

SR 531/43rd to 67th Corridor Pre-Design Analysis

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Washington State Department of Transportation Northwest Region

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Executive Summary



Developing a plan to improve safety and relieve congestion

State Route 531, also known as 172nd Street NE, is an important corridor connecting developing urban areas in Snohomish County. SR 531 is a key link between I-5 and SR 9 and serves the growing communities surrounding Arlington and Marysville, as well as the Arlington Airport.

Together with the city of Arlington, we have identified current and future safety and mobility needs on SR 531 between 43rd Avenue NE and 67th Avenue NE. The purpose of this analysis was to update previous work by WSDOT and city of Arlington and provide a reliable preliminary cost estimate and footprint that accounts for likely risks to budget and project delivery. Although there is no funding currently available to implement recommended improvements, the corridor pre-design is a necessary first step toward making future improvements in the corridor and will guide decision-makers as they seek funding for projects.



Growth contributes to congestion, delays

This area is planned as a regionally-significant commercial and industrial center. New residential growth is occurring to the east and north of SR 531. Growth forecasts indicate that by the year 2025:

- Arlington's urban growth area will see a 90 percent increase in employment
- Arlington's population will increase by 75 percent
- Marysville's urban growth area will see a 71 percent increase in employment
- Marysville's population will increase by 64 percent

Traffic on the SR 531 corridor is affected by this growth, especially during peak commute hours. In the future, motorists, freight carriers and businesses that rely on SR 531 will experience significantly longer travel times, delays and increased congestion at intersections and at access points for businesses, schools and the airport. Forecasted peak hour traffic conditions for SR 531 from 43rd to 67th indicate that a vehicle trip that takes three to four minutes today will take eight minutes by 2015 and 14 minutes by 2035 if travel patterns continue and the SR 531 corridor is not improved.

Rising congestion leads to more frequent collisions

From 2003 to 2007, there were 186 collisions on this stretch of SR 531. 87 percent of those collisions occurred at intersections and access points. Congestion was a contributing factor in many of the collisions. Not only has the frequency of collisions increased over the past five years, but collisions occurred more frequently during afternoon peak traffic hours than during other hours of the day.

SR 531 Corridor Recommendations

What is a corridor pre-design analysis?



The corridor pre-design analysis recommends future improvements that will be refined as traffic conditions change and funding for more detailed engineering becomes available.

Corridor pre-design analysis combines engineering and public input to assess existing and future safety and mobility needs and examine improvement options. It results in recommendations for future improvements and suggests an implementation strategy, but does not guarantee funding.

WSDOT and the city of Arlington began the corridor pre-design analysis of SR 531 between 43rd Avenue NE and 67th Avenue NE in fall 2008. Arlington's comprehensive plan calls for development of a preliminary design for SR 531 to position the city to implement improvements through partnerships with developers.

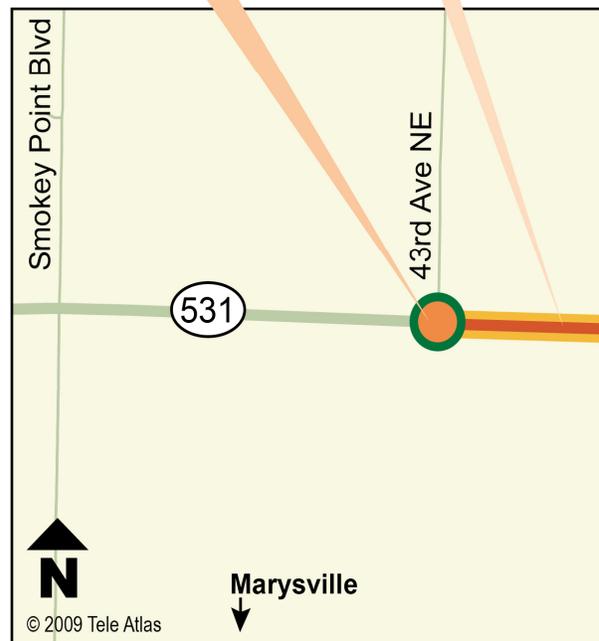
We studied the collision history of SR 531 and reviewed current and forecasted traffic volumes. We spoke with stakeholders along the highway to share information and gather feedback about the highway. Through this process we identified current and future safety and mobility problems on SR 531, and developed a list of recommendations for the corridor. Our pre-design analysis included preliminary engineering to develop initial estimates for construction costs and right-of-way needs.

Working with corridor stakeholders, we will review and revise the recommendations in the future as traffic conditions change and funding for more detailed engineering becomes available.

Recommended future improvements

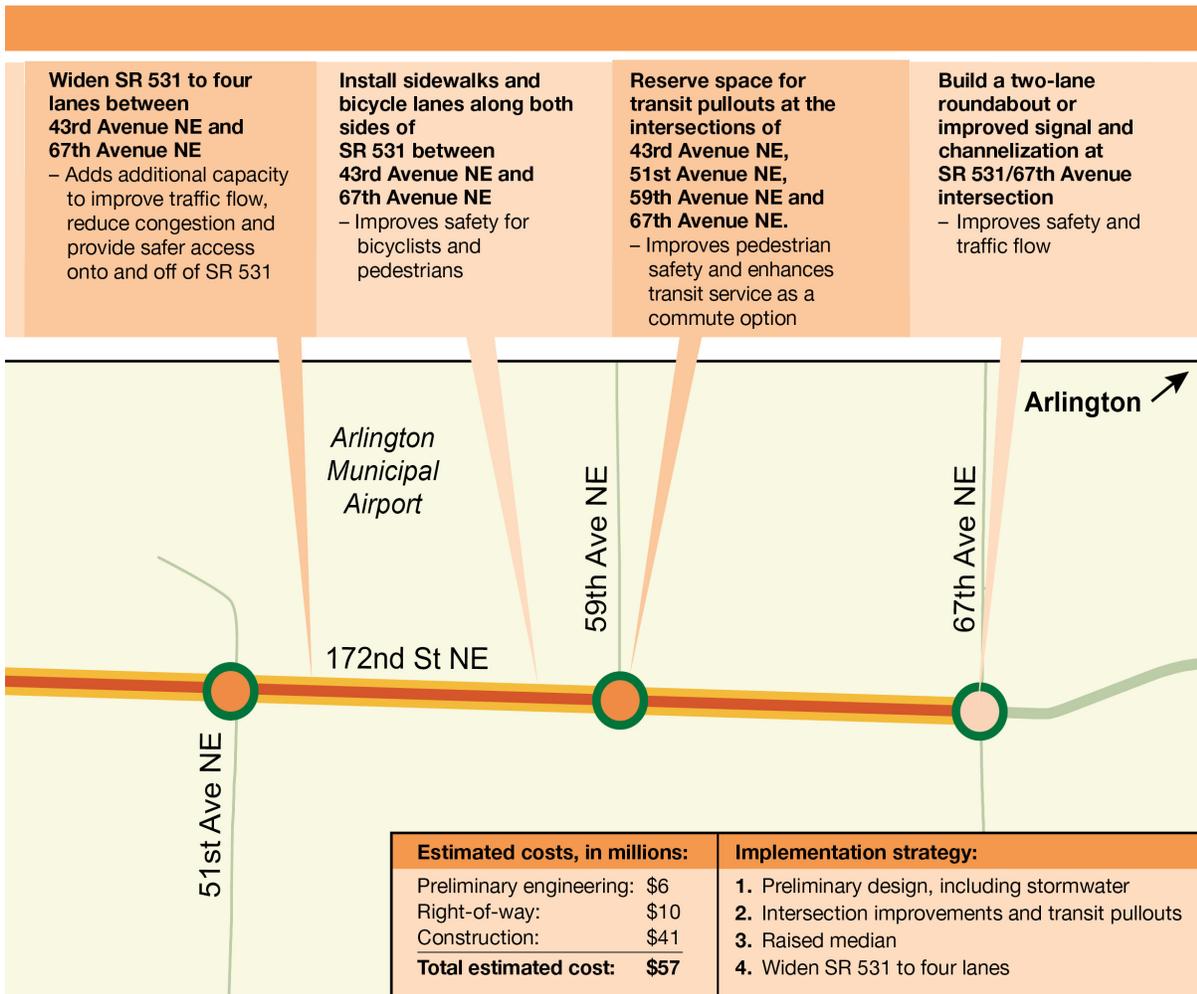
Build two-lane roundabouts at SR 531 intersections at 43rd Avenue NE, 51st Avenue NE, and 59th Avenue NE
– Improves safety and traffic flow

Add a raised median to separate oncoming traffic and manage turning movements.
– Reduces the risk of serious collisions involving drivers turning onto and off of SR 531



Benefits of Roundabouts – When compared to traditional intersections, national statistics have shown that roundabouts typically achieve:

- 37 percent reduction in overall collisions
- 75 percent reduction in injury collisions
- 90 percent reduction in fatality collisions
- 40 percent reduction in pedestrian collisions
- 89 percent average reduction in vehicle delays
- 56 percent average reduction in vehicle stops
- Reduced fuel consumption
- Reduced vehicle emissions at intersections



Trucks and roundabouts

Modern roundabouts are designed to accommodate large commercial trucks with long wheelbases and equipment. A combination of features including roundabout diameter, lane and shoulder width, drivable shoulder aprons, striping and signage are all design elements tailored to provide a safe and efficient intersection for trucks, and for the other vehicles, pedestrians and bicyclists they share the roadway with.

Pedestrians, cyclists and roundabouts

Roundabouts provide a safer route through an intersection for pedestrians. Driver speeds are lower and pedestrians need only cross one direction of traffic at a time. A bicyclist can travel through the roundabout as a pedestrian or ride in the circular roadway with vehicles.

Roundabouts reduce congestion and the risk of serious collisions. For more information go to www.wsdot.wa.gov/projects/roundabouts.



WSDOT worked with freight interests to design roundabouts for SR 539, a busy freight route in Whatcom County.

SR 531 Corridor Recommendations

WSDOT and the city of Arlington partnered in this analysis and development of the recommended improvements. Both agencies will have a role in any future improvement of the highway.

- **City:** The city will take the lead in pursuing locally-funded improvements and securing contributions through developer mitigation.
- **State:** Washington's highway needs far exceed the funds available to address them, so the state prioritizes projects based on the legislature's policy goals of preservation, safety, mobility, environment and stewardship. In managing congestion, the aim is to first maintain, preserve and improve the operating efficiency of the existing highway system before adding capacity.

What's next?

We currently do not have funding for additional improvements on SR 531 between 43rd Avenue NE and 67th Avenue NE. However, this plan will help decision-makers prioritize future projects as funding becomes available. It may be possible to fund some improvements in conjunction with new development along the corridor.

For example, the intersection and signal at 43rd Avenue was recently improved as part of the Whidbey Island Bank development. As planned retail development occurs in the future, the existing four-lane section of SR 531 will be extended east to the intersection at 43rd Avenue.

Recent and current WSDOT projects on SR 531:	
I-5 - Smokey Point: 172nd Street NE (SR 531) Interchange Modifications and SR 531 Safety Improvements	Complete June 2006
SR 531 Lakewood Schools Sidewalks	Complete August 2007
I-5 - 172nd Street NE (SR 531 Smokey Point) Interchange Improvements	Complete late 2010
Upcoming WSDOT projects:	
SR 9/SR 531-172nd St NE Intersection Improvements	construction begins summer 2011



Learn more

Visit the project Web site for more information:
www.wsdot.wa.gov/projects/sr531/corridoranalysis

Stay informed with WSDOT e-mail updates:
www.wsdot.wa.gov/emailupdates

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Chapter 1: Introduction

Drivers on the section of SR 531 between 43rd Ave NE and 67th Ave NE experience congestion and operational problems due to large traffic volumes. Future growth forecasted for the surrounding area will add more vehicles to the roadway, exacerbating the current congestion. Forecasted peak hour traffic conditions for SR 531 from 43rd to 67th indicate that a vehicle trip that takes three to four minutes today will take eight minutes by 2015 and 14 minutes by 2035 if travel patterns continue and the SR 531 corridor is not improved.

What are the consequences of these changes? Motorists, freight carriers and businesses that rely on the highway will experience significantly longer travel times, delays and increased congestion at intersections and at access points for businesses, schools and the airport.

SR 531 is a state highway that also serves as a key city arterial. Both WSDOT and the city of Arlington have a stake in the future of the corridor, which is why the agencies partnered in the development of this corridor plan.

We evaluated a wide range of potential improvements to enhance safety and relieve congestion. Although there is no funding currently available for improvements, the corridor pre-design analysis will provide a blueprint for decision-makers as they determine funding for future projects.

The corridor pre-design analysis was a year-long process that began in Fall 2008. The project team completed the work in five steps as shown below.

Identify corridor needs, opportunities and risks

Test the improvement options

Recommend improvements

Develop preliminary footprint and cost estimates

Set an implementation strategy



What is a corridor pre-design?

Corridor pre-design analysis combines engineering and public input to assess existing and future safety and mobility needs and examine improvement options. It results in recommendations for future improvements and suggests an implementation strategy, but does not guarantee funding.

