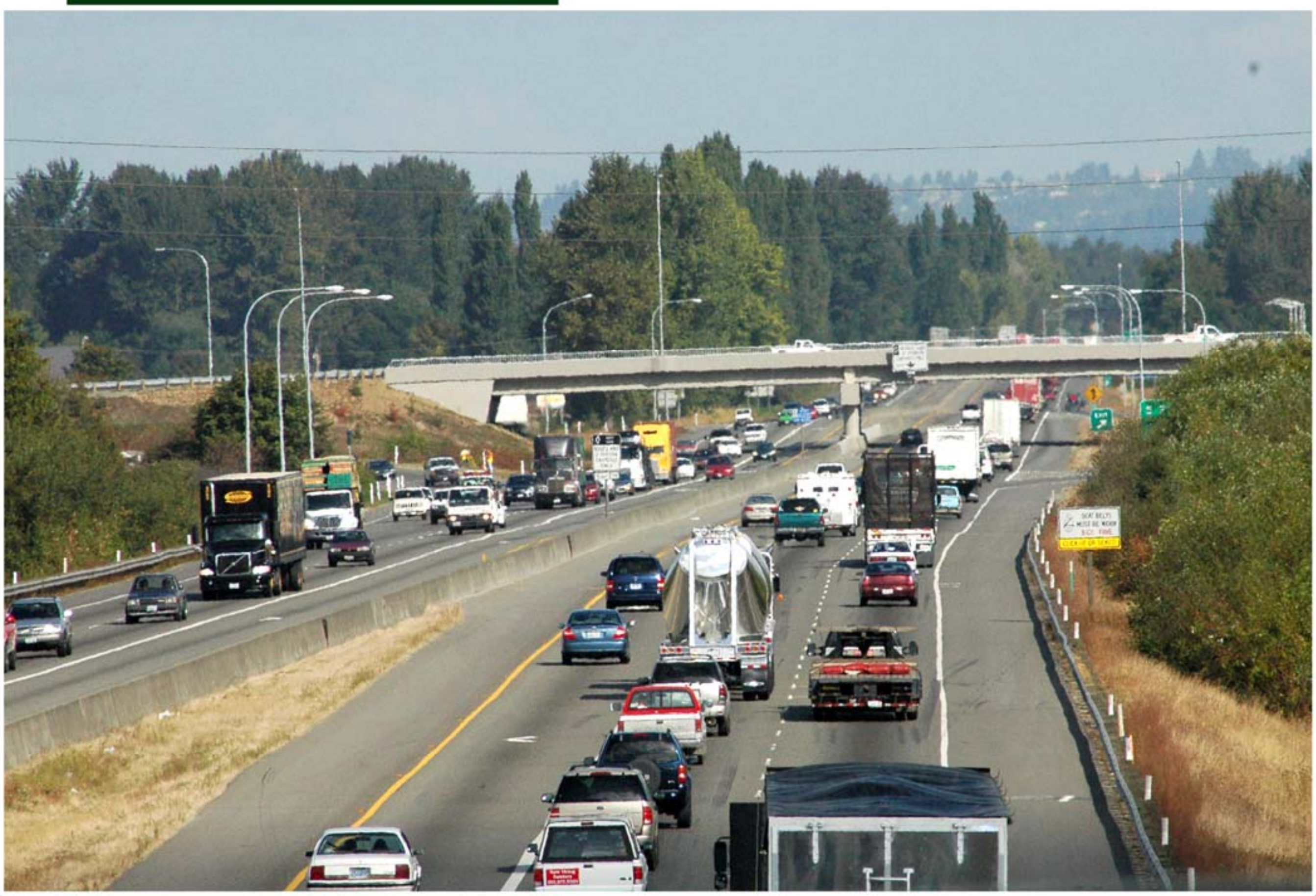
SR 167 Corridor Plan

Technical Memorandum 7: Evaluation and Final Screening of SR 167 Corridor Options



Washington State Department of Transportation

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Introduction

What's the purpose of the Corridor Plan?

The Washington State Department of Transportation (WSDOT) is developing the State Route (SR) 167 Corridor Plan to respond to increasing growth in the region. This planning effort models future growth in population, employment, and travel needs, then identifies a series of travel improvement projects to increase safety, enhance freight movement and provides options to allow commuters alternative ways of travel. This plan identifies existing and future transportation-related problems in the SR 167 corridor and proposes solutions to address those problems.

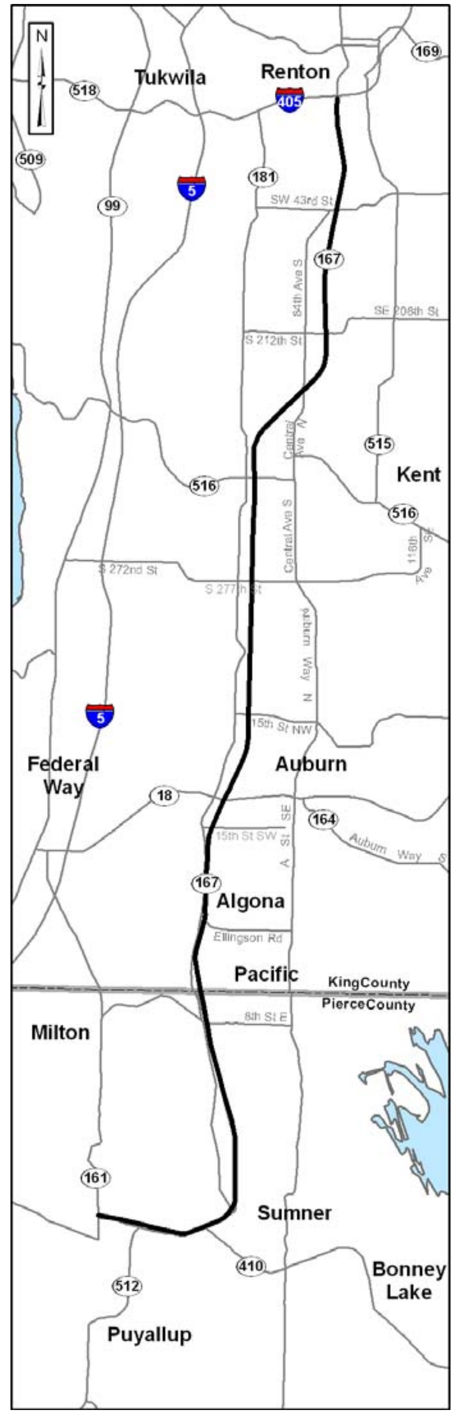
The SR 167 Corridor Plan will identify a long-term vision for the corridor. It will also identify projects that can be completed in the short-term (these projects are also called "bottlenecks") to improve the route's capacity and safety. The final projects selected for the corridor will:

1. Provide an efficient set of transportation solutions for the SR 167 corridor;
2. Make many communities in the corridor more livable;
3. Provide opportunities for commuters to choose alternative methods of travel with shorter and higher reliability of predictable travel time;
4. Maintain or improve air quality, protect and enhance fish-bearing streams, and continue to protect the integrity of the local natural environment;
5. Contribute to a vigorous state and regional economy by satisfying existing and future travel needs; and
6. Accommodate planned regional growth.

In the end, this plan will propose the most effective method of providing additional travel capacity through additional lane capacity, transit enhancements, commuter rail increased service and other methods of responding to growing travel demands.

This technical memorandum completes the documentation, evaluation and screening of the short-term (bottlenecks) and

Exhibit 7-1
SR 167 Corridor



long-term corridor options. It presents more detail about impacts of each of the options under consideration and the screening evaluations conducted to compare each option. It builds on the traffic data provided in *Technical Memorandum 6: Future Travel Demand and Travel Operations* to provide a complete comparison of each of the short and long-term options being considered. This memo screens the options, recommends an implementation strategy, provides a prioritization of the bottleneck projects, and includes a summary of funding needs.

What long-term options are WSDOT considering?

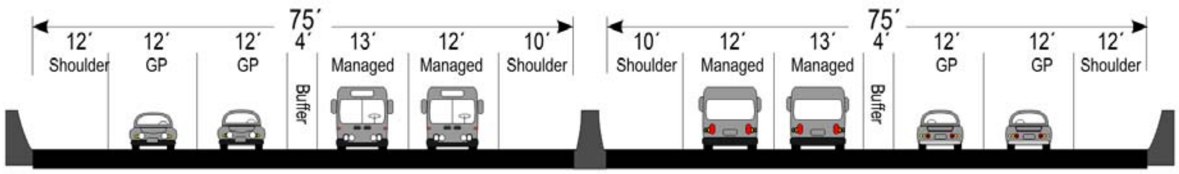
Long-term options for the corridor provide solutions for safety, congestion, travel delays, and environmental concerns. The long-term options WSDOT evaluated in this modeling effort for the SR 167 Corridor Plan include two variations of an 8-lane option (Options 2 and 2A), and three variations of a 10-lane option (Options 4, 4A and 5). These options are defined in greater detail in *Technical Memorandum 5: Corridor Improvement Options*.

The long-term options are modeled with the assumption that they are complete by 2030.

The 8-lane options will provide four travel lanes in both the northbound and southbound directions.

- Option 2 will provide three general purpose lanes and one managed lane (HOT lane).
- Option 2A will provide two general purpose lanes and two managed lanes (HOT lanes).

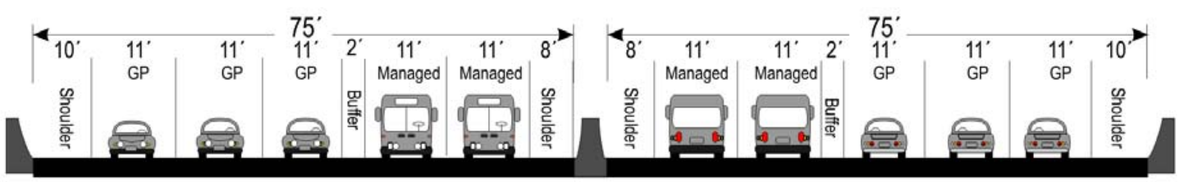
Exhibit 7-2
SR 167 8-Lane Option



The 10-lane options will provide five travel lanes in each direction.

- Option 4 will provide three general purpose lanes and two managed lanes (HOT lanes).
- Option 4A provides the same configuration as Option 4 from I-405 to SR 18, then converts to eight lanes with two general purpose lanes and two managed lanes (HOT lanes) south of SR 18.

Exhibit 7-3
SR 167 10-Lane Option



Technical Memorandum 6: Future Travel Demand and Travel Operations described how each of the long-term and short-term options impact travel for people, vehicles, freight, and also how the options impact levels of congestion. This memorandum continues the evaluation of options by examining additional criteria including freight delivery, safety, transit, Transportation Demand Management (TDM), environmental impacts, and cost.

WSDOT completed an analysis for each of the options to look at the movement of people and freight. This analysis included traffic operations, impacts to non-motorized facilities, impacts to transit service, and impacts to the flow of freight.

Bottleneck Segment Improvement Options

Bottleneck segment improvement options, are stand-alone improvements that contribute to the long-term improvement of the corridor. Bottleneck segment improvement options enhance safety and relieve congestion on selected segments of the SR 167 corridor. These projects can include strategic improvement to a section of SR 167, such as adding traffic lanes to relieve congestion near an off-ramp or on-ramp, adding a general purpose lane or HOV lane in a section of the highway, or improving interchanges.

Bottleneck segment improvement options are essentially stages to achieving the ultimate, long-term goals of the corridor. The following bottleneck segment improvement options were examined as part of this study. For modeling analysis purposes only, they are listed according to their possible date of completion.

2010 Bottleneck Segment Improvement Options

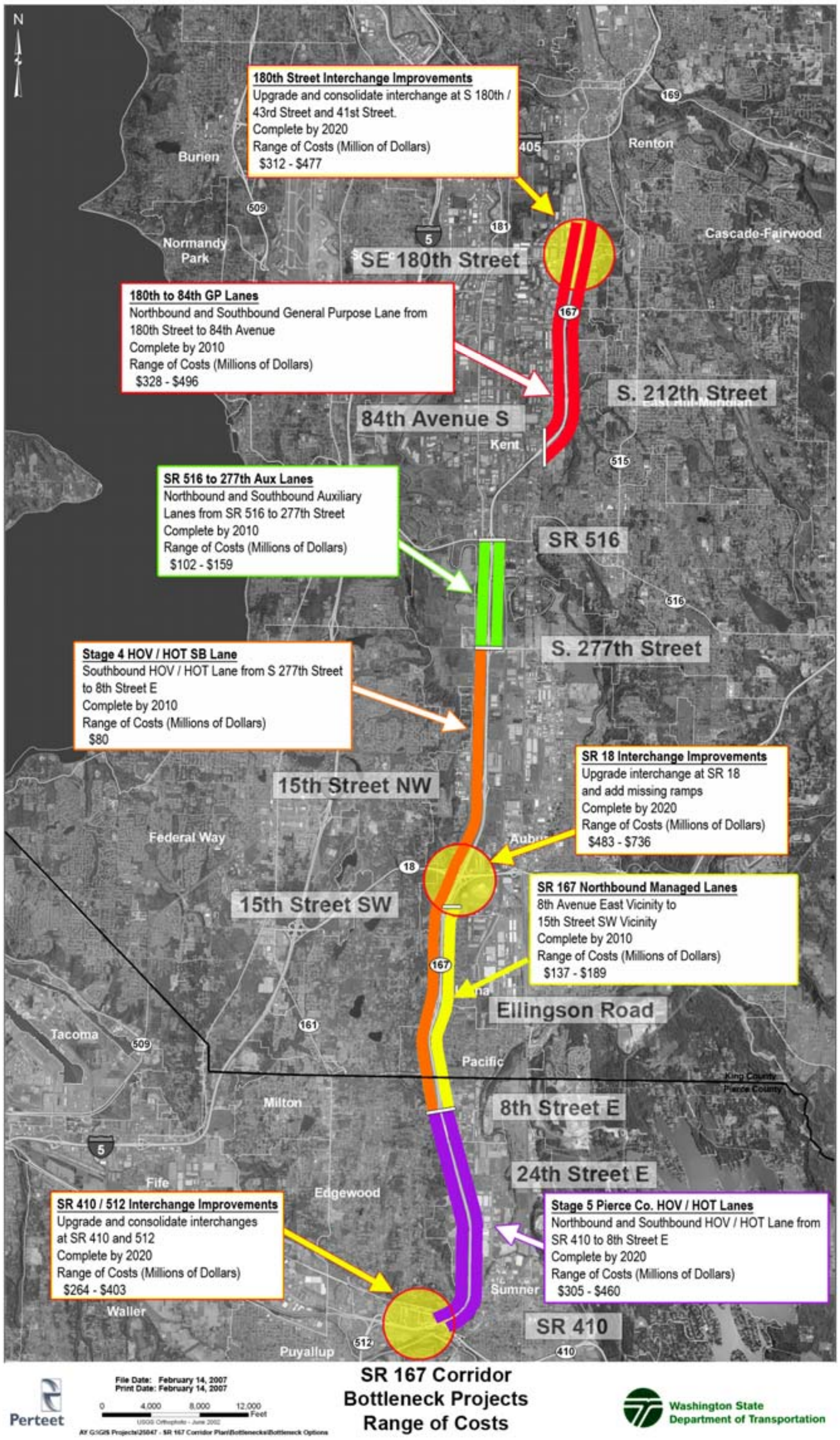
- Add a southbound HOV/HOT lane between South 277th Street and 8th Street East.
- Add a northbound HOV/HOT lane between 8th Street East and 15th Street SW.
- Renton/Kent General Purpose Lanes - adds a north and southbound general purpose lane between South 180th Street and 84th Avenue South.
- Kent Auxiliary Lanes - adds a north and southbound auxiliary lane between SR 516 and South 277th Street.

2020 Bottleneck Segment Options

- Add a north and southbound HOV/HOT lane between 8th Street East and SR 410. This completes the HOV/HOT lane system in the entire corridor providing continuous service between I-405 and SR 410.
- South 180th Street Interchange Project - consolidates and improves the arterial connections and the linkages with SR 167.

- SR 18 Interchange Improvements - provide the "missing ramps" in the southwest quadrant (northbound SR 167 to westbound SR 18 and eastbound SR 18 to southbound SR 167). Improvements to the 15th Street SW interchange were also included as part of this project.
- SR 410/SR 512 Interchange Projects - improve the short-weave section between SR 410 and SR 512 with either collector-distributor systems or braided ramps plus provide direct connections between the HOV/HOT lane system on SR 167 and SR 410.

Exhibit 7-4
SR 167 Corridor Bottleneck/Segment Improvement Projects and Estimated Costs



Move More People

Each of the options analyzed in this study propose to add capacity to SR 167 in order to move more people. The models have demonstrated that expanding lane capacity will not be sufficient to meet the growth in travel demand.

How will the long-term options accommodate increasing travel demand?

Travel demand across all of the screenlines will increase between now and 2030 whether or not any improvements are made, as illustrated in Exhibit 7-5. If no changes are made to the existing highway, this increased travel demand will cause peak periods to grow longer and congestion to increase with travel time growing from about 30 minutes to more than 90 minutes from Puyallup to Renton in the general purpose lanes if only minor improvements are made. This increase in congestion will cause travel to become less predictable and commuters will have to leave earlier and spend more time making trips in order to arrive at their destination on time if only the basic improvements are made as defined in this report. The following exhibit shows how each long-term option will help accommodate travel demand in daily person trips.

A congested future?

If only the basic improvements are made, congestion will increase and travel will become less predictable. Commuters will have to leave earlier to spend more time making trips in order to arrive at their destination on time.

Exhibit 7-5

Forecasted 2030 Afternoon Peak Hour Average Travel Speed for the General Purpose Lanes

		Baseline	Option 2	Option 2A	Option 4	Option 4A
North Segment	Northbound	56 mph	56 mph	56 mph	56 mph	56 mph
	Southbound	26 mph	26 mph	28 mph	26 mph	28 mph
Central Segment	Northbound	47 mph	55 mph	47 mph	55 mph	55 mph
	Southbound	8 mph	10 mph	9 mph	9 mph	13 mph
South Segment	Northbound	46 mph	46 mph	46 mph	51 mph	46 mph
	Southbound	15 mph	20 mph	17 mph	19 mph	14 mph

Source: Perteet

How will the bottleneck segment options accommodate increasing travel demand?

