

II. Improvement Program

Highway Safety

What We Have Done

WSDOT has been performing work on the State Highway System for over 100 years (est. 1905 as Department of Highways?). Consistent with the Strategic Highway Safety Plan strategies the Washington Transportation Plan (WTP) has committed pre-existing funds (PEF), Nickel, and Transportation Partnership Act (TPA) funds to the statewide effort to reduce the occurrence of crashes on the State Highway System. Over the next 20-years (2007-2026) the WTP proposes to fund \$3.4 billion on Safety, yet there will still be \$2.9 billion in unfunded needs (see graphic below).

The table below shows the WSDOT Subprogram I2 expenditures each fiscal year for the past six bienniums. WSDOT has an ongoing commitment to Safety.

What We Are Doing Now

Highway Safety investments are intended to reduce the societal costs of accidents by reducing the frequency and severity of accidents. Consequently, safety projects on Washington State highways have two primary focuses:

- » The Accident Reduction approach has two elements; A spot locations approach to High Accident Locations (HAL), and a corridor sections

approach to High Accident Corridors (HAC). This program reactively addresses crashes based on history at a specific location.

- » Accident Prevention addresses locations with a higher risk of collision occurrence, including cross center line and run-off-the road accidents. This program allows WSDOT to proactively address location with a higher than average potential for accidents based upon traffic volumes, shoulder widths, speed, vertical and horizontal curves, etc.

HAI's/HAC's with high societal costs are addressed in ranked priority. Today we find that most HAL's do not reoccur from one biennium to another.

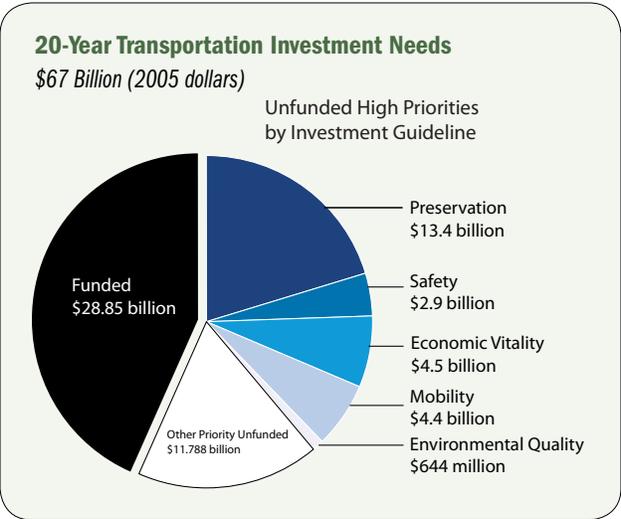
Societal Costs of Motor Vehicle Crashes

Cost based on property damage only (PDO), possible injury, evident injury, disabling injury, and fatalities are used to calculate annualized societal cost based on history. This enables us to calculate the present value benefits of proposed safety improvements.

The source of these cost factors is the Federal Highway Administration's (FHWA) Technical Summary "The Cost of Highway Crashes", Publication No. FHWA-RD-91-005. This summary is used for assigning dollar values for the societal cost of crashes.

2005 Data Shows an Increase in Traffic Fatalities

Over the past decade, there has been a general downward trend in traffic fatalities on Washington State's highways, city streets, county roads, and



Biennium	Dollars
95/97	66
97/99	99
99/01	118
01/03	133
03/05	133
05/07	193

other public roadways. Washington experienced a low point in fatalities in 2003 and 2004, with 600 and 567 deaths, respectively.