The purpose of the corridor pre-design is to:

- Refine the details of the capacity expansion strategy for SR 531 that is carried in local comprehensive plans and the regional transportation plan managed by the region's Metropolitan Planning Organization (MPO), the Puget Sound Regional Council.
- Examine data and solicit community involvement to assess existing safety and mobility problems
- Forecast future travel demand to determine impacts of future development on safety and mobility in the corridor
- Identify existing and future corridor improvement needs and opportunities
- Evaluate alternative intersection improvements within project limits
- Utilize WSDOT's *Moving Washington* approach to develop a range of improvement options to address high-priority corridor needs: Operate Efficiently, Manage Demand, and Add Capacity Strategically;
- Position WSDOT to take advantage of project partnerships with local agencies and private developers;
- Develop reliable preliminary estimate of right-of-way needs and cost;
- Anticipate risks and opportunities likely to affect project implementation and cost; and

- Build support for planned improvements among local partners and stakeholders.

What the corridor plan is:

- Creates a project record that documents technical analysis and stakeholder outreach conducted during the planning effort.
- Identifies recommended improvements.
- Suggests an implementation strategy.

What the corridor plan is not:

- It does not guarantee funding for improvements.
- It does not prioritize projects against other WSDOT needs.
- It does not prevent the city of Arlington from advocating for a particular improvement.

Partnerships

WSDOT and the city of Arlington worked closely together on development of the plan. City staff advised WSDOT throughout the project by reviewing technical work and endorsing interim reports. We also worked with community members, particularly at the beginning of the project, to understand their concerns and learn from their experience with the highway.

The perspectives of WSDOT, the city and members of the public are represented in this report.

WSDOT perspective

The legislature set five goals (outlined in RCW 47.04.280) that guide transportation planning and investments:

- ***Preservation*** – To maintain, preserve, and extend the life and utility of prior investments in transportation systems and services
- ***Safety*** – To provide for and improve the safety and security of transportation customers and the transportation system

- **Mobility** – To improve the predictable movement of goods and people throughout Washington State
- **Environment** – To enhance Washington citizens’ quality of life through transportation investments that promote energy conservation, enhance healthy communities, and protect the environment
- **Stewardship** – To continuously improve the quality, effectiveness, and efficiency of the transportation system

City of Arlington perspective

The city’s comprehensive plan highlights the importance of the Smokey Point/SR 531 corridor as a primary city entryway. The plan calls for a corridor analysis that would address allowed uses, design, and the streetscape. The plan also notes that while funds are not likely to be available in the near future, a preliminary design for SR 531 should be produced to position the city to implement the improvements through partnerships with developers.

The *Arterial Circulation Study for the Southeast Arlington Urban Growth Area and Vicinity*, published November 5, 2009 as a joint effort between Snohomish County and Arlington, identifies future improvement needs for SR 531/172nd.

As owner and operator of Arlington Municipal Airport, the city’s plans also point to the importance of that facility for transportation and economic development. Ongoing coordination efforts between WSDOT, the city and the Federal Aviation Administration have focused on the importance of preserving airport property and airspace for aviation activities.

Stakeholder perspectives

We contacted representatives from local companies, public agencies and community groups with an interest in the corridor and/or a history of participation in previous corridor planning efforts so they could share their knowledge and concerns about the corridor. Project team members used their feedback to inform our data analysis and help identify risks for future design and implementation.

What we heard from stakeholders:

- Access points along the highway are a concern – they back-up traffic and drivers often make unsafe left turns.
- Development of local street network connections to relieve traffic on the highway would be very helpful.
- Existing 50mph posted speed seems too high for conditions and also seems inconsistent with 35mph elsewhere in the corridor.

Regional planning perspective

SR 531 has been recognized by several organizations as a high priority corridor. In 2002, legislation passed that gave the three-county area (Snohomish, King and Pierce) the authority to develop a road improvement ballot measure. This measure identified the most critical needs in the Central Puget Sound area and included the SR 531 improvement project. Although the measure failed in 2007, the process identified highway projects that are the highest priority for the three-county area through an extensive public process. As there are a lot of needs in the Central Puget Sound region, it is significant that SR 531 was identified as one of the region's most critical needs.

SR 531 is included as a project priority in the Smokey Point Master Plan, Snohomish County Comprehensive Plan, and the Puget Sound Regional Council (PSRC) regional transportation plan. PSRC works with local government, business, and citizens to build a common vision for the region's future. The SR 531 project is included in two of PSRC's planning documents, VISION 2040 and Destination 2030, as a preferred alternative. SR 531 is also the focus for other large projects including interchange improvements at I-5, becoming part of a Bus Rapid Transit (BRT) corridor.

The pre-design analysis will be used to refine the details of the capacity expansion strategy that is carried in the regional transportation plan managed by the Puget Sound Regional Council.

What you'll find in this report

This report provides a summary of the results of our corridor pre-design analysis. It highlights our key findings with

relevant data. More detailed analysis is provided in the appendix (available online and by request).

SR 531 corridor profile

Background information about the highway

Corridor needs

Identifies safety and mobility needs, as well as improvement opportunities and potential risks for project delivery

Testing the options

Describes the numerous improvements considered and highlights the results of the technical analysis

Recommendations

Highlights improvements that are recommended for further development

Corridor pre-design

Provides a preliminary footprint and cost estimate for recommended improvements

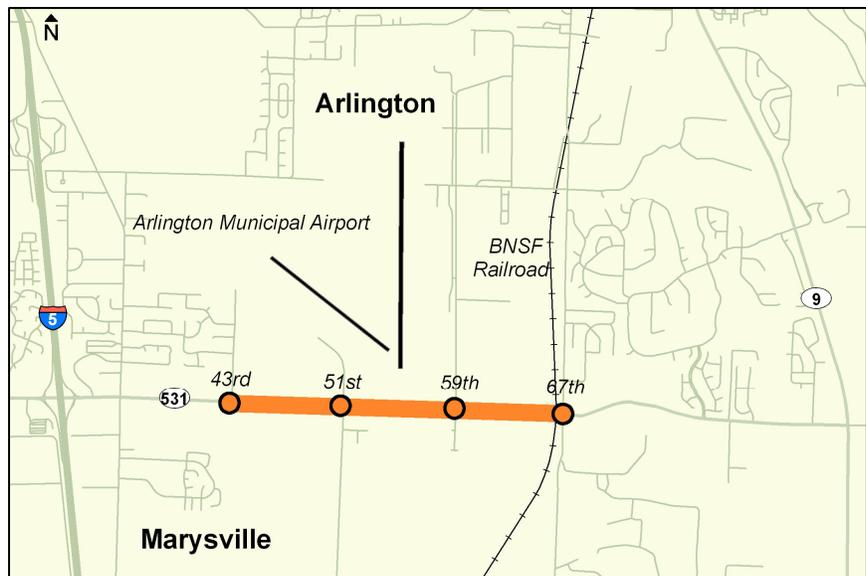
Implementation strategy

Suggests a sequence of interim steps that may be pursued as part of a strategy for full build-out.

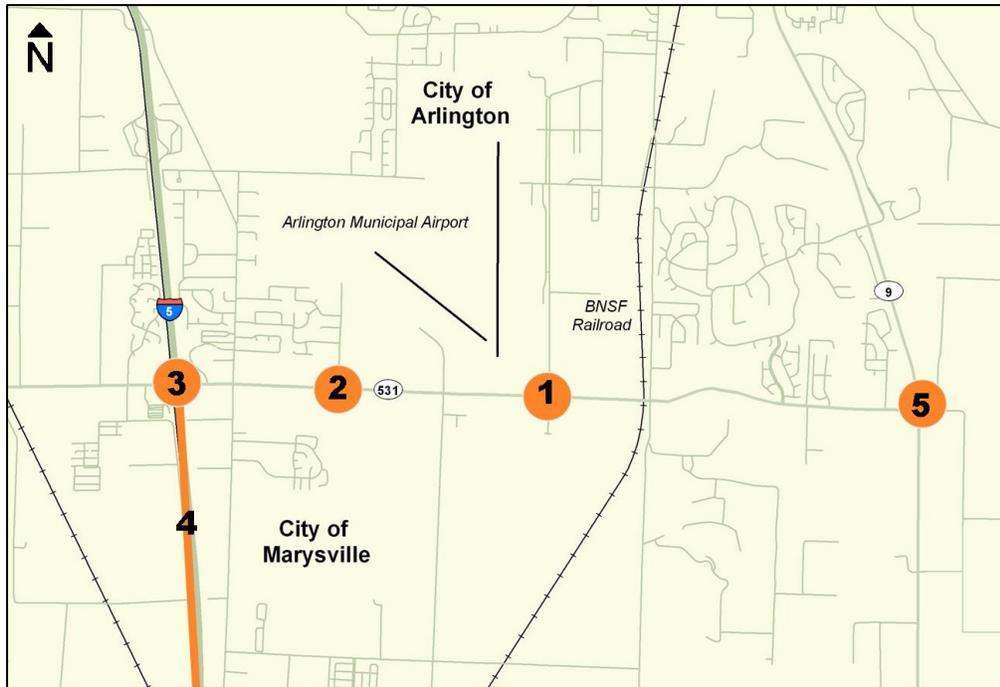
Chapter 2: SR 531 Corridor Profile

State Route 531, also known as 172nd Street NE, is an important corridor connecting developing urban areas in Snohomish County. SR 531 is a key link between I-5 and SR 9 and serves the growing communities surrounding Arlington and Marysville, as well as the Arlington Municipal Airport.

The SR 531 corridor analysis area is 1.7 miles in length and includes four intersections and numerous driveways and access points. It is a two-lane highway with varying shoulder widths.



Recent and current projects on SR 531



1. In 2004 developer-funded improvements completed roadway widening, channelization, access, stormwater detention, and signal modifications to complete the south leg of the signalized intersection at 59th Ave. and provide a westbound left turn lane from 59th Ave. to SR 531 as part of Crown Distributing's development.
2. In 2008, an agreement between WSDOT, the city of Arlington and local developers provided developer mitigation funding for roadway improvements at 43rd Avenue. These included frontage improvements, channelization, and a new traffic signal that provides enhanced commercial access to SR 531 and a south leg to this intersection. This development was initiated to accommodate a proposed Whidbey Island Bank and future Wal-Mart.
3. Construction is underway on improving access to and from I-5 at SR 531 (172nd Street NE) by improving the interchange. It is expected that construction will be complete in late 2010.

The improvements will:

- Realign the ramps to and from I-5 to fit the wider, longer bridge.
- Add a loop ramp from westbound SR 531 to southbound I-5. The ramp will have a HOV bypass lane and a metered general purpose lane.
- Widen both the northbound and southbound I-5 on- and off-ramps.
- Add right-turn lanes and traffic signals.
- Widen the existing eastbound SR 531 to southbound I-5 on-ramp to include an HOV bypass lane and a metered general purpose lane.
- Widen the existing northbound I-5 off-ramp to two lanes.
- Upgrade lighting, striping, signing, guardrail and fencing.

We will also construct a new park and pool lot off of SR 531 at 27th Avenue, with over 60 parking spaces. The old lot will be demolished to make way for the new improvements.

4. A project titled, “SR 531 to Marine Drive,” set for construction in 2009, will install technology improvements, or *Intelligent Transportation Systems* (ITS) on I-5. Improvements include: closed-circuit television cameras, data stations, ramp meters, variable message signs, highway advisory radio, and ITS infrastructure, including mainline fiber optic cable. These tools aid in traffic management to provide more efficient operation of the interstate highway.
5. East of the SR 531 corridor analysis area, there is a series of funded corridor improvements on SR 9 to help relieve congestion, improve traffic flow, and enhance safety. These improvements span most of the length of SR 9 in Snohomish County. Construction began in 2005 and will be completed in 2013. Improvements will widen SR 9 to four lanes in some areas, add turn lanes at key intersections, install divided medians at select locations and upgrade pavement markings, guardrail, drainage, culverts, and lighting where needed. A project to construct a roundabout on SR 9 at

the intersection with SR 531 is scheduled for a construction start in Spring 2011 and will be completed by Fall 2012.

Future changes

Arlington is a growing community. The influx of new homes and jobs will increase traffic on SR 531. The number of homes located east and north of the corridor have continued to increase in recent years. By 2025, the population is expected to increase by 75 percent in Arlington, and 64 percent in Marysville. Traffic on the SR 531 corridor is affected by this growth in population, especially during peak commute hours.

In addition, this area is planned as a regionally significant commercial/ industrial center. Targeted development in this urban area is expected to increase employment by 90 percent in Arlington's urban growth area (UGA) and 71 percent in Marysville's UGA by 2025. Numerous parcels on the south side of the corridor currently used for agricultural purposes are zoned for general commercial development and are expected to accommodate a range of uses. For example:

- Wal-Mart is expected to open a new store near the southwest corner of the SR 531/43rd intersection.
- Arlington is developing 126 acres at the southwest corner of Arlington Municipal Airport for the Arlington Airport Business Park. This development is located along the north side of SR 531 between 43rd and 51st.
- The city of Marysville also has an economic development plan for 1,859 acres that make up the *Smokey Point Master Plan Area and Neighborhood* which will also attract additional trips to this corridor.
- Arlington annexed the Brekhus-Beach UGA expansion area in 2006. This area, located southeast of the intersection at SR 531 and SR 9, consists of approximately 337 acres and will accommodate a substantial number of housing units and some

commercial development. This development will attract additional trips to the SR 531 corridor.

