Department of Transportation's (WSDOT) policy to assure that no person shall, on the grounds of race, color, national origin or sex, as provided by Title VI of the Civil Rights Act of 1964, be excluded from participation in, be denied the benefits of, or be otherwise discriminated against under any of its programs and activities. Any person who believes his/her Title VI protection has been violated, may file a complaint with WSDOT's Office of Equal and Civil Rights. For additional information regarding Title VI complaint procedures and/or information regarding our non-discrimination obligations, please contact the Office of Equal and Civil Rights' Title VI Coordinator at (360) 705-7090.

Table of Contents

Figures

Appendices

List of Abbreviations

FHWA	Federal Highway Administration
HOT	high-occupancy toll
HOV	high-occupancy vehicle
I-5	Interstate 5
I-90	Interstate 90
I-405	Interstate 405
NEPA	National Environmental Policy Act
PEL	Planning and Environmental Linkages
SR	State Route
SSB	Substitute Senate Bill
WSDOT	Washington State Department of Transportation

Executive Summary

Purpose

In March 2022, the Washington State Legislature authorized the historic Move Ahead Washington transportation package to invest $16.9 billion over 16 years in major projects throughout the state to create a safe, sound, and smart transportation future.

Part of the package included direction that the Washington State Department of Transportation (WSDOT) develop recommendations for improving high-occupancy vehicle (HOV) system efficiency in the Interstate-5 (I-5) corridor while preserving adaptability for future mobility technology. I-5 is a vital north-south transportation corridor for regional, national, and international economies and supports thousands of people traveling each day.

Document Organization:

- **Purpose**
- **Context and History**
- **Study Area**
- **Key Findings and Recommendations**
- **Range of HOV System Options and Evaluation Considerations**
- **Next Steps**
- **Appendices**

Senate Substitute Bill (SSB) 5975 directed WSDOT to:

- Identify and prepare recommendations for near-term actions to improve HOV lane system-wide performance.
- Identify steps required to convert HOV lanes to a different managed lane operating concept such as express toll lanes, including detailed analysis and environmental process.

The recommendations for a full I-5 HOV system conversion must include the following:

- Planning, design, and environmental review
- Equity considerations
- Community engagement
- Traffic and revenue analysis
- Rate setting
- Related engineering considerations

Context and History

The first HOV lane project in Washington was completed in the 1970s—the I-5 express lanes between Seattle and Northgate. The HOV inventory quickly expanded in the 1980s along I-5, Interstate 405 (I-405), and Interstate 90 (I-90). With the creation of the HOV Study Committee in 1989, WSDOT has since been evaluating and implementing the state HOV system, including HOV improvements on I-5. This committee ensured that the HOV system would have a transit focus and consistent, regional policies across all WSDOT HOV facilities. In the 1990s and 2000s, WSDOT completed several studies and plans that recommended HOV lanes and transit lanes along the I-5 corridor to help keep

Washington travelers moving (Appendix A). Many of these HOV improvements have been completed along I-5 in Pierce and King counties, while other I-5 HOV improvements remain unfunded, such as the final gap needed to implement continuous HOV lane on I-5 through Pierce County (South 38th Street to Thorne Lane).

In 2018, there was a two-stage process to identify strategies to benefit I-5 by implementing low-cost solutions. WSDOT collaborated with transportation agencies and partners to develop a list of multimodal near-term (1 to 4 years) actions that aimed to manage congestion; provide more travel options; and improve performance for all users, including trucks delivering freight, commuters, and public transit.

Figure 1. I-5 HOV Study Area

Study Area

Figure 1 shows the study limits for this Interim Report: I-5 Near-Term and Longer-Term HOV Lane Recommendations (*I-5 HOV Interim Report*). The HOV study area stretches from Arlington in the north to south of Joint Base Lewis-McChord, and includes the current HOV system on I-5..

Range of HOV System Options and Evaluation Considerations

A safe, sound, and smart transportation future requires a suite of immediate and longer-term solutions. A range of options were considered for the HOV system, including those that can be accomplished in the next 1 to 3 years (near term) and those that take longer than 3 years to accomplish (longer term).

To meet the intent of SSB 5975, options were evaluated based on the following considerations:

- Improving safety
- Protecting the environment
- Improving corridor efficiency and person-throughput for all modes of travel
- Enhancing transit mobility
- Providing equitable access for all users
- Developing cost-effective and implementable solutions

The options that best meet the intent of SSB 5975 are recommended for implementation and/or future study.

Key Findings and Recommendations

Near-term actions can begin to address congestion and safety concerns. While there are no quick single solutions to substantially improve overall HOV system efficiency and safety on I-5, a bundle of near-term actions can provide benefits to travelers and set the foundation for the implementation of longer-term solutions. Longer-term managed lane recommendations need further study to determine appropriate application in the I-5 corridor and surrounding communities now and in the future relative to the vision of the anticipated completion of the I-5 Master Plan.

Near-Term Actions for HOV System Improvement

Near-term actions that best meet the intent of SSB 5975 are listed below:

- **Automated HOV occupancy verification and/or enforcement** to increase person throughput by increasing occupancy and maximizing volume in I-5 HOV lanes
- **Eliminating HOV bypass of ramp meters and metering unmetered lanes and/or ramps** to better control entrance ramp flow onto I-5 to improve access to HOV lanes
- **Highway system-to-system ramp meters** to reduce collisions and smooth the flow of traffic onto I-5 to improve access to HOV lanes and maintain HOV lane efficiency
- **Electronic roadside signs** to communicate advisory speeds or other information that will prepare drivers for unexpected events to improve reliability of I-5 HOV lanes while **planning**

for future technology

- **Buses on shoulders** to improve transit travel time reliability or **hard shoulder running** to reduce delay and improve travel time for all system users in select locations along I-5
- **Minor operational improvements on and along I-5** to improve access to and reliability of HOV lanes

Longer-Term Recommendations for Evaluating HOV System Efficiency

Longer-term recommendations that best meet the intent of SSB 5975 and warrant future study are listed below:

- Convert existing HOV lanes to managed lanes
- Convert existing HOV lanes to managed lanes and widen for a new second managed lane
- Convert existing HOV lanes to managed lanes and convert an existing general purpose lane to a managed lane
- Designate heavy vehicle (such as truck or bus) only lanes

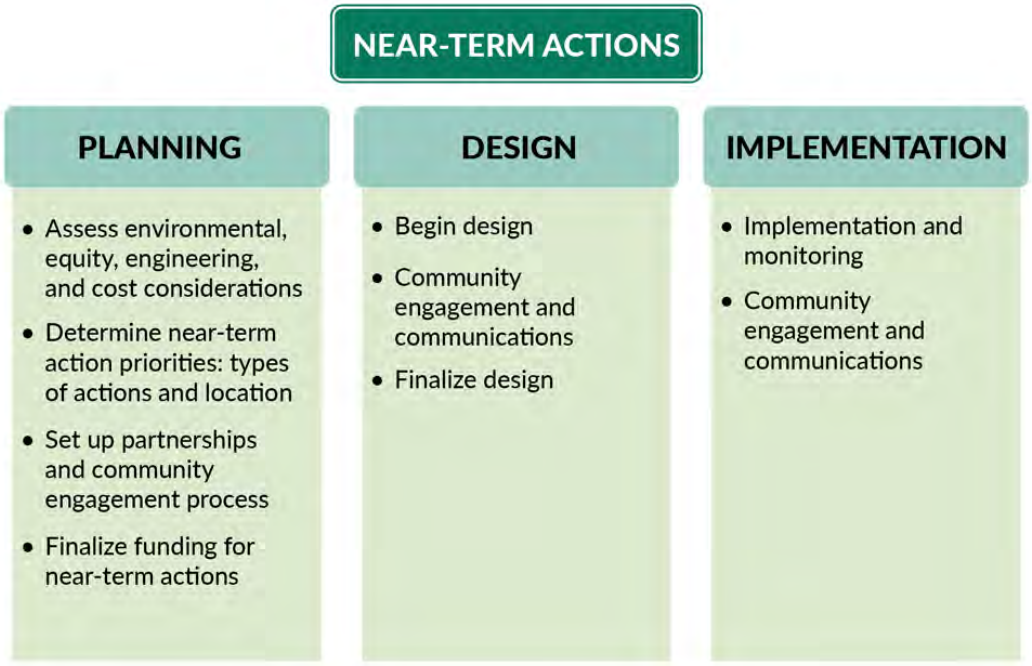
Longer-term managed lane options can be combined with different sub-options, such as dynamic pricing or variable occupancy requirements. Future-proof communications infrastructure can be included to accommodate future connected/autonomous vehicles and improve long-term operations. In some areas of the I-5 corridor, there may be opportunities to help enhance transit service or access.

Next Steps

Near-Term HOV Actions.

The next steps to improve HOV system efficiency can happen immediately to benefit Washington travelers. Figure 2 shows the work recommended over the next 1 to 3 years to implement near-term actions and set the stage for longer-term solutions.

Figure 2. Near-Term HOV Actions



Longer-Term HOV Actions

Conversion of HOV lanes to a different managed lane concept is a complex and iterative process subject to multiple studies, approvals, authorizations, and community buy-in before implementation can begin. This long-term process consists of the following seven major stages:

1. Planning Study
2. Environmental Approval
3. Authorization to Implement
4. Practical Design Analysis & Preliminary Engineering
5. Procurement
6. Final Design, Development, and Implementation
7. Operations and Maintenance

HOV conversion will need to happen within the context of the anticipated I-5 Master Plan for the I-5 corridor. This Master Plan is expected to develop a vision for the corridor and identify comprehensive and clear alternatives to achieve that vision. This effort would be coordinated with any additional analysis of HOV modification and expansion. It would also include a focused effort to engage overburdened communities to gain an understanding of how changes to the HOV system will affect those communities, in terms of benefits and impacts.

I-5 Study Project Website

https://wsdot.wa.gov/construction-planning/search-studies/i-5-study

Americans with Disabilities Act (ADA) Information: This material can be made available in an alternate format by emailing the Office of Equal and Civil Rights at wsdotada@wsdot.wa.gov or by calling toll free, 855-362-4ADA (4232). Persons who are deaf or hard of hearing may make a request by calling the Washington State Relay at 711.

Title VI Notice to Public: It is the Washington State Department of Transportation's (WSDOT) policy to assure that no person shall, on the grounds of race, color, national origin or sex, as provided by Title VI of the Civil Rights Act of 1964, be excluded from participation in, be denied the benefits of, or be otherwise discriminated against under any of its programs and activities. Any person who believes his/her Title VI protection has been violated, may file a complaint with WSDOT's Office of Equal and Civil Rights. For additional information regarding Title VI complaint procedures and/or information regarding our non-discrimination obligations, please contact the Office of Equal and Civil Rights' Title VI Coordinator at (360) 705-7090**.**

Purpose

Interstate 5 (I-5) is a vital trade route for regional, national, and international economies and supports thousands of people traveling each day. In the Puget Sound and Olympic regions, I-5 is a critical part of the state's transportation system and the primary north-south transportation corridor. This I-5 HOV study provides recommendations on next steps to improve the efficiency of high-occupancy vehicle (HOV) and other managed lane options along I-5 within these regions. These recommendations are intended to improve person-throughput and safety while accounting for equity and climate change considerations.

For the past several years, the Puget Sound and Olympic regions have been experiencing a decline in effective traffic operations. While there was a slight decline in vehicle congestion in 2020 related to the pandemic, since mid-2021, traffic in the region has returned to pre-pandemic levels. The Washington Department of Transportation (WSDOT) is pursuing strategies to preserve and manage I-5 in a manner that benefits existing and future Washington travelers.

In March 2022, the Washington State Legislature authorized the historic Move Ahead Washington transportation package to invest $16.9 billion over 16 years in major projects throughout the state to create a safe, sound, and smart transportation future.

Part of the package included direction in a proviso that WSDOT develop recommendations for improving HOV system efficiency in the I-5 corridor while preserving adaptability for future mobility technology.

Senate Substitute Bill (SSB) 5975 directed WSDOT to:

- Identify and prepare recommendations for near-term actions to improve HOV lane system-wide performance.
- Identify steps required to convert HOV lanes to a different managed lane operating concept, such as express toll lanes, including detailed analysis that encompasses the following:
    - Planning, design, environmental review
    - Equity considerations
    - Community engagement
    - Traffic and revenue analysis
    - Rate setting and related engineering considerations

Evaluation Considerations and Objectives

The following six evaluation considerations were established for the I-5 HOV Interim Report. Each of these considerations were balanced with an associated objective; these serve to guide the process of identifying near-term actions to improve existing HOV lane performance and longer-term actions to convert HOV to different managed lane operating concepts.

Evaluation Consideration: Improve safety for all users.

Objective:

- Reduce the number of fatal and severe crashes on the I-5 corridor.

Evaluation Consideration: Protect the environment.

Objectives:

- Reduce vehicle emissions through reduction of vehicular delay and the use of alternative travel modes.
- Prioritize options that avoid or minimize adverse environmental impacts.

Evaluation Consideration: Improve corridor efficiency and person-throughput for all modes.

Objectives:

- Enhance regional travel and improve corridor operations for vehicular traffic.
- Increase person throughput.
- Operate managed lanes effectively in the long term.

Evaluation Consideration: Enhance transit mobility.

Objective:

- Improve corridor operations for transit and increase mode share.

Evaluation Consideration: Provide equitable access for all users.