Northbound HOV/HOT Lane 15th Street SW to 15th Street NW

Northbound HOV/HOT Lane project adds capacity through the SR 18. The peak usage of SR 167 northbound occurs during the morning. Assuming travel in the northbound direction is as bad as it is today or worse, an HOV/HOT lane user could experience up to 1.5 minutes of travel time savings in the HOV/HOT lane.

Southbound HOV/HOT Lane 277th to 8th Street

Southbound HOV/HOT Lane project includes an additional lane starting somewhere between S 277th Street and 15th Street NW and extending south to 8th Street. The lane would be fully utilized in the PM peak hour with up to 2,800 persons accessing the HOT lane in less than 1,500 vehicles. Persons traveling in the HOV/HOT lane would experience a travel time savings of 6.5 minutes compared to the GP lane users through this section and 16 minutes through the full length of the managed lane southbound

Northbound King Co. HOV/HOT Lane 8th Street to 15th Street SW

This project extends the northbound HOV/HOT lane down to 8th Street. The travel time savings are estimated to be about 7 minutes during the AM peak which lasts for several hours. The lane is expected to be fully utilized (2,800 persons per hour) during the AM peak period because the GP lanes are congested.

Renton/Kent GP Lanes

The addition of a third general purpose lane between 84th Avenue South and South 180th Street would result in a small increase in traffic demand in the PM peak hour (about 400 vph in the southbound direction, 100 vph in the northbound direction). Some of the additional vehicle trips continue south of South 180th Street, which adds to the existing congestion. The operational analysis indicates travel time would increase by up to a minute and a half by adding this lane. Northbound, the addition of the third GP lane has no effect on the afternoon peak period travel time.

Kent Auxiliary Lanes

This improvement adds southbound and northbound GP auxiliary lanes to help reduce the merge and diverge conflicts in this stretch of SR 167. While this improvement has no impact on travel time or the number of vehicles served, it will help to reduce the number of collisions, and will make it easier for trucks merging into and out of the general purpose traffic. SR 167, between these two interchanges, has the highest traffic volume experienced in the corridor.

Historically, this stretch of SR 167 between 277th and SR 516 has experienced more than 30 collisions per year northbound, and 36 collisions per year southbound. While this is not the highest collision rate in the corridor, it is among the highest incident areas, and these collisions appear to be easily linked to the congestion and traffic weaving occurring between these interchanges. Northbound, approximately two-thirds (66%) of these incidents are likely related to vehicles entering or leaving the freeway, while southbound the number probably related to weaving is even greater, at 75 percent.

Truck volumes through this portion of SR 167 are significant. More than 12,000 trucks per day with about 800 of these trucks traveling during the peak hour currently use this section of the freeway. While the collision statistics do not indicate a significant number of truck related incidents it is likely that the merging of trucks can cause congestion and disruptions in flow that likely are contributing factors towards many of the other vehicle collisions. The additional merge and diverge area will allow all vehicles additional area to perform these functions with increased safety.

What are the alternative options to move more people?

This study has clearly demonstrated that no single solution will address the growing problem of congestion on SR 167. This section of the memorandum will further explore opportunities for providing commuters with alternative ways to meet their travel needs other than driving alone, such as enhancing HOV/HOT lanes by adding direct-access ramps, implementing transportation demand management (TDM) techniques, and improving transit service in the region. TDM provides various strategies that attempt to change how, when and where people travel in order to improve traffic conditions. Please refer to **Appendix 7-D** for further information on how WSDOT and local agencies can cooperate to implement travel management options to help commuters. The policies of the Corridor Working Group (CWG) jurisdictions in **Appendix 7-D** provide an idea of what the future framework will be for coordinated implementation of these TDM and TOD strategies.

What is Transportation Demand Management and Transit-Oriented Development, and how might it help congestion?

TDM strategies often include the following types of programs:

- HOV lanes and direct access ramps
- Transit improvements, including integration with bicycles
- Non-motorized improvements, such as sidewalks
- Commute Trip Reduction
- Rideshare programs
- Flextime and Telework
- Car sharing
- Taxi improvements
- Guaranteed ride home
- Road tolls
- Commuter financial incentives
- Parking pricing

TDM programs also relate to land use planning concepts such as smart growth and transit oriented development (TOD). Smart growth generally encourages jurisdictions to integrate transportation and land use decisions by encouraging more compact, mixed-use development within existing urban areas, and discouraging urban sprawl, which typically necessitates automobile use. The regional growth centers have or are developing TOD neighborhoods, which typically is focused around transit station (rail/bus), and relatively high-density development that is likely to include multi-story commercial and residential buildings and pedestrian friendly design. Some land use policies also encourage TDM, such as car free areas, parking management, and traffic calming. The TDM strategies could also support increased residential and employment growth in the corridor urban centers.

Would direct access ramps help?

One of the delays that cause transit and other users of the managed lane systems extensive delay is the process of gaining access. This usually means merging onto the freeway with other traffic then working across the general purpose lanes in order to enter the managed lane. The use of direct access ramps has been shown to substantially improve the efficiency of operation of managed lanes.

Direct Access ramps can be an effective improvement to help provide fast and reliable transit service, encourage commute trip reduction, and improve the efficiency of freeway operations. Direct Access ramps are generally defined to be exclusive ramps for transit and other high occupancy vehicles (HOV's), usually from the managed lane of the freeway to provide easier access to transit facilities and major employment areas. They can also be used to provide direct connections between the managed lanes of multiple limited access facilities. In the case of the SR 167 corridor, because the managed lanes would include High Occupancy Toll (HOT) lanes, the direct access ramps would also be used by single occupant toll paying vehicles.

Because the SR 167 corridor is part of a regional system that provides access to regional growth centers (as designated in the Puget Sound Regional Council's regional growth strategies, Vision 2020) and other major employment areas, it is important to identify the opportunities for maximizing the efficiency of movement of people and goods between the regional growth centers and transportation facilities. Direct Access Ramps are one method to help improve that efficiency. Other than the Smith Street direct access ramp in Kent that is included in the long term options, there are no other direct access ramps currently planned along the SR 167 corridor. The purpose of this analysis was to identify those locations that are potential candidates for further consideration as direct access ramps.

Where are direct access ramps most effective?

Direct Access lanes are most feasible where they serve major transit hubs (such as transit centers and park & ride lots with multiple transit routes), combined with major nearby employment sites. They are most effective when they are used to provide an optional route to areas where existing ramps are currently congested. The lanes help to improve speed and reliability for transit, and provide easy access for other users (HOV and toll users) to and from the managed lanes. Improved transit speed and reliability will result in attracting new potential transit riders, thereby increasing the overall efficiency of the regional transportation system. Direct access ramps that also serve major employment areas provide additional benefit to commuters who rideshare. Finally, they can be used to provide more seamless connections between multiple limited access highways, and thereby improve the traffic flow along the mainline operation. For the SR 167 corridor, this was considered to be an important consideration, given the number of state routes that link to SR 167, including SR 18, SR 410 and SR 512. Based on these assumptions, the analysis of potential direct access ramps along the SR 167 corridor examined:

- Potential benefit to mainline operations
- Major existing or planned transit facilities and service
- Major employment areas, including Urban Growth Centers

As these criteria were analyzed, other considerations were examined, including:

- Existing or planned transportation improvements
- Existing and future congestion at current ramps
- Planned major trip generators or activity centers
- Potential for direct access ramp to accommodate freight

What is the potential benefit of direct access ramps to SR 167?

A typical Direct Access ramp, in the case of HOV operations, provides a benefit to transit and high occupancy vehicles. These ramps are intended to provide a reduced travel time for buses to reach transit facilities, and for ride sharers to reach park & ride lots or major employment areas.

The SR 167 corridor is unique in that the managed lanes will include HOT lanes, which would allow single occupant vehicles to use the direct access ramps. Therefore, the real benefit is that by allowing these users, as well as HOV's to use the ramps, the mainline operates more efficiently because motorists don't need to merge between the managed lanes and general purpose lanes to access ramps.

Long-term options that include dual managed lanes in each direction can provide even greater benefit, as more vehicles are able to use the managed lanes thereby providing more capacity on the mainline. Dual managed lanes also provide greater opportunities for freight because of the increased capacity. With that in mind, there are more opportunities for locations of direct access ramps along SR 167 than would typically be considered for a facility with only HOV lanes. Direct access ramps could potentially be located in areas that may not have a transit facility, but allow easier access to major warehousing districts, such as the Kent MIC, especially where existing access points are congested.

In addition, direct access ramps can also be used to provide direct connections between SR 167 managed lanes and other limited access roadways, such as SR 18 and SR 410. Providing direct access ramps between the general purpose lanes of these highways and the managed lanes of SR 167 will result in less merging on the mainline, thereby improving mainline operations, while also providing time savings for those users.

What are the major employment areas that would benefit from direct access ramps?

There are four urban centers designated by PSRC near the SR 167 corridor, including Renton, Tukwila, Kent and Auburn. These are areas that are targeted for population, housing and employment growth as well as transportation funds. Only Kent and Auburn's regional growth centers are directly adjacent to the SR 167 corridor, and thus are considered as part of this analysis. In addition, the Kent Manufacturing / Industrial Center is a designated Manufacturing/Industrial Center (MIC).

Outside of these regional growth centers and MIC's are other major employment areas along the SR 167 corridor, including:

- Renton Industrial Area (West of SR 167 between I-405 and SW 43rd St.)
- Valley Medical Center (East of SR 167 at SW 43rd Street)
- The Supermall of the Great Northwest (East of SR 167 & south of SR 18)
- Sumner
- Downtown Puyallup

For the full details on potential direct access ramp locations please see **Appendix 7-A.**

What factors affect the use of Transportation Demand Management?

The success of TDM depends on various factors including:

1. Availability of alternatives to driving, such as: transit, carpooling, vanpooling, bicycling, walking, and telecommuting.
2. Emerging urban centers or TOD that integrate transit or other multi-modal connections as components for residents and workers.
3. Alternative travel options must be available when people need to commute in order to be competitive enough for commuters to shift their behavior from driving alone.

4. Convenience and comfort for using alternative travel options compared to driving alone must be competitive enough for commuters to shift their travel behavior.

5. Travel cost advantages for alternative travel options, such as incentives, subsidies, and parking management programs, must be great enough for commuters to shift their travel behavior.

How will Transportation Demand Management strategies be used to help the SR 167 Corridor?

Currently, WSDOT is implementing and supporting TDM strategies for the SR 167 corridor by:

- Expanding the HOV lanes along the corridor to help reduce the number of trips made by solo drivers,
- By adding direct access ramps, and
- By implementing a pilot-project High Occupancy Toll (HOT) lane,
- By implementing the Commute Trip Reduction (CTR) Act.

However, WSDOT is not an agency that can directly implement TDM strategies alone. WSDOT is responsible for building and maintaining the HOV facilities, but it must rely on the participation of transit agencies, and state government and local jurisdictions to promote TDM as well. The combined efforts of these agencies in the areas of transportation infrastructure and TOD are key to the success of the SR 167 corridor transportation projects.

Transit agencies are responsible for operating the transit service and building transit facilities. In addition, Sound Transit, King County Metro and Pierce Transit offer TDM programs such as regional and local transit services, vanpool programs, and ride matching services.

The State of Washington passed the Commute Trip Reduction Act (RCW 70.94.521) in 1991 and the Commute Trip Reduction Efficiency Act in 2006. This law requires employers of 100 or more employees who arrive between 6:00 a.m. and 9:00 a.m. to develop and implement a program to encourage

What is the CTR Efficiency Act?

Under the Commute Trip Reduction (CTR) Efficiency Act, counties and local jurisdictions should continue to implement the CTR programs and encourage greater employer participation in the program.

their employees to reduce vehicle miles traveled and single occupant vehicle trips.

Local and regional jurisdictions and agencies have developed numerous goals and policies that support TDM, some examples follow. The following King County – Countywide Level of Service Framework Guiding Principle 4 is a guideline for local jurisdictions:

> ***Develop demand-side transit performance measures***
>
> *In order to achieve non-single occupancy vehicle mode split goals, jurisdictions should adopt policies and implement actions that support transit investments. Transit supportive policies create the operating environment to promote increased transit mode share. Supportive policies and actions include, but are not limited to, the following: parking minimums and maximums, provisions for transit facilities, transit-oriented development guidelines, provisions for High Occupant Vehicle (HOV) and Transportation System Management (TSM) treatments, Transportation Demand Management (TDM), and Commute Trip Reduction (CTR) ordinances.*[1]

The Pierce County Countywide Planning Policy 9.3 states:

> *The County, and each municipality in the County, shall address concurrency through… encouraging new and existing development to implement measures to decrease congestion and enhance mobility through transportation demand and congestion management.*

How can public transit assist in meeting growing travel demands?

Transit service can be an effective mitigation tool to assist in reducing the overall demand for additional lane capacity on the SR 167 corridor. Transit service may be described as commuter rail service, regional express bus service, and local bus service. In the SR 167 corridor, regional express bus routes would

[1] Adopted by the Growth Management Planning Council on July 21, 1993 in response to Countywide Planning Policy T-4.

utilize the managed High Occupancy Toll (HOT) lanes and the potential direct access ramps at State Street in Kent plus additional direct access locations might be considered where they would reduce delays. Potential locations for additional access are discussed in another section of this report.

Current transit ridership in the SR 167 Corridor is displayed in Exhibit 7-6. This exhibit shows that transit plays a much larger role in the north segment of SR 167 compared to the south segment. There is low ridership on the one route that currently travels on SR 167 between Sumner and Auburn.

Exhibit 7-6

Daily Transit Ridership on SR 167 Among Long-Term Options

Segment	Option 2	Option 2A	Option 4	Option 4A
Renton	8,380	8,380	7,470	7,470
Auburn	4,145	4,145	3,099	3,099
Puyallup	1,634	1,634	1,316	1,316

The transit services that are included in the regional transportation forecast model presented in this study are based on Puget Sound Regional Council's (PSRC's) 2030 Baseline for travel demand which is fiscally constrained to 2010 budget levels. These assumptions do not include any improvements to rail or bus service that beyond those currently programmed. The modeling information clearly demonstrates that this system of transit service will not meet future demands.

All of the long-term options provide HOV/HOT lanes and the direct access ramp in Kent; therefore the relative travel times for transit are virtually identical in each of the options analyzed in this corridor plan.

What if more emphasis is given to enhancing transit in the corridor?

In order to better utilize transit as a way to move more people through the SR 167 corridor, a series of route improvements were developed and analyzed to meet travel demands, maximize efficiency, and improve speed and reliability.

The travel demand model run in *Technical Memorandum 6: Future Travel Demand and Travel Operations* shows the following transit trends:

- A large number of trips from the SR 167 Corridor are headed either to downtown Seattle or the Eastside employment concentrations in downtown Bellevue and Overlake. The volumes from these destinations tend to be directional, with employment traffic heading northbound in the morning and southbound in the afternoon. This similar type of pattern is projected to continue in 2030.
- During the peak periods in the peak direction, there is a high likelihood that Sounder will reach capacity well before 2030.

There do not appear to be any new bus routes estimated for the future SR 167 corridor and only two of those existing bus routes have improvements in headways, or time between buses, for 2030.

To maximize transit service, the traffic demand model was re-run using the 2030 Transit Service Network assumptions, which are fiscally **unconstrained**, meaning this baseline assumes operating and capital dollars are available to build, operate, and maintain the proposed services. The 2030 Transit Service Network features:

- Expanded Sounder Commuter rail service, including expanded peak service and bi-directional midday/evening service. Sounder Commuter Rail services would become the transit trunk of the Valley.
- Direct Kent Station to Bellevue/Overlake employment sites transit service to better serve the commuter market.
- Expanded feeder service into Sounder Stations.
- Park-and-Ride expansion at Sounder stations.

These new model results show dramatic increases in transit ridership between the 2030 Baseline and the 2030 Unconstrained Transit Service Network are possible if these new services can be developed. Daily transit ridership increases range between 8,700 and 11,700 riders – depending on the screenline, as shown in the following Exhibit 7-7.

Exhibit 7-7

Daily Transit Ridership in the SR 167 Corridor

Screenline	2000			2030 Constrained Baseline			2000-2030 Growth*	2030 Unconstrained TSN			2000-2030 Growth*	2030 Constrained Baseline to Unconstrained Growth
	Bus	Rail	Total	Bus	Rail	Total		Bus	Rail	Total		
Renton	12,655	0	12,655	24,875	8,788	33,663	266%	30,531	14,859	45,390	359%	135%
Auburn	10,878	0	10,878	22,647	7,728	30,375	279%	23,044	16,057	39,101	359%	129%
Puyallup	6,616	0	6,616	13,805	6,386	20,191	305%	18,183	12,074	30,257	457%	150%

**Unconstrained*

This additional ridership potential warrants further analysis as a potential benefit if the costs to implement justify the increased service. The analysis of the cost to increase transit service is beyond the scope of this study. It is recommended that additional analysis of transit services be conducted and the cost per person served compared to the cost of adding lane capacity to SR 167.

Reduce congestion and save time

Congestion is generally measured by travel time. A model must assume a baseline condition when projecting travel times and modeling traffic conditions. The baseline conditions for the long term options assume that one HOV/HOT Lane is completed in each direction between I-405 and SR 512 and that all of the bottleneck projects are completed.

As shown in Exhibit 7-8, the travel speed within the HOV/HOT lane averages 49 mph in the northbound direction, and 45 mph in the southbound direction during the p.m. peak hour. The travel speed within the general purpose lanes averages 49 mph in the northbound direction and 14 mph in the southbound direction during the p.m. peak. Therefore, in general terms, it can be stated that the southbound direction during the p.m. peak hour has safety issues due to the relatively low average travel speed. The sections below describe the travel speeds and relative safety during the p.m. peak hour, for the general purpose lanes within the three geographic sections of the corridor.