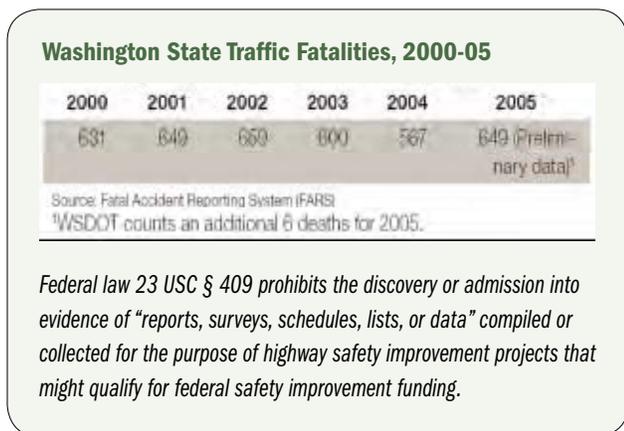
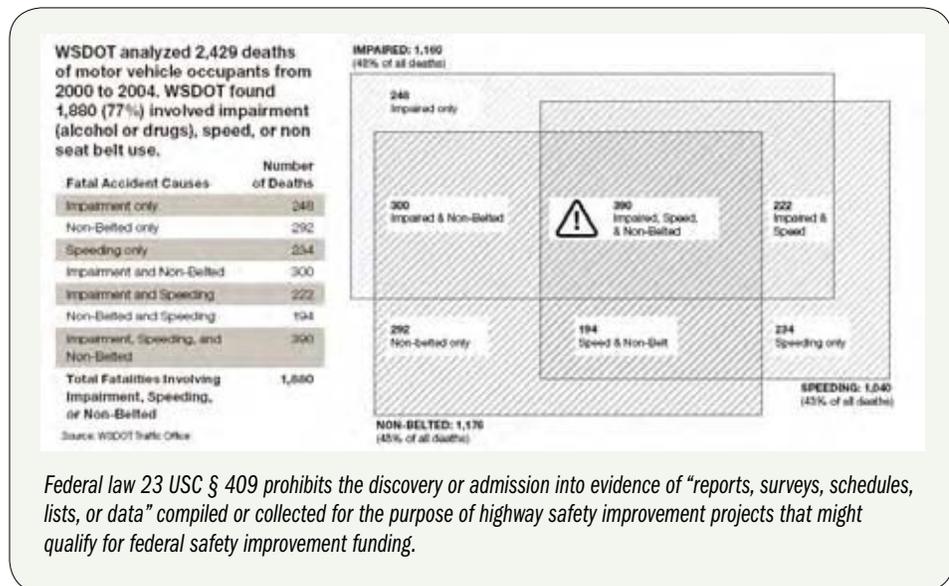
However, 2005 data shows an increase following these two low years. In 2005, total fatalities on Washington’s public roads increased 14 percent, from 567 in 2004 to 649 in 2005. Of the 82 additional fatalities, county roads accounted for 32 (39 percent), state highways accounted for 30 (37 percent), city streets accounted for 23 (28 percent); other roadways experienced a decrease of 3 (-4 percent). There was also an increase nationally. Fifteen percent of the increase in highway fatalities at the national level.

WSDOT takes this increase in highway fatalities very seriously, and is examining ways to keep the fatality trend continuing downward. 2006 accident data by the Transportation Data Office indicates fatalities are down compared to 2005 (622 for 2006), but still higher than 2004. This was the case for all roads and for state highways.

The increase in deaths on public roadways in 2005 is troubling. An initial analysis by WSDOT indicates impaired driving (alcohol and drug influence), speeding, and failure to wear seatbelts continue to be major contributing factors to

highway fatalities. In an examination of 2,429 fatal highway collisions from 2000-04, 1,880 (77 percent) were attributable to at least one of these three major factors. Frequently, more than one of these factors were involved in serious injury and fatal collisions (see graph below). In 1,106 (46 percent) of these highway deaths, two or more of these factors were involved; 390 deaths, or 16 percent, involved all three of these factors.

