Chapter 6 - Modeling and strategy development

For this study, WSDOT and TRPC partnered to develop a transportation modeling framework for the Thurston Region and adjacent areas, with emphasis on I-5 between 93rd Avenue in Tumwater to Mounts Road and US 101 from I-5 to Black Lake Boulevard. The modeling framework includes an integrated Travel Demand Model and a Dynamic Traffic Assignment model platform. The demand model estimates how many people will be traveling between different locations in the model area, by what mode of transportation, and when during the day they will travel. The traffic assignment model uses results from the demand model and predicts what routes people will take and how the system will operate under the forecasted traffic demand. The study team used these models to compare performance of the various scenarios identified in the study.

All model scenarios were built for a future year of 2040. TRPC developed the population and land use forecasts used in the modeling framework as part of their regional work program. See Appendix E for a description of assumptions and data used to produce TRPC’s 2040 Land Use Forecast.

A forecast is only as accurate as the assumptions that underlie it. They give us important information about our general direction, given what is known today. There are many other factors, unable to be considered in the forecast, which may impact future travel patterns. Decision-makers, planners, and the general public looking at results from this study should keep these limitations in mind.

Developing strategies

WSDOT and TRPC collaborated with study advisory groups to develop strategies to achieve study goals, incorporating ideas from previous studies and public input as discussed in chapters two and three. The study team used the following process to develop and refine strategies with local partners:

1. Present strategies from previous plans and public input to the advisory groups and brainstorm additional ideas.
2. Screen ideas to ensure they meet the study purpose.
3. Sort strategies into those that could be modeled and those that could not.
4. Engage relevant agencies and partners to determine any critical issues with individual ideas.
5. Work with advisory groups to refine ideas that could be modeled into strategy scenarios.
6. Work with advisory groups to refine and evaluate ideas that could not be modeled.
7. Work with advisory groups to analyze effectiveness of modeled scenarios and develop recommendations.

Models are useful but results must be considered with caution

Transportation models statistically estimate regional travel behavior. They rely on observed historical data such as population growth and household transportation survey results about travel behavior to forecast future conditions and behavior. They cannot predict some kinds of disruptive changes such as natural disasters or changes in travel behavior due to new technologies like autonomous vehicles. They should only be used for generalized planning purposes. For specific investment decisions more detailed modeling, such as operational modeling, is generally used.

WSDOT was unable to account for the following potential future conditions with modeling:

- Changes in travel behavior
- Future disruptions like natural disasters
- The effect of new technologies
- The effect of construction on travel behavior
- Induced travel demand from new capacity

Exhibit 6-1: Examples of improvement ideas by source

<table>
<thead>
<tr>
<th>I-5/US 101 Interchange Study</th>
<th>Reconfigure 4th Ave roundabout to allow direct access to Deschutes Parkway</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corridor Sketch</td>
<td>Update signal timing and channelization on local arterial streets</td>
</tr>
<tr>
<td>2040 Regional Transportation Plan</td>
<td>Add a fourth lane to I-5</td>
</tr>
<tr>
<td>I-5/Martin Way and Marvin Road Interchange Justification Report</td>
<td>Install loop ramps on Martin Way interchange (Exit 109) with transit-only access to park &amp; ride</td>
</tr>
<tr>
<td>WSDOT Highway System Plan</td>
<td>Install ramp metering</td>
</tr>
<tr>
<td>I-5 Near-term Solutions Study</td>
<td>Install part-time shoulder use on Southbound I-5</td>
</tr>
<tr>
<td>Public input surveys</td>
<td>Establish some sort of commuter or light rail service between Olympia and Tacoma</td>
</tr>
</tbody>
</table>
Reviewing previously completed studies and brainstorming new strategies with the study advisory groups and produced 81 ideas to consider for modeling. Public input provided an additional 66 ideas for consideration. See Exhibit 6-1 for examples of ideas gathered from previous studies and public input. A full list of ideas considered is provided in Appendix F.

The study team and technical advisory group reviewed all ideas. Many of the ideas from public input were similar to each other or those produced by the advisory groups. Similar ideas were combined and all were screened to ensure alignment with the study purpose and goals and that they did not go against any WSDOT policy or state, local, or federal rules. Only three ideas were initially removed from consideration for these reasons. An example of one of these was “halting development in the study area” as neither WSDOT nor its partners have the authority to implement this idea and it does not support study goals.

The study team also considered if an improvement idea would be able to be modeled. There were several reasons an idea may not have been able to be put into the model.

