II. Improvement

Highway Safety

What We Have Done

Consistent with the Strategic Highway Safety Plan strategies, the WTP has committed pre-existing funds (PEF), Nickel, and Transportation Partnership Act (TPA) funds to the statewide effort to reduce the occurrence of collisions on the state highway system.

Table 9 shows the WSDOT Safety Category 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 collisions by reducing their frequency and severity. Consequently, capital safety projects on Washington State highways have two primary approaches:

- The Collision Reduction program reactively addresses crashes based on history at a specific location. There are two elements to this program's approach: High Accident Locations (HAL), where collisions occur at a spot location such as a specific intersection, and High Accident Corridors (HAC), where collisions may occur within several areas of a corridor section.
- The Risk Prevention program addresses locations with a higher risk of collisions, including cross-centerline and run-off-the road incidents. This program allows WSDOT to proactively address locations with a higher than average potential for collisions based upon traffic volumes, shoulder widths, speed, vertical and horizontal curves, etc.

Table 9. Subprogram I2 Expenditure History
(Dollars in millions)

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

HAL'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 Collisions

Costs 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 WSDOT to calculate the present value benefits of proposed safety improvements by estimating the number of collisions that will be reduced.

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 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). During the same period, there was a 15 percent 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. Collision data for 2006 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 (see Table 10).

Table 10. Washington State Traffic Fatalities, 2000-05

2000	2001	2002	2003	2004	2005
631	649	659	600	567	649 (Preliminary data)[1]

Source: Fatal Accident Reporting System (FARS)
[1]WSDOT counts an additional 6 deaths for 2005.

Federal law 23 USC § 409 prohibits the discovery or admission into evidence of "reports, surveys, schedules, lists, or data" compiled or collected for the purpose of highway safety improvement projects that might qualify for federal safety improvement funding.

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 seat belts 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 contributing factors. Frequently, more than one of these factors were involved in serious injury and fatal collisions (see Figure 32). 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.

Figure 33 shows the location of completed, and in-progress safety projects on the state highway system since the 2003-2022 Highway System Plan (HSP) update. It also shows the general locations for some currently funded future safety work.

Description of the Issues

What Does the Future Hold

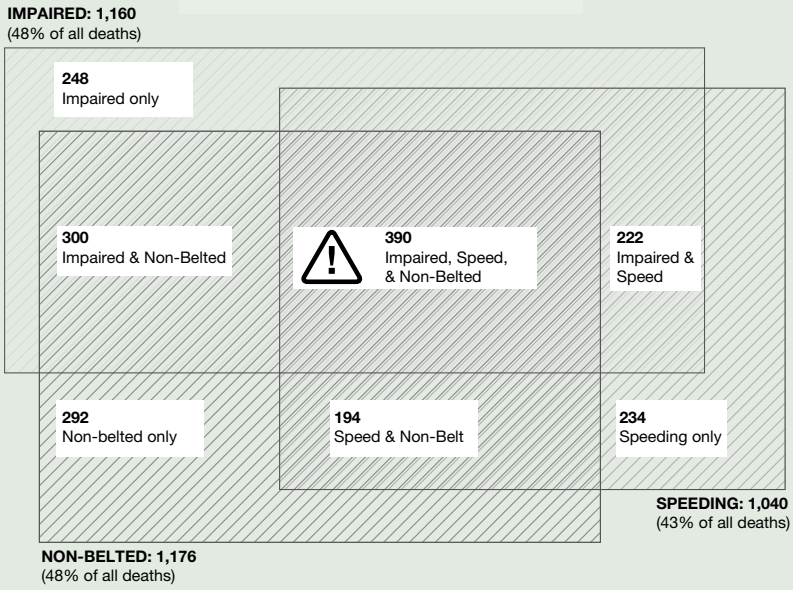
Looking to the future, WSDOT is working with national research groups to help identify cost effective solutions to known accident locations, do risk assessment, and reduce the severity of those collisions that do occur. By looking at behavioral issues and roadway geometrics, WSDOT may be able to reduce the severity of collisions. 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.