Objective:

- Improve access to reliable driving, transit, walking and bicycling options for all, including overburdened populations, and improve corridor operations for transit to provide reliability for those who are transit-dependent.

Evaluation Consideration: Develop cost-effective and implementable solutions.

Objectives:

- Prioritize options that leverage existing planned projects and programs.
- Prioritize options that are geometrically feasible.
- Prioritize options that are constructable in phases.
- Prioritize lower-cost, high-benefit options.

Context and History

HOV History

The first HOV lane project in Washington was completed in the 1970s—the I-5 express lanes between Seattle and Northgate. The HOV inventory quickly expanded in the 1980s along I-5, Interstate 405 (I-405), and Interstate 90 (I-90). From 1992 to 2017, I-90 featured reversible express lanes like those on I-5 that carried transit, HOV, and Mercer Island traffic[1]. The express lanes were closed in 2017 and replaced by HOV lanes on the I-90 floating bridges. The express lane right-of way will be used for a Sound Transit Link light rail extension.

WSDOT's HOV lane network today centers around the Puget Sound and Olympic regions where the population density is greatest and extends from Everett in the north through Bellevue and Seattle to south of Tacoma. This network also includes HOV lanes on the Olympic Peninsula in Pierce County. The network as of 2021, which is shown in Figure 4, includes various types of managed lanes on State Route (SR) 16, SR 167, I-5, I-90, SR 520, and I-405.

Tolling is an important component of the managed lanes system because it ensures, as much as possible, that the toll lanes maintain an improved level of operations and do not become as congested as the general purpose lanes so that they offer a faster and more reliable trip.

Express toll lanes and high-occupancy toll (HOT) lanes allow drivers the choice to pay a toll for a faster, more reliable trip. Toll rates adjust based on traffic conditions to keep traffic moving in the express toll lane(s). Carpoolers with the designated number of occupants, transit, and vanpools travel toll-free in the express toll lane with a Good To Go! pass. Good To Go! is the system that WSDOT uses to collect its tolls like other electronic tolling systems in the United States, such as FasTrak and E-ZPass. It also offers a pay-by-mail option. Currently, Good To Go! works exclusively in Washington, but work is underway to allow interoperability with adjacent states.

Starting with the creation of the HOV Study Committee in 1989, WSDOT has since been evaluating the state HOV system. This committee ensured that the HOV system would have a transit focus and consistent, regional policies across all WSDOT HOV facilities. In the early 1990s, WSDOT developed the Core HOV System Plan, which identified 310 HOV lane miles that would be constructed in the future. Tolling began in 2008 with the SR 167 HOT lanes, which feature dynamic rate tolls to help improve managed lane performance. Bridge tolling began in 2007 on SR 16, in 2012 on SR 520, and in 2019 on SR 99. Dynamic tolling expanded to I-405 in 2015 with the express toll lanes.

In 1996, Sound Move was enacted as the first phase of a regional high-capacity transit system. Along with funding the first commuter rail and Link light rail, this plan also funded some of the HOV infrastructure along I-5, including special HOV/transit access ramps. The Link light rail system was expanded with the Sound Transit 2 plan in 2008, and with the Sound Transit 3 plan in 2016 to complete a 116-mile system.

[1] https://www.mercerisland.gov/community/page/r8a-adding-hov-lanes-i-90-complete

Study Area

The I-5 HOV study area is in the Puget Sound and Olympic metropolitan areas, including the cities of Olympia, Tacoma, Seattle, Everett, and Arlington. The study area includes approximately 100 miles of I-5 from the Trosper Road interchange in the south (milepost [MP] 103) to Arlington (near MP 206) in the north (Figure 3). It is intended to identify potential improvements by looking at HOV and HOT lanes along I-5 within the two regions.

Figure 3. Overall I-5 HOV Study Area

Figure 4 shows the I-5 HOV lane status as of 2022, including various types of managed lanes, with existing managed lanes and locations for planned managed lanes. Figure 5 shows the current number of general purpose lanes in each direction of I-5 in the I-5 HOV study area.

Figure 4. Planned and Current I-5 HOV Lanes (2022)

A single solution or approach to managing traffic along the length of such a long freeway corridor is impractical. The possible solutions along the corridor are likely to vary in different locations. Some sections of I-5, such as the viaduct sections north and south of downtown Seattle and the tunnel beneath Freeway Park in downtown Seattle, are highly physically constrained, with little space due to topography or existing development. I-5 from Northgate to Lynnwood, along with other sections of the regional corridor, may be constrained by the proximity of Sound Transit Link to the I-5 travel lanes or the environmental context.

Figure 5. I-5 General Purpose Lanes (2022)

Key Findings and Recommendations

Near-term actions can help to address some congestion and safety issues. While there are no quick single solutions to substantially improve the overall I-5 HOV system efficiency and safety, a bundle of near-term actions can provide benefits to travelers and set the foundation for implementation of longer-term solutions. Longer-term managed lane recommendations, which are discussed in the next section, need further study to determine appropriate application in the I-5 corridor.

Near-Term Actions for HOV System Improvement

Near-term actions that best meet the intent of SSB 5975, are listed below:

- **Automated HOV occupancy verification and/or enforcement** to increase person throughput by increasing occupancy and maximizing volume in I-5 HOV lanes
- **Eliminating HOV bypass of ramp meters and metering unmetered lanes and/or ramps** to better control entrance ramp flow onto I-5 to improve access to HOV lanes
- **Highway system-to-system ramp meters** to reduce collisions and smooth the flow of traffic onto I-5 to improve access to HOV lanes and maintain HOV lane efficiency
- **Electronic roadside signs** to communicate advisory speeds or other information that will prepare drivers for unexpected events to improve reliability of I-5 HOV lanes while **planning for future technology**
- **Buses on shoulders** to improve transit travel time reliability or **hard shoulder running** to reduce delay and improve travel time for all system users in select locations along I-5
- **Minor operational improvements on and along I-5** to improve access to and reliability of HOV lanes

These actions could improve HOV system efficiency by smoothing traffic flow, minimizing lane changes, and reducing stops and starts where there are high volumes of vehicles getting on and off the HOV system. These actions could also make transit a more attractive travel option by improving travel times and reliability and improving vehicle occupancy compliance.

Longer-Term Recommendations for Evaluating HOV System Efficiency

Longer-term recommendations that best meet the intent of SSB 5975 and warrant future study are listed below:

- Convert existing HOV lanes to express toll lanes.
- Convert existing HOV lanes to express toll lanes and widen for a new second managed lane.
- Convert existing HOV lanes to express toll lanes and convert an existing general purpose lane to an express toll lane.
- Designate heavy vehicle-only managed lanes (in select segments)

These recommendations would improve HOV system efficiency by creating more HOV capacity and smoothing HOV system operations. Future study will determine which actions works best for the I-5 corridor and its unique opportunities and constraints.

Longer-term managed lane options can be combined with different sub-options, such as dynamic pricing or variable occupancy requirements. Future-proofing communications infrastructure can be included to accommodate future connected/autonomous vehicles and improve long-term operations. In some areas of the I-5 corridor, there may be opportunities to help enhance transit service or access.

Range of Options and Evaluation Considerations

A wide range of both near-term and longer-term options in the study area were identified for evaluation. Criteria were developed to consider the benefits and potential issues related to these options. A scorecard was used to evaluate concepts. The near-term and longer-term options that best met the Move Ahead Washington transportation package proviso were recommended for further analysis and evaluation.

While the focus of this study is on improving the managed lane system of I-5, the preferred managed lane improvements should fit into a larger vision for the transportation system along I-5 in the Puget Sound and Olympic regions as well as the entirety of I-5 in the state of Washington. A coordinated and connected vision is a key consideration for successfully implementing I-5 managed lane system improvements. This coordinated vision will require substantial public and agency engagement and should fit into the upcoming I-5 Master Plan vision. Another key consideration is integrating transit into the longer-term vision as well as near-term improvements. Appendix A and Appendix B include additional background and context on this topic.

Near-Term Improvements Evaluated

The near-term improvements are described below along with benefits to the HOV system, assumptions, equity considerations, and next steps for the HOV system on I-5.

Automated Occupancy Verification and/or Enforcement

Description:

- Verifies whether vehicles are eligible to drive in the HOV lane based on their occupancy level. Requires all HOV users to register and participate in the program. Uses emerging technologies to determine the number of occupants in the vehicle, such as exterior cameras, cell phones, Bluetooth devices or other mechanisms. Uses a combination of pre-registration and follow-up verification to identify and confirm vehicle occupants and for potential enforcement. A variety of services are being developed and tested across the United States.

Benefits:

- Verifies compliance with desired vehicle occupancy requirements to vehicle occupancy.
- Can increase person throughput by increasing occupancy and maximizing volume in the HOV lane.

Assumptions:

- Accuracy of newer technology will justify the capital cost.
- Mode shift or vehicle occupancy during peak hours will increase.

Equity Considerations:

- Improves travel time for all users of the system, including overburdened populations.

- Will need clear communication to avoid misperceptions about privacy, especially with populations that have experienced a lack of transparency with government in the past.

Next Steps:

- Coordinate with State Department of Justice on potential legal considerations.
- Engage community and establish government partnerships (such as Washington State Patrol, and State Legislature).
- Evaluate the current and emerging technologies to identify preferred options for automated occupancy verification.
- Pilot new technologies to help identify preferred options and refine implementation.

Eliminating HOV Bypass of Ramp Meters and Metering Unmetered Lanes and/or Ramps

Description:

- Eliminate HOV bypass of ramp meters and meter lanes and/or ramps currently unmetered.

Benefits:

- Slight improvement to mainline performance by improving merging areas with better control over entrance ramp flow, potentially indirectly improving HOV performance by improving overall I-5 operations. Improved access to HOV lanes.

Assumptions:

- HOV meter bypass traffic makes up a significant proportion of ramp traffic.
- Locations to be determined.

Equity Considerations:

- Improves safety and travel time by better managing weaving and merging for all users of the system, including overburdened populations.

Next Steps:

- Determine locations based on proportion of HOV traffic at specific locations and a demonstrable impact on downstream weaving and merging operations.

Highway System-to-system Ramp Meters

Description:

- Ramp metering of system-to-system ramps to control entering traffic flow onto I-5 and better managing weaving and merging to improve access to HOV lanes and maintain HOV lane efficiency.

Benefits:

- Reduces collisions on mainline I-5.

- Decreases travel time and reduces I-5 congestion and delay.
- Smooths the flow of traffic onto I-5.
- Is proven and cost-effective.

Assumptions:

- Locations to be determined and subject to further analysis.

Equity Considerations:

- Improves safety and travel time by better managing weaving and merging for all users of the system, including overburdened populations.

Next Steps:

- Determine locations and verify the ability to accommodate for storage and acceleration lengths.

Electronic Roadside Signs to Communicate Advisory Speeds or Other Information and Planning for Future Technology – Intelligent Transportation Systems (ITS) and Transportation System Management and Operations (TSMO)

Description:

- Expand the existing system of electronic signs communicating various information pertaining to travel or weather conditions and changing regulatory conditions (such as speed limits and winter tire requirements).

Benefits:

- Better prepares drivers for unexpected events.
- Harmonizes traffic flow approaching congested areas.
- Improves reliability of HOV lanes.

Assumptions:

- Drivers act on the information or guidance provided by adjusting speeds or routes.
- Locations to be determined.

Equity Considerations:

- Improves safety and travel time for all users of the system, including overburdened populations.
- Need plans for how to ensure messaging is helpful for those who do not speak English as their primary language.

Next Steps:

- Determine locations (where safety conditions and travel reliability could improve by location).

- Verify communications and power availability.
- Collect community engagement and pilot programs to understand needs for overburdened populations.

Bus-on-shoulder or Hard Shoulder Running in Select Locations

Description:

- Bus-on-shoulder allows buses to travel on roadway shoulders during peak periods.
- Hard shoulder running allows all traffic to travel on roadway shoulders during peak periods.

Benefits:

- Bus-on-shoulder allows transit to bypass general congestion, thereby improving transit travel time reliability and travel time savings during congested periods.
- Hard shoulder running improves mobility for all users by adding roadway capacity during congested periods to reduce delay and improve travel times.

Assumptions:

- Can be changed by time of day and using dynamic messaging (e.g., to communicate shoulders are open).
- Collects data using traffic sensors to display the open and closed status of the shoulder lane.
- Locations to be determined.

Equity Considerations:

- Bus-on-shoulder helps improve transit travel time reliability, including for people who are transit-dependent.
- Hard shoulder running improves travel time for all users of the system, including overburdened populations, during congested periods.

Next Steps:

- Determine locations – check shoulder widths, junction boxes, and pavement depths.

Minor Operational Improvements

Description:

- Mitigate queuing and weaving issues through reconfiguring an interchange, increasing lane and ramp storage, adding auxiliary lanes on mainline, or modifying lanes. Some projects could have notable benefits to I-5 corridor throughout the Puget Sound and Olympic regions at relatively low costs.

Benefits:

- Improves mainline flow by mitigating the impact of queue spillback onto mainline from interchange ramp terminals or interchange weaving areas.

- Improves access to and reliability of HOV lanes.

Equity Considerations:

- Improves travel time for all users, including overburdened populations.

Next Steps:

- Prioritize locations by identifying recurring bottlenecks and potential cost of improvements.
- Identify funding.