Exhibit 7-8

PM Peak Hour Average Speed (mph) 2030 Baseline

Segment	Northbound	Southbound
Renton	56 – GP & HOV/HOT	26 – GP, 45 – HOV/HOT
Auburn	47 – GP & HOV/HOT	8 – GP, 45 – HOV/HOT
Puyallup	46 – GP & HOV/HOT	15 – GP, 45 – HOV/HOT
Average	49 – GP & HOV/HOT	14 – GP, 45 – HOV/HOT

The following section summarizes the predicted changes in travel times for each long term option. The results are tabulated at the end of the section by segment.

Evaluation of long-term options

Option 2

Option 2 assumes that a HOV/HOT Lane is completed in each direction between I-405 and SR 512. It also assumes a total of 3 GP lanes, and auxiliary lanes constructed between I-405 and South 180th Street, and between SR 516 and South 272nd Street. The Baseline option assumes the bottleneck projects listed in this document have been completed. Option 2 would include upgrades to all of the interchanges in order to accommodate the freeway widening. For modeling purposes, it was assumed that these upgraded interchanges would improve safety and reduce the number of collisions.

The completion of the HOV/HOT lane in each direction will help to improve overall safety by providing additional capacity, and reducing vehicles in the general purpose lanes. The travel speed within the HOV/HOT lane averages 51 mph in the northbound direction, and 45 mph in the southbound direction during the p.m. peak hour. The travel speed within the general purpose lanes averages 51 mph in the northbound direction and 17 mph in the southbound direction during the p.m. peak, a slight improvement when compared with the Baseline alternative.

Option 2A

Option 2A, consists of two managed and two general purpose lanes in each direction between I-405 and SR 18, south of SR 18 to SR 512 would be two GP and 1 HOV/HOT lane. Similar to Option 2, auxiliary lanes are constructed between I-405 and South 180th Street, and between SR 516 and South 272nd Street. For modeling purposes, it was assumed that all of the interchanges are upgraded to accommodate the freeway widening. These upgraded interchanges would improve safety and reduce the number of collisions in the corridor.

With two HOV/HOT lanes, a greater share of vehicles would use those lanes. The details related to the operation of this alternative can be found in Technical Memorandum #6. In the southbound peak direction, the share of vehicles using the HOV/HOT lanes is greatest in the southern (36%) and central (43%) sections of the corridor, illustrated by Exhibit 7-9.

Exhibit 7-9
Percent of Vehicles in HOV/HOT Lane 2030

	Baseline	Option 2	Option 2A	Option 4	Option 4A
Renton	21	22	22	34	34
Auburn	24	21	36	34	34
Puyallup	27	21	43	34	43

The travel speed within the HOV/HOT lane averages 49 mph in the northbound direction, and 45 mph in the southbound direction during the p.m. peak hour. The travel speed within the general purpose lanes averages 49 mph in the northbound direction and 15 mph in the southbound direction during the p.m. peak, similar to the Baseline option.

Option 4

With Option 4, there are two managed lanes and three GP lanes the entire length of the corridor between I-405 and SR 512. For modeling purposes, this option also assumes that all of the interchanges are upgraded to accommodate the freeway widening. These upgraded interchanges would improve safety and help to reduce the number of collisions.

Like Option 2A, the inclusion of two HOV/HOT lanes results in a greater share of vehicles using those lanes, compared with the Baseline and Option 2. In the southbound peak direction, the share of vehicles using the HOV/HOT lanes (34%) is the same among all three sections of the corridor. In comparison to Option 2A, this represents a decrease in HOV/HOT share within the central and southern sections, but an increase in the northern section (34 percent compared with 22 percent respectively). Like Option 2, these lanes operate at a minimum average speed of 45 mph, it can be said that there are a greater share of vehicles that would operate under safer conditions.

The travel speed within the HOV/HOT lane averages 53 mph in the northbound direction, and 45 mph in the southbound direction during the p.m. peak hour. The travel speed within the general purpose lanes averages 53 mph in the northbound direction and 16 mph in the southbound direction during the p.m. peak.

Option 4A

Option 4A is nearly identical to Option 4, the difference being that south of SR 18, the roadway reduced from three to two GP lanes. For modeling purposes, this option also assumes that all of the interchanges are upgraded to accommodate the freeway widening.

Similar to Options 2A and 4, the inclusion of two HOV/HOT lanes results in a greater share of vehicles using those lanes, compared with the Baseline and Option 2. In the southbound peak direction, the share of vehicles using the HOV/HOT lanes is 34 percent within the northern and central sections. However, within the southern section, the share of vehicles using the HOV/HOT lanes rises dramatically to 43 percent. This is because there are only two general purpose lanes (each direction) in this section, resulting in a greater demand to use the HOT/HOV lanes. With both of the HOV/HOT lanes operating at a minimum average speed of 45 mph, there are a greater share of vehicles that would operate under safer conditions.

The travel speed within the HOV/HOT lane averages 51 mph in the northbound direction, and 45 mph in the southbound direction during the p.m. peak hour. The travel speed within the general purpose lanes averages 51 mph in the northbound direction and 16 mph in the southbound direction during the p.m. peak.

Summary

In summary, the p.m. peak hour predictions of travel time upon implementation of the long term options show:

- Options 2A and 4A show the most improvements in travel time for the north segment,
- Option 4A has the most improvements in travel time for the central segment, and
- Options 2 and 4 show the most improvements in travel time in the south segment.
- Exhibit 7-10 lists the predicted travel times within GP lanes for each of the long term options.

Exhibit 7-10

Summary of Predicted Travel Speeds for GP Lanes Upon Implementation of the Long-Term Options 2030

Segment	Baseline	Option 2	Option 2A	Option 4	Option 4A	
North NB	56	56	56	56	56	
North SB	26	26	28	26	28	
Central NB	47	55	47	55	55	
Central SB	8	10	9	9	13	
South NB	46	46	46	51	46	
South SB	15	20	17	19	14	

Evaluation of bottleneck segment improvement options

The following summarizes the corridor operations with the bottleneck segment improvement options during the peak commute:

- The HOV/HOT lane projects would provide congestion relief for up to 45 percent of the persons on the corridor for more than three hours of the day. About 2,800 persons per hour save:
    - 1.5 minutes of travel time (compared to GP lanes) by extending the HOV/HOT lane northbound through the SR 18 interchange.
    - 6.5 minutes of travel time (compared to GP lanes) by extending the HOV/HOT lane southbound from SR 18 to 8th Street.

  - o 7 minutes of travel time (compared to the GP lanes) by extending the HOV/HOT lane northbound from 8th Street to SR 18.

- 45 percent of the persons on the corridor would utilize the HOT lane. These persons are carried in 25 percent of the cars.

Exhibits 7-11 and 7-12 provide a summary comparison of the proposed 2010 bottleneck improvement projects based on the measures of effectiveness (MOE) criteria for transportation system performance.

Detailed operational analyses were conducted for the PM peak hour but not conducted for the AM peak. It is assumed projects providing additional capacity in the northbound direction would provide some benefit in the AM peak. To quantify the benefit, it was assumed northbound AM traffic operations in the future would continue to mirror southbound PM traffic operations.

By the numbers

45 percent of the persons on the corridor would utilize the HOT lane. These persons are carried in 25 percent of the cars.

Exhibit 7-11

MOE Performance Comparisons: 2010 Bottleneck Segment Improvement Options

Are the 2010 bottleneck segment improvement options effective during the peak travel periods?*						
	Stage 3 HOV/HOT Lane (Baseline)	**+ Stage 4 HOV/HOT Lane**	**+ Stage 5 King Co. HOV/HOT Lane**	**+ Renton /Kent General Purpose Lanes Improvement**	**OR**	**+ Kent Auxiliary Lane Improvement**
Move More People	Yes	Yes	Yes	No		No
Move More Vehicles	Yes	Yes	Yes	No		No
Reduce Travel Time	Yes	Yes	Yes	No		No
Improve Arterial Operations	No	No	No	No		No

Exhibit 7-12

MOE Performance Comparisons: 2010 Bottleneck Segment Improvement Options

How effective are the 2010 bottleneck segment improvement options during the peak travel periods?							
	Existing Conditions	**Stage 3 HOV/HOT Lane (Baseline)**	**+ Stage 4 HOV/HOT Lane**	**+ Stage 5 King Co. HOV/HOT Lane**	**+ Renton /Kent General Purpose Lanes**	**OR**	**+ Kent Auxiliary Lanes**
AM Peak Period (Northbound)							
Travel Time (minutes)	36.0	Up to 1.5 min savings in HOV/HOT lane	Same as Stage 3	Up to 7.0 min savings in HOV/HOT lane	Same as Stage 5		Same as Stage 5
PM Peak Period (Southbound)							
Move People (persons per hour) In GP Lanes In HOV/HOT Lane	3,590 2,150	3,560 2,690	3,540 2,870	3,540 2,870	3,610 2,870		3,580 2,870
Move Vehicles (vehicles per hour)	4,560	4,790	4,830	4,830	4,890		4,860
Travel Time (minutes) In GP Lanes In HOV/HOT Lane	37.5 30.5	48.0 36.5	39.5 23.0	39.5 23.0	40.5 23.0		39.0 23.5
Arterial Traffic Volumes		+10% North, South -10% Central	Same as Stage 3	Same as Stage 3	Same as Stage 3		Same as Stage 3

Do the proposed 2020 bottleneck projects improve traffic operations?

When compared to the 2020 Baseline, SR 167 with the proposed 2020 bottleneck segment improvement options are expected to provide for improved southbound travel on the SR 167 corridor during the PM peak hour.

Exhibit 7-13 provides a comparison of SR 167 southbound person and vehicle trip performance during the 2020 PM peak hour with the 2020 bottleneck segment improvement options. The table provides forecasted corridor performance with completion of the Stage 5 Pierce County HOV/HOT lane project.

Will extending the HOV/HOT Lanes into Pierce County help travel?

The extension of the HOV/HOT lanes into Pierce County to the SR 410/512 interchange improves the southbound flow during the PM and likely would improve the northbound during the AM peak. The lane is utilized with an increase in HOV trips compared to the year 2010. The result is an increase in person trips (about 3,450 persons per hour during the peak periods in each direction). Travel time southbound is reduced by another 1 to 2 minutes compared to the baseline conditions in the PM peak in either direction.

In the year 2030 congestion on SR 167 in Pierce County is expected to increase significantly. The GP lane travel time will increase to 33 minutes from SR 18 to SR 512 but the HOV/HOT lane extended to SR 410/SR 512 as part of this project is expected to stay around 11minutes thus saving users of the managed lane 22 minutes.

The details related to the operations of the bottleneck segments in 2010 and 2020 traffic conditions can be found in Technical Memorandum #6.

Exhibit 7-13

MOE Performance Comparisons: 2020 Bottleneck Segment Improvement Options

How effective are the 2020 bottleneck segment improvement options during the peak travel periods?			
	Existing Conditions	**Baseline**	**+ Stage 5 Pierce Co. HOV/HOT Lane**
PM Peak Period			
Southbound			
Move People (persons per hour) In GP Lanes In HOV/HOT Lane	3,590 corridor average 2,150 corridor average	3,980 corridor average 3,300 corridor average	4,160 corridor average 3,450 corridor average (+470 HOT lane users in southern section)
Move Vehicles (vehicles per hour)	4,560 corridor average	5,410 corridor average	5,660 corridor average, Or + 750 south section
Travel Time (minutes) In GP Lanes In HOV/HOT Lane	37.5 30.5	69.0 33.5	64.5 32.0
Northbound			
Move People (persons per hour) In GP Lanes In HOV/HOT Lane	3,010 corridor average 1,230 corridor average	3,230 corridor average 2,270 corridor average	3,240 corridor average 2,400 corridor average (+380 HOT lane users in southern section)
Move Vehicles (vehicles per hour)	3,540 corridor average	4,410 corridor average	4,510 corridor average, (+300 south section)
Travel Time (minutes) In GP Lanes In HOV/HOT Lane	21.5 20.5	28.0 25.0	28.5 24.0
Arterial Traffic Volumes		+14% North -9% Central +22% South	Same as Baseline

What improvements is WSDOT considering for the South 180th Street Interchange?

Technical Memorandum 5: Corridor Improvement Options presents two improvement concepts for the interchange at the north end of this corridor study at South 180th/SW 41st Street. Both of these interchange designs include a single point urban interchange SPUI concept at South 180th Street and grade separation of East Valley and South 180th Street. The primary difference between the two ideas is that Concept 1 includes closure of the ramps to 41st Street, while Concept 2 maintains this access.

Concept 2 with both sets of ramps to 41st Street and South 180th Street operates better as the traffic volume demand to and from SR 167 increases. The intersection of South 180th Street/Lind Avenue operates at LOS E with channelization improvements.

Concept 1 with only access to South 180th Street and the ramps to 41st Street closed consolidates the traffic movements to and from the freeway at the South 180th Street intersections. The local street network does not operate as efficiently if the 41st Street southbound ramps are removed. The intersection of South 180th Street/Lind Avenue operates at LOS E assuming additional channelization improvements beyond what is needed to maintain LOS E with Concept 2. At the South 180th Street/SR 167 ramp SPUI, a second general purpose lane is necessary for the southbound on ramp to serve traffic demand through the ramp meter.

The LOS for intersections within the South 180th Street interchange is summarized in Exhibit 7-15.

Based on the traffic analysis, WSDOT prefers the Concept 2 alternative with ramps open at 41st.

Exhibit 7-14
South 180th Street Interchange
Option 1

Option 2

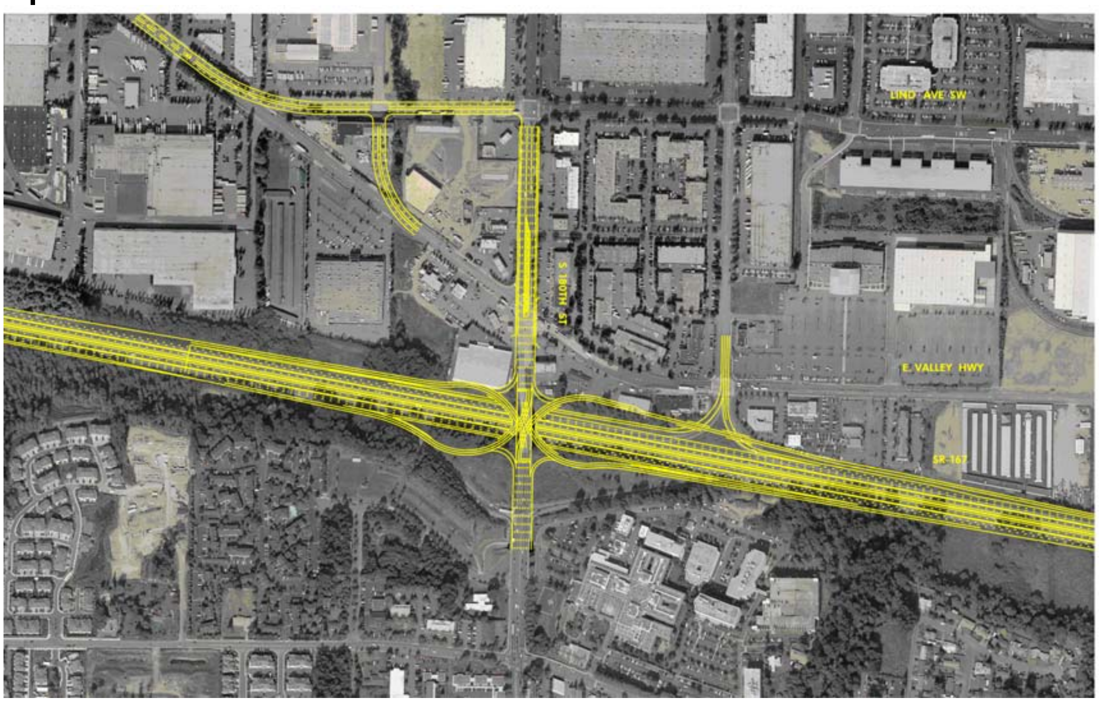


Exhibit 7-15
South 180th Street Interchange Intersection LOS

Intersection	LOS (Delay sec/vehicle)			
	2005 Existing Conditions	**2020 Baseline Conditions**	**Option 1**	**Option 2**
South 180th Street/Lind Ave	C	C	NA	NA
1 L, 2 T, 1 R all approaches	NA	NA	F	F
With channelization improvements	NA	NA	E	E
South 180th Street/ E Valley	E	F	Grade separated	Grade separated
South 180th Street/SR 167 NB ramp	C	D	NA	NA
South 180th Street/SR 167 NB and SB SPUI	NA	NA	C	C
Talbot/SW 43rd Street	D	D	D	D
41st Street/Lind Ave	B	C	C	C
41st Street/E Valley	E	F	C	C

What improvements are being considered for the SR 18 Interchange?

Both SR 18 and SR 167 currently carry high volumes of traffic through this interchange and in the future congestion increases greatly. The current interchange does not provide direct linkages between SR 167 to the south and SR 18 to the west. Also the interchange is complicated by the closely adjacent interchanges between SR 18 and the West Valley Highway and between SR 167 and 15th Street SW. Traffic currently must use these two interchanges to travel between SR 167 south and SR 18 west.