- The idea was larger than the scope of the model used
- The idea involved an undeveloped or developing technology
- The software used could not model the idea
- The idea was too vague as proposed

A good example that encompassed several of these issues was the suggestion for a statewide rapid transit system. This study used a model of the transportation system within the south Puget Sound region, mainly Thurston and Pierce counties. Implementation of rapid transit systems within this region is only just being piloted and is outside the scope of this study. The additional planning and modeling for that type and size of network needed to achieve large scale regional performance impacts is too complex and outside the fiscal resource for alternative development as well. Finally, big questions like where a statewide rapid transit system would be located and how it would be operated would need to be answered and refined.

The study team further grouped ideas that could be modeled by the strategy they would fall under. For example, expanding telework options was grouped in transportation demand management and adding a lane to I-5 was grouped in capacity expansion/widening. These groups of solutions ultimately formed the strategy scenarios that the study team would later test in the model to evaluate their effect on the transportation system.

The study team and advisory groups also worked together to determine the order in which scenarios would be modeled. The final order used was selected to implement one aspect of Practical Solutions; which is to use lower cost solutions to achieve performance outcomes before considering more expensive fixes. Lower cost solutions were modeled first with each subsequent scenario including improvements from previous scenarios except where strategies were mutually exclusive. The table below shows the strategy scenarios that were modeled along with the order of modeling.

**The baseline scenario: It’s the year 2040**

The baseline scenario includes all projects currently funded for completion in the study area before 2040 and a “business as usual” population and land use forecast developed by TRPC in 2012 that was based on observed trends in population and job growth as well as development patterns. The scenario includes the following elements:

- TRPC 2040 Land Use forecast. This is the ‘business as usual’ land use forecast developed in 2012. 
- Traffic signal timing updates to facilitate optimized traffic flow through the study area within the model.

1 TRPC 2040 Land Use Forecast Documentation website - https://www.trpc.org/236/Population-Employment-Forecasting
The scenarios developed for this study do not consider all possible strategies

The study team was not able to model all potential solutions or strategies that could be used to improve transportation system performance in the study area. There are several reasons for this. First and foremost was the study had a finite amount of time and financial resources to spend on modeling solutions.

Another reason was if an idea conflicted with local or state development policies or plans. Finally there were also technical limitations to the modeling software used that precluded modeling some strategies. There were a few key strategies the study team, advisory groups, and/or the public were interested in that were not modeled:

- Any rail transportation solutions including light rail like the Link system or commuter rail like the Sounder.
- Changes to the local transportation system beyond those identified in current local plans.
- New state highways to serve as an alternate to I-5.
- Tolling facilities to manage demand.

Further study would be needed to investigate the viability of these options.

through the JBLM area\textsuperscript{2} which will widen the highway, add some new frontage road connections, and improve interchange operations, the highway will neck down from five lanes to three lanes, with one lane dropping as an exit only lane and another merging right before the Mounts Road bridge. The model predicts this location will become a new bottleneck with traffic backing up as far as Thorne Lane SW in Tilloicum on southbound I-5 given the assumptions of the model and demand forecast.

Scenario One – Operations

Scenario One - Operations contains a variety of intersection improvements identified by project partners to address congestion issues in the 2040 baseline scenario. Operations refers to features and enhancements made to roads and transportation facilities that support movement of people and goods across the transportation network.\textsuperscript{3}

There are 11 of these improvements, which are all off of I-5 with the exception of a small revision to the merging taper on the ramp between northbound I-5 and westbound US 101 at Exit 104 (shown on page 6-4, Exhibit 6-4). Some of the improvements are on WSDOT facilities like SR 507 near WSDOT JBLM Area Improvements website: https://www.wsdot.wa.gov/Projects/I5/JBLMImprovements/default.htm


\textsuperscript{2} WSDOT JBLM Area Improvements website - https://www.wsdot.wa.gov/Projects/I5/JBLMImprovements/default.htm

Operational improvements are small changes that help improve traffic flow at key locations. For example, WSDOT is planning to add ramp metering to southbound I-5 through Olympia to help smooth traffic flow at merge points.

\textsuperscript{3} WSDOT Transportation Systems Management and Operations: Operations webpage - https://tsmowa.org/category/Operations%20%26%20Supporting%20Infrastructure
Yelm while others are on the local roadway network. The general intent of this strategy was to improve performance through small projects at key locations on the network. See Appendix G for a full list of projects included in this scenario.