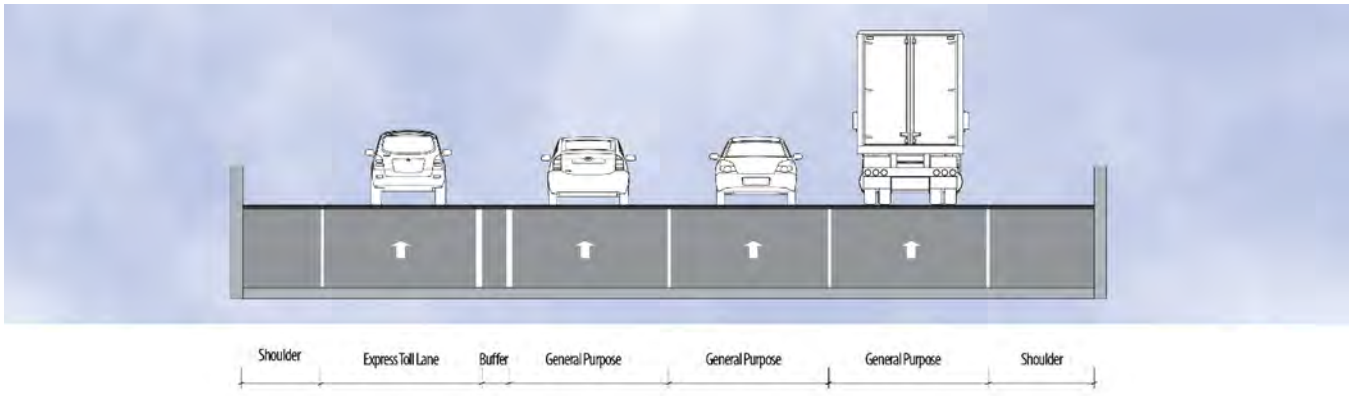
Longer-Term Managed Lane Options Evaluated

Convert HOV Lane to Express Toll Lane

This option would maintain all existing general-purpose lanes. Where an HOV lane exists, this option features a direct conversion of the HOV lane to an express toll lane and is shown in Figure 6. Where HOV lanes do not exist, a new lane would be added as an express toll lane.

Implementation of this option may require some lane widening, even in locations that already have an existing HOV lane. In some cases, additional space is needed for toll collection equipment along with junction boxes and power. Some widening may be needed to provide for separation between the general purpose lanes and the express toll lane. Additional width may also be required for the implementation of ingress/egress areas. The required width depends on the details of the express toll lane design and would be determined in future studies.

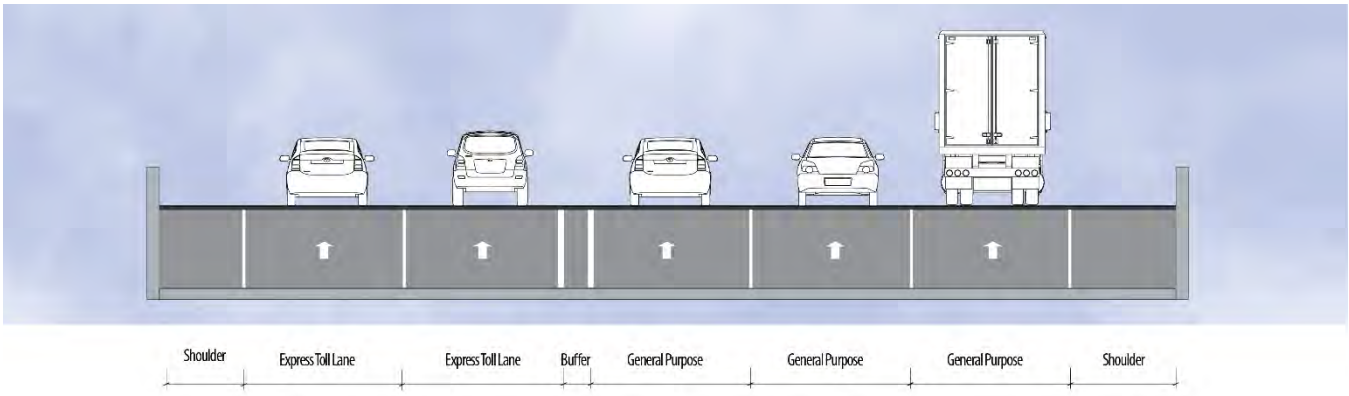
Figure 6. Convert HOV Lane to Express Toll Lane



Convert HOV Lane to Express Toll Lane and Widen for a Second Express Toll Lane

This option assumes no changes in the number of existing general purpose lanes. Where an HOV lane exists, this option assumes that the HOV lane would be converted to an express toll lane and that a new lane would be added as the second express toll lane (Figure 7). In segments where no HOV lane exists, this option would include two lanes of widening, both of which would form the two-lane express toll lane system.

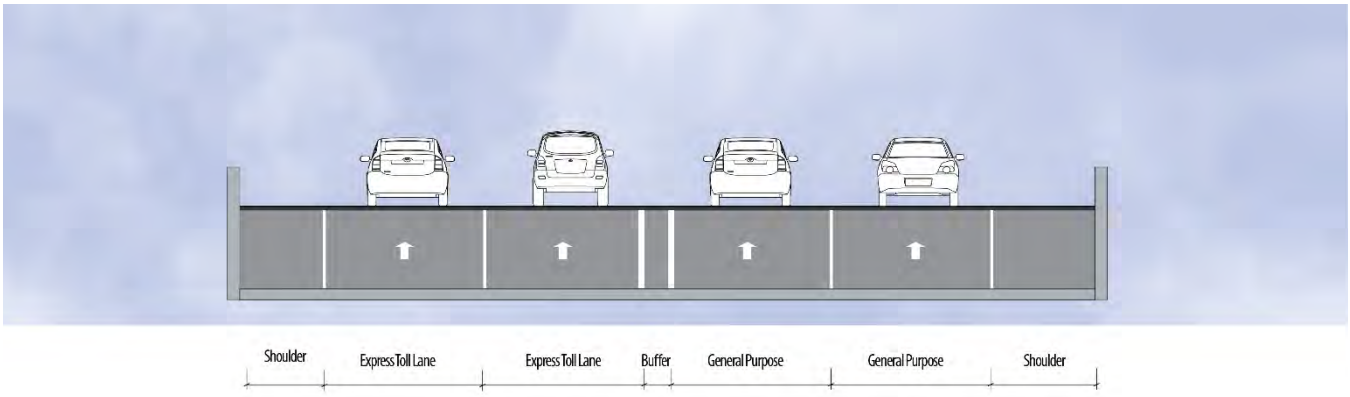
Figure 7. Convert HOV Lane to Express Toll Lane and Widen for a Second Express Toll Lane



Convert HOV Lane to Express Toll Lane and Convert one General Purpose Lane to Express Toll Lane

This option assumes a reduction in the number of existing general purpose lanes by one. Where an HOV lane exists, this option assumes that the HOV lane would be converted to an express toll lane and that a general-purpose lane would be converted to the second express toll lane (Figure 8). In segments where no HOV lane exists, this option would include one lane of widening along with a general purpose lane conversion to form the two-lane express toll lane system.

Figure 8. Convert HOV Lane to Express Toll Lane and Convert one General Purpose Lane to Express Toll Lane



Heavy Vehicle (such as Truck or Bus) Only Lanes

Conversion of the existing HOV lane to truck only should not be considered because this requires heavy vehicles to weave across all traffic. A non-physically separated system on the right side of the road should also not be considered because all interchange traffic would be required to weave into and across this lane at every interchange.

A truck-only system would provide direct benefits to freight users. The truck-only system would require redundancy in access to and from each interchange without the need to mix with general traffic. Recommendations would be to limit access not by vehicle type but by driver type and licensing. This would allow buses to use the managed lanes as well. This may be a good option to consider in more rural areas with high truck volumes or in segments adjacent to the Port of Tacoma.

Sub-option Considerations and Opportunities

With each of these longer-term options, there are sub-options and transit opportunities that can be paired to analyze how best to optimize the system. Future analysis should include these sub-options and transit opportunities, described below, to understand what best meets different environmental and community contexts along the I-5 corridor.

2+ or 3+ Occupancy (Modify Existing Occupancy Requirement)

This sub-option would change the occupancy requirement for the existing HOV system from two to three persons per vehicle at all times.

Dynamic/Variable 2+/3+ (Existing System, Modify Occupancy by Time of Day

This option changes the occupancy requirement for the existing HOV system from two to three persons per vehicle based either on a static time of day schedule or a dynamic response to congestion and/or HOV lane capacity, thus raising the requirement when the lane is over capacity or lowering it to increase lane use.

Transit Opportunities

The list below summarizes the future longer-term transit options that could be considered and evaluated in conjunction with new managed lane improvements:

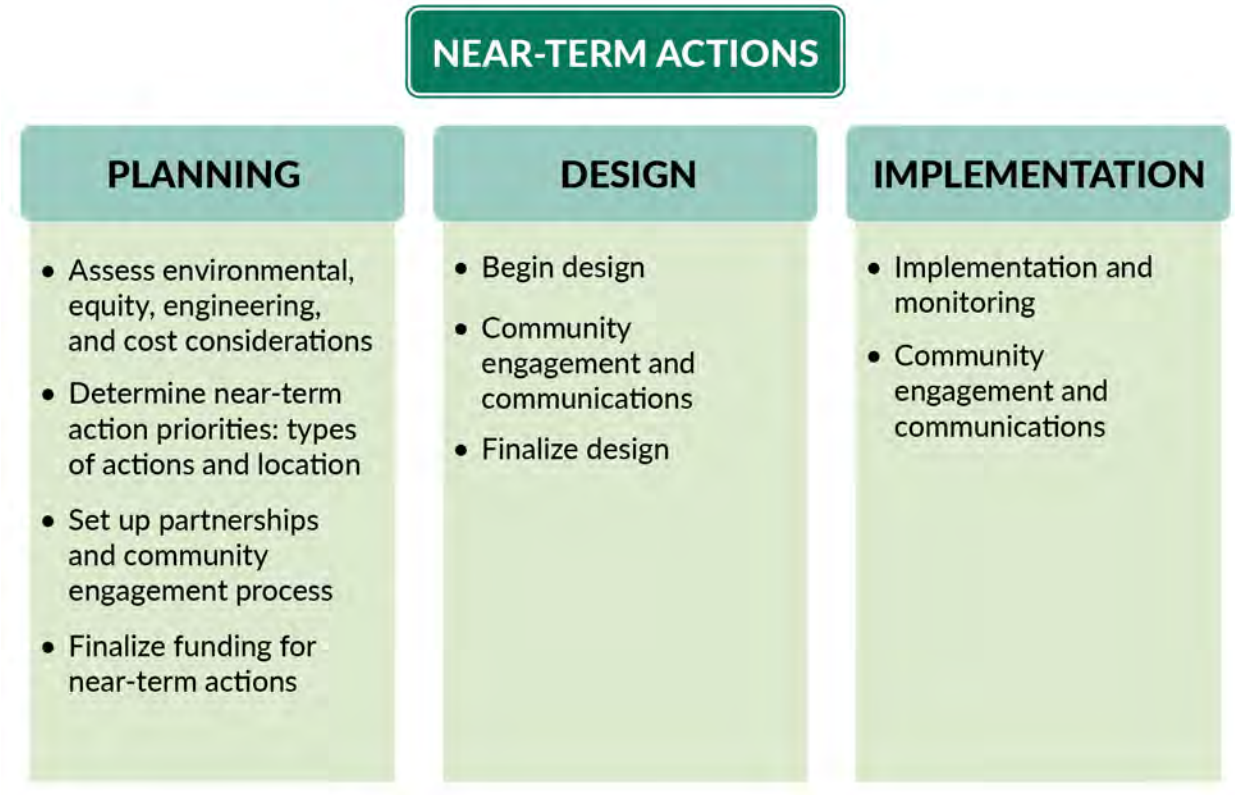
- Bus on outside shoulder
- Bus on inside shoulder
- Increased level of transit service
- Transit-detecting entry ramp metering
- Bus on shoulder with pavement upgrades
- Increased enforcement for lanes used by transit
- Shared exclusive transit/freight lanes
- Shared transit/tolled vehicle lanes
- Exclusive peak-only transit lanes
- Exclusive transit lanes
- Reversable peak-direction, transit-only lanes
- Elevated or center transit guideway

Next Steps

Near-Term Actions

The near-term improvements to the existing I-5 HOV system identified in this report will require additional steps for implementation over a 1- to 3-year time horizon. Next steps include assessing environmental, equity, engineering, and cost considerations for each action (Figure 9). During the assessment, near-term actions and locations can be prioritized, partnerships identified, and the community engagement process established. These steps will lead to finalizing funding for the priority near-term actions and the start of design. As design advances, community engagement and communication should continue to ensure constituents are given opportunities for input and kept apprised of progress. After design is complete and implementation begins, the improvements should be monitored to evaluate their efficacy and the results should be reported. These next steps to improve HOV system efficiency can happen immediately to benefit Washington travelers.

Figure 9. Near-Term Actions



Longer-Term Actions

Converting HOV lanes to a different managed lane concept is a complex and iterative process subject to multiple studies, approvals, authorizations, and community buy-in before implementation can begin. The proviso specifically directs this report to address several elements in the following next steps to convert I-5 HOV lanes to a different managed lane concept:

- Planning, design, environmental review
- Equity considerations
- Community engagement
- Traffic and revenue analysis
- Rate setting, and related engineering considerations

The next steps for longer-term actions that address these proviso elements, and more, are summarized below in seven major stages, from planning to operations and maintenance.