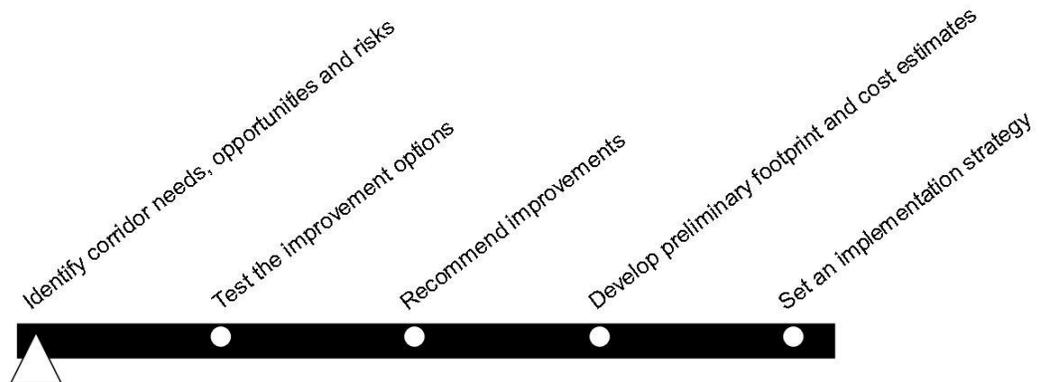
In the future, motorists, freight carriers and businesses that rely on access to or along SR 531, will experience significantly longer travel times, longer delays and increased congestion at signalized intersections and at access points for businesses, schools, and the airport.

Capacity expansion on SR 531 is included in two of PSRC's planning documents, VISION 2040 and Destination 2030, as a preferred alternative. The preferred alternative also calls for other projects for SR 531, including development of a Bus Rapid Transit (BRT) corridor.

Local comprehensive plans identify numerous transportation improvements that will serve traffic destined for commercial, industrial and residential growth adjacent to SR 531. For example:

- Arlington is seeking funds for construction of a bicycle path and pedestrian trail that connects the schools and downtown area with athletic fields and parks near the airport.
- Arlington's comprehensive plan articulates the city's intention to develop adequate transportation links to Marysville as it grows in the currently undeveloped area south of Arlington. The cities have planned north/south extensions of roadways that currently cross SR 531 at 43rd, 51st and 59th Avenues.
- Local comprehensive plans identify the need for improvements to SR 531, including widening the mainline to four or five lanes and intersection improvements at 43rd, 51st, 59th and 67th Avenues.

Chapter 3: Corridor needs, opportunities and risks



The first step in the corridor pre-design analysis process was to identify needs on SR 531. These are problems that WSDOT must address when planning for improvements because of their relationship to the agency's policies and standards. Five goals set by the legislature and outlined in RCW 47.04.280 guide the state's transportation planning and investments:

1. **Preservation** – To maintain, preserve, and extend the life and utility of prior investments in transportation systems and services.
2. **Safety** – To provide for and improve the safety and security of transportation customers and the transportation system.
3. **Mobility** – To improve the predictable movement of goods and people throughout Washington State.
4. **Environment** – To enhance Washington citizens' quality of life through transportation investments that promote energy conservation, enhance healthy communities, and protect the environment.
5. **Stewardship** – To continuously improve the quality, effectiveness, and efficiency of the transportation system.

These goals guide our identification of future needs for SR 531. While environmental protection and stewardship are goals that

ultimately influence which improvements are recommended, and the importance of preserving the existing system influences funding for maintenance activities, safety and mobility are the key factors we consider in future planning.

An evaluation of any highway typically reveals numerous opportunities. Opportunities are improvements that go beyond the basic safety and mobility needs identified by the legislature. Instead, they represent the potential for serving other community values such as economic development and recreation. They also may suggest opportunities for cost savings. While our analysis focused on safety and mobility needs, we also identified several opportunities.

Safety

WSDOT has a responsibility to provide for and improve the safety and security of transportation customers and the transportation system. Safety requires a great deal of effort and vigilance, but our efforts are achieving results. Washington continues to see a decline in the number of deaths due to traffic collisions. Our traffic fatality rates are among the lowest in the nation, but we have a long way to go. Highway improvements play a key role in safety, and we are committed to reducing collisions and reducing risk to Washington's drivers.

What did we learn? Over a five year period (2003 – 2007) there were 186 collisions in the corridor analysis area from MP 7.00 to 8.72.

- There were 16 injury collisions which account for approximately nine percent of all collisions in the corridor. Of those, five collisions resulted in serious injuries. Four of the five serious injury collisions occurred at the signalized intersections at 51st Ave., 59th Ave., and 67th Ave.
- Total number of collisions have increased each year over the past five years.
- Forty-three percent of all collisions in the corridor occurred during the hours between 3 p.m. and 7 p.m. Of those, 65 percent involved eastbound traffic.

Highway Safety

The *Strategic Highway Safety Plan: Target Zero* was developed to identify Washington State's traffic safety needs and to guide investment decisions in order to achieve significant reductions in traffic fatalities and disabling injuries. Using data to drive decision-making, we identify the worst locations through an analysis of crash frequency and severity and focus on strategies for reducing traffic fatalities and disabling injuries as funding becomes available.

More information is available at:
<http://www.wsdot.wa.gov/safety/>



- Rear end collisions represent 62 percent of all collisions in the corridor. The vehicle being struck from behind was legally stopped in traffic in 76 percent of all rear end collisions.
- Collisions occurred most often at intersections and access points. Together they represent 87 percent of all of the collisions in the corridor. One notable location is the driveway at the Stillaguamish Athletic club and Weston High School, where numerous collisions have been recorded.

Mobility

Managing traffic congestion is critical to the future of Washington’s families and our economy. *Level-of-service (LOS) analysis* is a measure of delay that helps us understand how efficiently the highway is serving its users. We performed that analysis for SR 531, both under existing conditions and into the future, to determine congestion levels on the highway.

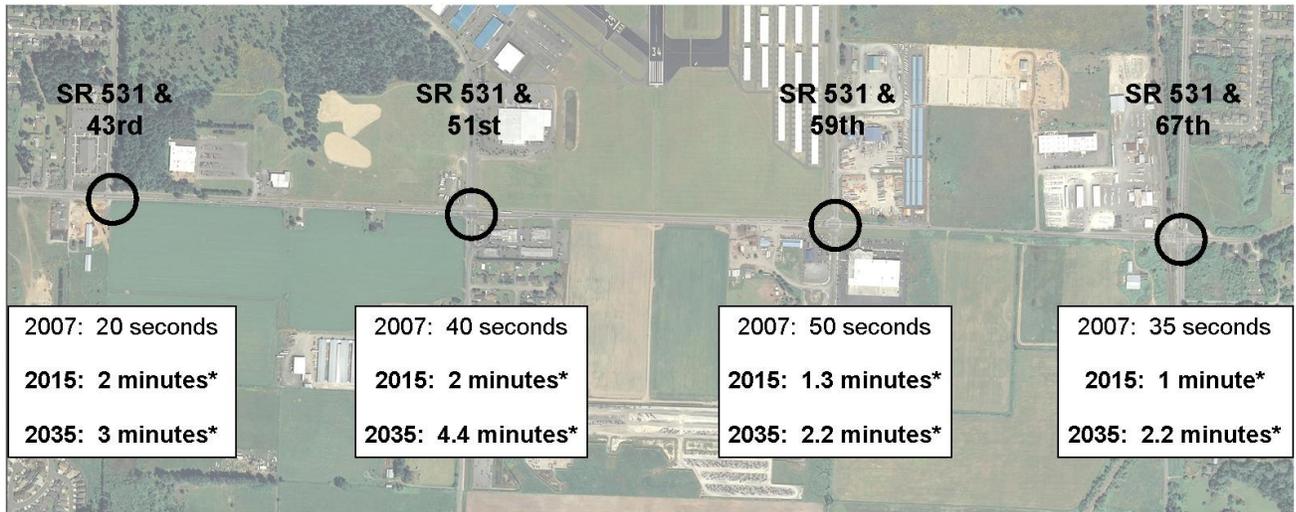
What did we learn? The traffic analysis reveals level-of-service deficiencies at each of the intersections in the corridor, both under existing conditions and into the future.

Drivers will experience significant intersection delays in 2015 and 2035. Overall intersection level-of-service is projected to be at LOS E or F during evening peak traffic periods in 2015 and 2035. For stakeholders, including motorists, freight carriers and those having facilities that rely on access to or along SR 531, this means significantly longer travel times, longer delays, and increased congestion at intersections and at access points for businesses, schools, and the airport. Severely congested traffic conditions will spread well beyond the current peak traffic time periods. As the corridor grows more congested, traffic operations on connecting roads and intersections will degrade.

Performance measurement

In Washington State, level-of-service standards for highways not designated as *Highways of Statewide Significance* are set by the Regional Transportation Planning Organization. For SR 531, which is designated an “urban connector,” the Puget Sound Regional Council set the standard at LOS D. Intersections that operate at LOS E or F are considered deficient.

PM Peak hour intersection delays:
2007, 2015 and 2035



*The regional standard for level-of-service on SR 531 is LOS D. Delays exceeding that standard are considered "failing" and are shown in **bold**.

Travel times will double by 2035. The baseline travel time through the corridor in 2007 was two minutes at the posted speed of 50 mph, not including delays for slower vehicles or traffic signals. Adding in peak hour traffic and signal delays, travel takes three to four minutes in 2007 traffic conditions. By 2015, peak hour traffic travel time will degrade to four to eight minutes. By 2035 peak hour traffic travel time will further degrade to seven to 14 minutes, depending on direction of travel and time of day.

SR 531 Intersection Operation Summary

I/S	2007				2015				2035			
	AM		PM		AM		PM		AM		PM	
	DELAY	LOS	DELAY	LOS	DELAY	LOS	DELAY	LOS	DELAY	LOS	DELAY	LOS
43rd	18.3 s	C	18.1 s	C	32.8 s	C	120.8 s	F	71.4 s	E	175.8 s	F
51st	22.0 s	C	42.7 s	D	28.2 s	C	124.1 s	F	74.9 s	E	284.4 s	F
59th	58.4 s	E	47.2 s	D	98.8 s	F	85.4 s	F	209.8 s	F	209.9 s	F
67th	30.8 s	C	36.3 s	D	41.2 s	D	59.9 s	E	104.1 s	F	134.0 s	F

“Delay” is the average delay per vehicle at each intersection, in seconds.

Corridor performance will decrease significantly by 2035. Corridor travel speed is another congestion measure used in long-range planning to gauge performance. WSDOT has approved a goal in the Washington Transportation Plan (WTP) to manage the state highway system to achieve maximum utilization of roadway capacity (throughput). Traffic traveling at or above 70 percent of posted speed in the peak hour indicates that a corridor is performing optimally to maximize throughput and take full advantage of available capacity. Traffic that is projected to be traveling at less than 70 percent of posted speed in the peak hour is an indicator that conditions are degrading and that the corridor is not performing at its most efficient levels. For this corridor, with a posted speed of 50 mph, corridor efficiency begins degrading when average speeds drop below 35 mph. The corridor falls below 70 percent of posted speed in both directions in 2015 and 2035.

Other corridor improvement considerations

In addition to safety and mobility, there are other needs specific to SR 531 in Arlington that must be addressed as we consider future improvements for the highway.

Proximity of highway to Arlington Municipal Airport

SR 531 is directly adjacent to the airport between 51st and 59th Avenues. Highway improvements must account for and accommodate planned changes at the airport and must be consistent with policy direction provided by the city and state.

The city of Arlington has designated Arlington Municipal Airport as an *Essential Public Facility*. Arlington’s comprehensive plan indicates its intent to promote the airport, encourage compatible development at the airport, and ensure that “the airport remains a viable employment and economic engine for the city of Arlington.” The city of Arlington’s zoning includes two categories of land use regulations that may affect future improvement of SR 531. The first category is regulation of airspace. This element of the zoning code specifies height limits for structures, regardless of their type and function. The second category is regulation of land use types. This affects the type of development that may be constructed within defined zones adjacent to the airport runways.



WSDOT has also recognized the importance of this airport – it is designated as a *regional service airport* in the *Washington State Long-Term Air Transportation Study*. Regional service airports accommodate high aviation activity levels and can accommodate nearly all types of general aviation aircraft, including corporate and air ambulance jets. The study indicates that regional service airports are, “. . . vital assets for regional economic development and quality of life.”

The aircraft landing approach crosses SR 531 at low altitude. Safety is improved for aircraft and highway users when vehicles are not queued on the highway at adjacent intersections underneath the landing flight path.

Proximity of railroad to 67th Avenue intersection

The BNSF railroad line is very close to the intersection of SR 531 and 67th. Train crossings contribute to traffic delays and congestion. There is additional concern on the part of stakeholders that longer vehicles cannot get close

enough to the stop bar to activate the traffic signal without blocking the rail crossing. Improvements at this location should observe WSDOT design manual standards for vehicle storage length at intersections.

Presence of large vehicles and oversized loads

A substantial number of large and oversize vehicles regularly use SR 531, including freight, school buses, fire trucks and transit vehicles. These must be considered when choosing a design vehicle and determining corresponding geometric features of highway improvements.

Multi-modal transportation

Multiple modes of transport are important to the implementation of regional planning priorities for this urban center. Arlington's comprehensive plan lists the following goals and policies related to multi-modal travel:

- Enhance this truck route to serve expected freight travel.
- Work with Community Transit and other appropriate entities to improve access to the regional transit system. This could include the incorporation of additional park-and-ride facilities and increasing transit frequency to meet expanding needs.
- Encourage carpooling and use of public transit as an alternative to single-occupant automobiles.
- Provide for safe and efficient movement of bicycles and pedestrians along streets and highways by constructing sidewalks and other footpath systems as well as bicycle paths and lanes.