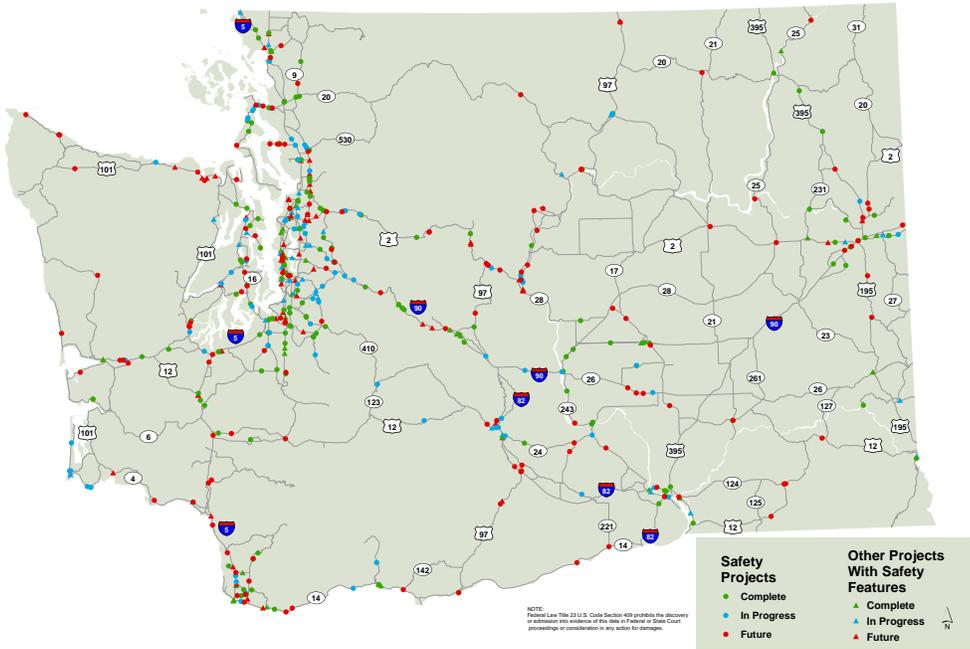
The map on the following page shows the location of completed, and in progress safety projects on the State Highway System since the 2003-2022 HSP update. It also shows the general locations for some currently funded future safety work.



What Does the Future Hold

Looking to the future, WSDOT is working with national research groups to help identify cost effective solutions to known accident locations, do risk assessment, and reduce the severity of those accidents that do occur. By looking at behavioral issues, and roadway geometrics, accident severity may be reduced. Using an incremental approach in prioritizing safety work similar to the tiered approach used for mobility projects will help us make the best use of available funding. A triangle graph showing the three tiered approach to project implementation can be seen both in the Mobility Section of the HSP, and in the Appendix.

Safety Projects



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We are not including lists of conceptual safety solutions in the HSP because accident locations and patterns change over time. A second is that planning level safety strategies in a statewide plan are not always those chosen during project development. We anticipate looking more at corridors as opposed to individual spot location for safety projects.

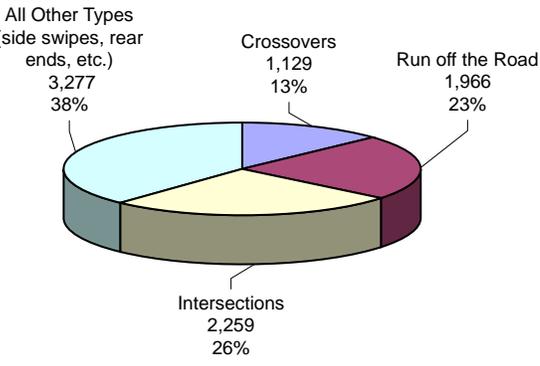
Improvements in highway safety occur throughout the WSDOT program regardless of whether their stated intent is to address highway safety. This occurs because projects are required to address certain safety aspects in their design and construction. These types of projects enhance the safety return throughout the highway system when combined with focused safety programs benefits.

Prioritization Process for Selecting Projects

One of the primary goals of priority programming is to maximize return on investment dollars. To ensure to the greatest extent possible that transportation dollars are being spent in those areas with the highest benefit & lowest cost, where possible.

The approach for this HSP update will be a combination of Special Safety Initiatives. These initiatives are prioritized by highest benefit for the least cost, as well as minimum, moderate, and maximum fixes

Total Fatal and Disabling Collisions, 1999-2005



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which might provide partial benefits; or moderate, and maximum cost fixes that could include secondary benefits or different design alternatives. These are prioritized based on available funding, and in some cases the solutions chosen provide a first step towards a future more permanent and costly fix that may be warranted as additional funding becomes available.

Needs

Between 1999 and 2005 the three major causes of fatal and disabling collisions are: Crossover, Run Off the Road, and Intersections. System wide, low cost Safety improvements to reduce the number and severity these three types of collisions have the potential save the lives of many Washington Citizens, and visitors that use our State highways. Strategies for reducing these three types of collisions are discussed later on in the Safety section.

Strategies

Target Zero

WSDOT has developed the Strategic Highway Safety Plan, Target Zero. The plan's mission is to identify Washington State's traffic safety needs and guide investment decisions to achieve significant reductions in fatalities and serious injuries on all public

roads. The vision for this plan is that Washington State will achieve a transportation system that has zero traffic deaths and zero disabling injuries by the year 2030. In order to achieve Target Zero, the state must experience 24 fewer fatalities each year for the next 25 years.