Planning Process, Milestones, and Decision-Making

The planning process will begin with the integration of the I-5 Master Plan, ultra-high speed ground transportation (UHSGT), air mobility planning, and other ongoing efforts to design a coordinated approach to decision-making and partner, agency, and community engagement.

As directed by the legislature on April 2023 in ESHB 1125, Section 219, WSDOT will use information from the listening sessions to begin I-5 planning work to:

- Develop a framework
- Coordinate corridor needs
- Develop core evaluation criteria and a prioritization process
- Identify early action priority projects that address safety or resiliency, or both, along the corridor

The planning process will be informed by data and refined by WSDOT management and staff, federal agencies, resource agencies, tribes, local jurisdictions, CBOs, and community feedback. It is anticipated that the I-5 Master Plan will establish a structure to make and elevate decision-making, likely with both state-level and local/regional-level committees and groups.

Additionally, the legislature directed WSDOT to submit a report to the transportation committees by December 1, 2024, with recommendations for future phases of the planning work and a detailed funding request for work planned through 2029.

Environmental Process and Approvals

Alternatives advanced from the I-5 Master Plan (developed consistent with PEL) will need to meet National Environmental Policy Act requirements to evaluate environmental impacts of the preferred alternative(s). This would include engagement with agencies and the community, the (Transportation Commission), FHWA, and other agencies. Several subtasks are included in the environmental approval stage:

- Confirm environmental class of action (e.g., Categorical Exclusion, Environmental Assessment, Environmental Impact Statement)
- Engage the Transportation Commission.

- Conduct agency and community engagement
- Conduct environmental analyses.
- Seek environmental approvals and documentation.

Authorization to Implement

State of Washington statutes and regulations define the roles and responsibilities in the implementation and operation of toll roads. This includes the State Legislature, WSDOT, Transportation Commission, and Office of the State Treasurer, each of which has the following authority:

- State Legislature – Enable tolling legislation
- Transportation Commission – Conduct a public rule-making processes for rate and policy setting.
- Office of the State Treasurer – Issue toll debt if financing is needed

Practical Design Analysis and Preliminary Engineering

This stage will advance the design of the selected alternative, including preliminary engineering, systems engineering analysis and development of a concept of operations; develop technical and functional requirements; and develop a detailed financial plan. Four subtasks are part of this stage:

- Preliminary Engineering - Advancing the infrastructure design
- Systems engineering analysis and concept of operations
- Develop technical/functional requirements
- Develop financial plan

Procurement

Procurements, if needed to implement the selected alternative, include these subtasks:

- Identify method of procurement (if any).
- Develop procurement documents.
- Facilitate the procurement.

Final Design, Development, and Implementation

Implementation of a toll system would follow these steps:

- Final design
- Implementation
- Testing
- Commissioning

- Go-live/revenue commencement

Operations and Maintenance

Once a system is operational, this stage would involve the following:

- Monitoring and quality control
- Reporting and independent assessments
- Change management

Additional Considerations

Beyond the tasks in the stages summarized above, other considerations could affect implementation of longer-term actions, notably the anticipated I-5 Master Plan. The Master Plan is expected to develop a vision for the corridor and identify comprehensive and clear alternatives to achieve that vision. This master planning effort would be coordinated with any additional analysis of HOV system modification and expansion. It would also include a focused effort to engage overburdened communities to understand the impacts and opportunities that changes to the HOV system could have on those community members.

Other tasks and considerations to be addressed in a scope of work for the conversion of HOV lanes to other types of managed lanes are listed below:

1. Developing a Project Management Plan
2. Conducting Risk Assessments prior to and at key milestones
3. Addressing equity factors in congestion charges throughout the development, implementation, and monitoring of managed lanes projects
4. Developing a rational nexus between revenues from managed lanes and distribution of those toll revenues to build civic buy-in
5. Building strong cross-sector support and partnerships
6. Understanding that exemptions and discounts may inversely affect performance of managed lanes.
7. Seeking to future proof for changes in tolling technology to increase long-term viability and cost-effectiveness

Appendix A:
Background Memorandum

I-5 HOV

BACKGROUND MEMORANDUM

To: Robin Mayhew, WSDOT
Travis Phelps, WSDOT

From: Andrew Johnson, HDR
Smith Siromaskul, HDR

May 21, 2023

WSDOT

HDR

Americans with Disabilities Act (ADA) Information: This material can be made available in an alternate format by emailing the Office of Equal and Civil Rights at wsdotada@wsdot.wa.gov or by calling toll free, 855-362-4ADA (4232). Persons who are deaf or hard of hearing may make a request by calling the Washington State Relay at 711.

Title VI Notice to Public: It is the Washington State Department of Transportation's (WSDOT) policy to assure that no person shall, on the grounds of race, color, national origin or sex, as provided by Title VI of the Civil Rights Act of 1964, be excluded from participation in, be denied the benefits of, or be otherwise discriminated against under any of its programs and activities. Any person who believes his/her Title VI protection has been violated, may file a complaint with WSDOT's Office of Equal and Civil Rights. For additional information regarding Title VI complaint procedures and/or information regarding our non-discrimination obligations, please contact the Office of Equal and Civil Rights' Title VI Coordinator at (360) 705-7090.

Table of Contents

Table of Figures

Table of Tables

List of Abbreviations

HOV	high-occupancy vehicle
HOT	high-occupancy toll
I-5	Interstate 5
I-90	Interstate 90
I-405	Interstate 405
I-5 HOV Study	Interim Report: I-5 Near-Term and Longer-Term HOV Lane Recommendations
SR	State Route
SSB	State Senate Bill
USC	United States Code
WSDOT	Washington State Department of Transportation
WSP	Washington State Patrol

Introduction

For the past several years, the Puget Sound and Olympic regions have experienced a decline in effective traffic operations. While there was a slight decline in vehicle congestion in 2020 related to the pandemic, since mid-2021, traffic in the region has returned to pre-pandemic levels. Interstate 5 (I-5) is a critical part of the state's transportation system and the primary north-south transportation corridor on the West Coast. The Washington State Department of Transportation (WSDOT) is pursuing strategies to preserve and manage I-5 in a manner that benefits existing and future Washington travelers.

The Interim Report: I-5 Near-Term and Longer-Term HOV Lane Recommendations (I-5 HOV study) provides recommendations on next steps to improve the efficiency of high-occupancy vehicle (HOV) and other managed lane options along I-5 within western Washington. These recommendations are intended to improve person-throughput and safety while accounting for equity and climate change considerations.

In March 2022, the Washington State Legislature authorized the historic Move Ahead Washington transportation package to invest $16.9 billion over 16 years in major projects throughout the state to create a safe, sound, and smart transportation future. Senate Substitute Bill (SSB) 5975 directed WSDOT in a Proviso to develop recommendations for improving HOV system efficiency in the I-5 corridor while preserving adaptability for future mobility technology.

The Proviso stated: *(4) As an initial element of the study, the department must identify and prepare recommendations for near-term actions to improve HOV lane system-wide performance. The study should identify steps required to convert HOV lanes to a different managed lane operating concept such as express toll lanes, including detailed analysis and environmental process. The recommendations must include the planning, design, environmental review, equity considerations, community engagement, traffic and revenue analysis, rate setting, and related engineering considerations necessary for a full I-5 HOV system conversion. The department shall submit an interim report on near-term recommendations to the legislative transportation committees by June 30, 2023.*

This background memorandum describes WSDOT's existing managed lane systems, the 45-miles per hour (mph) performance standard for HOV facilities, HOV enforcement challenges, and how the Sound Transit link connection provides transportation options along the I-5 corridor throughout the study area.

Existing Managed Lane Systems

The first HOV lane project in Washington was completed in the 1970s - the I-5 express lanes between downtown Seattle and the Northgate area. The HOV inventory quickly expanded in the 1980s, along I-5, Interstate-405 (I-405), and Interstate- 90 (I-90). From 1992 to 2017, I-90 featured reversible express lanes like those on I-5 that carried transit, HOV, and Mercer Island traffic. The express lanes were closed in 2017 and replaced by HOV lanes on the I-90 floating bridges. The express lane right-of way will be used for a Sound Transit Link light rail extension.[1]

WSDOT's HOV lane network today centers around the Puget Sound and Olympic regions, where the population density is greatest. This network extends from Everett in the north through Bellevue and Seattle to south of Tacoma. It also includes links on the Olympic Peninsula in Pierce County. The network as of 2021, which is shown in Figure 1, includes various types of managed lanes on State Route (SR) 16, SR 167, I-5, I-90, SR 520, and I-405. WSDOT has a mixture of HOV, high-occupancy toll (HOT), and express toll lanes that make up the entire managed lanes system. Tolling is an important component of the managed lanes system because it ensures, as much as possible, that the toll lanes maintain an improved level of operations and do not become as congested as the general purpose lanes, so that they offer a faster and more reliable trip.

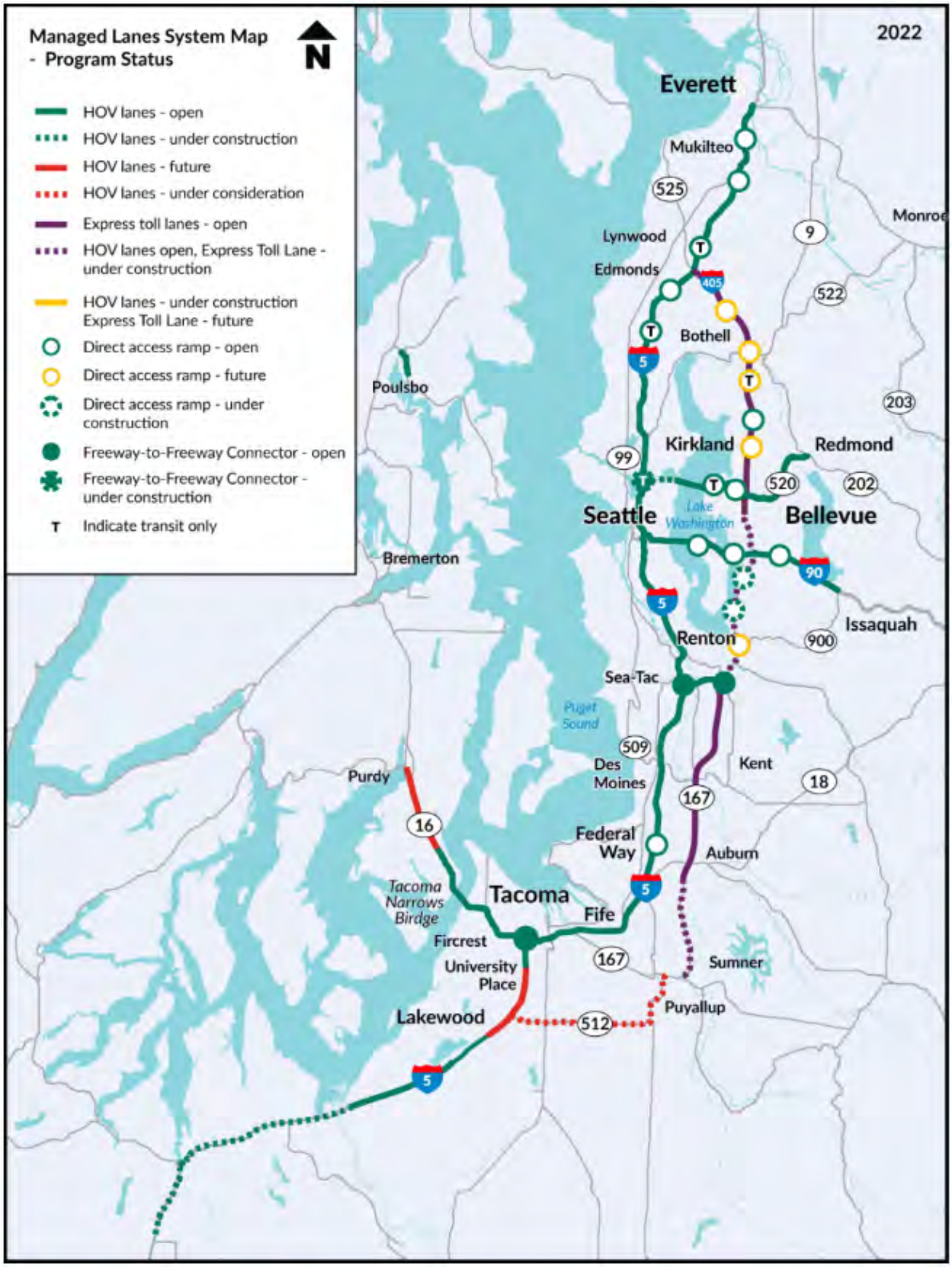
Express toll lanes and HOT lanes allow drivers the choice to pay a toll for a faster, more reliable trip. Toll rates adjust based on traffic conditions to keep traffic moving in the express toll lane(s). Carpools with the designated number of occupants, transit, and vanpools travel toll-free in the express toll lane with a Good To Go! pass. Good To Go! is the system that Washington uses to collect its tolls like other electronic tolling systems in the United States, such as FasTrak and E-ZPass. It also offers a pay-by-mail option. Currently, Good To Go! works exclusively in Washington, but work is underway to allow interoperability with adjacent states.