Transit and non-motorized transportation in the corridor is limited. For example, there is no space for transit vehicles to stop on this busy, two-lane highway. Bicyclists and pedestrians also find travel difficult in this corridor. Some areas have shoulders wide enough to accommodate bike and pedestrian travel, and the Airport Trail serves users between 43rd and 59th. However, other portions of the corridor study area have no provision for bicycle and pedestrian connections.

Washington State design standards

The existing SR 531 corridor was built to the standards set at the time of design for a local rural arterial. Through the years, these standards have changed as the corridor became urbanized and when the roadway became a state highway. The current roadway met past standards, but when improvements are made to the corridor, certain features of the roadway – lane width, shoulder width, turning radii for intersections, etc. – need to be updated consistent with current requirements.

Access Management

Access management regulates traffic movement onto and off of roadways in order to improve system performance, minimize traffic conflicts, and increase traffic flow. Access management techniques include minimum spacing between intersections and driveways, dedicated turn lanes, and median treatments. These and other access management strategies are known to reduce accidents by as much as 55 percent and increase road capacity by as much as 30 percent.



Access to a state highway is regulated. State law requires cities to adopt access permitting standards for state highways that meet or exceed WSDOT standards. SR 531 has the highway access classification of Class 3, which seeks to balance access and mobility, rather than favoring one over the other. Class 3:

- requires a minimum access spacing of 330 feet,
- allows for only one access to contiguous parcels under the same ownership,
- encourages joint access for subdivisions (private direct access allowed with reason).

Several access points along corridor are not currently consistent with the requirements for a highway designated as Class 3. Excessive access points can slow traffic and contribute to collisions.

Corridor opportunities

Our analysis revealed several options that do not address specific corridor problems but represent enhancements that would provide benefits for community members and the traveling public. While the evaluation of improvement options and pre-design work conducted as part of this project focused on the most critical problems affecting safety and mobility, these opportunities represent additional improvements that may be pursued if funding becomes available to further other community and state transportation goals.

Corridor gateway treatments	Arlington’s comprehensive plan identifies SR 531/172 nd as a primary entryway for Arlington and expresses interest in installing aesthetic enhancements in the corridor.
Recreation	Arlington has developed a multi-modal recreation trail that circles Arlington Municipal Airport and parallels SR 531 between 59 th and 51 st . The city has expressed interest in pursuing improvements and/or extensions to the trail.

Striving for projects that are on-time, on-budget: understanding risks for project delivery

Risks are issues that are not yet fully understood but are expected to affect project delivery. Why is it so important to identify risks in a corridor plan? Our goal is to gather as much information as we can so the footprint and cost estimates we provide are as accurate as possible. This reflects our commitment to providing accurate information about the real costs of an improvement *before it is funded* so we can be sure to deliver projects on-time and on-budget.

Risks will be continually reviewed, refined and updated as recommended improvements progress through detailed design engineering and ultimately construction, in order to avoid surprises and assist with accurate budgeting.

Availability of developable land: The current zoning along the corridor shows that the existing farmland may be converted for other uses. The area surrounding Smokey Point provides industrial, commercial and retail zoning in close proximity to I-5, SR 9, and residential areas. Future development in these areas will contribute to traffic on the highways.

Soils, groundwater and drainage: The project area is very flat. It may be necessary to design slopes into the highway to create low points for water drainage. However, it will still be necessary to find a way to convey water from drainage structures to detention ponds without the benefit of a natural slope. The flat terrain in the corridor is likely to increase costs for design and construction due to the need for additional right-of-way and the need for intensive engineering and additional infrastructure to address water conveyance.

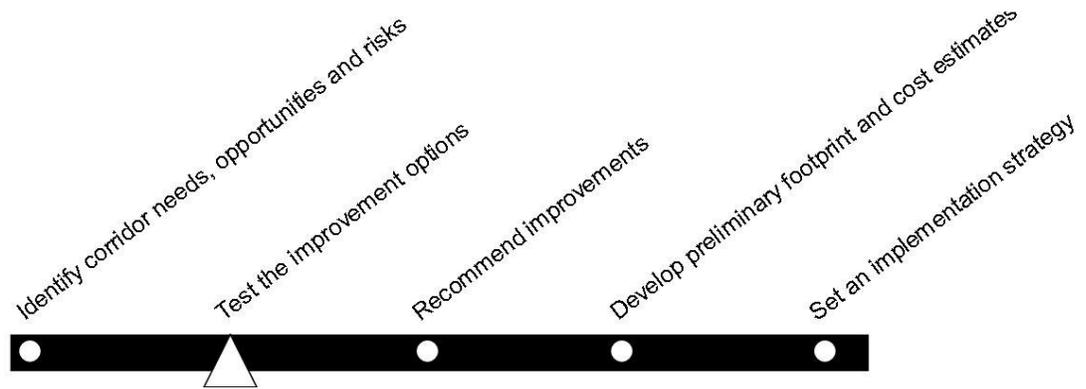
Wetlands: Every effort will be made to avoid wetland impacts entirely, but this may not be possible if the highway is to be widened between 59th and 67th as there are wetlands on both sides in that section of the highway. Wetland impacts must be minimized to the extent practicable. Remaining impacts may be mitigated by creating, enhancing or restoring wetlands at an off-site location. Wetland mitigation adds time and costs to a project.

Railroad: WSDOT will need to reach an agreement with BNSF Railway to pay them to widen and upgrade their crossing and provide flaggers during construction. The railroad has a sporadic train schedule, with just a few runs each week. The presence of the railroad in close proximity to the intersection of SR 531 and 67th complicates the design of intersection improvements.

Airport: The Arlington Municipal Airport borders SR 531 on the north between 51st Ave and 59th Ave. Protected airspace for the airport extends south of the runway across SR 531. The design of highway improvements must account for the land and airspace needs of the airport.



Chapter 4: Testing the options



Once we identified corridor problems, the next step was to evaluate the various options available to address them. Our analysis produced a wealth of data about each option; we used objective evaluation criteria to make sense of the technical information and highlight the benefits and disadvantages of each potential improvement. The criteria allowed us to compare and contrast, and ultimately rate each improvement option.

What follows is a summary of the steps taken to identify, evaluate and recommend a final set of improvement concepts for the pre-design analysis.

How did we identify improvement options?

An initial set of improvement options was determined based on their ability to respond to corridor needs and opportunities as well as to meet guidelines established for all potential improvements. We focused on the problems and transportation needs identified in the previous chapter:

Safety

A majority of collisions occurred at intersections and driveways along the corridor.

Congestion

While intersections were generally operating at or above adopted level-of-service in 2007, planned land use will increase travel demand in the corridor in coming years.

Intersections at 43rd, 51st, 59th and 67th Avenues will operate at LOS F on or before 2035. Long traffic queues at those intersections will degrade traffic flows on SR 531 and connecting streets. Corridor travel time will increase significantly and become more unpredictable.

Multi-modal mobility

Freight movements will be negatively impacted by congestion. Access improvements for public transportation and bicycles and pedestrians are needed.

Our analysis also identified opportunities to pursue corridor improvements that would support the city's goals for growth and economic development. These goals and associated improvements are identified in the city's comprehensive plan. city of Arlington's long range plans call for new intersections at 47th Ave and 63rd Ave. The city's plans also call for corridor design enhancements such as a landscaped median and shoulders along the state highway.

Improvement Concepts

Our list of concepts for analysis included two types of improvements. The first set of improvements was proposed in response to observed collisions and congestion and multi-modal mobility needs identified for the corridor. For example, intersection improvements and corridor widening were proposed to reduce the risk of collisions and reduce travel times. Similarly, facilities for non-motorized and public transportation were proposed to accommodate numerous travel modes and help reduce vehicular travel demand.

We also evaluated improvements proposed by the city as opportunities to address their long-range plans. These included landscaped medians and shoulders and the creation of two new intersections in the corridor. These enhancements do not address documented transportation needs; rather, they address the city's vision for the corridor and economic development objectives for the community. They exceed what is needed to address safety and mobility, so it would be necessary to construct these enhancements with local funds. The city would be responsible for ongoing maintenance.

Several factors guided the team in their development and selection of improvement concepts for further analysis:

- Improvement concepts are cost effective
- They minimize impacts to the natural and built environment
- They meet WSDOT design standards
- They are consistent with the city of Arlington’s adopted plans
- They address issues and concerns raised by corridor stakeholders
- They are scaled to the forecasted level of travel demand in the corridor

For comparison purposes we included an evaluation of corridor operations and collisions without making any improvements. This provides a context in which to evaluate various improvement concepts contrasted with a “no-build” scenario.

Two improvement options that were suggested by stakeholders were not included in the evaluation.

Not evaluated: *Reduce the speed limit*

The setting of speed limits on streets and highways is a technical science backed by many years of research and experience on what works and doesn't work for the safety and benefit of the motorist. Safety is always a factor, but the setting of speed limits is, for completely practical reasons, more fundamentally influenced by some basic principles of human behavior.

When setting speed limits, traffic engineers base decisions on several fundamental concepts proven over the years to be true:

- The majority of motorists drive in a safe and reasonable manner
- The normally careful and competent actions of a reasonable person should be considered to be legal
- Laws are established for the protection of the public and the regulation of unreasonable behavior of a few individuals
- Laws cannot be effectively enforced without the consent and voluntary compliance of the majority.

Research and experience have shown that effective speed limits are those that the majority of motorists naturally drive, and that raising and lowering speed limits doesn't substantially influence that speed.

We did a new speed study in Winter 2009 that allowed us to examine the existing speed limit given the recent and expected growth in the area. We learned that current travel speeds support the existing speed limit. However, if travel speeds decline over time as volumes increase, WSDOT will consider adjusting the speed limit in the future as appropriate for conditions.

More detailed information about how speed limits are set is available in the appendix.

Not evaluated: *Construct a two-way center turn lane*

There are several reasons why we are not recommending a two-way left-turn lane:

- There is frequent congestion related to turns in this corridor. A significant percentage of collisions occurred at or near access points and driveways. A center turn lane would exacerbate conditions that contribute to enter-at-angle collisions, particularly as development increases.
- For safety reasons, industry standards discourage the use of a center turn lane at traffic volumes of 25,000 ADT and above. Volumes on the corridor are expected to increase rapidly; in fact, the western section of SR 531 between 43rd and 51st will exceed that threshold by 2014 or sooner.
- A center turn lane would be inconsistent with the access management measures recommended for the corridor between 43rd and 67th, as well as the existing access management located west of 43rd.

Not evaluated: *Improve lighting along SR 531*

Several stakeholders, when asked to share their concerns about the corridor and ideas for improvements, cited a need for additional lighting along the highway. This option does

not address the specific safety and mobility needs we identified for SR 531, so we did not evaluate this option as part of our detailed analysis. However, the addition of highway lighting is typically a good strategy for enhancing visibility at night and during poor weather conditions. If funding becomes available for detailed design and construction of improvements on SR 531, lighting improvements – as well as other upgrades to current standards - would be considered as part of that process. For example, illumination at improved intersections is part of state design standards and would be included in any intersection improvement project.

The following table lists the improvement concepts and identifies the problems and needs addressed by each. The effectiveness of each improvement at addressing those problems is discussed in a later section of this report.

Improvement Concepts Selected for Analysis	Corridor Problems and Needs												
	Improvement ID	Intersection LOS F in 2035	Intersection Traffic Queues	Corridor Travel Time	Freight Impacts	Collisions at Intersections	Collisions Near Access Points	Growth in Future Travel Demand	Future Land Use Access Needs	Transit Access	Bi-Ped Safety and Access	City's Planned Street Network	City's Corridor Design Enhancements
Intersection Improvements													
Roundabouts	1a	●	●	●	●	●		●	●		●	●	
Signals with right-turn lanes	1b	●	●	●	●	●		●					
Adding GP Lanes													
Add one eastbound lane	2a	●	●	●	●		●	●	●				
Add one westbound lane	2b	●	●	●	●		●	●	●				
Intersection Improvements & GP Lanes													
Roundabouts with EB & WB lanes added	3a	●	●	●	●	●	●	●	●		●	●	
Signals with RT lanes & EB/WB lanes added	3b	●	●	●	●	●	●	●	●				
New Intersections at 47th & 63rd ave.													
Roundabouts at 47th & 63rd ave.	4a							●	●			●	
Signals at 47th and 63rd ave.	4b							●	●			●	
Unsignalized at 47th & 63ave	4c							●	●			●	
Access Management													
Right-in/right-out to/from all driveways	5			●			●	●			●		
Corridor Design Enhancements													
Landscaped median and shoulders	6			●			●	●			●		●
Multi-modal Improvements													
Transit pullouts at existing intersections	7a							●		●	●		
Eastbound sidewalk / westbound trail	7b							●			●		●
Short-term Safety Improvements													
EB left-turn lane at Westin School	8a						●				●		
Right-in/right-out access to/from Westin Sch.	8b						●				●		

This table shows the list of improvement options and which corridor problems they address. A dot indicates the improvement concept addresses the corridor problem and need.

How did we evaluate the improvement concepts?