SR 18

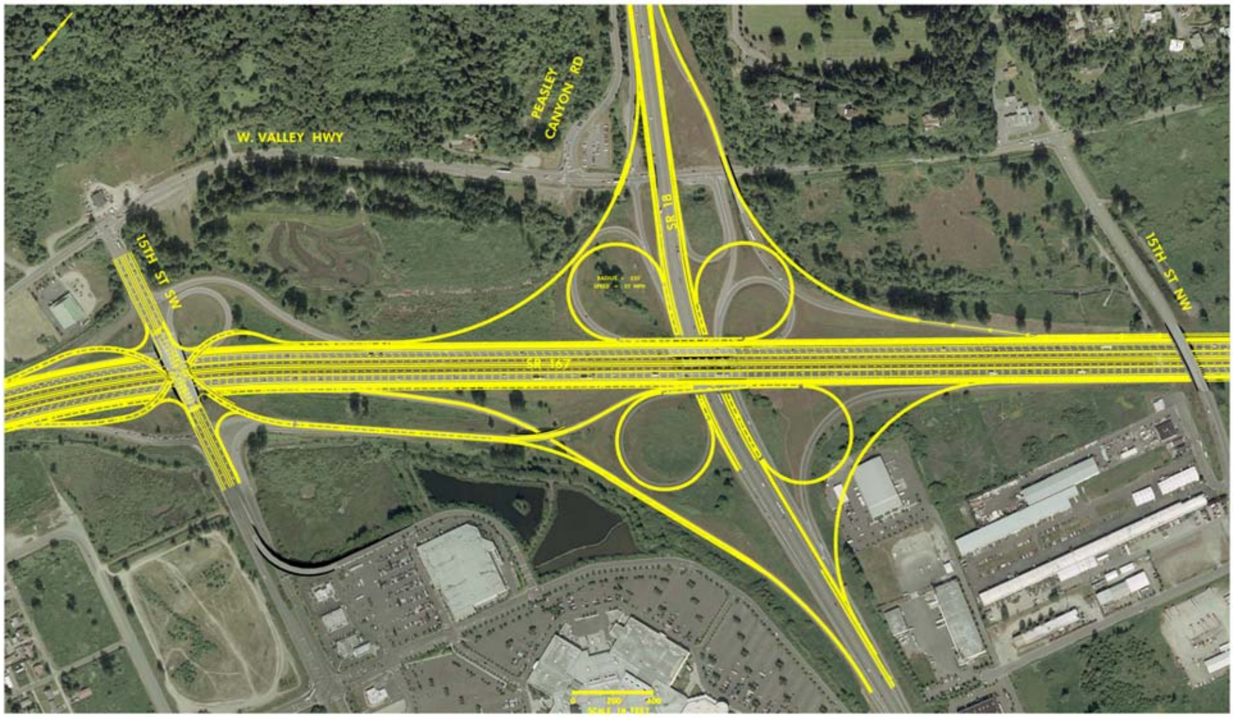
Technical Memorandum 5: Corridor Improvement Options describes two interchange options which allow the missing movements to and from the south and west. Both alternatives remove the interchange between SR 18 and the West Valley Highway. WSDOT studied these two options, as shown in Exhibit 7-16, using traffic operations modeling.

Alternative 1 (a full clover-shaped ramp) includes loop ramps to and from the south and west. Alternative 1 has a short weave section between the westbound SR 18 to southbound SR 167 and southbound SR 167 to eastbound SR 18 ramps. The short weave section combined with a high traffic volume causes queues to backup on the ramps. SR 167 operates with speeds less than 43 mph with this ramp configuration.

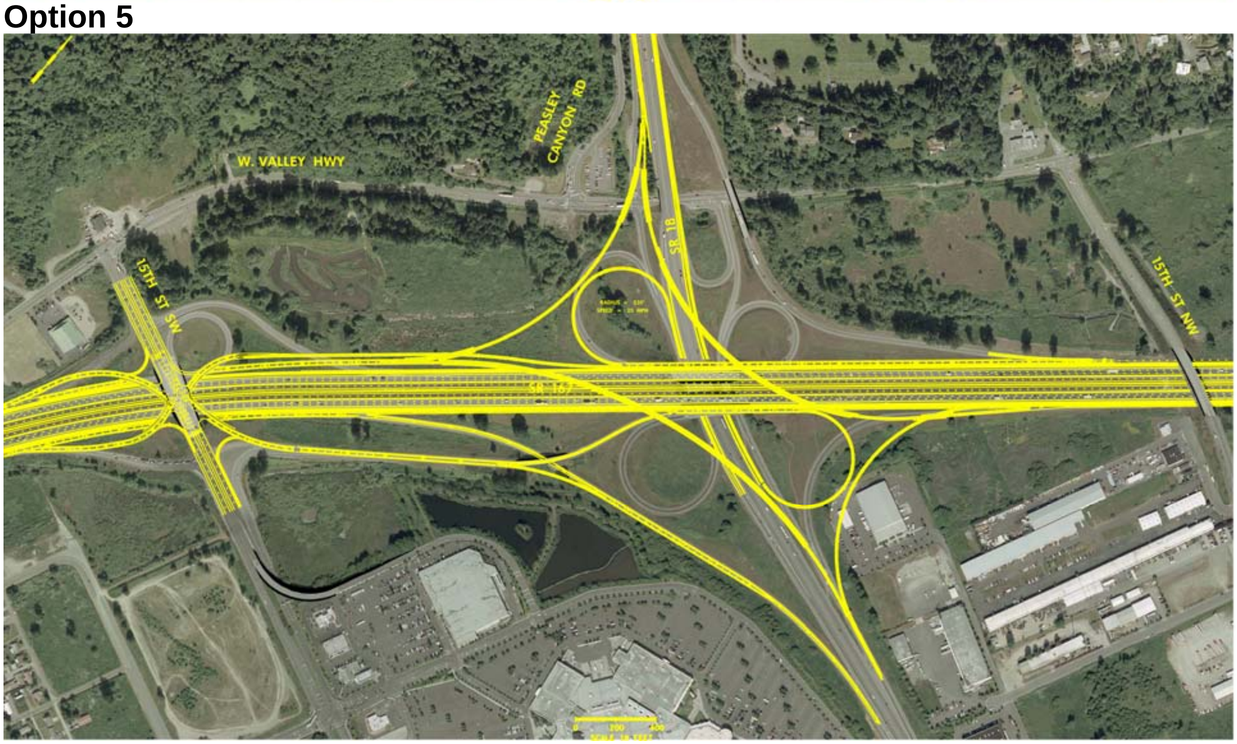
In the northbound direction there is a short weave section between the eastbound SR 18 on ramp and the westbound SR 18 off ramp. The speeds on the lane through this section are less than 35 mph. A slow moving queue forms on the SR 18 eastbound ramp to SR 167 northbound with speeds less than 20 mph.

Alternative 4 (high-volume directional ramps) removes the weave sections by using flyover ramps for the eastbound to northbound and westbound to southbound ramps. With this option, the SR 167 interchange operates at free-flow speeds and is the preferred option.

Exhibit 7-16
Interchange between SR 18 and SR 167
Option 1



Option 5



With either Alternative 1 or 4, the 15th Street SW interchange currently includes redesign as a SPUI to increase the spacing between 15th Street SW and SR 18 ramps.

What improvements are being considered for the SR 410/SR 512 Interchange?

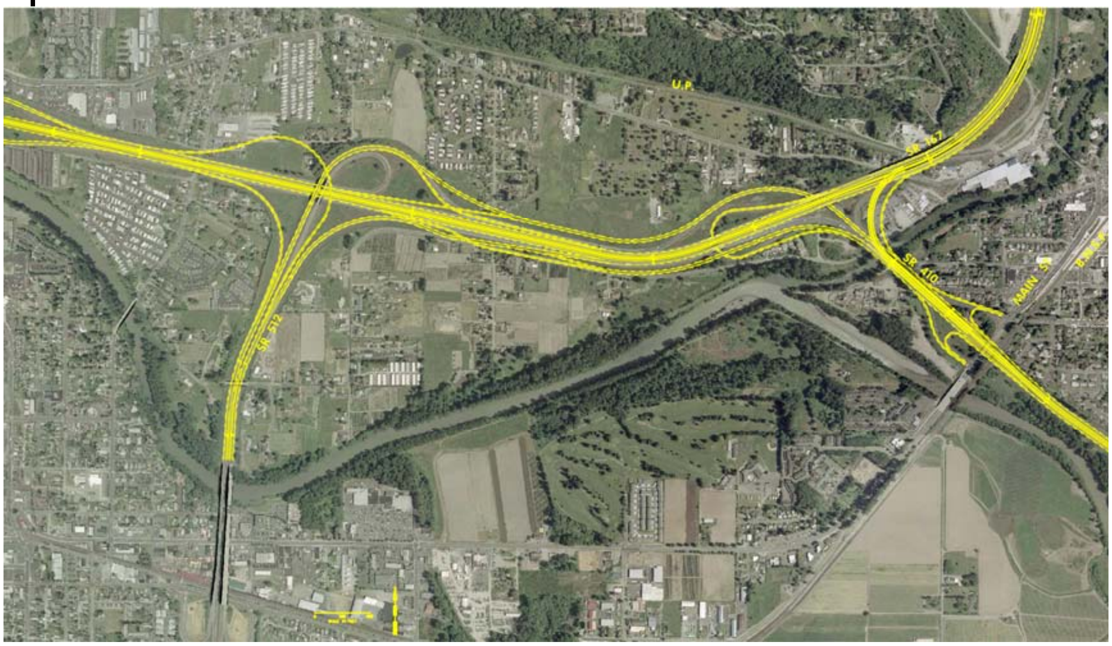
Technical Memorandum 5: Corridor Improvement Options summarizes the alternatives that have been considered to enhance the operation of the SR 410/SR 512 interchanges. These two interchanges provide a series of complex choices for the traveler. A large volume of traffic uses this section of SR 167 to travel between SR 410 and SR 512. In fact, the highest volume through this weave section is between SR 410 and SR 512, not movements between SR 410 and SR 512 to SR 167.

The two alternatives that were analyzed with the traffic operations model, Options 1 and 5, address the following three objectives:

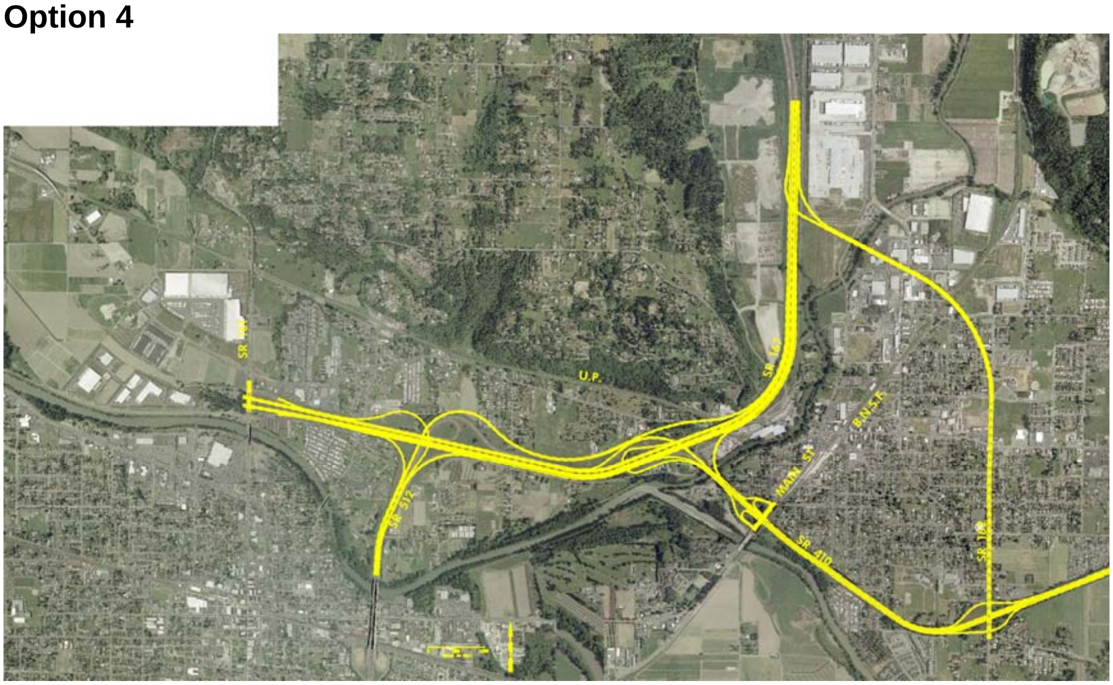
1. Remove the conflict points on SR 167 by either braiding ramps or providing a series of collector distributor lanes.
2. Improve the tight loop ramps from SR 512 northbound to SR 167 southbound and from SR 410 northbound to SR 167 northbound.
3. Add capacity to the traffic movements between SR 410 and SR 167 to the north by either increasing capacity at the existing interchange or providing a new north-south route.

Some sections of each option may require design modifications and potentially could provide similar benefits. WSDOT's decision of which option to choose and further develop is a complex one, and may include a combination of two or more options. Portions of each option are not mutually exclusive to other options. The following describes how the alternatives operationally address the two objections

Exhibit 7-17
SR 410 and SR 512 Interchange Improvements
Option 1



Option 4



Weave Section between SR 410 and SR 512

Option 1 braids the SR 512 on-ramp with the SR 410 off-ramp in the northbound direction. In the southbound direction, SR 512 off ramp is braided with the SR 410 on ramp. This eliminates all short weave movements between the two interchanges with SR 167.

Option 5 includes a collector-distributor (CD) system northbound through the SR 512 and SR 410 interchanges. The CD system moves all weave movements off the mainline onto the CD system.

The entrance to the CD system however shows significant congestion. Exhibit 7-17 depicts the lane configuration for SR 167 northbound near the SR 161 on ramp and the CD off ramp. 2,400 vph access the outside lane south of SR 161. The capacity of this lane is less than 2,200 vph so congestion occurs. To maintain free-flow speeds, the CD on-ramp would braid with the SR 161.

Improve Tight Loop Ramps

Options 1 and 5 both reconfigure the ramp from SR 512 northbound to SR 167 southbound and the ramp from SR 410 northbound to SR 167 northbound. However for both locations, improving the ramps shortens the weave distance to the nearest ramp.

The distance between Main Street and the northbound SR 167 off-ramp on SR 410 northbound today is about 600 feet. With a higher speed ramp (larger radius), the weave section is reduced to less than 500 feet. It is recommended to extend this weave section.

Capacity to and from SR 410 and SR 167 to the north

Option 1 provides direct HOV connections between SR 167 and SR 410. Since in all future 2030 operations the general purpose lanes are congested throughout the entire length of SR 167 the use of HOV/HOT lanes will become the reliable form of travel during peak periods. Option 1 will provide a higher level of reliability for traffic during peak periods.

The new interchange and direct connection with SR 162 as shown in Option 4 does provide potential benefits to handle future travel from the rapidly growing area south of Puyallup. This new interchange and the connection to SR 162 will require additional community involvement in order to develop local support. As an alternative, a connection could be made further east to the Lake Tapps Highway and the interchange between SR 410 and 169th Avenue. The scope of further analysis of these alternatives is beyond this study.

WSDOT recommends that Option 1 be further analyzed for development as the means by which to improve the interchange between SR 167 and SR 410/SR 512.

Improve truck mobility and efficiency

SR 167 is home to the region's largest freight distribution center and consequently has a high concentration of freight traffic.[2]

On an average weekday in 2005, more than 12,000 trucks use SR 167, representing about 10 percent of the total daily traffic (120,000 daily vehicles). The transition in future land use and development, as well as dramatic projections of future growth from the Ports of Seattle and Tacoma will double the freight movement and truck usage on SR 167 corridor in the year 2030 to almost 24,000 trips, representing about 15 percent of the total 2030 average daily traffic of 156,000 vehicles.

SR 167: An industrial corridor

About 40 percent of industrial and warehouse space within Snohomish, King and Pierce counties is located in the Green River Valley.

Source: Co Star Industrial Report Year-end, 2005, Seattle/Puget Sound Industrial Market (2005)

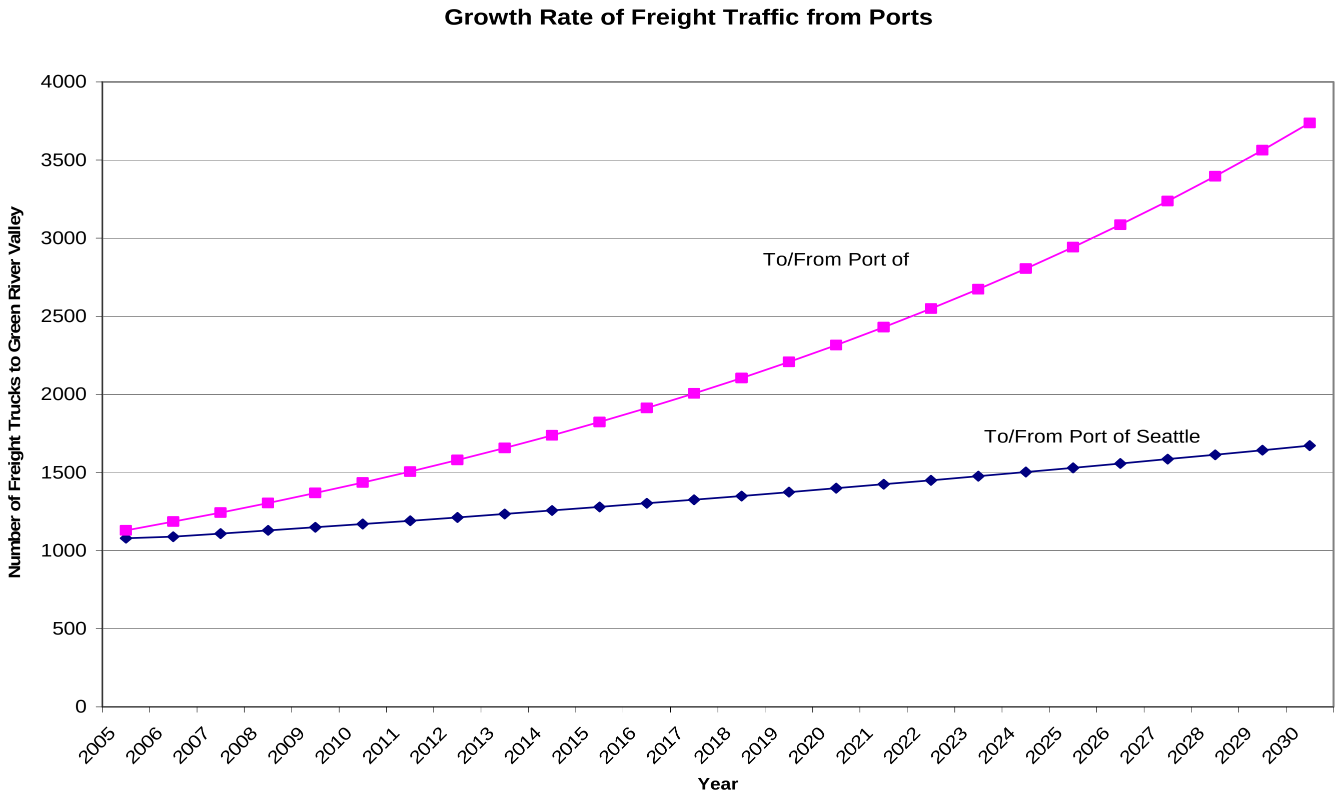
The peak truck volumes on SR 167 will continue to occur mid-day period as trucks avoid the morning and afternoon peak travel periods. By 2030 nearly, 2,000 trucks per hour will travel on SR 167 during the mid-day period (between 10 a.m. and 2 p.m.), representing almost 50 percent of the total traffic. The trend towards an increasing number of single unit trucks is expected to continue, the growth in double unit trucks is expected to remain steady, and the triple unit trucks (two trailers) is expected to remain flat or decrease.