Crashes are the leading cause of death in the United States for people from age 3 to 33. We understand that many of the deaths can be reduced by changes in driver behavior, vehicle design and roadway improvements. Unfortunately deaths and injuries continue to occur. Our desire is to improve the quality of life in this state by doing our best to ensure that parents survive to parent, that children live to adulthood, and that teens don't pay for driving mistakes with their lives.

Target Zero incorporates four traditional highway safety components commonly referred to as the "four Es": enforcement, engineering, education, and emergency services. While WSDOT supports education and emergency service activities, these are typically a function of partner agencies, such as the Washington State Patrol and the Traffic Safety Commission. WSDOT takes a more active role in the Engineering and Enforcement components of the "four Es".

Engineering

Highway safety improvements are WSDOT's main "Target Zero" focus. Focus areas for roadway improvements in the 2000 plan include a reduction in serious and fatal collisions associated with running off the road, crossing the median of divided highways, and running stop signs or red lights at intersections. In addition to the low-cost improvements and roundabouts, activities in the plan include bridge rail and guard rail upgrades, installation or upgrading of traffic signal systems, installation of

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pedestrian-related improvements such as school advance warning signs, crosswalks, and islands, and upgrading standard roadway intersections to freeway style interchanges.

Enforcement

The Traffic Safety Commission, State Patrol, Department of Licensing, and Department of Health take the lead on Target Zero strategies that focus on traffic and driver behavioral issues. WSDOT works with these and other agencies on programs such as Click It or Ticket, safety corridor projects, and ticketing aggressive drivers.

One of the largest contributors to fatal collisions is driving while intoxicated. Impaired drivers are involved in approximately 40 percent of all the fatal collisions in Washington State. Despite an increased focus on reducing numbers of impaired drivers, the rate of alcohol involvement in fatalities remains high.

Dangerous drivers, including aggressive and drowsy drivers, also contribute to fatalities. Included in this group are drivers that weave in and out of traffic, flash their lights, tailgating, street race, driving too fast for conditions, or fall asleep at the wheel. Young drivers (16-20 years old) have a higher fatal collision rate than any other age group. Legislation passed in July 2001 established the requirement of 50 hours of supervised behind-the-wheel driving time for drivers under the age of 18 before they can obtain a license.

Early statistics collected after the law took effect show about a 30 percent drop in the number of fatalities and disabling injuries for 16- and 17- year-old drivers. New strategies and policies will be needed to address aging driver safety needs as Washington State's population ages.

Where to Invest Next

WSDOT is working with national research groups to help identify cost effective solutions to known accident locations on State Routes and the Interstate, do risk assessment, and reduce the severity of those accidents that do occur.

The current WSDOT method for evaluating roadway projects for safety upgrades relies on procedures that combine frequency and severity of accidents at locations in a weighted manner. This is a

reasonable procedure that captures a significant portion of locations deserving of safety upgrades in a consistent manner. However, what is not apparent from the programming process is the cause of turnovers of locations from year to year. One main issue underlying the turnover rate is the reliability of predictions of accident risk. The second issue related to the turnover rate is one of efficient investment. For example, any given highway accident corridor needs to be examined in terms of benefits and costs from safety investments, and how they efficiently relate to performance measure of the location. The reliability of prediction of accident risk and the efficiency of safety programs in addressing risk through proper and timely investment are the main issues addressed in this research.

WSDOT is a leader in the management of fatal and disabling injury rates nationally. Washington State has one of the lowest fatal accident rates per hundred million vehicle miles traveled (see graphic on next page) among all 50 states. WSDOT evaluates past accident history to determine strategies to further reduce fatal and disabling crashes. This approach is incorporated into the state's long range plan (Washington Transportation Plan) and used to direct future capital investments.

WSDOT is working to continually improve the safety management process through approaches that are pro-active. A pro-active approach improves potentially problematic areas before severe accidents and the damages associated with accidents had occurred.

Reducing and Preventing Injury Collisions

Approaches for improving highway safety continue to evolve. The traditional approach is to reconstruct highways to meet current design standards. While rebuilding roadways to full design standards will reduce the risk of collisions, this approach can be very costly, particularly impacts to property or environmentally sensitive areas as a result of the improvement. The success of this program shows that by spending money more strategically through the application of the appropriate standards we can achieve the greatest safety benefit within limited resources.