Technical Analysis of Improvement Concepts

Our analysis of improvement concepts included a level-of-service analysis, collision analysis, risk analysis, highway and roadside design elements, a preliminary assessment of wetland impacts and a preliminary cost estimate. The following analysis parameters guided the work of the project team.

- Improvement concepts for intersections and additional lanes were analyzed for 2015 and 2035 peak hour travel demand conditions.
- The addition of new intersections at 47th and 63rd Ave. were evaluated for 2035 peak conditions only.
- Intersection traffic operations were analyzed for level-of-service, total intersection delay, approach queues and likelihood of collision reduction (based on traffic engineer's professional assessment of the characteristics and frequency of collisions referencing state and national findings).
- Mainline sections of SR 531 were analyzed for level-of-service, volume-to-capacity and likelihood of collision reduction.
- Future forecasts of travel demand on an expanded city road network that includes new intersections at 47th and 63rd Ave. were not available from the city or MPO; therefore, for the traffic analysis, the project team assumed approach and turning movement volumes for these intersections on SR 531 and reduced volumes at adjacent intersections.

Evaluation Criteria

We developed a set of evaluation criteria used to compare and contrast improvement concepts based on the policy guidance identified earlier in this report.

Once the technical evaluation of each improvement concept was complete, the project team (representing WSDOT traffic engineering, design engineering and planning) reviewed the analysis results to determine if each improvement concept met the objectives identified in the evaluation criteria. The evaluation is based on the analysis results for 2035 evening peak traffic

Finding the right tool for the job

When considering intersection improvements, we examine a wide variety of options including roundabouts as well as all types of signal improvements - additional turn lanes, through lanes, longer turn pockets, etc. Ultimately we look for the right tool for the right job. Our recommendations for intersection improvements are based on:

- Nature and size of traffic volumes
- Balance between legs of the intersection
- Number of turns, left and right
- Nature and frequency of collisions

conditions which provides the greatest demand on corridor operations and safety. Evaluations ratings were:

- + Met the criteria objective
- Did not meet the criteria objective
- Neutral
- ~ Results in meeting the criteria objective were variable within segments of the corridor.

These ratings were used by the team to compare the improvement options and make decisions about which of them were recommended for further analysis in the pre-design process. A summary of the evaluation results is shown in the following table.

Improvements Concepts

Evaluation Criteria	1a: Roundabouts at existing Intersections	1b: Signal/Charnelization Improvements at existing Intersections	2a: Add 1 GP lane EB	2b: Add 1 GP lane WB	3a: Roundabouts with 4 GP lanes (1a, 2a+2b)	3b: Signal Chan Improv with 4 GP lanes (1b, 2a+2b)	4a: New Roundabout Intersections (47th & 63rd), assuming 3a elsewhere	4b: New Signalized Intersections (47th & 63rd), assuming 3b elsewhere	4c: New unsignalized Intersections (47th & 63rd), R/Ro assuming 3a elsewhere	5: R/Ro access from all driveways, assuming 3a improvements elsewhere	6: Landscaped median/shoulders	7a: Transit pullouts EB & WB at existing Intersections	7b: Add sidewalk EB, improve extend trail WB	8a: EB LT Charnelization at Westin School	8b: R/Ro access to Westin School
SAFETY															
Addresses the highest collision locations	+	o	+	+	+	+	-	-	-	+	+	+	o	+	+
Will provide a safer environment for bicycles and pedestrians	+	o	-	-	+	-	-	-	-	+	+	+	+	o	+
DESIGN															
Improvement addresses geometric problems	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o
No deviations from design stds	+	+	+	+	+	+	-	-	-	+	-	+	+	+	+
MOBILITY															
Meets or exceeds adopted intersection LOS standards	+	-	-	-	+	-	+	-	-	o	o	o	o	o	o
Reduces the travel time for corridor trips versus no-build	+	o	o	o	+	+	+	o	+	+	o	o	o	o	o
Does not degrade connecting street LOS versus no-build	+	-	+	o	+	+	+	o	+	o	o	o	o	o	o
ENVIRONMENT															
Minimal impact on the natural environment	~	~	-	-	-	-	-	-	-	+	+	+	+	+	+
Minimal impact on the built environment	~	~	~	~	~	~	~	+	+	+	~	+	~	+	+
Minimal or no R/W required	-	o	-	-	-	-	-	-	-	+	-	+	-	+	+
Avoids sensitive and critical areas	~	+	o	o	~	o	o	o	o	+	~	+	o	+	+
Preserves existing parks and Section 4(f) resources	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Enhances healthy communities	o	o	o	o	o	o	o	o	o	o	+	+	+	o	o
MODAL OPTIONS															
Provides future transit or HOV opportunities	o	o	o	o	o	o	o	o	o	o	o	+	o	o	o
Improves nonmotorized access across & through the corridor	+	o	-	-	+	-	-	-	-	+	+	+	+	o	+
Improves the predictable movement of people in the corridor	+	o	+	+	+	+	-	-	-	+	+	+	+	+	+
ACCESSIBILITY															
Improve access to the corridor for adjoining Land Use	o	o	o	o	o	o	o	o	o	-	-	o	o	o	-
FREIGHT & ECONOMIC VITALITY															
Reduces the travel time for freight within the corridor	+	o	+	+	+	+	-	-	-	~	~	o	o	o	o
Improves access to the corridor at key freight access points	+	o	+	+	+	+	-	-	-	~	~	o	o	o	o
Improves the predictable movement of freight in the corridor	+	o	+	+	+	+	-	-	-	~	~	o	o	o	o
PRESERVATION															
Maintains, preserves & extends life & utility of existing transp. infrastructure	+	+	+	+	+	+	+	+	+	+	o	+	+	+	+
COMPATIBILITY															
Compatible with local, regional, and state plans	+	+	+	+	+	+	-	-	-	+	+	+	+	+	+
IMPLEMENTATION															
Improvement can be made incrementally	+	+	+	+	+	+	+	+	+	-	-	+	+	+	+
The improvement has early benefits that could be implemented by 2015	+	-	o	o	+	+	-	-	-	+	-	+	+	+	+
Provides effective improvements that can be scaled to available funding	+	-	+	+	+	+	-	-	-	+	+	+	+	o	o
Minimize or avoid tear-out of improvements	+	-	+	+	+	-	+	-	-	+	+	+	+	-	+

Evaluation Definitions

- + Meets Criteria
- Does Not Meet Criteria
- o Neutral
- ~ Impact is Variable Depending Upon Design and Location

Key findings

Intersection congestion is the primary problem.

Without corridor improvements, all intersections will operate at LOS F in 2035, and all but 67th Avenue NE will operate at LOS F in 2015 during the evening peak hour. Intersection delay will range from 134 seconds to 264 seconds per vehicle. Intersection approach queues are the longest at the eastbound approaches at each intersection. Those queues range from 1697 ft. to 3029 ft. Congestion and queuing at the intersections is the primary factor limiting the capacity of SR 531, but mainline capacity is also becoming a capacity constraint in the west end of the corridor from 43rd to 59th.

Adding lanes without improving the intersections was ineffective.

Without the benefit of intersection improvements, lane widening serves only to move higher volumes of traffic to a bottleneck. Our analysis indicates that widening SR 531 to four lanes is not needed by 2015; in fact, such improvement may not be required to accommodate demand until after 2020. To improve travel times in the corridor, intersection improvements are needed to improve traffic flow.

Roundabouts were the most effective in improving intersections.

Roundabouts at 43rd, 51st, 59th, along with a raised median in between intersections to manage left turns, indicates significant safety benefits and reductions in congestion and delay even without widening the highway. The intersection at 67th would benefit from a roundabout or improved signal. This finding is consistent with the benefits we are experiencing with modern roundabouts throughout the state and our nation. Roundabouts keep traffic moving by balancing varying traffic volumes throughout the day. They also represent a strategy for improving the efficiency of the existing highway system.

Roundabouts with a raised median between intersections provided best balance of safety and access.

Roundabouts allow drivers to complete the equivalent of an intersection u-turn safely and efficiently within the roundabout to change direction. That allows individuals to access businesses along the highway without all of the negative effects associated with left turns on heavily traveled roadways.

Another option for achieving a balance of safety and access is to develop parallel corridors and frontage roads along the highway. For example, Arlington and Marysville have identified several options for north-south connections that would improve accessibility to properties along SR 531 while at the same time reducing the volume of traffic depending on the corridor. Another example is the city of Arlington's plan for 173rd, which would extend west of 51st as part of the Airport Business Park development. The city installed a gravel road along this alignment in 2008, and drivers coming to and from the Weston School and Stilliguamish Athletic Club appreciate the ability to utilize the traffic light at 51st to make left turns rather than turning at the driveway. When the roadway is finalized as planned by the city, this change will concentrate traffic at a controlled intersection, thereby reducing congestion and the risk of collisions related to turns on and off the highway.

What is a roundabout?

A modern roundabout is a circular intersection where drivers travel counterclockwise around a center island. There are no traffic signals or stop signs in a modern roundabout. Drivers yield at entry to traffic in the roundabout, then enter the intersection and exit at their desired street.

Studies by the Federal Highway Administration have found that roundabouts can increase traffic capacity by 30 percent to 50 percent compared to traditional intersections.

Modern roundabouts are designed to accommodate vehicles of all sizes, including emergency vehicles, buses, and truck and trailer combinations. In a modern roundabout, drivers enter the intersection by navigating a gentle curve. Drivers yield at entry to traffic already in the roundabout, then proceed into the intersection and exit at their desired street.

A main feature of the modern roundabout is a raised central island. The circular shape is designed to control the direction of traffic and reduce speeds to 15 to 20 mph. It also reduces the likelihood of t-bone or head-on collisions.

The central island of many roundabouts includes a truck apron, a raised section of concrete that acts as an extra lane for large vehicles. The back wheels of the oversize vehicle can ride up on the truck apron so the truck can easily complete the turn, while the raised portion of concrete discourages use by smaller vehicles.

In addition to the central island, roundabouts also feature triangular splitter islands designed to slow and direct traffic. The islands also provide a refuge for pedestrians. This means pedestrians can choose to cross one direction of traffic at a time and have a safe place to wait before crossing another direction of traffic.



Source: WSDOT's *Driving Roundabouts*,
<http://www.wsdot.wa.gov/Safety/roundabouts/BasicFacts.htm>

Detailed evaluation of options

Our evaluation and final recommendations for each improvement concept are summarized below. Improvements that are “recommended” are most effective in improving safety, reducing congestion and facilitating multi-modal mobility. Also summarized below are improvements that are “appropriate for enhancement”. They exceed what is needed to address safety and mobility, but they may be pursued by the community to support its economic development goals if funding becomes available.

Recommended improvements and enhancements that could be considered for local funding are examined in more detail in Chapter 5.

Improvement Concept 1a:

Roundabouts at existing intersections with no other corridor improvements.

1a: Roundabouts at existing intersections with no other corridor improvements.

Not recommended

Improvement concept 3a provides the same set of intersection improvements as 1a with the additional benefit of one added general purpose lane in each direction to address deficient future mainline capacity between intersections. The additional lanes also provide continuity with the section of highway west of 43rd. For this reason 3a is recommended rather than 1a.

Improvement Concept 1b: *Signal and channelization improvements at existing intersections with no other corridor improvements.*

1b. Signal and channelization improvements at existing intersections with no other corridor improvements.

Not recommended

This improvement would add right-turn lanes on all legs at all existing intersections, and optimize signal timing. There was little or no benefit to traffic operations identified in our analysis. All intersections would fail (LOS F) by 2035.

Improvement Concepts 2a & 2b: *Add one general purpose (GP) lane eastbound and westbound.*

2a/2b. Add one general purpose (GP) lane eastbound and westbound.

Not recommended

Intersection operations are the primary factor in the safety and operation of the corridor. Adding one GP lane eastbound and westbound without corresponding intersection improvements will not significantly improve safety or traffic operations. For this reason, adding additional GP lanes is only recommended as part of

improvement 3a which includes intersection improvements.

Improvement Concept 3a: Roundabouts at 43rd, 51st, 59th and 67th, with one new GP lane eastbound and westbound.

Our analysis clearly shows that two-lane roundabouts at 43rd, 51st, 59th provide the greatest safety and traffic operational improvements in the corridor versus all other improvement concepts by eliminating conflicting turning movements and reducing traffic queues. Adding GP lanes provides higher capacity to address forecasted mainline volumes as well as providing safer access for vehicles turning on and off at driveways along the corridor. A paved shoulder reduces conflicts and the potential for collisions between mainline travelers and those needing to use the shoulder. The shoulder will also provide adequate space for bicycle travel, perhaps via a striped lane.

At 67th, the proximity of an infrequently used railroad line crossing the west leg of the intersection must be considered further before recommending a final intersection improvement. Our operational analysis shows that 67th would operate equally well with an improved signalized intersection with additional GP lanes or a two-lane roundabout when the crossing is not in use. The roundabout provides the greatest level of safety, but further analysis is needed to determine if a roundabout can be designed with the necessary intersection controls needed when the railroad crossing is in use. The signalized intersection may provide greater flexibility to meet the needs at 67th, particularly if the frequency of railroad operations increase at the crossing or if they occur during peak traffic periods. Further analysis is needed to determine the characteristics of future railroad operations at the crossing, and to identify roundabout designs with railroad crossing controls that would be safe and effective at 67th.

Improvement Concept 3b: Signal and channelization improvements at existing intersections with one new GP lane eastbound and westbound.