An estimated 33 percent of all regional truck trips generated by the Ports of Seattle and Tacoma would be destined to locations in the Green River Valley. It is expected that freight traffic

[2] The CoStar Industrial Report, Year-end 2005, Seattle/Puget Sound Industrial Market (2005).

coming from or going to Port of Seattle facilities will increase at a rate of 1.8 percent a year, while freight traffic coming to and from Port of Tacoma facilities will increase at a rate of 4.9 percent a year. The following exhibit shows freight traffic patterns in 2030, based on the projected growth rates.[3]

Exhibit 7-18
Growth Rate of Freight Traffic from Ports



Source: Technical Memorandum, SR 167 Corridor Plan, Port Truck Growth in SR 167 Corridor, October 2006, Heffron Transportation.

How long will the long-term options effect freight mobility?

The general purpose lanes under all of the long term options will operate poorly in the a.m. and p.m. peak period conditions as nearly all the improvements proposed in the long term options are for the managed lanes, in which freight traffic is not allowed.

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[3] 2004 Marine Cargo Forecasts

Freight movement by truck on the SR 167 corridor is constrained by the length of the AM and PM peak periods of congestion. Trucks generally choose to travel during uncongested conditions to improve the speed and reliability of their trip. With all options, there is an impact to freight movement and truck use on the SR 167 corridor, as it reduces the trucking industry's effective hours of operation from 6 hours (9 a.m. to 3 p.m.) to about 4 hours (10 a.m. to 2 p.m.).

As general purpose lanes become filled, the average speed declines to approximately 15 to 16 mph, resulting in poor roadway operations – level of service E or F. In addition, as traffic is attracted to SR 167 there would be an increase in traffic on arterials near the interchanges to SR 167.

The managed lanes (HOT) operate much more efficiently under all of the options, because the variable tolling system would be operated to maintain a consistent level of speed (45 mph or better), and therefore, a better level of service (LOS D). Single occupant vehicles that elect to pay the toll and enter the managed lanes results in general purpose traffic that moves out of the general purpose lanes and into the managed lanes.

What long-term design considerations should WSDOT incorporate to meet the trucking industry's needs?

There are other treatments that could be considered in the long term options to increase capacity for trucks besides adding through lanes on SR 167, such as:

- Freight in managed lanes;
- Freight in by-pass lanes;
- Enhanced design for truck mobility; and
- Intelligent transportation systems.

Some options, such as improving ramp interchanges, also increase capacity for general-purpose traffic. Improvements to truck mobility will also benefit general purpose traffic.

Freight in Managed Lanes

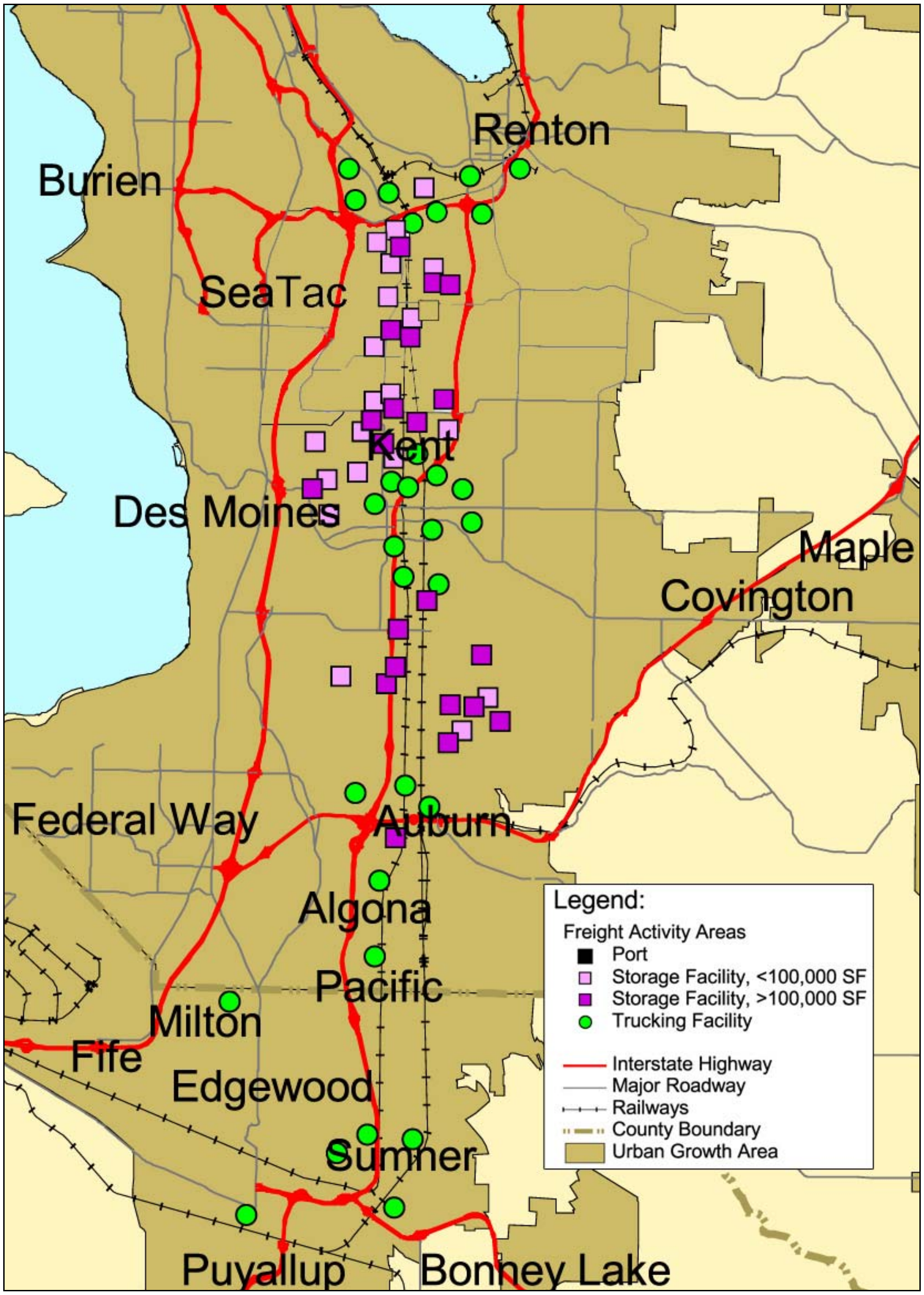
Freight in managed lanes could be a range of facilities from truck-only lanes, to a pair of managed lanes where vehicles pay a fee to enter the lanes when there is excess capacity. Managed lanes are typically designed for high occupancy vehicles, but recently urban areas are exploring the concept of Truck Only Toll lanes (TOT lanes).

Managed lanes would provide a travel time benefit only for long distance truck trips. For short trips, the time delay associated with weave maneuvers, to enter and exit the truck-only lane or a managed lane, is a large portion of the total travel time. Warehouse and distribution centers are located throughout the length of the SR 167 corridor, necessitating frequent access to SR 167 for trucks. These short trips on SR 167 would not benefit from a truck-only lane. In addition, there is no net travel time benefit for managed lanes during the off peak, and no need pay a fee to enter the lane.

Truck-only facilities on a limited access facility are generally recommended to be physically separated from general-purpose traffic to reduce or eliminate the effect of trucks weaving into and out of this lane. Because of this separation, direct-access ramps to the truck-only lane would be required, and would likely have limited locations. The footprint of a direct access interchange is substantial, and the physical separation of the truck only lane would add to the width of SR 167. The cost and environmental impacts of added infrastructure within this corridor would be considerable.

The freight truck travel patterns through the Green River Valley are illustrated in Exhibit 7-19, which shows that trucks use nearly all of the interchanges to access SR 167. However, if direct access ramps were constructed they would likely be limited to a few select locations. Therefore, truck-only lanes would only benefit those businesses or trucks with origins or destination served by a few direct ramps.

Exhibit 7-19
Locations of Freight Activity Areas Along SR 167 Corridor



There is limited research with regard to criteria for truck-only lanes. The criteria from two sources are included herein as examples. These sources state that truck-only lanes should be considered when:

1. Truck volume exceeds 30 percent of the normal traffic mix[4].

2. Daily two-way truck volume of heavy (3+axle) trucks exceeds 20,000 for a distance of 10 miles.[5]

Trucks are 10 percent of daily traffic on SR 167 just north of South 212th Street, estimated to reach 15 percent by 2030. The total daily truck volume on SR 167 just north of South 212th Street is approximately 12,110 trucks and estimated to reach 24,000 by 2030. Of the existing 12,110 trucks, 52 percent are tractor-trailer trucks with 3+axles. The volume of 3+ axle trucks on SR 167 would not reach the levels recommended for implementation of a truck-only lane. Ultimately, a decision to implement a truck-only lane would require a benefit-cost analysis including analysis based on truck volumes that would use the lane, potential disadvantage for trucks that could not use the lane, travel time savings, cost savings to truck transport and cost of the facility.

Freight by-pass lanes

By-pass lanes can accommodate a high volume of through trips around a system interchange (freeway to freeway) or around a major arterial interchange. A freight by-pass lane could also be applied to ramps, and be used to avoid starting from a stop at ramp meters. Freight by-pass lanes could divert truck traffic past an interchange, thus minimizing potential for delay due to local congestion. In addition to benefiting trucks, it removes

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[4] *Feasibility of Exclusive Facilities for Cars and Trucks, Final Report, Contract No. DTFH61-89-Y-00018,* Center for Transportation Analysis, Oak Ridge National Laboratory, Oak Ridge, TN, B. N. Janson and A. Rathi, April 1990.

[5] Handbook for Planning Truck Facilities on Urban Highways, *James G. Douglas, AICP, August 2004*

trucks from the freeway mainline and improves the ability for general-purpose traffic to weave onto the mainline.

Truck by-pass lanes on a ramp can be used to allow trucks to by-pass a ramp meter. This is particularly useful on uphill ramps where a truck would not be able to reach highway speeds if they have to accelerate from a ramp meter located partway up the ramp. Such a bypass lane not only reduces the delay for truck, but can increase capacity of the mainline by increasing the speed at which truck traffic merges into the mainline. This benefit would be most noticeable during off-peak conditions when the highway speeds are highest. It can also extend the periods of uncongested flow by limiting the slow-down effect of trucks.

Enhanced design for truck mobility

Enhanced design for truck mobility addresses the difference in operating characteristics between trucks and general-purpose traffic, such as:

- Trucks are longer and heavier;
- Trucks require longer distances for acceleration and deceleration;
- Trucks are affected more significantly by steep grades; and
- Trucks are more limited in mobility around tight curves and on super elevated curves.

When truck speeds and mobility differ from that of general-purpose traffic, they have the effect of reducing the capacity along a mainline segment and on a ramp. Improvements that increase the speed of a merging truck can increase the overall capacity of a freeway facility. Improvements could include:

- Increasing the length of the ramp.
- Providing an acceleration lane parallel to the mainline.
- Increasing the radius and decreasing the super elevation of loop ramps.
- Reducing the grade of on-ramps.

Trucks must accelerate from a stop at ramp terminal and ramp meters. For a typical ramp design with a three (3) percent uphill grade and 1,000 feet of ramp length, heavy trucks are entering the freeway at 29 mph. Furthermore, where grade has the affect of decreasing truck speed, the affect is to reduce the passenger car equivalent of each truck, which is typically the equivalent one-and-a-half passenger cars.

Geometric improvements will also reduce the number of crashes due to grades (speed differential), ramp curves and superelevation, merge and weave distances, and clear zones to fixed objects.

Intelligent Transportation Systems (ITS)

Intelligent Transportation System (ITS) applications improve freeway operations and can be developed to provide truck-specific information. Examples include: advance information about major construction changes, real-time information about incidents and emergencies, and changeable message signs in advance of route choice. The incident information is particularly useful for freight movements. If provided via e-mail alerts or fax bulletins, it allows businesses to hold trucks at the site rather than have them get stuck in a traffic jam from which a large truck cannot escape (unlike cars, trucks cannot easily U-turn or use streets with steep topography).

A well-developed incident management program to quickly clear blockages is a cost-effective method to reduce congestion. Incidents are events that disrupt the normal flow of traffic, usually by physical impedance in the travel lanes. Events such as vehicular crashes, breakdowns, and debris in travel lanes are the most common form of incidents.

Studies show that over one half of urban congestion is due to incidents. When freeway lanes are blocked, congestion levels increase dramatically and take a long time to dissipate. The Texas Transportation Institute estimates that incidents cause 52 percent of the delay6, based on a study of 85 urban areas in 2003. The extent that ITS applications smooth traffic flow

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[6] Source: U.S. Federal Highway Administration, Focus on Congestion:, http://www.fhwa.dot.gov/congestion/factoids.htm

would result in less congestion and an expected reduction in congestion-related crashes.

Secondary crashes such as rear-end crashes due to congestion also occur during the congestion caused by blocked freeway lanes. A combined program of ITS applications during severe congestion, combined with a well-developed incident management program can reduce congestion and crashes for general purpose traffic and truck traffic.

A broad array of truck mobility design concepts was discussed and evaluated for applicability in the SR 167 corridor in the Technical Memorandum *SR 167 Corridor Study, Truck Mobility Design Concepts*, December 18, 2006, Heffron Transportation, Inc.

How will the potential bottleneck segment options affect freight mobility?

In summary, the potential bottleneck segment options will improve safety by improving location specific safety issues, especially ramp design issues. The bottleneck segment options will also reduce the frequency of crashes in the corridor and reduce bottleneck congestion that results in crashes. In addition, the bottlenecks will increase capacity on SR 167 in advance of full development of the preferred long term alternative for SR 167. An increase in capacity would also reduce impacts on regional arterials, which carry a significant amount of the truck traffic in the Green River Valley. The following exhibit summarizes the specific improvements that each bottleneck project will provide to freight traffic.

Exhibit 7-20

Summary of Truck Mobility Benefits from Bottleneck Segment Options

Project (listed north to south for reference to map)	Truck Mobility Benefit
S 180th Street Interchange Improvements	Major corridor for Kent trucking and distribution centers
South 180th Street to 84th Avenue General Purpose Lane	Adds capacity in one segment
SR 516 to S 277th Street NB/SB Auxiliary lanes	Opportunity to address ramp and merging issues, adds capacity to SR 167
SR 18 Interchange Improvements	Improves accessibility for freight movements.
	Providing for general purpose traffic needs may reduce traffic volumes through interchange Ramp improvements addresses truck operating concerns
Stage 4 HOV/HOT Lanes	HOV lane is and additional lane that removes passenger cars from general purpose lane and increases available capacity for trucks.
Stage 5 HOV/HOT Lanes (King and Pierce Counties)	HOV lane is and additional lane that removes passenger cars from general purpose lane and increases available capacity for trucks.
SR 512-/ SR 410 Interchange Improvements	Addresses truck operating concerns

Improve safety

Technical Memorandum 3: Existing Conditions provided an overview of the locations where accidents are most prominent along the SR 167 corridor. Higher collision frequencies are found in locations with high congestion, including the interchange areas of SR 167 at I-405, at SR 516, at SR 18, and at SR 410. WSDOT has identified eleven High Accident Locations (HALs) in the corridor. A HAL is a stretch of road less than a mile long that has an accident rate higher than the state average for a similar route. The areas with the greatest frequencies of collisions occur near SR 512 and near I-405. There are five HAL's near SR 512, where most collisions occur in the southbound direction. There is one HAL near I-405 where most collisions occur in the northbound direction.

Many of the collisions on SR 167 are the result of abrupt changes in speed and driver frustration with congested road conditions. During rush-hour periods, travel speeds are significantly below the posted speeds. There is a direct relationship between traffic congestion in rush hour periods and higher accident rates. Many areas where traffic from interchange ramps merges onto mainline traffic are congested. Higher collision rates occur in the northbound direction in morning rush hour and in the southbound direction in the afternoon rush hour.

Accidents involving freight trucks are typically rear-end accidents that result from congested conditions. In addition, side-swipe accidents frequently occur on ramps due vehicles attempting to merge and diverge on short ramps, with slow truck speeds, and congested traffic conditions.

Exhibit 7-21
SR 167 High Accident Locations

"Under 23 U.S. Code, Section 409, this data cannot be used in discovery or as evidence at trial in any action for damages against State, Tribal or Local Government that involves the locations mentioned in this data."

Evaluation of long-term options

For the long term alternatives, safety is generally measured by travel speed. If higher travel speeds are maintained, there is a greater likelihood that there will be fewer collisions.

For all of the alternatives, the average managed lane travel time and speed remains constant, because the variable toll rate would be designed to maintain an average speed of 45 mph in the southbound direction during the p.m. peak hour and 49 mph in the northbound direction. Therefore, safety is generally improved for motorists who use the HOV/HOT lanes.

Travel speeds within the general purpose lanes, however, will vary by alternative, according to time of day, and by geographic area. Overall, the average northbound and southbound general purpose lane travel times for the entire corridor are similar among options. However, differences can be seen among options within the various sections. The travel speed within the general purpose lanes averages 49 mph in the northbound direction and 14 mph in the southbound direction during the p.m. peak. Therefore, in general terms, it can be stated that the southbound direction during the p.m. peak hour has safety issues due to the relatively low average travel speed. Exhibit 7-22 displays the differences in the p.m. peak travel speed within the general purpose lanes by alternative, and section of the corridor.