Starting with the creation of the HOV Study Committee in 1989, WSDOT has since been evaluating the state HOV system. This committee ensured that the HOV system would have a transit focus and consistent, regional policies across all WSDOT HOV facilities. In the early 1990s, WSDOT developed the Core HOV System Plan, which identified 310 HOV lane miles that would be constructed in the future. Tolling began in 2008 with the SR 167 HOT lanes, which feature dynamic rate tolls to help improve managed lane performance. Bridge tolling began in 2007 on SR 16, in 2012 on SR 520, and in 2019 on SR 99. Dynamic tolling expanded to I-405 in 2015 with the express toll lanes.

In 1996, Sound Move was enacted as the first phase of a regional high-capacity transit system. Along with funding the first commuter rail and Link light rail, this plan also funded some of the HOV infrastructure along I-5, including special HOV/transit access ramps. The Link light rail system was expanded with the Sound Transit 2 (ST2) plan in 2008, and the Sound Transit 3 plan in 2016 to complete a 116-mile system.

[1] https://www.mercerisland.gov/community/page/r8a-adding-hov-lanes-i-90-complete

Figure 1. Map of WSDOT HOV Facilities in 2022



Source: https://wsdot.wa.gov/travel/roads-bridges/hov-lanes/hov-system-map

State Route 16

SR 16 connects Tacoma to Port Orchard via the Tacoma Narrows Bridge, which is tolled in the eastbound direction only. SR 16 has HOV lanes in both directions from Gig Harbor to the I-5 interchange. There are direct single lane, HOV-only ramps to and from SR 16 to both northbound and southbound I-5.

State Route 167

The SR 167 HOT lanes are located between Renton and Auburn (Figure 2) east of I-5. HOT operational hours are between 5 a.m. to 7 p.m., and use of these lanes is free overnight. These HOT lanes are always free for motorcycles and carpools with two or more people. During HOT operating hours, toll pricing varies between 50 cents and $9, depending on real-time traffic conditions. In August of 2022, a new northbound HOV lane opened on SR 167 between Sumner to Auburn. The SR 167 Master Plan recommends adding future express toll lanes on southbound SR 167 from SR 18 to SR 410 and converting existing HOV/HOT lanes to express toll lanes on northbound SR 167 from SR 410 to SR 18. These improvements are funded.

Figure 2. SR 167 HOT Lanes

I-90

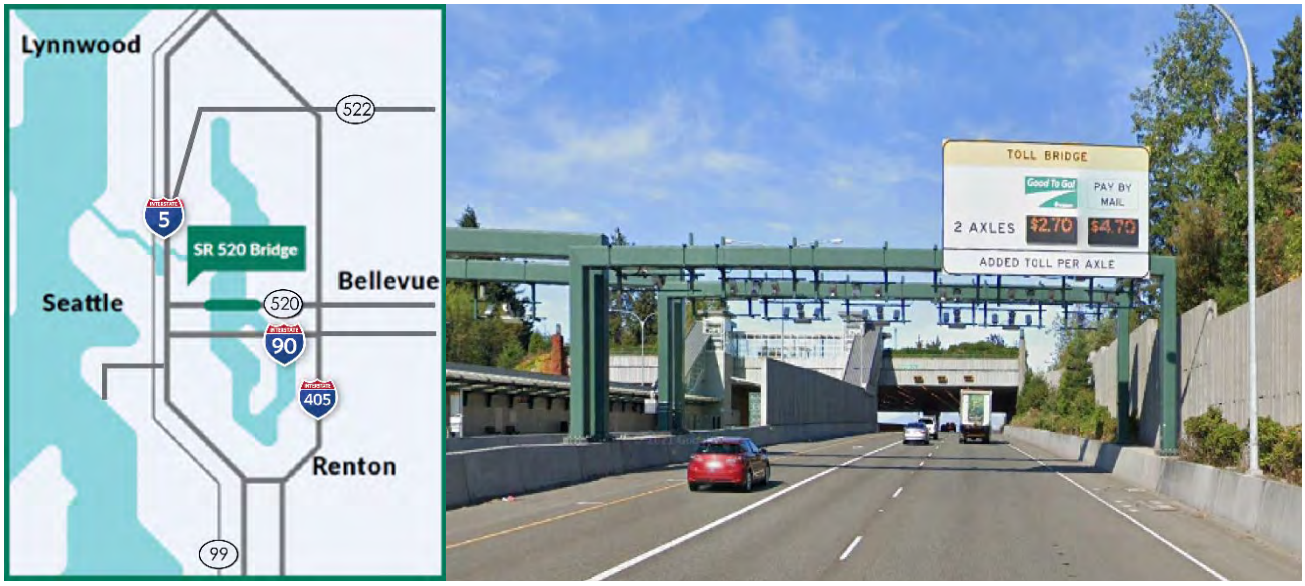
The I-90 HOV lanes start east of I-5 in Seattle and continue across the I-90 bridge on Lake Washington before ending in SE Newport Way exit (Exit 13) after approximately 13.5 miles. There is a single 2+ HOV lane in each direction along I-90. There are also HOV and transit only direct connect ramps at 142nd Place to a park and ride.

State Route 520

SR 520 connects I-405 and I-5 between Bellevue and Seattle. SR 520 crosses Lake Washington via a toll bridge (Figure 3). This bridge trip is a paid toll at all hours, with the toll varying between $1.25 to $4.30 with a Good To Go! pass, depending on day of week and time of day. Tolls are collected for both

directions of the bridge.

Figure 3. SR 520 Connection



I-405

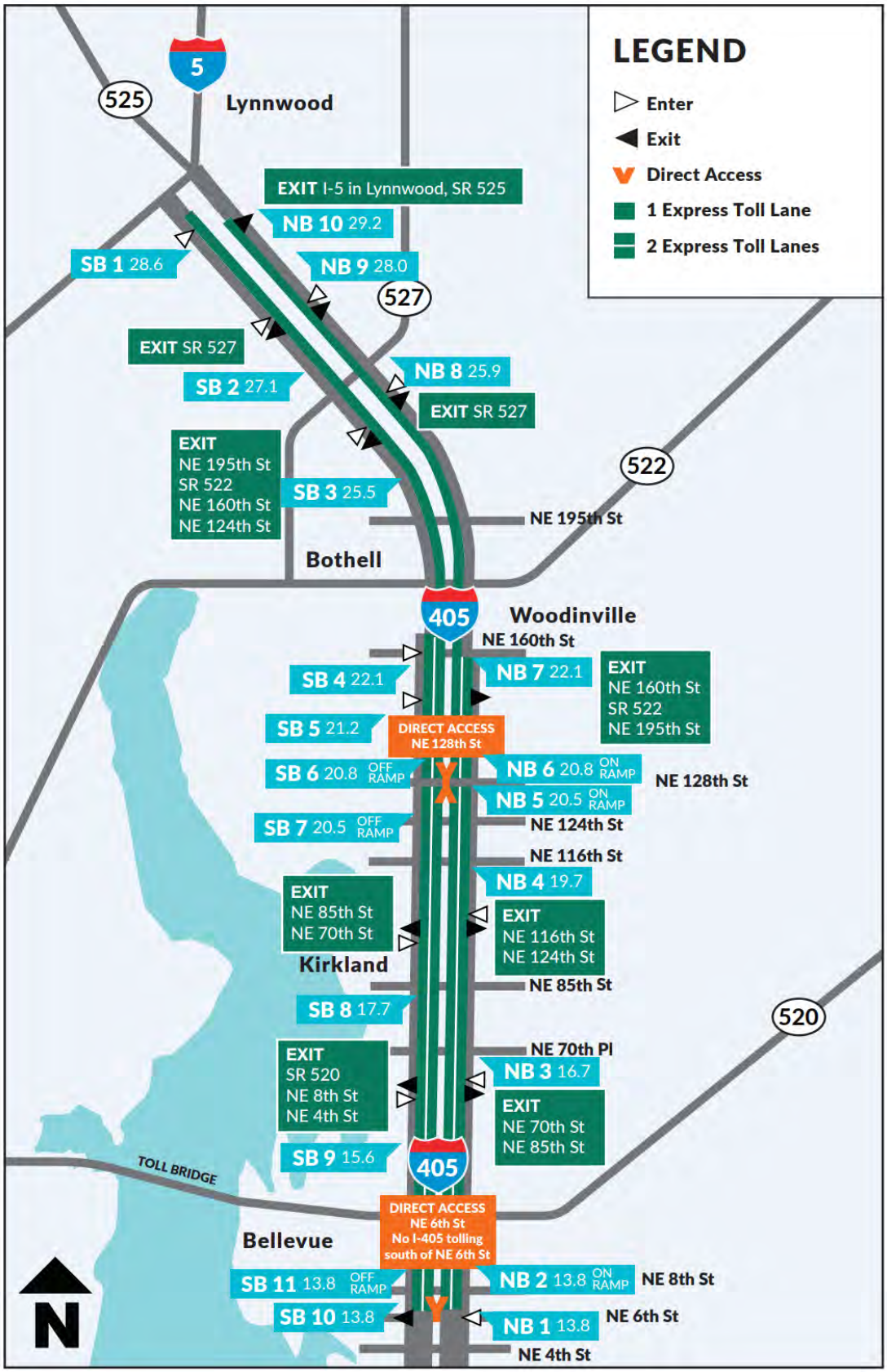
Express toll lanes on I-405 are currently in operation between Bellevue and Lynnwood. Currently, there is an HOV lane between Bellevue (NE 6th Street) and Renton (I-5). Construction of express toll lanes, which will replace the HOV lane, is underway.

The express toll lanes operate 5 a.m. to 7 p.m. Monday through Friday and are free on evenings and weekends. Toll rates range from 75 cents to $10, depending on real-time traffic conditions. During the express toll lane operating hours, vehicles with the right number of occupants and a Good To Go! Flex Pass can travel toll-free. During the peak AM and PM periods, the requirement is three or more people, but during the middle of the day it is only two or more.

Figure 4 shows the variable message signs used on I-405 that are updated to show current toll pricing as well as occupancy requirements. The I-405 express toll lanes are accessed and exited via designated areas and separated from general purpose lanes with a double white striped line. Figure 5 shows the toll lanes on I-405.

Figure 4. I-405 Variable Message Signs

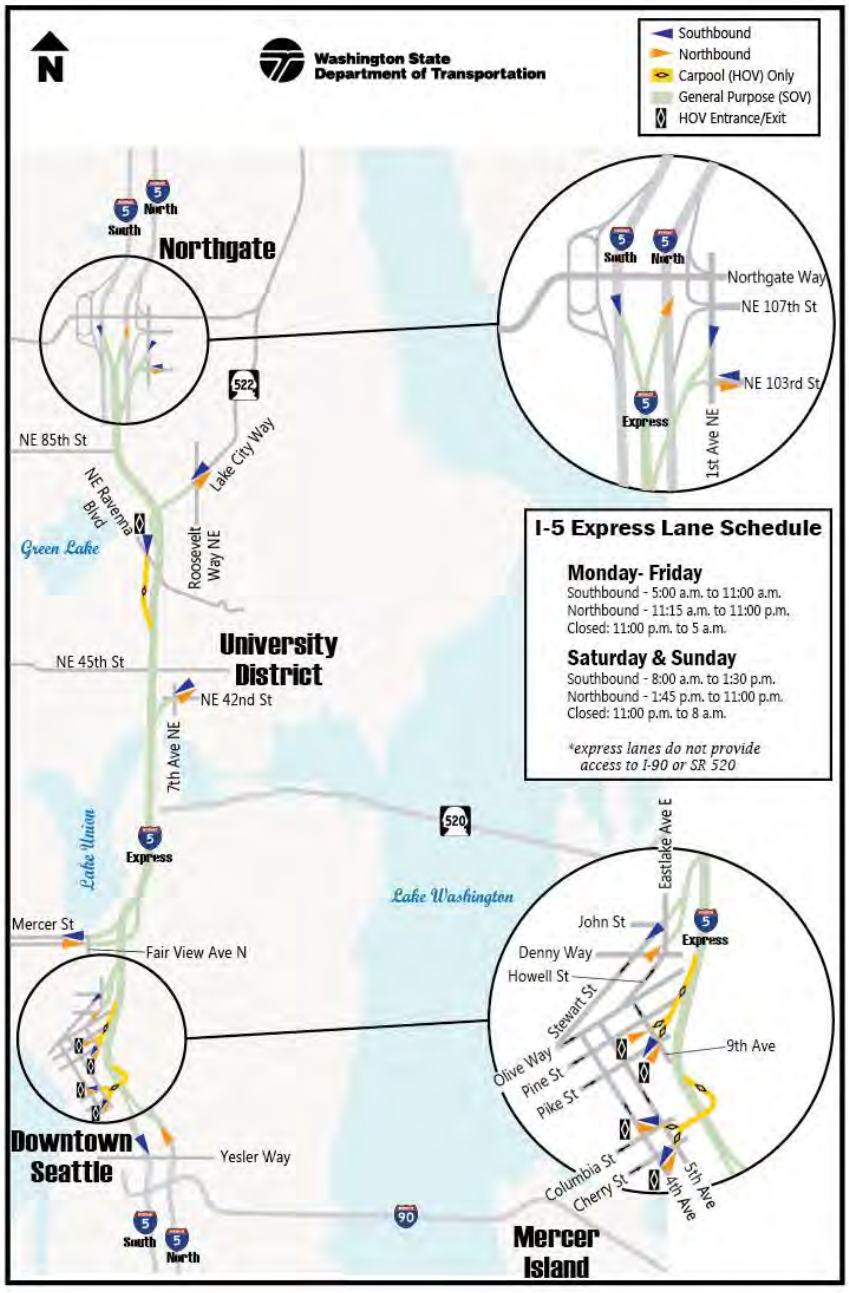
Figure 5. I-405 Toll Lanes



I-5

I-5 in the Puget Sound region has both HOV lanes and reversible express lanes. The express lanes are between downtown Seattle and Northgate and change direction based on a time-of-day schedule (Figure 6). During the AM peak hour, the lanes are southbound and during the PM peak hour, the lanes are northbound. The express lanes do not have access to either I-90 or SR 520. However, there is a 520 connection to the I-5 express lanes currently being constructed that is scheduled to open in 2023. The express lanes have several HOV-only entrances and exits, as shown in Figure 7 and Figure 8. Additionally, there is an HOV lane on the I-5 express lanes that is controlled mostly via signage due to the reversing directions.