Although intersection operations improve at 43rd, 51st and 59th with additional GP lanes and improved signalized intersections, the benefits were less than those attributed to roundabouts with new GP lanes (3a). A signalized intersection at 67th Ave. combined

3a. Roundabouts at 43rd, 51st, 59th and 67th, with one new GP lane eastbound and westbound.

Recommended

3b. Signal and channelization improvements at existing intersections with one new GP lane eastbound and westbound.

Not recommended

with additional GP lanes matched the traffic operational performance but not the safety benefits of a roundabout. Further analysis of railroad operations at the crossing adjacent to 67th must be evaluated before a final recommendation can be made for the 67th Ave intersection.

Improvement Concept 4a: *New roundabout intersections at 47th Ave and 63rd Ave, with 3a improvements elsewhere.*

4a. New roundabout intersections at 47th Ave and 63rd Ave, with 3a improvements elsewhere.

Not recommended –
Reassess when regional travel demand model provides travel forecast, perhaps as part of the city’s comprehensive plan/transportation element update.

The anticipated traffic volumes on 47th and 63rd are unclear without further analysis to fully evaluate distribution of traffic within the city’s street network; information that was not available from the regional travel demand model at the time of this corridor analysis. In our analysis we made an assumption of traffic volumes at the new intersections. Based on that analysis the roundabout intersections meet corridor traffic operational objectives at existing intersections as well as at the proposed new intersections at 47th and 63rd. However, the addition of two new intersections will create more vehicle conflict points in the corridor. The new intersections would reduce intersection spacing to less than one quarter mile between adjacent intersections which would inhibit efficient progression of traffic through the corridor. In addition, it does not meet minimum WSDOT design standards calling for half-mile spacing between intersections.

Improvement Concept 4b: *New signalized intersections at 47th Ave and 63rd Ave, with 3b improvements elsewhere.*

4b. New signalized intersections at 47th Ave and 63rd Ave, with 3b improvements elsewhere.

Not recommended.

Intersection traffic operations and safety objectives would not be met at existing intersections nor at the potential new intersections at 47th and 63rd, and the intersection spacing issue listed above for improvement 4a would also apply to 4b. This option would also introduce new turning movement conflicts in the corridor, which would degrade operations and potentially contribute to collisions.

Improvement Concept 4c: *New unsignalized intersections at 47th Ave and 63rd Ave, with 3a improvements elsewhere.*

4c. New unsignalized intersections at 47th Ave and 63rd Ave, with 3a improvements elsewhere.

Not recommended.

The new intersections would be configured for full turning movements with the exception of no left-turns from 47th and 63rd onto SR 531. Intersection traffic operational objectives would not be met, and the change would increase conflict points and exacerbate substandard intersection spacing. This option would

also introduce new turning movement conflicts in the corridor, which would degrade operations.

Improvement Concept 5: *Right-in/right-out access from all driveways, with 3a improvements elsewhere.*

This lower-cost alternative would provide significant safety and traffic operation benefits in the corridor by reducing turning conflicts that degrade operations and contribute to collisions. A raised median would eliminate left-turns to and from driveways and SR 531, restricting access to right-in/right-out turning movements only. This could negatively affect businesses and services along the corridor without provisions for alternate access. For this reason this improvement is only recommended in conjunction with roundabouts at 43rd, 51st, 59th and 67th in order to provide travelers reasonable travel alternatives to access corridor businesses and services.

5. Right-in/right-out access from all driveways, with 3a improvements elsewhere.

Recommended (see also improvement #6)

Improvement Concept 6: *Landscaped median and landscaped strips adjacent to shoulders.*

This improvement may be pursued as a corridor enhancement, consistent with adopted city plans and state design standards. In our evaluation we determined that a landscaped median and shoulder strips would have no detrimental affect on corridor safety and traffic operations. In fact, the median would function in the same way as improvement #5 in restricting turning movements across the median. It is recommended that if a landscaped median is developed, that it be constructed in conjunction with roundabouts at 43rd, 51st, 59th and 67th. It would be necessary to construct with local funds. The city would be responsible for ongoing maintenance.

6. Landscaped median and landscaped strips adjacent to shoulders.

Appropriate for locally funded enhancement.

Improvement Concept 7a: *Transit pullouts eastbound and westbound at existing intersections.*

A lower cost improvement that improves travel alternatives, has the potential to reduce travel demand in the corridor, and provide safety benefits for motorists and transit users by separating transit buses from mainline flow during passenger loading and unloading.

7a. Reserve space for transit pullouts eastbound and westbound at existing intersections.

Recommended

7b. Add sidewalk eastbound, improve and extend trail westbound.

Recommended:
5' sidewalks, eastbound and westbound.

Appropriate for locally funded enhancement:
12' multi-use path, westbound.

Improvement Concept 7b: *Add sidewalk eastbound, improve and extend trail westbound.*

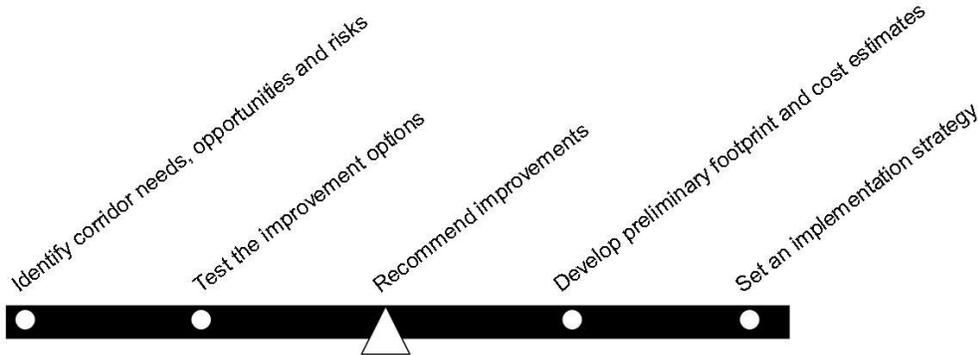
In our evaluation we determined that properly designed sidewalks would enhance pedestrian access and present some potential to reduce travel demand if more travelers chose to walk or bicycle along the corridor.

While it exceeds the mobility needs of the corridor, the city may choose to pursue construction of a multi-use trail just north of the highway on the westbound side. This would involve an improvement to the existing Airport Trail. It would be necessary to construct with local funds. The city would be responsible for ongoing maintenance of the trail.

Improvement Concept 8: *Address access at the Weston School/Athletic Club driveway.*

Numerous stakeholders shared their concerns about traffic congestion at this location, noting that eastbound traffic back-ups from the intersection at 51st, which creates a recurring congestion problem. The city of Arlington's plan for 173rd, which would extend west of 51st as part of the Airport Business Park development, would provide an alternate access for drivers coming to and from the Weston School and Stilliguamish Athletic Club. Left-turn access on-and off SR 531 would no longer be necessary, as the new roadway would allow drivers to utilize the traffic light at 51st to make left turns. When the roadway is finalized as planned by the city, this change will concentrate traffic at a controlled intersection, thereby reducing congestion as well as conflict points related to turns on and off the highway.

Chapter 5: Recommendations



One of the key objectives of the corridor pre-design analysis was to identify future improvement options to serve as a blueprint for future funding decisions. Funding is not secured at this time; when funding is made available for improvements, each will be subject to a detailed design process that includes further opportunities for the public to get involved.

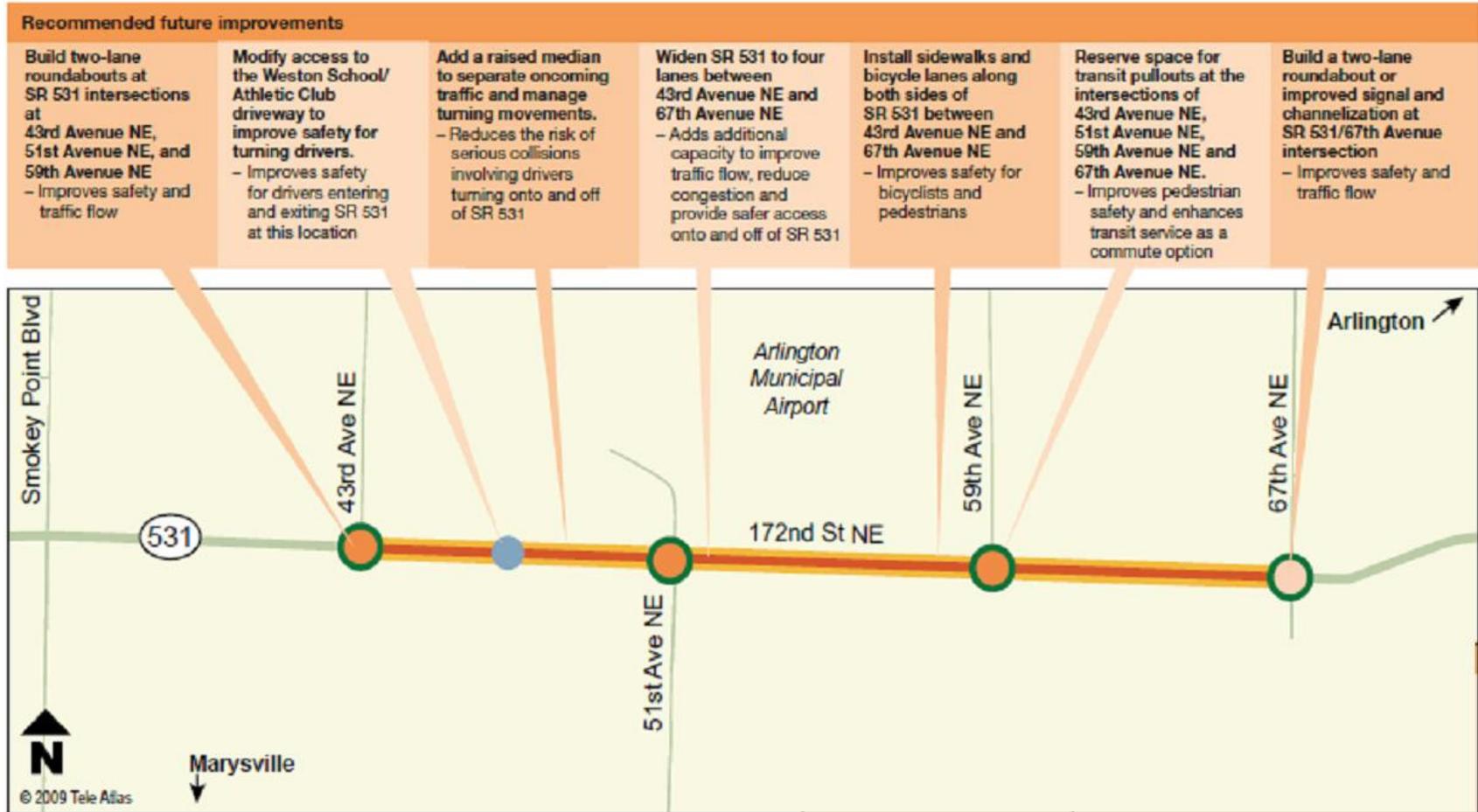
Outlined below are *recommended* improvements as well as additional *enhancements*. The recommended improvements address the basic mobility needs identified in Chapter 2. State transportation funds are used for these kinds of improvements. Enhancements are improvements that may be pursued to support local community values – for example, landscaping to further Arlington’s economic development plans and a multi-modal trail to support Arlington’s parks and recreation program. Enhancements are constructed with local funds.

Recommended improvements

The following improvements moved forward to the pre-design phase in order to address congestion and multi-modal mobility needs.

- Two-lane roundabouts at 43rd, 51st and 59th. An improved signal with additional lanes and channelization or a two-lane roundabout at 67th. All intersections must be designed to accommodate large freight vehicles.

- Widen SR 531 to four lanes. Include paved shoulders that provide adequate space for bicycle travel (i.e. striping for bike lanes). The pre-design recommends a raised median through the length of the corridor.
- A raised median to eliminate left-turns and restrict access to right-in/right-out turning movements only. This improvement is only recommended in conjunction with roundabouts or u-turn capability at signalized intersections in order to provide travelers reasonable turn-around access to businesses and services along the highway.
- Sidewalks paralleling SR 531 from 43rd Ave. to 67th Ave, eastbound and westbound
- Reserve space for transit pullouts at the eastbound (near side locations) and westbound (far side locations) intersections at 43rd Ave, 51st Ave, 59th Ave. and 67th Ave.



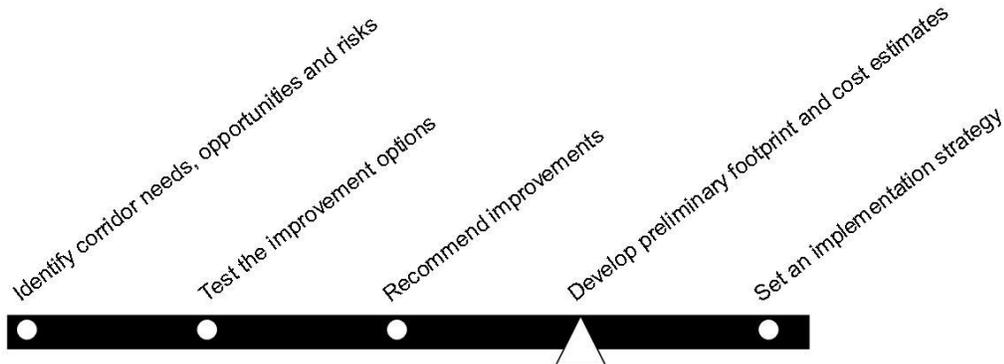
Locally-funded enhancements

In addition, the city may pursue the following improvements identified in its long-range plans as corridor enhancements that address economic development goals.