Exhibit 7-22
Average Travel Speed for General Purpose Lanes (PM Peak Period) 2030

	Baseline	Option 2	Option 2A	Option 4	Option 4A
Renton	56 mph NB	56 mph NB	56 mph NB	56 mph NB	56 mph NB
	26 mph SB	26 mph SB	28 mph SB	26 mph SB	28 mph SB
Auburn	47 mph NB	55 mph NB	47 mph NB	55 mph NB	55 mph NB
	8 mph SB	10 mph SB	9 mph SB	9 mph SB	13 mph SB
Puyallup	46 mph NB	46 mph NB	46 mph NB	51 mph NB	46 mph NB
	15 mph SB	20 mph SB	17 mph SB	19 mph SB	14 mph SB

Evaluation of bottleneck segment improvement options

Most of the bottleneck segment improvement options will provide some added benefit in terms of improving safety. It can be assumed that the added capacity and interchange improvements associated with the bottleneck segment improvement options will help to improve safety by reducing congestion and improving travel speed.

South 180th Street Interchange Project (2020 – Model Assumption)

Currently, the southbound on and off-ramps are located at SW 41st Street, while the northbound on and off-ramps are located at South 180th Street/SW 43rd Street. The southbound off-ramp is relatively short. The bottleneck segment improvement option would construct a single point urban interchange (SPUI) at South 180th Street. Between 2002 and 2005, there were a total of approximately 60 accidents on SR 167 in the vicinity of South 180th Street. The vast majority of these were in the northbound direction. There are a significant number of freight related accidents in this direction.

Renton/Kent General Purpose Lanes (2010 – Model Assumption)

There are a significant number of accidents that occur along this segment of SR 167. Between 2002 and 2005, there were nearly 170 accidents (53 southbound, 115 northbound) within the entire segment where this bottleneck project is located. The greatest concentration occurred near South 180th Street in both directions. The addition of a third general purpose lane between 84th Avenue South and South 180th Street results in an increase in traffic demand in the PM peak hour (about 400 vph in the southbound direction, 100 vph in the northbound direction). Some of the additional vehicle trips continue south of South 180th Street, which adds to the existing congestion. The operational analysis indicates travel time would increase by up to a minute and a half by adding this lane. Therefore, this improvement has negligible improvements to safety. Northbound, the addition of the third GP lane has no effect on the afternoon peak period travel time.

Kent Auxiliary Lanes (2010 – Model Assumption)

Between 2002 and 2005, there were over 70 accidents (40 southbound, 33 northbound) within the entire segment where this bottleneck project is located (between SR 516 and South 277th Street). The greatest concentration occurred near the SR 516 interchange along both directions. Historically, this stretch of SR 167 has experienced more than 30 collisions per year northbound, and 36 collisions per year southbound. While this is not the highest collision rate in the corridor, it is among the highest incident areas, and these collisions appear to be easily linked to the congestion and traffic weaving occurring between these interchanges. Northbound, approximately two-thirds (66%) of these incidents are likely related to vehicles entering or leaving the freeway, while southbound the number probably related to weaving is even greater, at seventy five (75%) percent.

Truck volumes through this portion of SR 167 are significant. While the collision statistics do not indicate a significant number of truck-related incidents, it is likely that these trucks are causing congestion and disruptions in flow that likely are contributing factors towards many of the other vehicle collisions.

The auxiliary lane in both directions will allow a much longer distance for vehicles to safety merge into the other lanes. This will help to reduce the number of collisions, and will make it easier for trucks merging into and out of the general purpose traffic. The additional merge and diverge area will allow all vehicles additional area to perform these functions with increased safety. This should lead to a decrease in the number of collisions.

SR 18 Interchange Improvements (2020 – Model Assumption)

The current interchange does not provide direct access ramps between SR 167 to the south and SR 18 to the west.[7] Also the interchange is complicated by the closely adjacent interchanges between SR 18 and the West Valley Highway and between SR

[7] Appendix A provides a discussion of the benefits of direct access ramps.

167 and 15th Street SW. Traffic currently must use these two interchanges to travel between SR 167 south and SR 18 west.

Between 2002 and 2005, there were approximately 64 (36 southbound, 28 northbound) collisions on SR 167 in the vicinity of the interchange of SR 18, including the interchange with 15th Street SW. The greatest concentration occurred in the southbound direction between SR 18 and 15th Street SW. Another issue associated with this ramp is the poor visibility associated with the merge from SR 18 to northbound SR 167.

The proposed improvements would include high-volume directional ramps option, which would remove the weave sections by using flyover ramps for the eastbound to northbound and westbound to southbound ramps. With this option, the SR 167 interchange operates at free-flow speeds, and therefore, results in better operations and improved safety.

Stage 4 HOV/HOT Lane (2010 – Model Assumption)

There are a significant number of accidents that occur along this segment of SR 167. Between 2002 and 2005, there were approximately 100 accidents (southbound) within the entire segment where this bottleneck project is located. The greatest concentration occurred between 15th Street NW and 15th Street SW, where there were approximately 60 accidents. Within this same area, and specifically, between the SR 18 onramp and to the south of Ellingson Road, there were high numbers of freight-related accidents. The addition of the HOV/HOT lane will improve capacity within this general area, thereby helping to reduce congestion and driver frustration, which could lead to fewer accidents. The added capacity for trucks should also help to reduce freight accidents.

Stage 5 King County HOV/HOT Lane (2010 – Model Assumption)

There were relatively few accidents within this portion of the corridor between 2002 and 2005, compared to other areas along the corridor. There were approximately 30 accidents (northbound) along this entire segment. The addition of the HOV/HOT lane will improve capacity in this area, thereby helping to reduce congestion and driver frustration, which could lead to fewer accidents.

Stage 5 Pierce County HOV/HOT Lanes (2020 – Model Assumption)

Between 2002 and 2005, there were a relatively low number of collisions that occurred along both directions of this section of SR 167, when compared with other portions of the corridor. There were approximately 70 accidents (33 southbound, 36 northbound), and the greatest concentration occurred near SR 410. In the southbound direction, the area between the Jovita Boulevard off-ramp and the SR 410 onramp had a significant number of freight related collisions. The addition of the HOV/HOT lane will improve capacity within this general area, thereby helping to reduce congestion and driver frustration, which could lead to fewer accidents. The added capacity for trucks should also help to reduce freight accidents.

SR 410/SR 512 Interchange Projects (2020 – Model Assumption)

These two interchanges provide a series of complex choices for the traveler. The distance between the SR 410 and SR 512 is limited. There are conflict points on SR 167 due to short-distance weaving between the ramps, as well as tight loop ramps from SR 512 northbound to SR 167 southbound, and from SR 410 northbound to SR 167 northbound. A large volume of traffic uses this section of SR 167 to travel between SR 410 and SR 512.

This section of SR 167 has a very high number of accidents due to the proximity of the interchanges, and their design. Between 2002 and 2005, there were a total of 130 accidents (74 southbound, 56 northbound) in the vicinity of the two interchanges.

There are two HAL's in this vicinity, including the loop ramp from SR 512 to southbound SR 167. The other HAL is the ramp from SR 410 to northbound SR 167. When entering the ramp, drivers adjust their speed to the curve. However, the curve sharpens and many vehicles are unprepared for the tighter curve. All but one of the accidents at this location involved vehicles overturning. In addition, there are significant numbers of freight related collisions that occur on the northbound SR 167 onramp from SR 512, as well as the SR 512 off-ramp to the SR 512 overcrossing.

The proposed improvements to this interchange include braiding the SR 512 on-ramp with the SR 410 off-ramp in the northbound direction. In the southbound direction, SR 512 off ramp is braided with the SR 410 on ramp. This eliminates all short weave movements between the two interchanges with SR 167.

This proposal also reconfigures the ramp from SR 512 northbound to SR 167 southbound and the ramp from SR 410 northbound to SR 167 northbound, thereby improving ramp speed. With this option, the travel speeds through these sections improve, and therefore, results in better operations and improved safety.

Be cost-effective

How much will it cost to improve SR 167?

Estimating the cost of future highway improvement projects has become an increasingly difficult process as environmental mitigation costs have escalated and the cost of actual construction has become less predictable. The WSDOT has adopted a process for cost estimating that attempts to quantify the various risks in order to provide more realistic estimates. This process is called the Cost Estimate Valuation Process (CEVP).

WSDOT did an extensive evaluation of the costs to expand the SR 167 Valley Freeway by a single lane in each direction. These costs were published in January 2007 and used to coordinate with the Regional Transportation Improvement District (RTID) program development. CEVP uses estimated cost to construct in the current year and then expands that estimate based upon the probability of a variety of factors occurring in order to develop a probable range of costs during the forecast year of construction. These estimates are then given a percentage of probability.

Exhibit 7-23 lists the cost to construct the improvements needed to provide eight lanes through the entire length of the Valley Freeway between SR 512 and I-405. North of SR 18 this table of cost estimates matches the January 2007 cost information. South of SR 18 the cost estimates provided in this January 2007 CEVP process were doubled to estimate the approximate cost to provide for the full eight lanes. The range listed is from the 60 percent to 90 percent probability values listed in CEVP.

Exhibit 7-23

Estimated Costs of the 8-Lane Long Term Options

Segment	Estimated Costs (2006 $ in millions)
S 212th St. to S 180th St.	$244-$365
S. 180th Street Interchange upgrade	$294-$434
84th Ave. S to S 212th St.	$84-$131
SR 516 to 84th Ave. S	$215-$362
S 277th St. to SR 516	$102-$159
15th St. NW to S 277th St.	$171-$268
15th St. SW to 15th St. NW	$276-$422
SR 18 Interchange Improvements	$590-$900
Ellingson Rd. to 15th St. SW	$225-$317
8th St. E to Ellingson Rd.	$296-$410
24th St. E to 8th St. E	$168-$235
SR 410 to 24th St. E	$442-$685
SR 410/512 Interchange improvements	$315-$488
TOTAL	$3,400-$5,200

The probability of the public funding for more than three billion dollars worth of improvements for SR 167 is not likely in the near future. A series of potential solutions to specific areas of congestion, or bottleneck segments, were developed and estimated. These bottleneck segment options are designed to be a part of the long term solution. Each of these proposed bottleneck segment options were estimated using the same January 2007 CEVP numbers. Exhibit 7-24 tabulates the possible range of costs for improvements that can be further considered for funding programs. This list is not prioritized in this table.

Exhibit 7-24
Estimated Bottleneck Segment Option Costs

Bottleneck	Range of Costs (2006 $ in millions)
South 180th Street Interchange Project	$294-$439
Renton/Kent Southbound Lane	$164-$248
Renton/Kent Northbound Lane	$164-$248
Kent Auxiliary Lanes	$102-$159
SR 18 Interchange Improvements	$590-$900
277th to 8th Street Southbound HOV/HOT Lane*	$80
8th Street to 15th S.W. Northbound HOV/HOT Lane	$137-$189
SR 512 to 8th Street Pierce County HOV/HOT Lanes	$305-$460
SR 410/SR 512 Interchange Projects	$315-$488

** This project is currently funded; therefore, it does not have a range of costs.*

Expanding the Valley Freeway to 10-lanes would provide the greatest flexibility for travel in the future, would allow better freight flow and would help to reduce future peak congestion periods. Estimating the cost to expand to 10-lanes was not undertaken in this study. Based on the costs to build 8-lanes it is expected that the 10-lane facility could cost between six and eight billion dollars to construct.

The projects most likely to provide immediate relief to existing and forecast future congestion and safety problems on SR 167 are listed in Exhibit 7-25. This table lists the projects in order of priority and provides the estimated benefit to users based upon estimated cost per commute hour saved and the cost per additional person utilizing the improvement.

Exhibit 7-25
Cost Analysis

Proposed Improvement	Cost (2006 $) 60% Probability (Millions of dollars)	Cost per Annual Commute Hour Saved	Daily Cost per Added Person Served
277th to 8th Street Southbound HOV/HOT Lane	$80	$100	$260,000
SR 167 and I-405 Direct Connection of HOV Lanes	$320	$292	Not Available
8th Street to 15th St SW Northbound HOV Lane	$137	$649	$440,000
SR 512 to 8th Street HOV/HOT Pierce Co.	$305	$500	$305,000
Kent Auxiliary Lanes North and Southbound 15th Street NW to SR 516	$272	$149	$880,000
Renton/Kent North and Southbound General Purpose Lanes	$328	$311	$1,060,000

Be environmentally effective

An environmental screening was conducted to assess the potential effects of the long term and short term traffic improvement options along the SR 167 corridor. This assessment was based on existing conditions, which were derived from numerous sources including local, state, and federal databases and geographic information systems (GIS) maps as well as some field data collected for on-going or recently completed projects along the corridor. This is an initial screening of identified options along with other engineering considerations; it is not intended for use for environmental regulatory approvals. Due to the high-level screening that was conducted and nature of the data used, numerous assumptions were made to conduct this environmental screening, which are documented in the methodology sections under the subsections for each environmental issue.

The environmental analysis evaluated the differences between the 8-lane (Options 2 and 2A) and 10-lane footprints (Options 4 and 4A). Some of the assumptions used in the design of the footprints for the long term options include:

- All on-ramps will be realigned to facilitate adequate acceleration, and widened (if necessary) for 2-lane on-ramps with a ramp meter plus a High Occupancy Vehicle (HOV) by-pass.

- All off-ramps will be adjusted to maintain adequate deceleration distance, while maintaining the existing lane configuration.
- All bridges will be replaced that cross over SR 167 and don’t provide 75 feet horizontal clearance.
- All bridges carrying SR 167 will be widened with liquefaction retrofit (without being torn down or rebuilt.).
- Widening will occur, where possible, within the median otherwise widening will occur outside the median.
- Retaining walls will be used along the mainline to avoid or reduce effects to sensitive areas.
- The proposed project effects do not include potential effects from construction of stormwater management systems, as the systems are developed on a project-by project basis.

Both the 8-lane and 10-lane footprints include the seven short term options.

All seven bottleneck projects were also evaluated for environmental constraints.

Methodology

The environmental screening was performed on each of the short term and long term options by taking the existing conditions in GIS format and overlaying the project’s area of analysis on the existing condition to calculate an area of effect.

In order to calculate the effects of the short term and long term options on environmental resources, we defined areas of analysis that account for the current preliminarily designed highway footprint and the area of land likely to be required for:

- Development of fill
- Slopes
- Retaining walls
- Noise walls
- Signs

- Other facilities
- The area likely to be subject to projects effects other than physical disturbance

No design for stormwater facilities has been completed at this time, and the environmental effects of the required stormwater systems could lie outside the currently defined areas of analysis. The current areas of analysis assume that the future stormwater system will incorporate some form of infiltration features along the side of the highway, as currently exist in the form of Ecology embankments and ditches.

In general, two different areas of analysis were defined for use in screening of project effects on environmental elements. A **compact** analysis area was used in determining project effects on environmental elements only affected by physical disturbance. The compact area of analysis was defined to include the proposed project footprint plus 50 feet on either side of the highway.

An **extended** analysis area was used in determining project effects on environmental elements which could be affected by noise, visual disturbance, and/or changes in stormwater quantity and quality, in addition to physical disturbance. The extended analysis area was defined to include the proposed project design footprint plus 300-feet on either side of the highway.

The Exhibit 7-26 summarizes whether project effects on the investigated environmental elements were calculated using the compact or standard analysis area.

Exhibit 7-26

Environmental Area of Analysis

Environmental Element	Compact Analysis Area	Extended Analysis Area
Wetlands and Wetland Buffers	X	
Floodplains	X	
Fish Habitat		X
Wildlife & Upland Habitat		X
Streams & Riparian Corridors	X	
Air Quality		X
Noise Quality		X
Groundwater	X	
Geology	X	
Hazardous Materials		X
Historic & Cultural Resources	X	
Land Use	X	
Section 4(f)	X	
Socio-economics & Environmental Justice*		X

** The socio-economic and environmental justice analysis was performed on a 660 foot n area (or 1/8 mile in area).*

Evaluation of long-term options

WSDOT quantitatively evaluated the long term options based on their overall effects to environmental resources based on cost, type of permitting required, actual affects to resources, and/or mitigation costs.

The following exhibit summarizes the results of the environmental screening of the long term options. Nearly all of the screening results are relatively similar between the two long term options. The ten lane option typically has a slightly higher effect on environmental resources than the eight lane option due to its larger footprint. Some of the more obvious differences are that the ten lane option has more significant impacts to:

- Wetland buffers
- Protected fish
- Fish and wildlife habitat
- Hazardous materials

In general, the 10-lane option may have more mitigation costs due to the impacts related to wetland buffers and fish and wildlife habitat, as well as potential additional work to identify hazardous materials sites. In addition, the 10-lane option will require major bridge modifications or replacements; whereas the 8-lane option will not. This is a costly endeavor, but would bring the bridges up to current seismic standards.

Exhibit 7-27

Long-Term Option Environmental Effects (Worst Case Scenarios)

Evaluation Criteria	Option 2/2A	Option 4/4A
Wetlands		
How many acres of wetlands will be affected by the project?	28	35
How many acres of wetlands buffers will be affected by the project?	40	48
Floodplains		
How many acres will the long term options effect in the 100 year floodplain?	47	50
How many acres will the long term options effect in the 500 year floodplain?	14	16
How many acres will the long term options effect in the floodway?	17	19
Fish Habitat		
How many fish species will be affected by proposed in-water work (culverts, bridges)?	3	10
How many fish species may potentially be affected by project stormwater or runoff in the area of analysis?	10	10
How many acres of non-forested riparian zone will be affected by the project?	668	760
How many acres of forested riparian zone will be affected by the project?	66	86
Wildlife		
How many acres of wildlife habitat in the form of urban natural open space will be affected by the project?	22	33
How many acres of waterfowl habitat will be affected by the project?	139	156
Streams and Riparian Corridors		
How many acres of streams, creeks, or rivers might the long term options effect?	2.6	2.8
How many acres of forested riparian might the long term options effect?	9	10
How many acres of non-forested riparian areas might the long term options effect?	190	205
Air Quality		
How will the project effect air quality?	NA	NA
Noise Quality		
How will the project affect the long term exterior noise levels of sensitive receptors in the area of analysis?	Moderate	Moderate
How will the project effect construction noise levels for sensitive receptors in the area of analysis?	Moderate	Moderate
Groundwater Resources		
How will the project effect wellhead protection areas? (acres)	183	194
How will the project affect Critical Aquifer Recharge Areas (CARA)? (acres)	237	245
How will the project affect sole source aquifers? (acres)	0	0
How much more impervious surface area will the long term options contribute to the existing roadway?	697	78%

Exhibit 7-27 (contd.)