Figure 6. I-5 Express Lanes Map



The HOV lanes along I-5 stretch continuously in both directions from Tacoma to downtown Seattle before ending at the downtown Seattle express lanes. South of Tacoma, there are open HOV lanes near Joint Base Lewis-McChord (JBLM) from Steilacoom-DuPont Road to Thorne Lane (northbound mileposts 120.6 to 124.53, and southbound mileposts 123.7 to 120.6). To the south of this segment of I-5, HOV lanes are planned for Mounts Road to Steilacoom-DuPont Road; these lanes will be operationally complete by 2026. To the north of this segment of I-5 (Thorne Lane to South 38th Street in Tacoma), future HOV lanes are also planned to close the gap. North of Seattle, the HOV lanes in both directions return at the end of the express lanes and continue to Everett at the U.S. Highway 2 (US 2) interchange.

Figure 7. I-5 Express Lane HOV Entrance- Downtown

Figure 8. I-5 Express Lane HOV Entrance - North Section

Performance Standards

45-Miles per Hour Performance Standard

A 45-mph performance standard is part of the United States Code (USC) and governs HOV facilities across the U.S. It creates the minimum operating speed of 45 mph, and "Section 166(d)(2)(B) further provides that an HOV facility is considered degraded if it fails to maintain a minimum average operating speed 90 percent of the time over a consecutive 180-day period during morning or evening weekday peak hour periods[2]."

Federal law currently requires agencies that operate HOV lanes to consider policy changes if average speeds in the HOV lanes drop below 45 mph for 90 percent of the time performance threshold over a consecutive 180-day period during the weekday peak periods (23 USC 166 (d)(2)(B)). Policy changes could include increasing the occupancy requirement for HOV lanes, varying the toll charged to vehicles to reduce demand, discontinuing allowing non-HOV vehicles to use HOV lanes, or increasing the available capacity of the HOV facility (23 USC 166 (d)(1)(D)).

The 45-mph performance standard was adopted by the state legislature in 1991 with an adjustment from the Federal standard. In Washington, the target is an average speed of 45 mph during 90 percent of the peak hour of travel, whereas the federal target is 90 percent of the time. This standard allows for WSDOT to adjust occupancy limits over the life of the HOV lanes to maintain the minimum speed standard. Table 1 contains the performance metrics that WSDOT currently uses to determine the performance of its managed lanes, which besides speed includes travel time and person throughput.

Table 1. HOV Performance Metrics[3]

Description	Performance	Measurement
HOV Person Throughput	Measures how many people, on average, move through a highway segment in HOV lanes during the AM (6–9 a.m.) and PM (3–6 p.m.) peak hours.	Estimated average vehicle occupancy based on sample data collected at specific monitoring locations for HOV lanes and adjacent single-occupancy vehicle (SOV) lanes
HOV Lane Performance and Reliability	An HOV lane is deemed "reliable" when it maintains an average speed of 45 mph for 90% of the peak hour.	Collected via loop data to evaluate speed and reliability
HOV Travel Times Compared to SOV	The HOV trip average travel time on a route during the peak 5-minute interval for all weekdays of the calendar year.	Average travel time and 95th percentile reliable travel time for HOV lanes at the peak 5-minute interval compared to equivalent SOV lanes

[2] 23 USC 166(d)(2))

[3] https://www.wsdot.wa.gov/publications/fulltext/graynotebook/CCR_methodology_2nd_edition.pdf

HOV Lane Performance Over Time

Most recurring congestion in the HOV lanes is caused by heavy traffic volumes and congestion in areas where HOV access is not restricted. Over time, HOV lane performance has degraded, as is most evident in the decrease in measures such as reliability. Figure 9 shows the HOV lane speed and reliability performance on I-5 and other major Puget Sound corridors between 2011 and 2015. HOV lane performance and reliability on I-5 has decreased from meeting performance goals during 64 to 82 percent of the peak hour in 2011 to only meeting performance goals during 18 to 32 percent of the peak hour in 2015. Further analysis of data available on the WSDOT Multimodal Mobility Dashboard[4] indicates that HOV performance and reliability on I-5 has continued to decrease, only meeting performance goals during 13 to 27 percent of the peak hour in 2019. As the population of the Puget Sound and Olympic areas continue to grow, HOV lane performance is likely to further degrade over time if not addressed.

Figure 9. HOV Lane Performance and Reliability (2011 to 2015)

HOV lane speed and reliability performance on major central Puget Sound corridors

2011 through 2015; Goal is to maintain 45 mph for 90% of peak hour = *Goal not met*

Commute routes	2011	2012	2013	2014	2015
Morning peak direction commutes					
I-5, Everett to Seattle SB	64%	54%	42%	28%	**26%**
I-5, Federal Way to Seattle NB	72%	51%	43%	30%	**18%**
I-405, Lynnwood to Bel SB[1]	94%	76%	54%	36%	**38%**
I-405, Tukwila to Bellevue NB	98%	93%	65%	35%	**26%**
I-90, Issaquah to Seattle WB	100%	100%	100%	98%	**98%**
SR 520, Redmond to Bel WB	97%	51%	50%	44%	**63%**
SR 167, Auburn to Renton NB[2]	99%	96%	94%	86%	**66%**
Evening peak direction commutes					
I-5, Seattle to Everett NB	76%	68%	66%	46%	**36%**
I-5, Seattle to Federal Way SB	82%	63%	53%	40%	**32%**
I-405, Bel to Lynnwood NB[1]	74%	56%	46%	19%	**26%**
I-405, Bellevue to Tukwila SB	60%	43%	41%	26%	**21%**
I-90, Seattle to Issaquah EB	99%	100%	99%	100%	**99%**
SR 520, Redmond to Bel WB	70%	54%	52%	52%	**73%**
SR 167, Renton to Auburn SB[2]	99%	98%	98%	98%	**95%**

Data source: Washington State Transportation Center (TRAC).

[4] http://test.wsdot.wa.gov/wsdot/about/multimodal-mobility-dashboard/dashboard/central-puget-sound/hov-performance-cps/reliability.htm

Enforcement Challenges

Enforcement is a crucial component in ensuring that an HOV facility functions properly and operations do not degrade. Currently Washington State Patrol (WSP) is the only entity that can enforce HOV violations. Enforcement is easier on barrier-separated facilities due to the limited access points because officers must only monitor a few entry locations. On non-barrier separated facilities, enforcement becomes more complicated due to the ability for cars to move in and out of the HOV facility anywhere along the corridor. Historical trends for the median percentage of HOV offenders on a 50-mile segment of I-5 indicate a noticeable increase in offenders in 2017 and 2018 compared to the previous 15-year period from 1998-2012. This is likely due to increased congestion in the general-purpose lanes.

The design of HOV facilities can help address this challenge by providing dedicated observation and law enforcement waiting areas so WSP can more easily observe HOV violations. Enforcement areas should be located on adjacent shoulders so stopping vehicles and officers do not have to cross multiple lanes of traffic to pull over.[5] It should be noted, enforcement efforts regarding occupancy will take away from time needed for other responsibilities. As technology advances, enforcement of managed lanes will become more consistent and accurate.[6]

There are some emerging technologies that can help automate HOV enforcement, including camera artificial intelligence (AI), motion sensors, Bluetooth sensors, infrared sensors, or phone apps. Utilizing these new systems would require a change in legislature to cite rule breakers. This would also require addressing equity considerations. Currently, state law[7] only allows WSP to issue citations for HOV violations that are physically observed and cannot depend on recordings or photos. Therefore, enforcement is a work intensive activity that is not regularly prioritized by WSP. Based on WSDOT observations, violation rates are approximately 30 percent.

[5] https://wsdot.wa.gov/publications/manuals/fulltext/M22-01/1420.pdf

[6] M22-01.21 Design Manual (wa.gov)

[7] RCW 46.61.165

Sound Transit Near I-5

As the Sound Transit Link light rail projects are completed, the overall people-moving capacity of the I-5 corridor will increase. The existing HOV and managed lanes system's design life will be extended as people move from cars to light rail. Due to induced demand, congestion will likely not be reduced but since the overall capacity of the transportation network is increased it will be able to handle population increases for longer. As Link expands, bus transit along the corridor is expected to drop as routes are altered in favor of light rail. Sound Transit Link connections that are planned to come online in the next few years are the Lynnwood Link Extension, Federal Way Link Extension, and Tacoma Dome Link Extension projects.

The Lynnwood Link Extension project is currently under construction and expected to open in 2024 (construction challenges may delay completion by four to six months)[8]. This project will expand Line 1 and Line 2 north from Northgate to Lynnwood (Figure 10) and cover 8.5 miles with four new stations, which will include Shoreline South, Shoreline North, Mountlake Terrace, and Lynnwood. Headways are expected to be 4 to 6 minutes during peak periods.

The Tacoma Dome Link Extension project, for which the environmental impact statement is currently being prepared, is planned to open in 2032 and will expand Line 1 south of Federal Way Transit Center to the Tacoma Dome Station (Figure 11)[9]. This 9.7-mile extension will include new stations at Federal Way, Fife, Portland Avenue, and the Tacoma Dome.

The Federal Way Link Extension project is expected to open in 2025 and will extend light rail from Angle Lake Station in the city of SeaTac to Federal Way Transit Center (Figure 12)[10]. This 7.8-mile extension will include three stations—Kent/Des Moines near Highline College, South 272nd Street, and the Federal Way Transit Center.