- Landscaped medians and shoulders.
- A westbound trail paralleling SR 531 from 67th Ave to 43rd Ave.

These corridor enhancements were not analyzed during the pre-design phase, but our highway cross-section and identification of right-of-way needs provides an assessment of the additional space required if the city decided to construct them.

Chapter 6: Corridor pre-design



Planning level pre-design cost estimates were completed for the recommended improvements. These are very preliminary; they provide a good blueprint for moving forward but will require more detailed engineering. The purpose of this step in the process is to: understand right-of-way needs; analyze risks for project delivery; develop reliable cost estimates and compare relative costs and benefits of recommended improvements.

Our corridor pre-design analysis included the following:

- Footprint/conceptual channelization plan
- Conceptual hydraulic plan
- Right-of-way estimate
- Cost estimates for PE, ROW and CN
- Risk assessment
- Benefit/cost analysis

Footprint

Our first step was to determine what the corridor would look like if all recommended improvements were constructed. This exercise is important for identifying issues that contribute to project costs. In addition, this information also clearly communicates future plans to property owners and the city as development occurs along the corridor.

The footprint for the recommended improvements roadway section, which varies between 100 and 116 feet in width is shown on page 46. It illustrates the following elements:

1. **10' Buffer:** This space serves as a guideline for current unknowns such as the area needed for landscaping and drainage.
2. **0-8' Transition:** Fill slope between sidewalk and buffer.
3. **6' Sidewalk**
4. **5' Shoulder and Bike Lane**
5. **Two 12' lanes - westbound**
6. **4' Shoulder**
7. **2' Mountable Curb:** This curb is approximately 4" tall. It restricts left turns to promote safety.
8. **4' Shoulder**
9. **Two 12' lanes - eastbound**
10. **5' Shoulder and Bike Lane**
11. **6' Sidewalk**
12. **0-8' Transition:** Fill slope between sidewalk and buffer.
13. **10' Buffer:** This space serves as a guideline for current unknowns such as the area needed for landscaping and drainage.

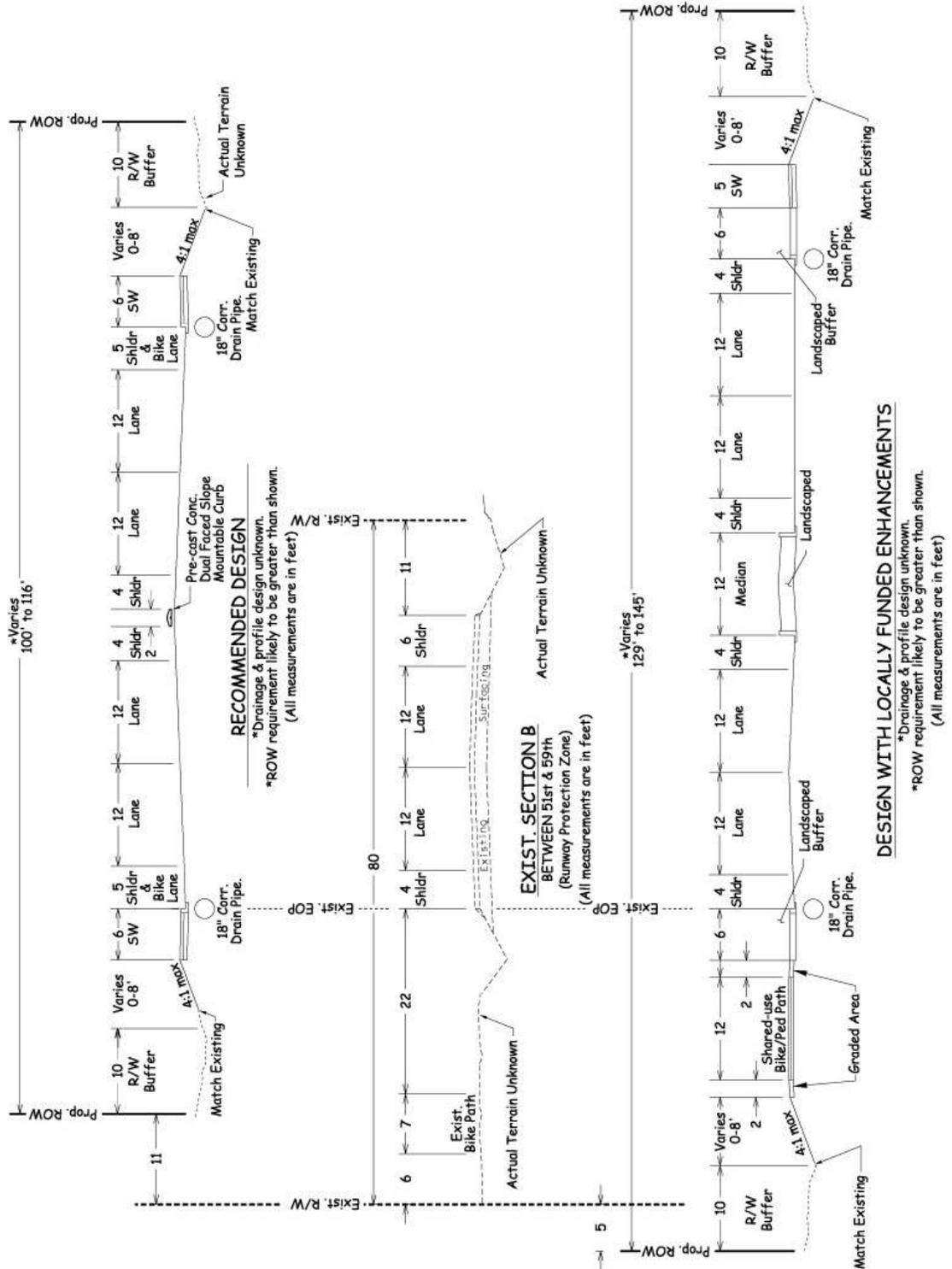
We also provide a footprint for a roadway section that might include locally-funded enhancements such as additional landscaping and recreation facilities. That footprint varies between 129 and 145 feet in width. It illustrates the following elements:

1. **10' Buffer:** This space serves as a guideline for current unknowns such as the area needed for landscaping and drainage.
2. **0-8' Transition:** Fill slope between shared-use bike/ped path and buffer.
3. **12' Shared-Use Bike/Ped Path:** This facility for non-motorized transportation would be provided only on the north side of the highway and would serve as a substitute for sidewalks and bike lanes. The city would be responsible for maintenance costs.
4. **6' Landscaped Buffer:** This area would allow the city to provide landscaping consistent with WSDOT

requirements. The city would be responsible for maintenance costs.

5. **4' Shoulder**
6. **Two 12' lanes - westbound**
7. **4' Shoulder**
8. **12' Landscaped Median:** This area would allow the city to provide landscaping consistent with WSDOT requirements. The city would be responsible for maintenance costs.
9. **4' Shoulder**
10. **Two 12' lanes - eastbound**
11. **4' Shoulder**
12. **6' Landscaped Buffer:** This area would allow the city to provide landscaping consistent with WSDOT requirements. The city would be responsible for installation and maintenance costs.
13. **5' Sidewalk**
14. **0-8' Transition:** Fill slope between sidewalk and buffer.
15. **10' Buffer:** This space serves as a guideline for current unknowns such as the area needed for landscaping and drainage.

Example Roadway Sections for Mainline (not for roundabout intersections)



Note: Drainage and profile design unknown. Right-of-way requirement likely to be greater than shown.

A sample roundabout design is also included. The illustration is only a concept for what a roundabout might look like, but it suggests the dimensions that might be required for a roundabout on SR 531. The conceptual designs show the center island, two lanes entering and exiting the intersection from each direction, and space for a transit pullout at the east and west legs of the roundabout.

Sample roundabout designs are also included as shown on page 48. The illustrations are concepts for what roundabouts might look like and suggest the dimensions that might be required for roundabouts on SR 531. The conceptual designs show the center island, two lanes entering and exiting the intersection from each direction, and space for a transit pullout at the east and west legs of the roundabout.

The shoulder/bike lane in the roadway section does not extend into the roundabout intersection. Bicyclists approaching a roundabout have two options: merge into a travel lane and ride through the roundabout, or use the sidewalk accessed via a ramp between the bike lane and the sidewalk. Sidewalk ramps would also be included on the departure leg of the roundabout to enable a bicyclist to merge from the sidewalk to the shoulder/bike lane.

The sample roundabouts include “spirals” which are used to align a vehicle exiting the two-lane roundabout to the single-lane departure legs out of the roundabout.

Roundabout Design for Non-Motorized Transportation

Pedestrians

Modern roundabouts are designed to be safer for pedestrians than traditional intersections. Vehicles are moving at a slower rate of speed in roundabouts - typically between 15 and 20 miles per hour.

Crosswalks are set further back from traffic, allowing drivers more time to react to pedestrians before merging into or out of the roundabout. Triangular islands between opposing lanes of traffic give pedestrians a safe place to wait if they choose to cross only one direction of traffic at a time.

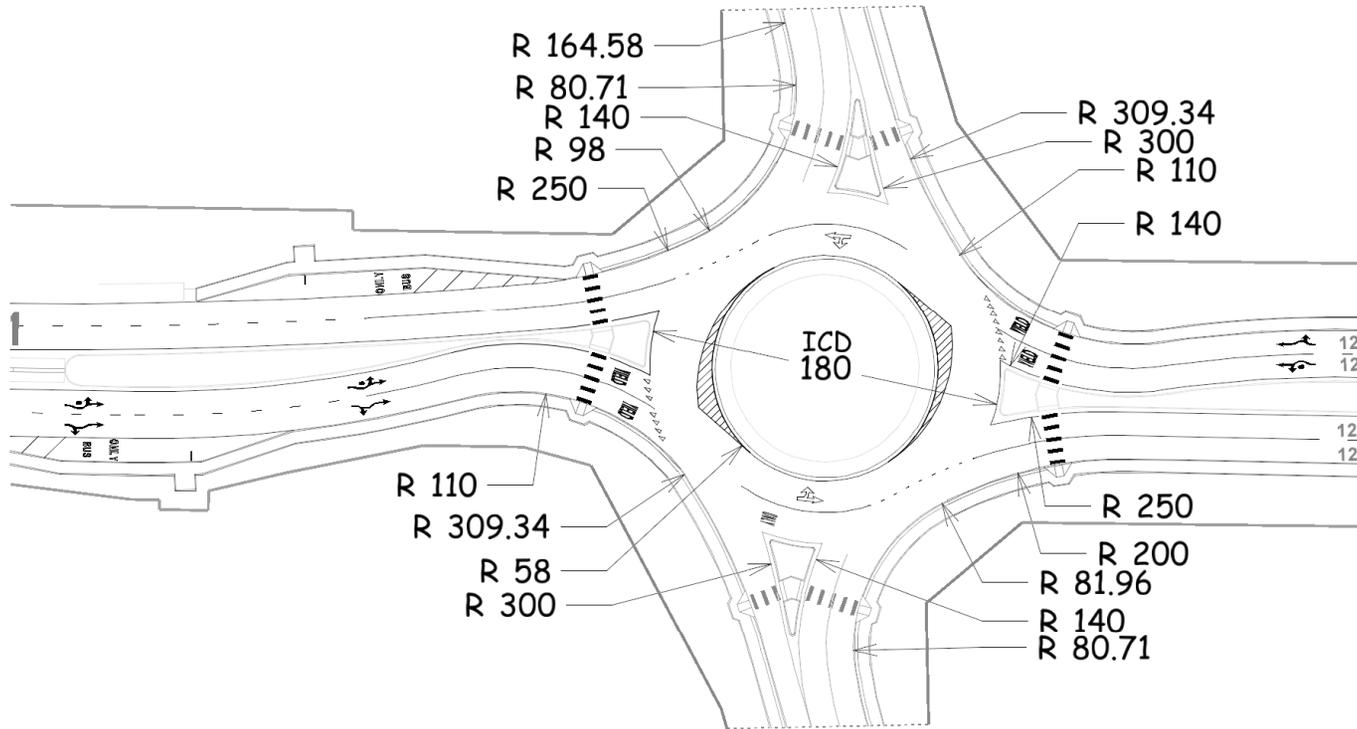
Pedestrians should look for approaching traffic, then walk through the crosswalk to the triangular island. Before continuing, they should look for traffic entering or exiting the roundabout. When it is safe, pedestrians can continue through the crosswalk.

Bicyclists

Bicyclists can choose to ride through the roundabout with traffic or walk their bicycles onto the sidewalk and through the pedestrian crosswalks -- much like they would in a traditional intersection. Like vehicles, cyclists must obey the rules of the roundabout as they proceed through the intersection. Riders who choose to walk their bicycles may find that some roundabout designs have a ramp onto the sidewalk, which makes it easier for bicyclists to use.