Long-Term Option Environmental Effects (Worst Case Scenarios)

Evaluation Criteria	Option 2/2A	Option 4/4A
Geologically Hazardous Areas		
How will the project affect seismic hazard areas? (acres)	225	232
How will the project effect high liquefaction hazard areas? (acres)	28	29
How will the project effect steep slopes of greater than 30%? (acres)	33	35
Hazardous Materials		
How many hazardous waste sites are within the area of analysis of the proposed project?	142	179
Cultural and Historic Resources		
How will the project effect archeological resources?	NA	NA
How will the project effect historic resources?	NA	NA
Land Use		
How will the project affect existing residential land use? (acres)	11	11
How will the project affect existing commercial land use? (acres)	9	10
How will the project affect existing industrial land use? (acres)	9	9
Section 4(f)		
How will the project affect Section 4(f) park properties?	9.5	12
How will the project effect Section 4(f) trail properties?	1,161	1,249
Socio-economics and Environmental Justice		
How will the project effect low-income populations? (number of census tracts effected)	9	9
How will the project effect minority populations? (number of census tracts effected)	7	7
Other		
How many culverts will need modification or replacement as a result of constructing the long term options?	8	8
How will the projects' proposed improvements to bridges effect fish bearing streams? (culverts & bridges over water)	0	8

Evaluation of bottleneck improvement segment options

WSDOT quantitatively evaluated the bottleneck improvement segment options based on their overall effects to environmental resources based on cost, type of permitting required, actual affects to resources, and/or mitigation costs.

The following exhibit summarizes the results of the environmental screening of the bottleneck improvement segment options. When conducting this screening, the area of analysis may show effected resources that require field verification and may not be directly affected. For example, the

Stage 4 HOV/HOT Lanes and Stage 5 HOV/HOT Lanes appear to have significant wetland effects. However, on-going field investigations have shown that the effected wetland area is much lower than estimated from this GIS screening. The SR 410/512 Interchange Improvement Project has the most potential effects on fish, surface water quality, groundwater resources, and geologically hazardous areas.

The projects with the least potential effects on environmental resources include the 180th Street to 84th Street General Purpose Lanes, the SR 516 to 277th Street Auxiliary Lanes, and the 180th Street Interchange.

Exhibit 7-28

Bottleneck Segment Option Environmental Effects

Evaluation Criteria	180th St. IC	180th St to 84th St GP Lanes	SR 516 to 277th St. Aux Lanes	SR 18	Stage 4	Stage 5	SR 410/ SR 512 IC
Wetlands							
How many acres of wetlands will be affected by the project?	12	24	3.8	26	12	4.3	0
How many acres of wetlands buffers will be affected by the project?	23	37	14	19	29	18	2
Floodplains							
How many acres will the long term options effect in the 100 year floodplain?	0.3	2.9	0	0.8	3.1	13.1	12.3
How many acres will the long term options effect in the 500 year floodplain?	2.1	0	0	0	0	0	0.9
How many acres will the long term options effect in the floodway?	1.1	0	0	4.3	0.1	0.8	1.5
Fish Habitat							
How many fish species will be affected by proposed in-water work (culverts, bridges)?	0	0	0	0	3	0	0
How many fish species may potentially be affected by project stormwater or runoff in the area of analysis?	2	4	9	3	4	3	10
How many acres of non-forested riparian zone will be affected by the project?	52	74	8	77	237	259	66
Wildlife							
How many acres of wildlife habitat in the form of urban natural open space will be affected by the project?	0	0	0	5	17	9	10
How many acres of waterfowl habitat will be affected by the project?	0	0	0	0	26	117	44
Streams & Riparian Corridors							
How many acres of streams, creeks, or rivers might the long term options effect?	0.07	0.49	0.09	0.12	0.82	0.51	0.31
How many acres of forested riparian might the long term options effect?	0.3	2.1	0.6	0.8	0.9	46	1.5
How many acres of non-forested riparian areas might the long term options effect?	12	16	1.2	18	46	51	18
Air Quality							
How will the project effect air quality?	NA	NA	NA	NA	NA	NA	NA

Exhibit 7-28 (contd.)

Bottleneck Segment Option Environmental Effects

Evaluation Criteria	180th St. IC	180th St to 84th St GP Lanes	SR 516 to 277th St. Aux Lanes	SR 18	Stage 4	Stage 5	SR 410/ SR 512 IC
Noise Quality							
How will the project affect the long term exterior noise levels of sensitive receptors in the area of analysis?	Moderate	Moderate	Moderate	Moderate	High	High	High
How will the project effect construction noise levels for sensitive receptors in the area of analysis?	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate
Groundwater Resources							
How will the project effect wellhead protection areas? (acres)	0	30	0	1	37	37	39
How will the project affect Critical Aquifer Recharge Areas (CARA)? (acres)	0	0	0	0.1	26	49	154
How will the project affect sole source aquifers? (acres)	0	0	0	0	0	0	0
How much more impervious surface area will long term options contribute to the existing roadway?	6%	3%	1%	20%	14%	7%	21%
Geologically Hazardous Areas							
How will the project affect seismic hazard areas? (acres)	0	0	0	0	29	45	147
How will the project effect high liquefaction hazard areas? (acres)	0	0	0.6	0	0	10	125
How will the project effect steep slopes of greater than 40%? (acres)	1.7	3.6	0.1	0.1	5.6	2.7	21
Hazardous Materials							
How many hazardous waste sites are in the proposed project analysis area?	45	56	14	8	6	4	0
Cultural and Historic Resources							
How will the project effect archeological resources?	0	0	0	0	0	0	0
How will the project effect historic resources?	0	0	0	0	0	0	0
Land Use							
How will the project affect existing residential land use? (acres)	0	0	0	0	0	11.24	0
How will the project affect existing commercial land use? (acres)	1.96	0	0	0	3.39	5.69	0
How will the project affect existing industrial land use? (acres)	0	0.64	0	1.07	0.14	0	0

Exhibit 7-28 (contd.)

Bottleneck Segment Option Environmental Effects

Evaluation Criteria	180th St. IC	180th St to 84th St GP Lanes	SR 516 to 277th St. Aux Lanes	SR 18	Stage 4	Stage 5	SR 410/ SR 512 IC
Section 4(f)							
How will the project affect Section 4(f) park properties?	1.7	0.2	0.2	0	0	0	0
How will the project effect Section 4(f) trail properties?	0	67	527	0	0	0	0
Socio-economics and Environmental Justice							
How will the project effect low-income populations? (number of census tracts effected)	NA	NA	NA	NA	NA	NA	NA
How will the project effect minority populations? (number of census tracts effected)	NA	NA	NA	NA	NA	NA	NA
Other							
How many culverts will need modification or replacement as a result of constructing the long term options?	0	0	0	0	4	0	0
How will the projects' proposed improvements to bridges effect fish bearing streams? (culverts & bridges over water)	0	0	0	0	0	0	0

Measures of Effectiveness

To identify the improvements that provide the most benefit, the options are evaluated using screening criteria, also known as measures of effectiveness (MOEs). An MOE is used to gauge how well an improvement would perform for the overall system or facility. It is especially important to understand how well each potential improvement would meet the needs and goals of the corridor, as outlined by WSDOT.

WSDOT has six key objectives for the improvements proposed and explored in SR 167 Corridor Plan. They are:

1. Move more people
2. Reduce congestion and save time
3. Improve truck mobility and efficiency
4. Improve safety
5. Be cost effective
6. Be environmentally sensitive

Exhibit 7-29 summarizes the comparisons of the measures of effectiveness of the projects analyzed in this study.

Exhibit 7-29

SR 167 Corridor project measures of effectiveness 2030

Screening Criteria	Performance Indicators	Baseline	Option 2 (3+1)	Option 2A (2+2)	Option 4 (3+2)	Option 4A (3N/2S+2)
Objective: Move More People						
Renton						
Person Trips Total	PM Peak Period	44,500	44,800	44,600	50,700	50,100
GP Lanes	PM Peak Period	27,100	27,400	26,800	27,000	27,000
HOV +3	PM Peak Period	15,400	15,400	15,800	21,700	21,100
Transit	PM Peak Period	2,000	2,000	2,000	2,000	2,000
Auburn						
Person Trips Total	PM Peak Period	43,300	47,100	47,900	56,400	54,900
GP Lanes	PM Peak Period	24,900	29,800	24,000	29,300	28,800
HOV +3	PM Peak Period	17,500	16,400	23,000	26,200	25,100
Transit	PM Peak Period	900	900	900	900	1,000
Sumner						
Person Trips Total	PM Peak Period	34,300	41,000	41,000	47,000	41,500
GP Lanes	PM Peak Period	20,100	26,900	19,800	26,600	20,100
HOV +3	PM Peak Period	13,900	13,800	20,900	20,100	21,100
Transit	PM Peak Period	300	300	300	300	300
Objective: Save Time						
Travel Time	PM Peak Period	SB/NB	SB/NB	SB/NB	SB/NB	SB/NB
General Traffic	Full Corridor Travel Time	88 / 25 min.	73 / 24 min.	78 / 25 min.	76 / 23 min.	74 / 24 min.
HOV/Transit/ Managed Lanes	Full Corridor Travel Time	27 / 25 min.	27 / 24 min.	27 / 25 min.	27 / 23 min.	27 / 24 min.
Speed (GP)	Average Speed (mph)	14 / 48 mph	16 / 50 mph	15 / 48 mph	16 / 52 mph	16 / 50 mph
Speed (HOV/HOT)	Average Speed (mph)	44 / 48 mph	44 / 50 mph	44 / 48 mph	44 / 52 mph	44 / 50 mph
Objective: Reduce Congestion						
Local Arterial Traffic						
Renton	Arterial Traffic Volume (PM Peak)	4,200	4,100	4,100	4,200	4,300
Auburn	Arterial Traffic Volume (PM Peak)	4,300	4,000	4,300	4,200	4,200
Sumner	Arterial Traffic Volume (PM Peak)	3,800	2,900	3,300	3,100	3,300
Hours of Travel	Daily Person Hours	122,900	138,300	116,600	139,000	126,400
Hours of Congestion	Daily Person Hours	27,000	29,300	25,400	29,600	27150
Access Efficiency	Ease of Access		Improvement	Improvement	Improvement	Improvement
Freeway Operations Efficiency	Congestion		Improvement	Improvement	Improvement	Improvement

Exhibit 7-29 (contd.)

SR 167 Corridor project measures of effectiveness 2030

Screening Criteria	Performance Indicators	Baseline	Option 2 (3+1)	Option 2A (2+2)	Option 4 (3+2)	Option 4A (3N/2S+2)
Objective: Improve Truck Mobility/Efficiency						
Daily Hours of Travel	All Vehicle Hours	90,400	101,700	85,700	102,250	92,950
Large Trucks	Truck Hours	665	750	655	825	800
Medium Trucks	Truck Hours	1,310	1,560	1,320	1,635	1,500
Travel Time	PM Peak Period	SB/NB	SB/NB	SB/NB	SB/NB	SB/NB
Large Trucks	Point to Point Travel Time	88 / 25 min.	73 / 24 min.	78 / 25 min.	76 / 23 min.	74 / 24 min.
Medium Trucks	Point to Point Travel Time	88 / 25 min.	73 / 24 min.	78 / 25 min.	76 / 23 min.	74 / 24 min.
Objective: Improve Safety						
Collisions	Accidents at HALs/HACs		Reduced	Reduced	Reduced	Reduced
Truck Collisions	Truck Collisions		No Change	No Change	No Change	No Change
Total Collisions	Annual Total		May Increase	May Increase	May Increase	May Increase
Objective: Be Cost Effective						
Cost	Capitol Cost (in billions)	$2 to $2.4	$3.4 to $5.2	$3.4 to $5.2	$6 to $8	$6 to $8
Cost Effective	Annual Vehicle Hours of Delay Saved per $1 million in investment		12,400	3,300	5,600	4,700
Collision Cost Savings	Annual Collision Savings		No Savings	No Savings	No Savings	No Savings
Freight Cost	Annual Operating Costs		Increases	Increases	Increases	Increases
Objective: Be Environmentally Responsive						
Streams	Impact		2.6 acres	2.6 acres	2.8 acres	2.8 acres
Wetlands	Impact		131 acres	131 acres	141 acres	141 acres
Floodplains	Impact		47 acres	47 acres	50 acres	50 acres
CARA	Impact		237 acres	237 acres	245 acres	245 acres
Geohazards (Liquefaction Areas)	Impact		28 acres	28 acres	29 acres	29 acres
Air Quality	Impact		Improvement	Improvement	Improvement	Improvement
Noise	Impact		Moderate	Moderate	Moderate	Moderate
Support GMA and Urban Center	Support Regional Links		Support	Support	Support	Support

Conclusions

What will future travel be like on SR 167?

The SR 167 corridor is going to experience continued rapid growth in travel demand from regional increases in housing and employment. Travel demand across all of the screenlines will increase between now and 2030 whether or not any improvements are made, as shown in Table 7-30. This increased travel demand will cause peak periods to grow longer and congestion to increase with travel time growing from about 30 minutes to more than 90 minutes from Puyallup to Renton in the general purpose lanes if no improvements are made, as shown in Exhibit 7-30. This increase in congestion will cause travel to become less predictable and commuters will have to leave earlier and spend more time making trips in order to arrive at their destination on time. A single occupant vehicle traveling during both the morning and afternoon peak periods will experience nearly a two hour increase in daily travel time through the corridor in 2030 if no improvements are made.

With no improvements …

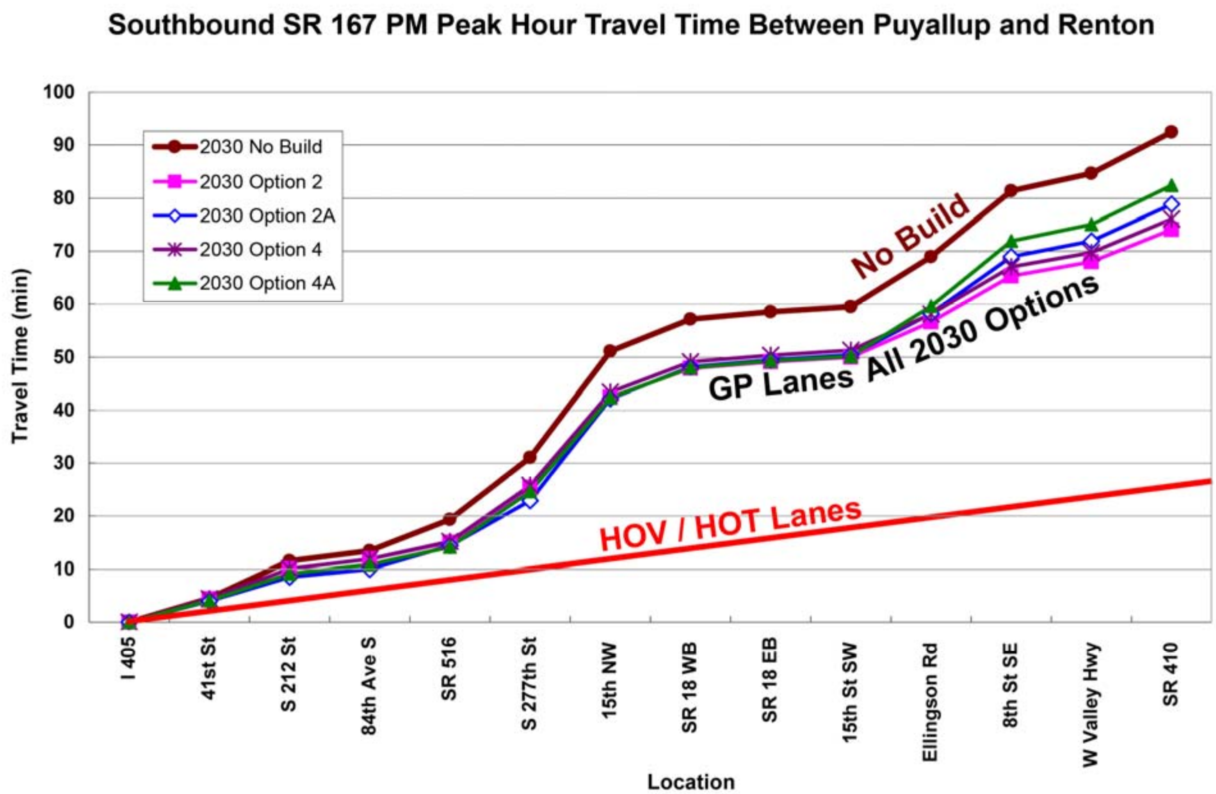
A single occupant vehicle traveling during both the morning and afternoon peak periods will experience nearly a two hour increase in daily travel time through the corridor in 2030 if no improvements are made.

Exhibit 7-30

Daily Person Trips Demand on SR 167

Sections	Existing Conditions	2030					
		No Build	Baseline	Option 2	Option 2a	Option 4	Option 4a
Northern Section (Renton)	145,000	209,500	225,900	232,300	225,200	231,700	230,100
Central Section (Auburn)	153,000	184,300	194,400	234,100	191,600	234,000	231,400
Southern Section (Puyallup)	117,000	139,500	147,200	188,000	145,500	188,900	147,300

Exhibit 7-31
SR 167 Peak Hour Travel Time (2030)



If SR 167 can be expanded to a ten lane facility the travel time for a single occupant vehicle in 2030 will improve by approximately 15 minutes when compared to the no-build option but that is still nearly 45 minutes longer than the same trip today, as shown in Exhibit 7-31. Congestion even with the maximum improvement will still cause the commute to be unreliable and subject to disruption caused by accidents or events that slow the flow.

It is clear that no matter what is done to improve capacity for SR 167 congestion is here to stay. Scenarios that provide alternative ways for commuting that allow users the option to bypass the general purpose travel lanes are needed. The conclusion of this corridor study is that the capacity needs to be expanded in the SR 167 corridor with the primary focus on providing methods for commuters to have alternatives other than travel in a single occupant vehicle.