[8] https://www.soundtransit.org/system-expansion/lynnwood-link-extension

[9] Tacoma Dome Link Extension | Project map and summary | Sound Transit

[10] Federal Way Link Extension | Project map and summary | Sound Transit

Figure 10. Lynnwood Link Extension

Figure 11. Tacoma Dome Link Extension

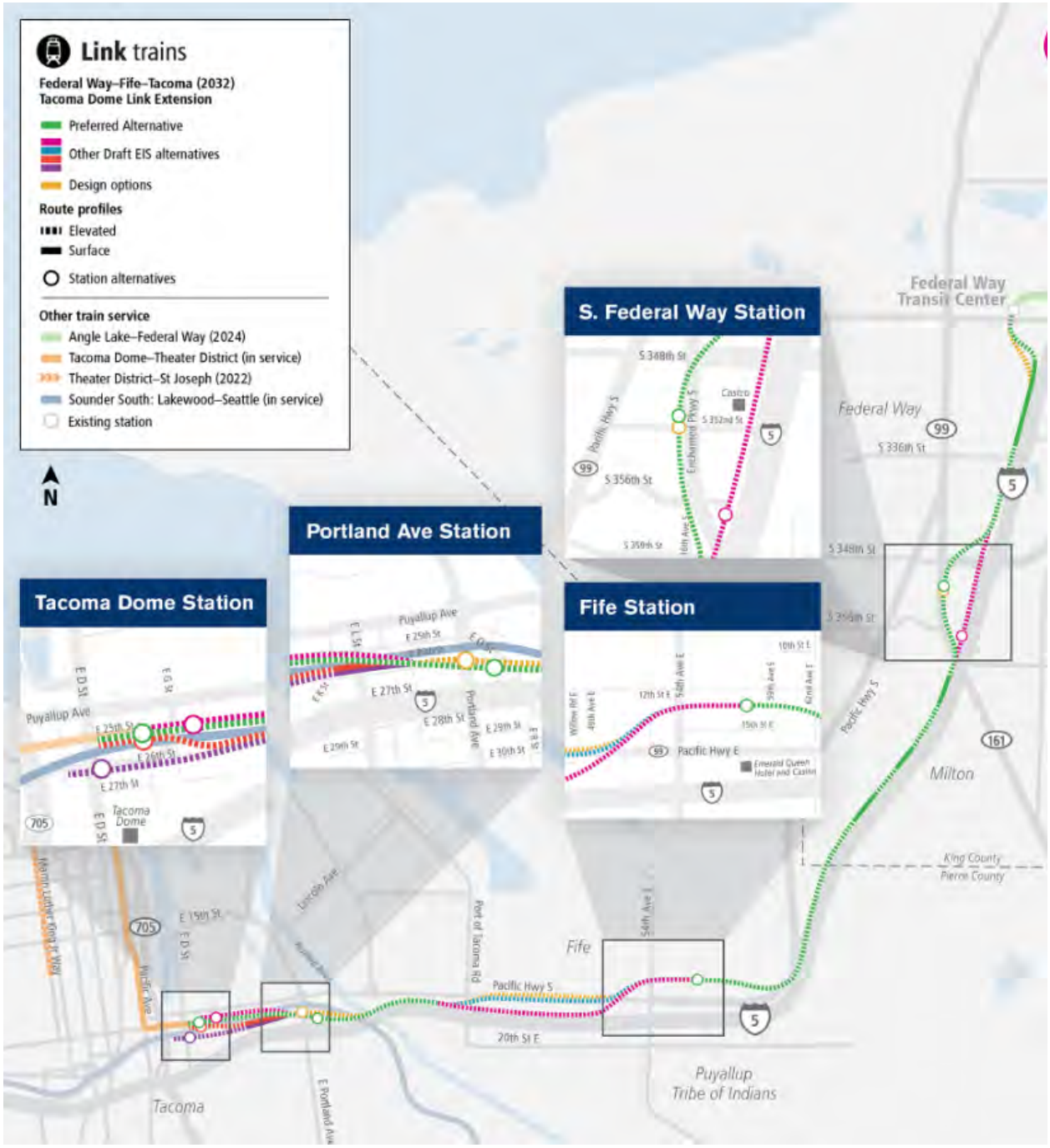
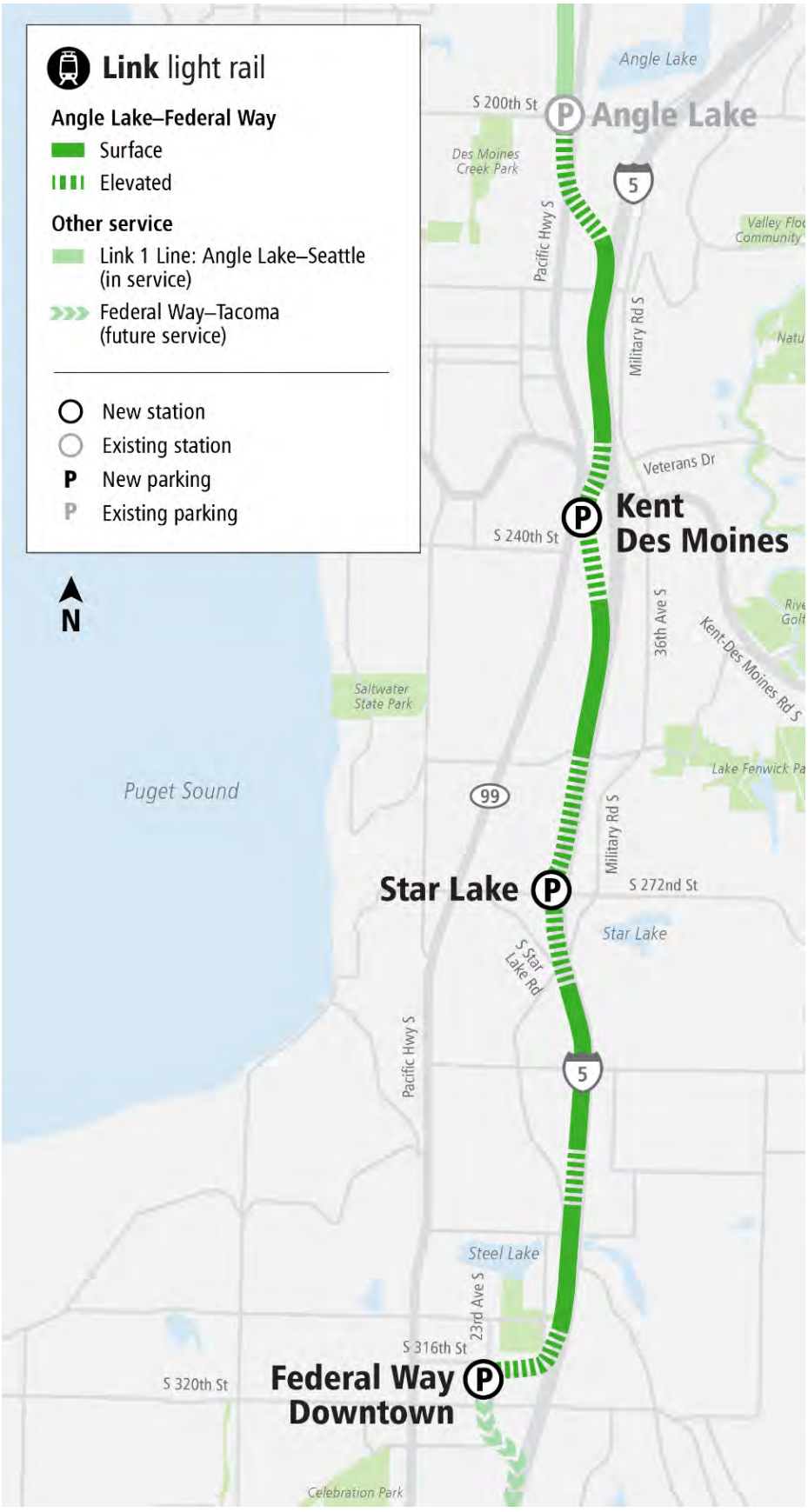


Figure 12. Federal Way Link Extension



Appendix B:
Express Toll Lane Conversion Memorandum

I-5 HOV

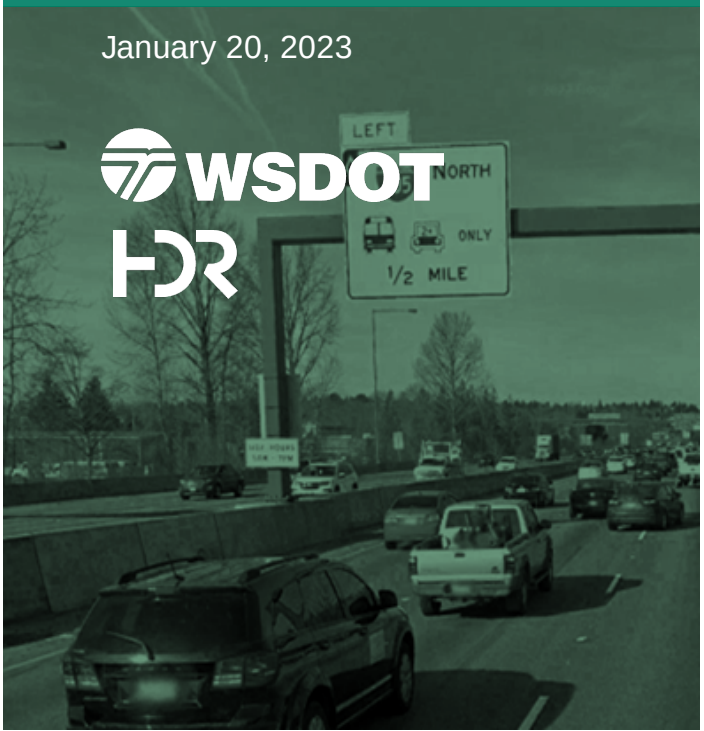
Express Toll Lane Conversion

Memorandum

To: Robin Mayhew, WSDOT

From: Andrew Johnson, HDR
Smith Siromaskul, HDR
Ellie Simpson, HDR
Camille Alexander, HDR

January 20, 2023



WSDOT

HDR

Americans with Disabilities Act (ADA) Information: This material can be made available in an alternate format by emailing the Office of Equal and Civil Rights at wsdotada@wsdot.wa.gov or by calling toll free, 855-362-4ADA (4232). Persons who are deaf or hard of hearing may make a request by calling the Washington State Relay at 711.

Title VI Notice to Public: It is the Washington State Department of Transportation's (WSDOT) policy to assure that no person shall, on the grounds of race, color, national origin or sex, as provided by Title VI of the Civil Rights Act of 1964, be excluded from participation in, be denied the benefits of, or be otherwise discriminated against under any of its programs and activities. Any person who believes his/her Title VI protection has been violated, may file a complaint with WSDOT's Office of Equal and Civil Rights. For additional information regarding Title VI complaint procedures and/or information regarding our non-discrimination obligations, please contact the Office of Equal and Civil Rights' Title VI Coordinator at (360) 705-7090.

Table of Contents

Table of Figures

Introduction

The Washington State Department of Transportation (WSDOT) is evaluating potential improvements to improve the movement of people and goods in the Interstate 5 (I-5) corridor. These improvements should consider preservation and safety needs, address climate change and resiliency, improve corridor efficiency and person-throughput, and improve managed lanes effectively for the long-term. I-5 is a critical part of the state's multimodal transportation system and the primary north-south transportation corridor. WSDOT intends to provide improvements by considering managed lane options along I-5 within the Puget Sound and Olympic regions.

This memo is intended to provide considerations on converting existing high occupancy vehicle (HOV) lanes to express toll lanes (ETL), including information on planning, policy, design, and case studies where this conversion has taken place.

HOV to ETL Conversion

Federal Toll Program Options for HOV to ETL Conversions

There are two primary federal programs that can facilitate HOV to ETL conversions on the interstate system. The first program specifically tailored to this conversion is Section 166 of US Code 23 and the second is the Value Pricing Pilot Program (VPPP). Within both programs, the primary objective must be congestion reduction. Agencies should explore the use of Section 166 tolling programs first. FHWA has a clear preference for use of Section, reserving the VPPP as an option for projects that don't fit within 166.

Section 166 directly addresses HOV to ETL conversions by allowing the tolling of vehicles that would not qualify for use of HOV lanes. Generally, Section 166 is intended to take advantage of unused capacity by allowing additional users to pay a toll to access the HOV lane. In order to qualify, the agency must demonstrate acceptable operating capacity, establish enrollment and participation programs, offer automatic toll collection options, establish policies and procedures to manage demand, use variable pricing, enforce the restrictions, and ensure over-the-road buses are provided the same terms and rates. Performance thresholds specified in US Code for HOV performance thresholds must still be met, unless a waiver is granted as it was on I-405, under 23 US Code 166 (d)(1)(F)(ii).

Participation in the VPPP is another way to implement tolls on congested roadways. VPPP, which provided funding as part of a grant process to states implementing congestion pricing strategies, including those wishing to convert HOV lanes to ETLs. The VPPP was established in 1991 by Congress, with final funding being distributed in 2012. Currently, 10 states have utilized the VPPP Program. The VPPP program also requires additional approval and coordination with US DOT and additional analysis and performance considerations.

Washington projects that were funded under the VPPP include the Seattle/Lake Washington corridor Tolling and Transit Urban Partnership Agreements (UPA) (2008), the Express Lanes System Concept Study (2009), the Implementation of Incentives as Alternatives to Parking (2010), the Parking Pricing for Delivery trucks in Seattle (2011), King County Park-and-Ride Pricing in Multi-Family Developments (2012), and the Express Toll lanes Continuous Access Demonstration (2012).

Defining HOV Lanes, HOT Lanes, and ETLs

HOV lanes can have similar access control as ETLs but generally do not charge a fee for use. Access is only restricted via occupancy requirements and vehicle types such as low-emissions vehicles and/or motorcycles.

High occupancy toll (HOT) lanes generally refer to facilities where HOVs (and specific vehicle types) are exempt from paying tolls, while single occupant vehicles (SOV) are charged for use.

ETLs are typically synonymous with HOT Lanes. However, in some parts of the United States, ETLs refer only to facilities where all users pay a toll, regardless of occupancy. The Federal Highway Administration (FHWA) uses the same definition for ETLs and HOT lanes[1]. In Washington, the terms

1 https://ops.fhwa.dot.gov/publications/fhwahop12031/fhwahop12027/index.htm

HOT and ETLs are used interchangeably, with HOT lanes only referring to the State Route (SR) 167 project. For the purposes of this memorandum, ETL will be used[2].

As of 2020, there were 53 ETL facilities in operation in the United States[3]. The following are a few examples of such facilities across the country:

- I-15 Express Lanes in San Diego, California
- US 290 Northwest Freeway QuickRide HOT Lanes in Houston, Texas
- I-394 and I-35W MnPass Express Lanes in Minneapolis, Minnesota
- I-25 Express Lanes in Denver, Colorado
- I-15 Express Lanes in Salt Lake City, Utah
- SR 167 HOT Lanes Pilot Project in Seattle, Washington
- I-95 Express Lanes in Miami, Florida
- I-680 Contra Costa Express Lanes in Alameda County, California
- I-85 Express Lanes in Atlanta, Georgia

Effects of HOV to ETL Conversion

The main operational effect of HOV conversion is the overall delay reduction for single occupancy vehicles (SOVs) across both the new ETLs and the general-purpose lanes. Figure 1 shows the effects of conversion. As SOV delay is reduced, demand on the facility is induced due to decreased travel times. Eventually, the Interstate and other network routes will reach an equilibrium, with a lower overall delay post-HOV to ETL conversion.