More specifically, making large investments at spot locations results in fewer locations being addressed and limits the public benefit of improvements.

U.S. Fatality Rate vs. Washington State Trend Line



Since 1980, the United States Fatality Rate has declined 56%. During this same period, Washington State has experienced an even greater decrease: 70% for all public roads and 74% for State Highways.

2003 Annual State Highway Collision Data Summary

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Therefore, the preferred approach to improving highway safety is investing in improvements that are relatively low cost per site/mile and provide significant reductions in the risk of serious collisions.

A systematic approach to bringing highways up to standards provides the public safer highways at a lower cost:

- » Collision Reduction Priorities:
 - Spot locations on the highway system with higher than average collision rates.
 - Corridor sections on the State Highway System with higher than average collision rates.
- » Collision Prevention addresses locations exhibiting a higher risk of collision frequency or high severity occurrence and includes the following focus areas:
 - Interstate Safety, Risk Reduction, At Grade Intersection, Intersection Improvements, Pedestrian Risk, and Special Safety Initiative.

This program allows WSDOT to address potentially hazardous situations before they become a problem:

- Identify corridors with geometric and roadside elements that contribute to accident probability and increased accident severity.
- Identify improved signalization, channelization, and roundabout opportunities to reduce collision risk.
- Identify at-grade intersections in high-speed multi-lane divided highway intersections exhibiting high accident potential.

Providing a Basic Level of Safety on All State Highways

Risk Reduction

Identify locations where fewer accidents have occurred but the potential for accident frequency or severity is above average due to traffic volumes, and the consequence for lane or road departure would result in high accident severity.

These projects are prioritized based on the number of potential societal cost of accidents that would be eliminated and the cost of the proposed project.

Efforts to Immediately Reduce Fatalities on State Highways

Based on analysis of the county-by-county data, recommendations for reducing the fatality rate focus on making improvements through a series of approaches: first, by targeting known locations with recurring accidents; second, by improving short sections of corridors (one to three miles) with accident rates above the average for the roadway type; and third, by making lower cost safety improvements (like rumble strips or guardrail upgrades) on routes where there are a large number of accidents throughout the corridor which are not concentrated in a particular spot or short segment. By using this three-prong approach, WSDOT intends to take action against the factors within its control to help reduce fatal and disabling accident rates.

The core of WSDOT strategy is efficient investments in safety improvements. Around the state, multiple low-cost highway improvements are saving lives almost as soon as they are installed, including centerline rumble strips, cable median barriers, guard

rails, and improved lighting and pavement markings. The costs for these highway improvements range from \$40,000-\$200,000 per mile, depending on the type of improvement. Roundabouts are a mid-range highway safety investment; they save lives by allowing traffic to proceed slowly through an intersection, eliminating the chances for high-impact collisions. A roundabout costs between \$1 to \$5 million to design and install.

Special Safety Initiatives

Special Safety Initiatives focuses on specific low-cost features that can be implemented statewide to reduce accidents and their severity. These initiatives include:

- » Install shoulder rumble strips, or stripes on rural multi-lane highways to alert sleepy drivers.
- » Replace non-standard guardrail installed prior to 1970.
- » Install thrie-beam guardrail to strengthen non-standard bridge rails built before 1968.
- » Install median cross-over protection on medians narrower than 50 feet wide to prevent vehicles from driving through.

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Before: Outdated guardrail at the SR 7/SR 705 interchange with I-5 in Tacoma.



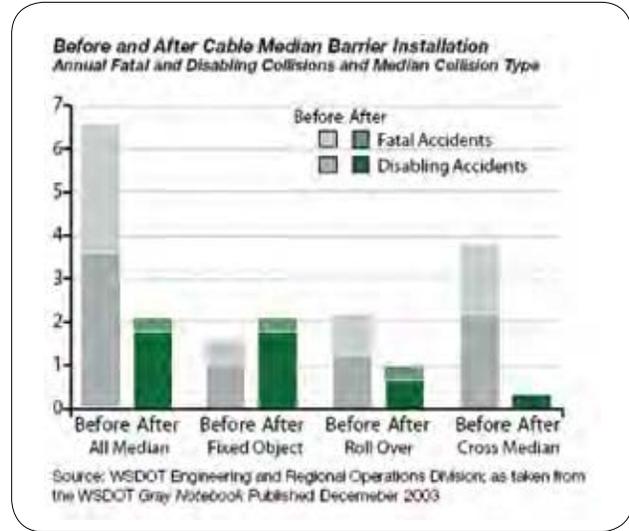
After: The replacement guardrail meets current safety standards, and creates a continuous transition to the bridge rail, removing the blunt end that had existed previously.