Scenario Two – Sustainable Thurston Land Use

Scenario Two – Sustainable Thurston Land Use assumes the region will achieve goals in TRPC’s Sustainable Thurston vision rather than the “business as usual” 2040 Land Use Forecast. Similar to the adopted forecast used in the previous scenario, the visionary 2040 forecast was last updated in 2013. Sustainable Thurston has two primary goals for land use:

- By 2035, 72 percent of all households in Thurston County’s cities, towns, and unincorporated growth areas will be within a half mile (comparable to a 20-minute walk) of an urban center, corridor, or neighborhood center with access to goods and services to meet their daily needs.
- Between 2010 and 2035, 5 percent of new housing will locate in the rural areas. Rural areas are defined as outside of the cities, towns, unincorporated urban growth areas and tribal reservations.

The intent of modeling this scenario was to test how transitioning auto-oriented corridors into an urban form more conducive to alternate modes of travel like walking and mixing housing, services, and amenities might affect travel behavior and system performance. You can see what strategies TRPC plans to use to achieve these goals in Appendix G.

Scenario Three – Transportation Demand Management

For Scenario Three – Transportation Demand Management, the study team built assumptions into the model that the region would achieve a higher level of participation in programs like teleworking and that more places in the region would have metered parking. Transportation demand management as a strategy focuses on reducing the amount people need to travel, particularly by driving alone during peak commute times. This is achieved by helping people use the infrastructure in place for transit, ridesharing, walking, biking and telework. Scenario Three consists of three elements:

- Expanded participation in telework/compressed work week and other commute trip reduction techniques. The study uses the assumption that this would result in 25 percent of employees in the government non-education and professional service sectors reducing travel by one day a week.
- Managed parking at key employment sites, including raising the parking rate where parking is currently managed.
- New shared use trails.

The areas where expanded managed parking was built into the model is shown in the map below. A list of all projects from this scenario can be found in Appendix G.

Scenario Four - Intercity Transit Long-Range Plan

For Scenario Four – Intercity Transit Long-Range Plan, the study team added new local bus service that is part of InterCity Transit’s long-range plan. This included the new bus rapid transit demonstration route “The One” as well as the new Zero-Fare system that was implemented.
January 1, 2020. The study team used an assumption that these changes, along with population growth and more transportation-efficient land use from Scenario Two, would result in a substantial increase in ridership. Scenario Four consists of the following elements:

- Increased transit services per Intercity Transit’s Long Range Plan8
- New transit routes (See Exhibit 6-7).
- A transit queue jump in downtown Olympia near the Olympia Transit Center.
- An assumed 30 percent increase in transit ridership based on implementation of a variety of measures to increase transit ridership, including a Zero-fare transit system.

The areas where expanded transit service was built into the model is shown in the map below. A list of all improvements from this scenario can be found in Appendix G.

**Scenario Five – Part-Time Shoulder Use**9

For Scenario Five – Part Time Shoulder Use, the study team added part time shoulder use as identified in the I-5 Near-Term Solutions Study. Part time shoulder use involves repurposing road shoulders during high demand conditions in order to improve efficiency and reduce congestion-related crashes on the transportation system.10 Part time shoulder use fits well within the Practical Solutions framework as it uses the existing highway footprint to add a lane for storage and congestion relief at peak periods, reducing costs for acquiring new right of way and construction especially if the shoulders are already thick enough to support regular use.

9 Scenario Five – Part-Time Shoulder Use includes improvements from all previous scenarios.

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9 Scenario Five – Part-Time Shoulder Use includes improvements from all previous scenarios.
For Scenario Five, the study team modeled allowing travel on the existing shoulder in the south-bound direction of I-5, between the Sleeter-Kinney on-ramp and the Henderson on-ramp (see Exhibit 6-8).

**Scenario Six – High Occupancy Vehicle Lane Conversion**

Scenario Six – High Occupancy Vehicle (HOV) Lane Conversion investigates what the effect of converting the left lane in both directions of I-5 between US 101 and Mounts Road HOV Lanes would be on study goals. HOV lanes are reserved for vehicles with either two or more or three or more occupants. These facilities move more people in fewer vehicles, as is the case on I-5 near Northgate in Seattle where the HOV lanes move close to three times as many people per lane than general purpose lanes. HOV lanes also benefit transit users by providing faster more reliable travel times for transit.

The study team modeled HOV lanes with a two plus occupancy requirement. In addition to the HOV lane conversion itself, Scenario Six included additional improvements that would help HOV and transit travel. Finally, the study team assumed WSDOT would complete HOV lanes between Mounts Road and 38th Street in Tacoma, creating a continuous HOV lane from Olympia to Everett. Specific improvements are outlined in Appendix G. The scenario includes four elements:

- Converting an existing general capacity lane to HOV.
- Adding HOV bypass at on-ramps with ramp meters.
- Increasing express transit service frequency.
- Adding new park-and-ride lots or expanding capacity in existing park and ride lots.