*Source: WSDOT's Driving Roundabouts,
[http://www.wsdot.wa.gov/Safety/roundabouts/
PedestriansCyclists.htm](http://www.wsdot.wa.gov/Safety/roundabouts/PedestriansCyclists.htm)*

Example Roundabout



NOT TO SCALE

Conceptual Roundabout Design

43rd, 51st, 59th Street

"ICD," or *Inscribed Circle Diameter*, is 180 feet curb to curb; center island diameter, including 8 foot truck apron, is 112 ft.

Cost estimate

We developed a preliminary cost estimate for the purposes of guiding future funding decisions. We constructed the estimates using information on bid prices from recent, similar projects. We also completed an assessment of unknown factors that could add cost – i.e. environmental mitigation, construction of stormwater management and drainage, etc. – and assigned probable costs for those risks.

Risk elements quantified in our analysis include:

Soils and groundwater: Soil types in the area are unknown. Geotechnical reports at some adjacent parcels indicate a high groundwater table. Uncertainty in drainage design can lead to escalation in scope, schedule, and budget.

Drainage design: Ponds may be undesirable for flow control treatment due to high groundwater, poor soil properties, or proximity to the airport Runway Protection Zone (RPZ). If pond is located within the RPZ it would have to be covered to prevent wildlife activity near pond, or located away from the RPZ. Alternate locations for drainage ponds would require additional right-of-way. Soil composition and groundwater may necessitate other BMPs (Best Management Practices) for infiltration and treatment which can expand the project scope, lengthen the schedule and ultimately increase costs.

Highway subgrade: If the highway profile is not raised, the excavation associated with building the subgrade is likely to encounter unsuitable foundation, especially given the proximity of the water table and evidence of significant alligator cracking in the existing pavement.



SR 530 near Arlington—the highway has been raised to allow adequate drainage in this flat area. This is an effective but costly option for addressing drainage challenges.

Proximity to railroad: Roundabout design at 67th Ave NE and the close proximity of railroad. Extensive design and approval for a roundabout and railroad combination may be required. WSDOT will need to reach an agreement with BNSF Railway to pay them to widen and upgrade their crossing and provide flaggers during construction. Train movements through RR crossing will add complexity to traffic control during construction.



Railroad tracks cross SR 531 just south of the 67th intersection.

Wetlands and creeks: Environmental impacts near 67th Ave NE due to Middle Fork of Quilceda Creek and wetlands. Additional right-of-way may be needed in order to avoid, minimize or mitigate for impacts to wetlands and Quilceda Creek. Intersection alignment and geometry could change in order to avoid or minimize impacts to wetlands and Quilceda Creek, increasing cost of construction.

Utilities: Right of way acquisition may involve parcels where there are existing pipeline easements. WSDOT may need to reach an agreement with Olympic Pipeline to pay them to extend the casing on their pipeline. The beginning of the project may need to be shifted west about 100 feet, potentially affecting Trans Mountain Pipeline as well.

Airport runway protection zone constraints: A 1997 letter signed by FAA, city of Arlington and WSDOT indicates a preference for avoiding roadway expansion north toward airport within the Runway Protection Zone. Realignment to the south to widen SR 531 to four lanes will add additional design considerations – for example, it would require additional right-of-way acquisition from neighboring private properties.



SR 531, between 59th and 51st, is bordered by Arlington Municipal Airport to the north and by several businesses to the south.



Project Cost Summary (\$Millions)

	Probable Cost, in millions
Preliminary Engineering	\$ 6
Right-of-Way	\$10
Construction	\$41
Total Project Cost	\$57

*Cost estimate in 2009 dollars. Actual project cost will be higher depending on inflation and construction schedule

Benefit/cost ratio

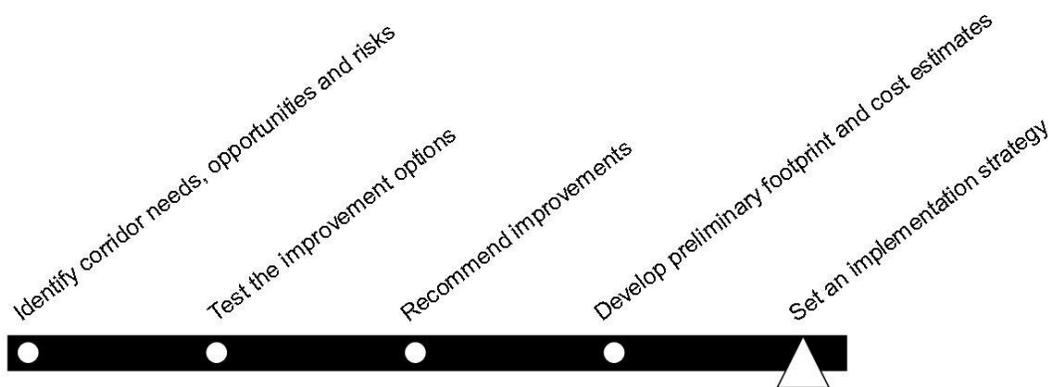
Our benefit/cost evaluation provides additional information that may be useful if it is necessary to prioritize the implementation of improvements. It provides an indicator of how much benefit is generated by an improvement, relative to the costs.

Each recommended intersection improvement resulted in a benefit/cost ratio greater than one indicating the benefits derived from the improvements exceeded their cost when evaluated over a 20 year period (2015 – 2035). Improvements that would widen the mainline to add one additional general purpose lane eastbound and westbound also provided a benefit/cost ratio greater than one for the mainline sections between 43rd Ave and 59th Ave. For the segment from 59th to 67th, the cost of improvements exceeded the benefits, resulting in a benefit/cost ratio less than one. The table on the follow page summarizes the results of the benefit/cost analysis.

BENEFIT/COST (B/C) ANALYSIS RESULTS

Recommended Improvement	B/C Ratio
Roundabout at 43rd Ave.	5.7
Roundabout at 51st Ave.	18.0
Roundabout at 59th Ave.	8.8
Roundabout at 67th Ave.	4.8
Add general purpose lanes 43rd to 51st (EB & WB) with raised median	1.6
Add general purpose lanes 51st to 59th (EB & WB) with raised median	1.2
Add general purpose lanes 59th to 67th (EB & WB) with raised median	0.6
B/C ratio for all improvements combined	2.6

Chapter 7: Implementation strategy



The improvements recommended in this pre-design corridor analysis set a direction for future improvements on SR 531 and serve as a first step in obtaining funding for detailed design and construction of improvements. The recommended corridor improvements will cost approximately \$57 million, an amount which cannot be met within the limits of existing funding. Included in the cost is an estimate for highway stormwater runoff facilities that carries with it significant risk in the scope, schedule and budget for the recommended improvements due to the challenges of the flat terrain and soils characterizing the corridor.

Recommended next steps

The steps outlined below are intended to guide implementation of improvements in the corridor. They are based on the forecasts, analysis, assumptions and risks identified during our corridor pre-design analysis completed in August 2009. These recommendations recognize that needs and priorities change over time which may necessitate that the implementation strategy be reviewed and revised in the future.

This implementation strategy is consistent with WSDOT's mobility strategy: first maintain, preserve and improve the operating efficiency of the existing highway system before adding

to the system. The benefit-cost analysis serves as a justification for the following recommendations.

Implementation Step One - Preliminary design, including stormwater

The first step in the implementation strategy is to address and resolve the risks associated with the design of a stormwater system that meets applicable standards. WSDOT and the city of Arlington have invested design resources in this corridor analysis, and in past scoping efforts, to address the storm water challenges inherent in the corridor. It is recommended that a design workshop or a value engineering analysis be conducted followed by further detailed design for the recommended storm water alternative in order to complete an estimate for a storm water system that carries with it a lower risk in scope, schedule and budget. Existing development mitigation funds could be used to fund this work.

Implementation Step Two – Roundabouts and transit pullouts

Our technical analysis revealed how implementation of discrete projects, scaled to more realistic funding levels, could be completed and still provide significant benefits to SR 531 stakeholders. Improving the intersections at 43rd Ave, 51st Ave and 59th Ave. with two-lane roundabouts, and an improved signal or roundabout at 67th Ave., provided the greatest benefit in terms of reduced congestion relative to the cost to design and construct them. Reducing congestion and vehicle conflict points reduces the risk for collisions at the intersections. Our traffic analysis revealed that the intersections will be the key capacity constraint in the SR 531 corridor by 2035. Widening the highway to four lanes without first addressing intersection capacity improvements would result in LOS F conditions at 43rd, 51st, 59th and 67th in the 2035 evening peak hour with significant traffic queues stretching as much as one-half mile from the intersections onto the SR 531 mainline. Our analysis indicates that certain intersections provide greater benefits than others and should receive a higher priority.

For this reason, the following intersection priority is recommended:

- First - construct two-lane roundabout at SR 531 / 51st Ave. NE intersection
- Second - construct two-lane roundabout at SR 531 / 59st Ave. NE intersection
- Third - construct two-lane roundabout at SR 531 / 43rd Ave. NE intersection
- Fourth - construct two-lane roundabout or improved signal with additional lanes and channelization at SR 531 / 67th Ave. NE intersection

Transit pullouts should be included in the design and construction at each of the four improved intersections. The roundabouts should be designed and constructed to integrate with all other recommended corridor improvements, funded or unfunded, including a widened and raised median, sidewalks, bike lanes, a widened four lane highway and storm water facilities.

Implementation Step Three – Raised median

Once two or more contiguous roundabout intersections are constructed, it is recommended that a raised median be constructed in the highway section between the roundabout intersections. The raised median will eliminate left turns on and off the highway, redirecting those turns to the roundabout intersections to benefit safety and traffic operations.

Implementation Step Four – Widen SR 531 to four lanes

Widening SR 531 to four lanes, adding one new general purpose lane eastbound and westbound, is the fourth step in implementation. This improvement should only be considered after all of the recommended improvements identified in steps one through three have been completed, or in conjunction with those improvements in one fully funded set of corridor improvements implemented concurrently. The forecast for 2035 indicates traffic volumes in the western end of the corridor between 43rd

Ave and 51st Ave are at significantly higher levels than those forecasted in the eastern end of the corridor. If a choice must be made to fund only a portion of SR 531 widening, emphasis should be given to widening those sections that provide the greatest congestion relief. The following priority is recommended:

- First – Add one eastbound and westbound lane between 43rd Ave. and 51st Ave.
- Second – Add one eastbound and westbound lane between 51st Ave. and 59th Ave.
- Third - one eastbound and westbound lane between 59th Ave. and 67th Ave.

Sidewalks and bicycle lanes should be included in the design, right of way and construction of each widened section of SR 531.

Roles and responsibilities

WSDOT and the city of Arlington partnered in this analysis and development of the recommended improvements. Both agencies will have a role in any future improvement of the highway.

Developer-funded improvements:

The city of Arlington is responsible for permitting future development and implementing review under the State Environmental Protection Act (SEPA). WSDOT participates in the process by reviewing and commenting on traffic impact analysis reports provided by developers. Together, the city and WSDOT work with developers to identify improvements that will mitigate their impacts on the highway.

Locally-funded improvements:

The city of Arlington pursue enhancements on the highway, provided they are consistent with WSDOT requirements and that the city assumes responsibility for ongoing maintenance. WSDOT will support the city when such opportunities arise, providing technical guidance and establishing inter-local agreements when appropriate.

State and federally-funded improvements:

The Washington State Legislature ultimately determines how state highway funds are distributed for projects across the state. Federal funds are divided: some are dispersed to the state for distribution to projects; some are dispersed to regional planning organizations for distribution as grants for local agencies; and some are reserved for dispersal to specific projects. These funds are focused on safety and mobility needs, rather than on any enhancements that may be desired.

As a cabinet agency that reports to the governor, WSDOT identifies projects through the Highway System Plan process and relies on direction from the governor and legislature to allocate state and federal funds. The state prioritizes projects based on the legislature's policy goals of preservation, safety, mobility, environment and stewardship. In managing congestion, the aim is to first maintain, preserve and improve the operating efficiency of the existing highway system before adding capacity.

WSDOT will endeavor to ensure the proposed improvements on SR 531 are carried in both the State Highway System Plan and the regional transportation plan, *Transportation 2040*, developed by the Puget Sound Regional Council. If desired, the city of Arlington may work individually or through its regional planning organization – the Puget Sound Regional Council – to seek state and federal funds for improvement needs on SR 531.

Chapter 8: Conclusion

The improvements recommended in this pre-design corridor analysis set a direction for future improvements on SR 531 and serve as a first step in obtaining funding for detailed design and construction of improvements. The estimated cost for the recommended improvements is \$57 million, an amount which cannot be met within the limits of existing funding.

Although there is no funding currently available for improvements, the corridor analysis will provide a blueprint for local jurisdictions and legislators as they determine funding for future projects and it will position WSDOT to take advantage of project construction partnerships with local agencies and private developers. The corridor pre-design analysis also provides us with an opportunity to share information about potential improvements with members of the public. In the future, if funding becomes available, there will be many more opportunities for community members to get involved and provide comment.

Appendix

A. Stakeholder interview report

- Stakeholder Interviews Summary Report
- Stakeholder Interviews Technical Report

B. Technical Memos

- Task 1 Report
- Task 2 Report
- Tasks 1 and 2 Technical Memo
- Task 3 Report
- Task 4 Report
- Task 5 Report
- Task 6 Report
- 3-12-09 Improvement Concepts Workshop
- Benefit/Cost Analysis

C. Supporting materials

- Setting Speed Limits
- Presentation: Preliminary Recommendations, July 2009
- Presentation: Pre-Design Findings, January 2010