- » Install centerline rumble strips on two lane rural highways.
- » Implement re-directional Landform Mitigation.
- » Add passing lanes as a safety strategy on two lane rural highways
- » Protect Re-directional Land Forms

These projects are prioritized two ways; either by the forecasted number of accidents eliminated and the cost of the proposed project or by the number and severity of accidents anticipated to be eliminated compared to the cost of the proposed project. The methodology used varies depending on the type of project.

Interstate Safety

WSDOT and the Federal Highway Administration (FHWA) agreed to create a strategy to identify non-standard features on the Interstate System and



initiate a program to bring them up to appropriate standards.

In the past, these projects were not prioritized but imbedded in roadway preservation projects already programmed. The amount of work programmed within a biennium is limited to funds available for this purpose (for the 2005-07 budget - \$16 million).

Research is currently underway to develop a more strategic approach than investing in standards upgrades on the interstate system. The results are expected to be available for development of the 2009-11 budget.

Safety Rest Areas

New Rest Areas

WSDOT strives to provide a safety rest stop every 60 miles on the National Highway System, (see Appendix D) and on Scenic and Recreational Highways. The Legislature requires that the department develop a partnership with another organization in order to build a new rest area.

The priorities in this category are determined by the cost effectiveness of serving an anticipated number of rest area users, including the benefits of reduced accidents due to the inattention or sleepiness, and includes the construction, operation, and maintenance costs of the facility.

Quick Facts

- » Statewide, the Washington State Department of Transportation (WSDOT) owns and operates 42 safety rest area facilities.
- » The purpose of safety rest areas is to give fatigued drivers a safe place to stop and rest.
- » The annual maintenance cost for state rest areas is over \$4 million. This includes:
 - Facility maintenance
 - Landscape maintenance
 - Trash disposal
 - Utilities (electric, water, sewer)
- » Parking is allowed in state rest areas for up to eight hours, unless otherwise posted. Hours are limited to prevent rest areas from being used as campsites.

Designed With the Traveler in Mind

Most safety rest area facilities provide these amenities:

- » Restrooms designed to meet the Americans with Disabilities Act standards
- » Picnic tables
- » RV dump stations - available at 19 of the 42 rest areas
- » Designated pet areas for leashed animals
- » Pay telephones
- » Snack machines
- » Motorist information - restaurants, hotels/motels, gas, local attractions
- » Free coffee program at 26 of the 42 rest areas

Intersection Improvements

Intersections are identified where traffic volumes are growing and/or minor accidents are beginning to occur. These projects improve safety by adding grade separation, channelization to eliminate rear-end collisions with left or right turning vehicles, and by adding signals or roundabouts as traffic volumes grow. These locations are prioritized based on traffic volumes, warrants, accidents and the cost of the



SR 28 35th Street NW to 31st Street NW

proposed project, and lend themselves to an incremental approach similar to the three tiered solutions approach used for mobility projects.

Roundabouts

WSDOT and a number of Washington State communities have been building roundabouts since 1997. Approximately 94 roundabouts are on the public roadway system in Washington, with 14 on the state highway system. Roundabouts cost between \$1 and \$5 million to design and build, making them more expensive than low-cost efforts such as rumble strips, but much less expensive than major highway safety projects such as interchanges or road widening.

Roundabouts are often touted as one of the safest intersection control devices, so their use on the public roadway system is replacing the traditional American approach of stop signs and traffic signals. National studies from the Insurance Institute for

Total Collisions in WSDOT Study of Nine Roundabouts by Type of Collision
Before and After Installation of Roundabouts

Type of collision	Collisions Before Installation	Collisions After Installation	Percent Change
Fatal and disabling	5	1 ¹	-80%
Evident injury ²	15	4	-73%

Source: WSDOT Traffic Office

¹This was a disabling collision. There have been no fatality collisions in any of the nine intersections after installation of the roundabouts.
²An evident injury is an injury that is verifiable by the police officer when arriving at the crash location and interviewing occupants of the vehicles (i.e. Lacerations, broken bones, and incapacitation)

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Highway Safety show that fatality crashes at an intersections drop 90 percent after the installation of a roundabout, and injury collisions drop by approximately 76 percent.