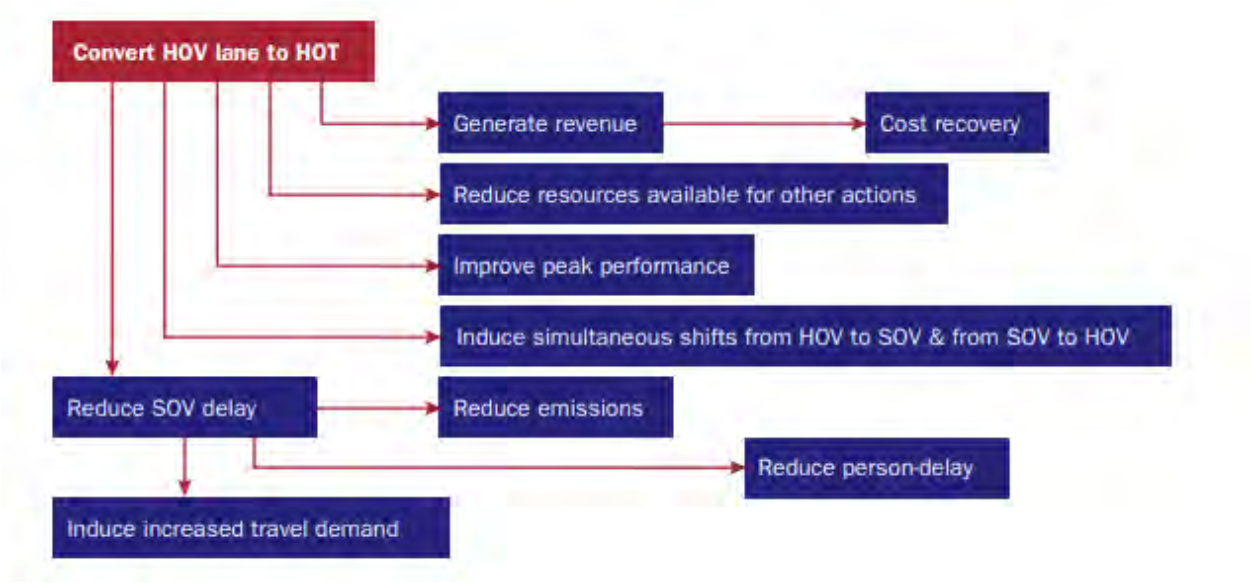
Benefits of Conversion (I-95)

An example of the benefit of conversion is I-95 in Florida where the conversion of a single HOV lane to dual ETLs. Prior to the conversion, the general-purpose lanes and single HOV lane were operating under 20 miles per hour (mph) during rush hour periods. After the express lanes opened, speeds were over 40 mph in the general-purpose lanes and 50 mph in the express lanes.

2 From Express Toll Lanes Concept Study – Draft Final Report v8 (October 2015)

3 https://ops.fhwa.dot.gov/publications/fhwahop20043/exec_summary.htm

Figure 1. Effects of Lane Conversion[4]



Impacts on Downstream Facilities (I-394 and SR 826)

Providing additional capacity of any kind increases the overall vehicular throughput delivered downstream. Where downstream bottlenecks are present, this can lead to significant unintended consequences. Three examples of this are I-394 in Minnesota, SR 826 in Florida, and I-5 in Washington.

In the Minneapolis, Minnesota area on I-394, an existing HOV lane was converted to an ETL while also adding a two-lane reversible ETL section. HOV 2+ and transit can use the lanes for free, and trucks are prohibited from using the facility. The reversible section of the ETLs is barrier-separated, but the non-reversible ETL is delineated by a double white stripe with no physical separation.

The additional peak direction capacity on I-394 heading into the downtown area significantly increased pressure on previously metered downstream bottlenecks. The increased vehicular throughput created backups in the downtown area. To mitigate this result, MnDOT constructed an auxiliary lane to provide additional capacity to accommodate the additional traffic.

The SR 826 Palmetto Expressway, located in western Miami-Dade County, Florida, was a freeway with no managed lanes system. In 2019, the section of SR 826 from near the Miami International Airport to I-75 in Miami Lakes added a managed lanes system by taking away one of the four existing general-purpose lanes and adding an additional lane to create a two-lane ETL facility. After opening, operations on this facility performed significantly worse than was expected and delay was significantly higher than the existing configuration. While the new configuration had a total of five lanes in each direction, one more than the previous condition, a critical weaving section within the project corridor was made exponentially worse due to the removal of the general-purpose lane from that weaving section. A direct result of the consequences of this project was increased political sensitivity regarding additional ETLs in the region.

A similar increase in congestion will likely be observed along I-5 after HOV conversion if existing bottlenecks, particularly in the vicinity of the I-90 and Mercer Street connections, are not also

4 https://ops.fhwa.dot.gov/publications/fhwahop08034/fhwa_hot_lane.pdf

addressed and resolved. The additional capacity added via the ETLs will exacerbate the existing congestion experienced in these areas and create further backups.

Impacts on Regional Network (I-4 Ultimate)

The I-4 Ultimate 21-mile project in Orlando, Florida, added two express lanes in each direction to form a barrier-separated ETL facility through the core of downtown Orlando and the northern theme park areas and was completed in 2022 via a private-public partnership (PPP). This. As a result of the increased capacity on the freeway, traffic throughput on I-4 significantly increased as latent demand was absorbed back onto the facility. The change in travel patterns due to the increased capacity on I-4 decreased the amount of traffic diverting onto other elements of the regional roadway network and resulted in a significant reduction in overall travel delay in the entire Orlando metropolitan area.

Project Life Cycle

Planning Considerations

There are several important considerations when converting HOV lanes to ETLs. Underused HOV lanes are considered the best candidates for conversion because they have available capacity that can be utilized by toll-paying SOV and do not require widening as part of the conversion. Congested HOV lanes require more consideration when deciding on conversion. According to FHWA, there are four main questions that should be answered when deciding whether to convert HOV to ETL:

1. "Is there sufficient excess peak capacity to allow SOV toll buy-ins on an existing HOV lane without the need to expand lane capacity?" Generally, HOV lanes are good candidates for direct conversion without expanding if they are experiencing chronic underuse (below 700 vehicles per lane per hour).
2. "If there isn't enough excess peak capacity in the existing HOV lanes to allow for SOV tolling, is there additional capacity that can be added to the existing HOV facility as part of an HOT conversion project?" Capacity can be added by either adding additional lanes or by increasing the occupancy requirements.
3. "If changing the HOV exemption from HOV 2+ to HOV 3+ or higher is necessary, will it result in behavioral shifts that undermine the mobility improvement objective?" A consequence of increasing occupancy requirements might cause HOV 2+ to change to SOV as the carpool motivation is offset by the presence of tolling.
4. "Are there any unique operational and physical characteristics of the existing HOV lane facility that will require major reconfiguration?"

Lane Management

Besides the number of lanes, the capacity of an ETL facility is a function of the number of access points, vehicle mix, roadway grades and geometry, separation treatments, and other variables. According to the FHWA, "The lane management system must establish LOS [level of service] performance objectives and determine the maximum allowable peak hour volumes to achieve those objectives." While variable tolling is an important tool in maintaining minimum facility operational levels, it is not the only factor that affects LOS and throughput.

Lane separation can impact toll collection, enforcement, and operations. Separation can include physical elements such as concrete barriers, unpaved buffers, bollards ("candlesticks"), and rumble strips, or a non-physical approach that relies on pavement markings alone, such as double or single solid white lines and hashed areas. WSDOT's ETL facilities currently use pavement marking separation.

Separation type also impacts and is impacted by access control. In some states, such as Florida, managed lanes systems are explicitly intended for longer distance travel. Access points are intentionally spaced to skip at least two interchanges. This ingress/egress spacing makes it easier to develop the geometry needed to create the access zones, barrier separation, and direct connect ramps. Barrier separation also makes toll collection and enforcement simpler. However, limiting the access to ETLs also requires care in selecting the access locations to allow for maximizing eligible trips (matching

access to origin-destination patterns to ensure the system is fully used by the allowed access) and also preclude access where interchange spacing is not ideal (thus creating lane diving situations where vehicles must cross multiple lanes in an unsafe distance). Separation type will also directly impact capacity from a turbulence standpoint. Significant speed differentials, where the general-purpose lanes are congested and the ETLs are not, can degrade the performance of the ETLs if there is no physical separation.

Facility design is an important factor in express toll lane success and can greatly affect construction feasibility and timeline. Barrier separation makes enforcement and maintenance of operations easier but can complicate a conversion project due to the need for widening.

Toll Collection

Toll collection technology has improved drastically from the original cash payments present on the first toll roads. Toll collection plays an important role in maintaining speeds on ETL facilities; if possible, toll collection should have no negative impact on traffic flow. Washington currently uses the GoodToGo system, which uses a transponder located in the vehicle to register a toll payment. If the customer does not have a GoodToGo account, video detection is used to take a photo of the license plate and a bill is sent to the registered address. The SR 167 HOT lanes use the GoodToGo system but requires users to self-declare their HOV eligibility using a transponder with a switch known as Flex Pass to determine if the vehicle meets the occupancy requirements to travel for free.

This system does require infrastructure in place to read the GoodToGo transponders, which is an overhead bar placed across the lane, as shown in Figure 2. During a conversion, this detection and collection infrastructure would need to be installed as well as any supporting infrastructure such as power and communications.

Figure 2. SR 167 Toll Collection Equipment

ETL Occupancy Verification Considerations

Enforcement of ETL usage must accomplish the following key operational functions:

- Verify toll payment (or credit)
- Provide access control
- Verify vehicle occupancy
- Assess fines to violators

Occupancy verification must be able to identify who is required to pay for ETL use and who does not have to pay (such as vehicles that meet the occupancy requirements). Enforcement depends heavily on the express lane facility design. Barrier separation is the most effective way at reducing toll evasion, but the space required can make it difficult to achieve, especially in areas where existing HOV lanes are being converted that do not already have space to provide barrier separation. The MnPass project uses a double white line to separate its express lanes from the general-purpose lanes, with a dotted white line indicating approved ingress/egress points. According to MnDOT, two years after the striping was implemented there was a drop-in violation rate from 20 percent to less than 10 percent. MnDOT used transponder technology in police vehicles to help them find express lane violations.

Currently, there are emerging technologies to allow for detecting occupancy, toll verification, and those weaving in and out of ETLs to avoid the tolling points. Companies such as GoCarma and RideFlag use the number of cell phones in a vehicle or facial recognition, respectively, to determine the number of people in a vehicle. While these verification systems are not cheat-proof, it adds a barrier to attempts to cheat the system. It is also a safer option than visual checks and policing on highways.

Many tolling agencies are piloting the automated occupancy detection provided by only a few toll system integrators. Colorado is currently piloting a project using infrared camaras for occupancy data collection. Other systems use facial recognition to determine the number of people in a vehicle. The express lanes in northern Virginia has a permanent enforcement solution installed that sends warnings to violators and, if detected violating a second time, assess the toll. The accuracy of these systems, however, is still questioned by many tolling operators.

HOV to ETL Implementation Considerations

There are several different options available for financing and constructing an HOV to ETL conversion project. Financing options include traditional public funds, federal grant support, revenue bonding, or public private partnerships (PPP). Project schedule is very dependent on the type of funding mechanism used as well as whether the project is delivered as design-bid-build or design-build.

Timelines in HOV to ETL Conversion

Converting an existing HOV facility to an express lane could require a lengthy National Environmental Policy Act (NEPA) study. This is dictated by the state requirements and extent of impacts but could easily extend past a year. FDOT achieved an accelerated conversion project that included widening the interstate in 2.5-3 years. The Florida I-95 express lane conversion was completed using design-build delivery, which decreased the project timeline from a design-bid-build approach. Typically conversions would take between 3–6 years, depending on the length of improvements, environmental approvals,

public and political acceptance, and amount of space available to accommodate the needed infrastructure.

The conversion timeline could be affected by the following elements:

- Data collection, including survey, traffic, and geotechnical data
- Expression of Interest submitted to FHWA if the intent is to use the VPPP
- Environmental permitting
- Drainage analysis and modeling
- FHWA Major Project Steps
    - Cost estimate review
    - Financial plan
    - Project management plan
- Traffic and revenue studies
- Preliminary design including:
    - Line and grade design
    - Typical section package
    - Structural feasibility analysis
    - Intelligent Transportation System/Signing master plans
    - Traffic analysis reports
- Request for Proposal (RFP) development (design-build)
- Toll System Integrator RFP if not part of a PPP

Considerations in HOV-ETL Conversion

First, it is important to consider the basic steps from a strategic perspective on how to achieve success. This includes the basic steps, including planning, the environmental process, public acceptance, regional coordination, design, construction, and maintenance of the proposed improvements.

It is also important to consider that Congress's approach to tolling has evolved over the years, and is now, more than ever, seen as an effective tool in expanding personal mobility through raised revenue, increased reliability, and improved travel options. FHWA's implementation of the U.S. Code also has evolved and changed based on political and social factors. Through discussions with FHWA, the path to success is in the strategic execution of the planning and communication of these programs. Recommendations for implementation and use of these programs are as follows:

- A strong political or politically connected champion is critical to help remove roadblocks, develop consensus among essential stakeholders, and assign the resources to the project.
- Plan and design any system with operations and maintenance in mind. Maintenance costs and safety, enforcement, and access are critical to the long-term success of the program.

- Integration into a regional network of ETLs or managed lanes. Networks of ETLs and managed lanes are most effective for regional benefit, even if phased in one corridor at a time.
- Allies and potential opponents must be identified early, and a strategic communications plan (focusing on the benefits) developed to engage them.
- Coordination with the FHWA Division Office should occur quickly after the project has been scoped.
- A comprehensive mobility plan incorporating all modes of transportation is needed to support developing agreements with FHWA.
- Clear and demonstrated commitment to use funds in accordance with the program is necessary. If allowed by the program, funds dedicated to expansion of transit service as a way to mitigate impacts of tolling is strongly favored by FHWA.
- FHWA appears to engage more quickly and positively to projects that have the momentum to become a reality as opposed to projects viewed as a planning study.
- Keep the program simple. Tolling gets complicated quickly with toll rates, discounts, variable tolling, etc. Simplifying the message of what it will cost users and how users will benefit from capital spending/congestion reduction will garner more support or less opposition.