**Scenario Seven – Regional Transportation Plan Local Projects**

Scenario Seven – Regional Transportation Plan (RTP) Local Projects consists of 31 unfunded local roadway and state highway projects not on I-5 that are included in TRPC’s 2040 RTP and anticipated to be included in the 2045 RTP. There were also two projects on the local network identified by the technical advisory group members that the study team included in the model. Scenario Seven generally includes projects consisting of:

- Street and road capacity projects (new lanes, center turn lanes, medians and roundabouts).
- Street and road extensions.
- Additional operational improvements.

Specific improvements are outlined in Appendix G. Further details on most of the projects can be found in the RTP, available on TRPC’s website.

11 Scenario Six – High-Occupancy Vehicle Lane Conversion includes improvements from all previous scenarios.


14 Scenario Seven – Local Network Improvements includes improvements from all previous scenarios.

15 TRPC Regional Transportation Plan – What Moves You: Appendix P Regional...
Scenario Eight – Interchange Improvements

Scenario Eight – Interchange Improvements includes improvements to interchanges along I-5 beyond projects already included in previous scenarios (particularly the 2040 baseline scenario). These improvements come from various sources including TRPC’s 2040 RTP, previous WSDOT planning efforts, and ideas developed with study advisory groups. Interchanges are common places for highway operations problems due to vehicles merging, diverging, or weaving. Issues can also be caused by other aspects such as old designs or when interchanges are spaced too close. Scenario Eight includes the following major improvements:

- A braided ramp on southbound I-5 approaching US 101 (Exits 105 and 104) to separate traffic destined for US 101 westbound before the Henderson Ave on-ramp, reducing the weave there.

- Revisions to the Martin Way interchange (Exit 109) that reduce the need for left turns on Martin Way and provides direct access for transit to the Martin Way Park and Ride from the northbound on-ramp.

- Roundabouts to improve traffic flow at the Tumwater Blvd SW (Exit 101), Trosper Rd SW (Exit 102), and Mounts Road (Exit 116).

- Part-time shoulder use on northbound I-5 between Exits 103 and 104 (US 101).

All improvements included in this scenario are listed and described in Appendix G.

Scenario Nine – Widen I-5: Add General Purpose Lanes, Retain HOV Lanes

Scenario Nine consists of making I-5 eight lanes wide (four in each direction) between the US 101 interchange and Mounts Road while retaining the HOV lanes established in Scenario Six – HOV Lane Conversion. In addition, this scenario includes some other capacity expansion type projects such as new ramps and auxiliary lanes designed to improve traffic flow issues observed in previous scenarios. Scenario Nine includes these major elements:

- Widen I-5 to four lanes in each direction between Mounts Road and US 101. This scenario retains the I-5/US 101 Braided Ramp interchange option in lieu of a fourth lane on the southbound I-5 mainline at the Plum St/Henderson Blvd interchange (Exit 105).

- Add auxiliary lanes at key locations such as southbound I-5 through Lacey and Olympia and northbound I-5 between US 101 and Pacific Ave. This replaces part-time shoulder use for southbound I-5 from Scenario Five – Part-Time Shoulder Use.

- Add a flyover exit ramp from I-5 northbound to US 101.

See Appendix G for a list of improvements included in this scenario as well as graphics and maps showing the rough

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Project List Detail-https://www.trpc.org/DocumentCenter/View/2940/Appendix-P-Regional-Project-List-Detail

16 Scenario Eight – Interchange Improvements includes improvements from all previous scenarios.

17 Scenario Nine – I-5 Capacity Expansion: Add a General Purpose Lane, Retain the HOV Lanes includes all improvements from previous scenarios except Scenario Six – Part-Time Shoulder Use. Scenario Nine expands the highway in these locations to include a full auxiliary lane and shoulder.

Exhibit 6-10: Map of improvement locations in Scenario Eight — Interchange improvements
Scenario Ten – I-5 Capacity Expansion: Add General Purpose Lanes, Convert HOV Lanes to General Purpose

Scenario Ten consists of the same elements as Scenario Nine, except the HOV lanes on I-5 in each direction are converted to general purpose use. The study team included this scenario to see if there was substantive performance differences between this scenario and Scenario Nine and based on public input received during Scenario Ten – I-5 Capacity Expansion: I-5 Capacity Expansion: Add General Purpose Lanes, Convert HOV Lanes to General Purpose includes all improvements from previous scenarios except Scenario Six – Part-Time Shoulder Use, and Scenario Nine – I-5 Capacity Expansion: Add a General Purpose Lane, Retain the HOV Lanes. Scenario Ten expands includes a full auxiliary lanes and shoulders where scenario six had part-time shoulder use. The HOV lanes from scenario six are converted to general purpose use.