Roundabouts: Before and After Safety Study

To measure roundabout performance in Washington, WSDOT performed a before and after safety study of nine roundabouts located at intersections on the state highway system. The study analyzed urban and rural roundabouts as well as single-lane and multi-lane roundabouts. In all of the locations, collision data was collected for the three years prior to installation of a roundabout. Once roundabouts were open to traffic, collision data was collected in the same locations. The table on the next page shows a comparison of the number of fatal and disabling injury collisions and evident injury collisions before and after installation of roundabouts.

Based on the analysis of the nine WSDOT roundabouts, fatal and disabling injuries dropped 80 percent. In fact, there have been no fatality collisions in the intersections after installation of the roundabouts. Evident injuries dropped an average of 73 percent at the nine locations. The results show that roundabouts improve safety. While this data represents raw numbers, analysis of rates by month show similar results. Many of the roundabout intersections in the study have also shown reduced average wait times for drivers at the intersection.

European and Australian traffic engineers who have shared information with American traffic engineers have cautioned that the “learning curve” for motorists can cause increases in very minor crashes at multi-lane roundabouts during the “educating motorist” years, usually a period of one to two



Roundabout at the intersection of SR 903 and Bullfrog Road near Cle Elum.

years. Nevertheless, long-term data supports the installation of roundabouts to increase safety and efficiency in intersections.

Pedestrian and Bicycle Risk

Walking and bicycling are integral parts of a balanced transportation system. Most of us are pedestrians at some point of every day and all modes of transportation include a pedestrian component. In some areas of the state, walking and bicycling play a significant role in reducing traffic congestion.

Locations are identified where pedestrians are at higher risk such as around schools, senior centers, and transit facilities. These locations are identified by WSDOT in coordination with local pedestrian bicycle advocacy groups.

These projects reduce pedestrian risk by installing or modifying features such as:

- » Sidewalks to reduce crossing distances at intersections
- » Better lighting,
- » Advance warning signs,
- » Refuge islands in the center of the roadway,
- » In-pavement warning systems.

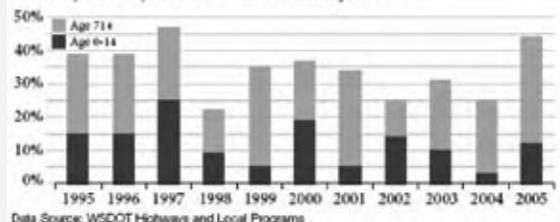
Projects are prioritized by the potential use and cost of the proposed project.

Currently, bicycling and walking account for approximately 5 percent of all trips, and over 6 percent of working trips in urban areas. An average of 88 pedestrians and bicyclists are killed in traffic

Washington State Pedestrian and Bicycle Fatalities by At-Risk Age

1995-2005

Percent of Total Bicycle and Pedestrian Fatalities per Year



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crashes across the state each year. Over 60 percent of the bicycle and pedestrian crashes that most often result in serious injuries and death involve young children or the aging. (Source: US Census and the federal Fatality and Accident Reporting System).

The primary strategies for increasing biking and walking while making it safer include:

- » Maximizing funding for safety needs through partnerships.
- » Raising awareness of bicycle and pedestrian safety needs.
- » Sharing information on bicycle and pedestrian issues between Washington’s agencies, jurisdictions, and organizations.



Half of the elementary schools in Washington are located on or very near state routes. State law requires elementary schools to produce walk route plans.

Performance Measures

Performance Measures are the indicators used to determine if a project, or type of projects are worth the expenditure of public funds required to build them in the first place. Safety Program performance measures include reduction in the number of:

- » Fatal and disabling accidents
- » Crossover head on accidents
- » Recurring congestion related crashes
- » Run off the road accidents
- » Enter at angle accidents
- » Same direction/Rear end accidents
- » Bicycle/Pedestrian Vehicle accidents
- » Fixed object Accidents
- » Driver fatigue accidents

We can’t prevent all traffic collisions. However, our goal is to make them more survivable. More importantly, the results of our success will be shown by fewer deaths and disabling injuries, and when accidents do occur those involved in the crash make a full and complete recovery.