What is the solution for transportation issues in the SR 167 Corridor?

It is clear that no matter what is done to improve capacity for SR 167 congestion is here to stay.

It is not likely that the funding capacity to build the full solutions in the SR 167 Corridor will be available in the foreseeable future. Therefore an implementation strategy is necessary to guide the investment of dollars as they become available. It is clear through the analysis in this report that growth will continue to outpace the ability to provide facilities for the future travel demands. The cost to make roadway improvements and expand capacity greatly exceeds the revenue stream currently available and the funding presently envisioned for the future. See Section 10 for a possible implementation strategy.

Infrastructure vs. Growth

In the next 20 years, even a 10-lane SR 167 Corridor would be overcome by demand. General purpose lane peak period travel times will double from approximately 37.5 minutes to 75 minutes, while the HOV/HOT lane travel time remains relatively constant.

Which long-term option is best?

Of the long term options considered, Option 4 the expansion to a 10-lane freeway facility with interchange improvements provides the best facility to respond to future travel demand and will carry the most peak hour traffic. This option would have substantial environmental impacts and an expensive construction budget. Option 2 – 8-lane with two HOV/Managed Lanes and one less general purpose lane would carry almost the same volume as Option 4, with less overall impacts and cost.

Exhibit 7-32

Time to Travel SB Along SR 167 Corridor by Segment (minutes)

Segment	Baseline		2020	
	GP Lane	HOT Lane	GP Lane	HOT Lane
North – Renton	30	13	29.5	13
Central – Auburn	18.5	7.5	15	7.5
South – Puyallup	20.5	13	20	11.5
Total Corridor	69	33.5	64.5	32

What needs to be done to help commuters?

Future improvements need to focus on expanding alternatives to single occupant vehicle use. Priorities need to focus on completing the high occupancy vehicle system and converting this system to managed lanes. While these options carry fewer vehicles and slightly fewer (-1%) people they greatly improve the travel time and reliability for users of the managed lanes.

Future travel in HOV/HOT Lanes

By 2030, fewer people will use the managed HOV/HOT lane because regional policy will change the number of occupants who can use the lanes from 2+ to 3+.

- Additional transit services need to be developed to allow commuters the opportunity to leave their vehicles behind by joining a carpool or riding transit buses in the managed lanes or riding the Sounder rail service.

- Additional direct access ramps need to be considered to provide rapid access to the managed lanes at key locations.
- Expanded park and ride facilities will need to be constructed at key locations in the corridor to allow users the opportunity to park and use transit facilities.
- Increases in transit services to better meet the demands for travel in this corridor need to be developed by transit agencies.
- Commute Trip Reduction (CTR) measures must be implemented to the maximum extent possible throughout this corridor.

SR 167 needs to be improved to meet the increased travel demands. The focus of improvements needs to be first on completing the high occupancy vehicle system and opening that system up to other users through a managed lane concept. With a managed lane other users can utilize the managed lane when capacity is available as long as that the additional use does not slow the flow. The key to a managed lanes success is the predictability of travel time for users.

What design considerations need to be followed during implementation of improvements?

The valley that SR 167 traverses is composed of saturated soil deposits from historic volcanic activity. These deposits create an increased risk that soils may liquefy during an earthquake event. Any structural improvements made to increase capacity must take into account this risk of liquefaction and examine existing structures and facilities for the need to retrofit them to reduce the risk of failure during an earthquake.

Bridges and structures that need to be expanded or widened for interim improvements need to be constructed wide enough to handle two additional lanes. This will allow the additional lane increase to expand to ten lanes without the need to rebuild them a second time. Generally a 75-foot clear width will allow a structure to carry a five lane facility in the future with a minimum deviation from standards.

When making improvements to expand the freeway to four lanes in each direction the roadway should be constructed to provide a 75-foot shoulder to shoulder width. Full depth pavement should be constructed to allow the full utilization of the entire section as necessary to carry traffic either during construction detours or ultimately for an expanded five lane facility.

Freight movement is a larger than normal portion of the travel demand in this corridor and special consideration needs to be given to truck issues. During detailed design for future improvements special attention needs to be placed on design considerations that affect freight movement. Roadway curves and grades need to be designed to assist trucks in maintaining highway speeds to limit the disruption they cause.

What is the priority of bottleneck segment improvement options, interchange options, and long-term options?

Based on the analysis and coordination with the local jurisdictions, this section provides a prioritization of projects that will provide additional capacity to the SR 167 Corridor as funds become available.

1. *Construct SR 167/ I-405 Interchange Direct Connection Ramps*

This I-405 Corridor bottleneck project will provide direct managed lane access between SR 167 and the northbound section of I-405. This will correct a critical area of congestion as traffic flows northbound onto I-405.

How does this improvement affect travel time and congestion?

Currently, the SR 167 northbound HOV lane ends and all HOV traffic heading onto I-405 north must merge right and exit SR 167 on the northbound I-405 ramp to continue their trip. When entering I-405, HOV traffic must merge across two lanes of general purpose traffic to once again use the managed lane.

Southbound traffic on I-405 currently must exit the HOV lane, merge right across two lanes of general purpose traffic, and exit to the right on a loop ramp then move left across SR 167 general purpose traffic to enter the managed lane.

This bottleneck improvement project includes construction of a direct access fly-over bridge to allow HOV travelers to flow freely between I-405 and SR 167 without having to mix with other traffic.

What is the cost benefit of this project?

SR 167 did not model or study this segment of the corridor, as it is an I-405 Corridor Project, but in a separate analysis “SMIP Technical Memorandum, January 18, 2007,” this improvement was considered. The annual person hours saved by this improvement is estimated at 1.3 million. This equates to a cost of $292 per person hour saved in the first year of operation for the new connection between I-405 and SR 167.

2. HOV/HOT King County Northbound Completion

This bottleneck will extend the northbound HOV/HOT lane to just south of the Pierce County line near the 8th Street East interchange.

How does this extension of the HOV system help commuters?

WSDOT estimates that the extension of this managed lane will provide additional capacity, and will improve travel time. The model results from the southbound afternoon peak hour and inferences to the morning peak hour commute predict that this bottleneck improvement will save approximately 230,000 hours of person travel time during its first year of operation.

What is the cost benefit of this project?

The cost of this project is estimated at $137 million, which equates to a cost of approximately $596 for each annual person hour of commute time saved in the first year of operation.

WSDOT ranks this improvement as the number two priority for the Corridor Plan because of the critical need for HOV/HOT lane continuity. This project is part of a series of projects that will accomplish the goal of having a continuous HOV/HOT lane from SR 512 to I-405.

3. Kent Auxiliary Lanes between 15th NW and SR 516

This bottleneck segment options would add one auxiliary lane in each direction between the 15th Street NW interchange and the SR 516 interchange. The southbound auxiliary lane would connect to a planned auxiliary lane that will continue on to exit at SR 18. This bottleneck can be constructed as single project or can be broken up into pieces depending upon the availability of funds.

If funding requires only a portion of this project to be constructed at a time, WSDOT recommends that the southbound portion be constructed first.

How will these auxiliary lanes impact SR 167 travel?

The addition of these auxiliary lanes will address the SR 167 Corridor's third-highest area for collisions. The auxiliary lanes will help to reduce the number of collisions that occur due to merging and weaving activity on this portion of SR 167. Ultimately, this additional lane will allow another lane to be converted to a second managed lane when the corridor moves to a 2 GP lane and 2 HOV/HOT lane configuration. The construction of this improvement does not lead to significantly more vehicles being able to use this stretch of SR 167, but it would reduce travel time. WSDOT predicts that the daily person hours of travel would be reduced by as many as 7,000 hours. However, due to congestion in other areas, this advantage is reduced to zero pending funding and construction of other improvements.

If there is no reduction in commute hours traveled, why build this segment?

The most important factor is reduction in collisions. While this improvement does not afford significant travel time savings initially, when combined with other bottleneck improvements it does provide significant travel time savings in the future.

Historically, almost 67 collisions per year have been occurring on SR 167 between 277th and SR 516. It is hard to predict how many of these collisions might be prevented with the addition of the auxiliary lanes to assist with safer lane changes.

However, it is assumed that this bottleneck will improve safety because almost three quarters of the collisions are either sideswipe or rear-end collisions. The goal of this bottleneck is for a decrease, or to match the corridor-wide collision average, which is approximately 22 collisions per year.

Once congestion is reduced in other areas, this project can reduce annual person hours of travel significantly. So, while other expenditures are required to realize the benefit, this project is a priority to reduce accidents and to prepare the SR 167 corridor to handle future travel.

What is the cost benefit of this project?

This project is estimated to cost $272 million at the time of construction. The cost of this improvement would be approximately $149 per annual hour saved in 2030.

4. Construct I-405 to SR 516 Additional Managed Lanes

SR 167 north of 180th will have been constructed in a 3GP lane and 1 HOV/HOT lane configuration by I-405 projects prior to this time. This project will extend the 8-lane section from the 84th Street interchange to 180th. Once this improvement is constructed, the entire segment should be configured as 2 GP lanes and 2 managed lanes in each direction from SR 516 to I-405. Previously, an improvement through this section was assumed as the addition of GP lanes. However, recent traffic modeling and analysis has shown that adding GP lanes provides no benefit, while adding managed lane capacity allows improved use of the direct-access HOV lanes at the junction of I-405 and SR 167. If funding is not available to construct this entire project, the southbound lanes should be built first.

How will this expansion of capacity improve the operation of SR 167?

As a stand-alone project, the addition of GP lanes through this section does not reduce congestion or improve travel times. When the addition of these lanes was tested in conjunction with the addition of direct-access HOV connection with I–405, the traffic modeling indicated that this still did not provide any reduction in travel time.

The 2010 traffic model predicates that 1,300 plus vehicles are traveling in the single HOV/HOT lane. This will leave very few slots available for additional HOV/HOT vehicles to enter the single HOV/HOT lane without degrading the level of service and creating congestion. However, adding a second managed lane, rather than an additional GP lane, provides capacity for single-occupant vehicles to buy their way into the managed lane to reduce their travel time.

By converting the additional lane to a HOV/HOT lane from a GP lane, this segment will improve travel time by approximately 1 minute for general purpose traffic. The managed lane has approximately a 2-minute advantage over the GP lane through this northern portion of the corridor from SR 516 to I-405. By 2030, the advantage for managed-lane users grows to approximately 7 minutes through this section.

What is the cost benefit of this project?

The cost of this improvement is approximately $328 million, which equates to a cost of approximately $311 per person hour saved in the first year of operation.

5. Construct SR 167 and SR 18 Interchange Improvements

This bottleneck will construct the missing ramps at the SR 18 interchange, which will allow all movements to be made between SR 18 and SR 167. High-volume, direct-access ramps will be constructed from eastbound SR 18 to northbound SR 167, and from westbound SR 18 to southbound SR 167. In order to improve merges and prepare to handle growing traffic volumes, the interchange at 15th Street Southwest will also be reconstructed as a single point urban interchange. This project improvement will remove the existing ramps connecting to the West Valley Highway. Traffic will need to exit at the 15th Street interchange to access the West Valley Highway.

These improvements will allow all vehicles enhanced access. In particular, the heavy truck volumes will be able to more efficiently and safely move through this interchange. The longer merge ramps will allow trucks a greater opportunity to build up speed before merging into traffic.

What is the cost benefit of this project?

The SR 18 and 15th Street SW interchanges are anticipated to cost between $480 and $740 million to construct.

6. Pierce County HOV/HOT Lane Completion

This bottleneck project will complete the managed lane system between SR 512 in the south to I-405 in the north by adding a lane each direction to the existing 2-lane highway. This additional lane will be added north and southbound between SR 512 and 8th Street. When this project is complete, the full length of SR 167 will have 2 GP lanes and 1 HOV/HOT managed lane in each direction.

How will completion of the HOV system improve travel in the corridor?

Even, with the continued growth of traffic projected over the next 20 years, the users of this bottleneck improvement will save time in their daily commute, as shown on the following exhibit.

HOV/HOT lane commuters traveling the full length of the corridor, between SR 512 and I-405, will save over 32 minutes of travel time when compared to general purpose traffic during the peak period.

What is the cost benefit of this project?

This project is estimated to cost $305 million at the time of construction, which equates to a cost of approximately $500 per annual person hour of commute time saved during the first year of operation. By 2030, as traffic continues to grow, this improvement will lead to approximately $80 per annual person hour saved by users of the managed lane system. A complete system of HOV/HOT lanes will give users a reliable, predictable way to travel, and will save managed lane users significant travel time.

7. Construct SR 410/512 Interchange Improvement

SR 167 has a complex set of ramps and connections at the junction of SR 410 and SR 512, two major freeways with interchanges very close together. This project would modify those interchanges and ramps to provide more opportunity for merging, and to improve the way in which drivers are led to their destination. The proposed solution would also provide direct HOV/HOT lane access to and from SR 410 to help better serve the rapid growth occurring in this southern end of the corridor.

What is the cost benefit of this project?

The improvements to these two interchanges will cost in the range of $260 to $400 million.

8. Construct Eight (8) Lanes SR 512 to I-405 in 2 GP + 2 HOV/HOT Configuration

One of the proposed long-term options is to eventually have 8 lanes of traffic throughout the SR 167 corridor, comprised of 2 GP lanes and 2 HOV/HOT lanes in each direction. After completing the first 10 projects listed above, an additional lane would still be necessary beginning at 15th Street NW and progressing south to SR 512. The goal of the project will be to build a 75-foot-wide, 8-lane configuration. In some areas, especially where bridges will not be replaced due to funding constraints, a deviation will be requested for a narrower roadway.

What is the cost benefit of this project?

This project is estimated to cost $1.4 billion.

9. Construct Ten (10) Lanes SR 512 to I-405 in 3 GP + 2 HOV/HOT Configuration

The ultimate proposed long-term option is to eventually have ten lanes of traffic throughout the SR 167 corridor, comprised of 3GP lanes and 2 HOV/HOT lanes in each direction. After completing the first 11 projects listed above, an additional lane would still be necessary throughout the corridor. The goal of the project will be to build the additional lane within the existing 75-foot-wide lane configuration. In places where the highway is not 75 feet wide, bridges may need to be widened in order for the roadway to be widened.

Then, the highway can be restriped into the 3 GP lanes and 2 HOV/HOT lanes as appropriate sections are available to allow this deviated section.

What is the cost benefit of this project?

This project is estimated to cost $2 billion.

The range of costs to complete the construction to provide an eight lane facility in a two general purpose plus two managed lanes is shown in Exhibit 7-33.

Exhibit 7-33
Estimated cost of bottleneck segment options

Bottleneck Project	Estimated cost (2006 $ in millions)
15th St. SW to 15th St. NW	$276-$421
Ellingson Rd. to 15th St. SW	$225-$316
8th St. E to Ellingson Rd.	$296-$409
24th St. E to 8th St. E	$168-$235
SR 410 to 24th St. E	$442-$685
TOTAL	$1,408-$2,069

12. Construct Ten (10) Lanes SR 512 to I-405 in 3 GP + 2 HOV/HOT Configuration

Beginning in the north and progressing south replace or widen bridges and structures as funding becomes available to a 75-foot width. Restripe the roadway into the three general purpose lane (3 GP) plus two managed lane (2 HOV/HOT) configuration as appropriate sections are available to allow this deviated section.

An initial estimate of cost to expand the SR 167 freeway from eight lanes to ten lanes ranges from $1.5 to 2.2 billion. Given how far in the future this work will likely occur further estimates will need to be prepared when the timing is appropriate.

SUMMARY

The SR 167 corridor has experienced rapid growth for many years and that growth is expected to continue for the next twenty years. This corridor study has looked in detail at the existing problems in the valley served by the facility. Extensive discussions have been held with stakeholders through the CWG made up of representatives of the local governments and citizen outreach efforts. The future travel demand has been computer modeled to forecast travel needs in 2010, 2020 and 2030 to assist in defining potential solutions that will correct existing problems and aid as the area continues to grow.

This effort has led to the series of recommended improvement projects for SR 167 that will need to be implemented along with an aggressive effort to expand transit, carpool and commute trip reduction services.

The cost to construct the needed roadway improvements far exceeds the known sources of funding that might be used. Clearly a mix of highway improvements along with enhancing transit, increasing ride sharing and focusing on trip reduction efforts needs to be pursued. Conversion of the traditional high occupancy vehicle lane system to managed lane system will assist in moving commuters out of the traditional single occupant vehicles and provide an opportunity for single occupant vehicles that need to have a greater certainty of travel time to pay for this service.

The overall recommended set of SR 167 projects, their probable cost and the cost per annual commute hour saved in the first year of operation is summarized in Exhibit 7-34.

Exhibit 7-34

Overall Project Recommendations and Estimated Cost

Proposed Improvement	Cost 60% Probability (2006 Millions of dollars)	Cost per Annual Commute Hour Saved	Daily Cost per Added Person Served
Stage 4 - Southbound HOV Lane 277th to 8th Street	$80	$100	$260,000
SR 167 and I-405 Direct Connection of HOV Lanes	$320	$292	
Stage 5 -Northbound HOV Lane 8th Street to 15th St SW	$137	$649	$440,000
Stage 5 - North and Southbound HOV Pierce Co. SR 512 to 8th Street	$305	$500	$305,000
Kent Auxiliary Lanes North and Southbound 15th Street NW to SR 516	$272	$149	$880,000
180th to 84th Add North and Southbound Managed Lane	$328	$311	$1,060,000
SR 516 to 84th Add North and Southbound Managed Lane	$215	Future Analysis	Future Analysis
180th Street Interchange Improvement	$310	Future Analysis	Future Analysis
SR 18 Interchange Improvement	$480	Future Analysis	Future Analysis
SR 410/152 Interchange Improvement	$260	Future Analysis	Future Analysis
Expand to 8 Lanes Between SR 512 and SR 18	$1,400	Future Analysis	Future Analysis
Expand entire corridor to 10 lanes	$1,500	Future Analysis	Future Analysis
TOTAL	**$5,607**	Future Analysis	Future Analysis

NOTE: Blanks indicate that no modeling information is available