Figure 32

WSDOT analyzed 2,429 deaths of motor vehicle occupants from 2000 to 2004. WSDOT found 1,880 (77%) involved impairment (alcohol or drugs), speed, or non seat belt use.

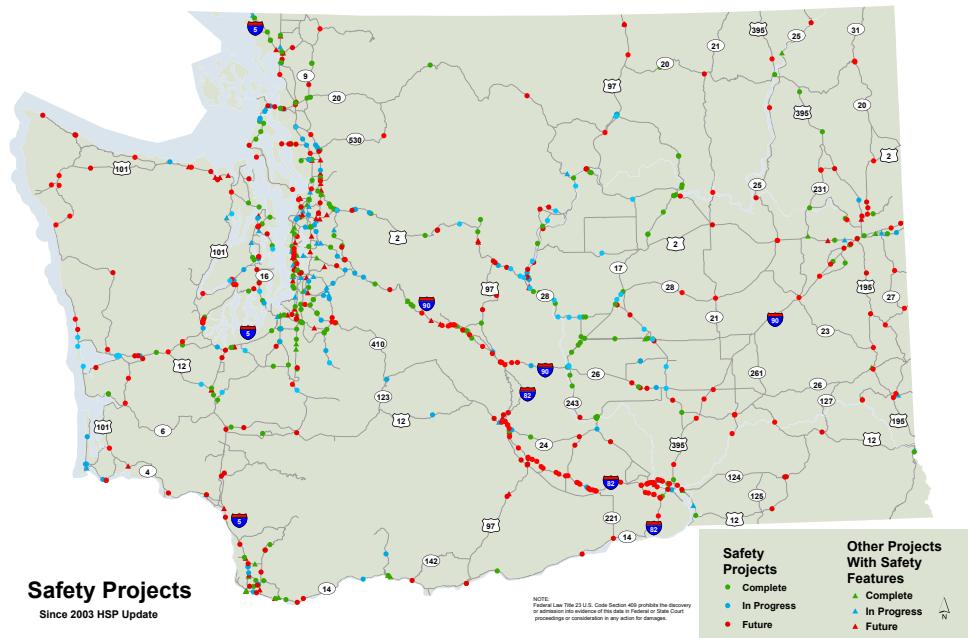
Fatal Accident Causes	Number of Deaths
Impairment only	248
Non-Belted only	292
Speeding only	234
Impairment and Non-Belted	300
Impairment and Speeding	222
Non-Belted and Speeding	194
Impairment, Speeding, and Non-Belted	390
Total Fatalities Involving Impairment, Speeding, or Non-Belted	**1,880**

Source: WSDOT Traffic Office



Federal law 23 USC § 409 prohibits the discovery or admission into evidence of "reports, surveys, schedules, lists, or data" compiled or collected for the purpose of highway safety improvement projects that might qualify for federal safety improvement funding.

Figure 33. Safety Projects



Federal law 23 USC § 409 prohibits the discovery or admission into evidence of "reports, surveys, schedules, lists, or data" compiled or collected for the purpose of highway safety improvement projects that might qualify for federal safety improvement funding.

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

Improvements in highway safety occur throughout the WSDOT highway construction 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.

Needs

WSDOT is a leader in the management of fatal and disabling injury rates nationally. Washington State has one of the lowest traffic fatality rates per hundred million vehicle miles traveled (see Figure 34) among all 50 states. WSDOT evaluates past accident history to determine strategies to further reduce fatal and disabling collisions.

Between 1999 and 2005, crossover, run-off-the-road, and intersections related collisions (see Figure 35) accounted for the greatest number of fatalities and disabling injuries. System wide, low cost safety improvements to reduce the number and severity of these types of collisions have the potential to 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.

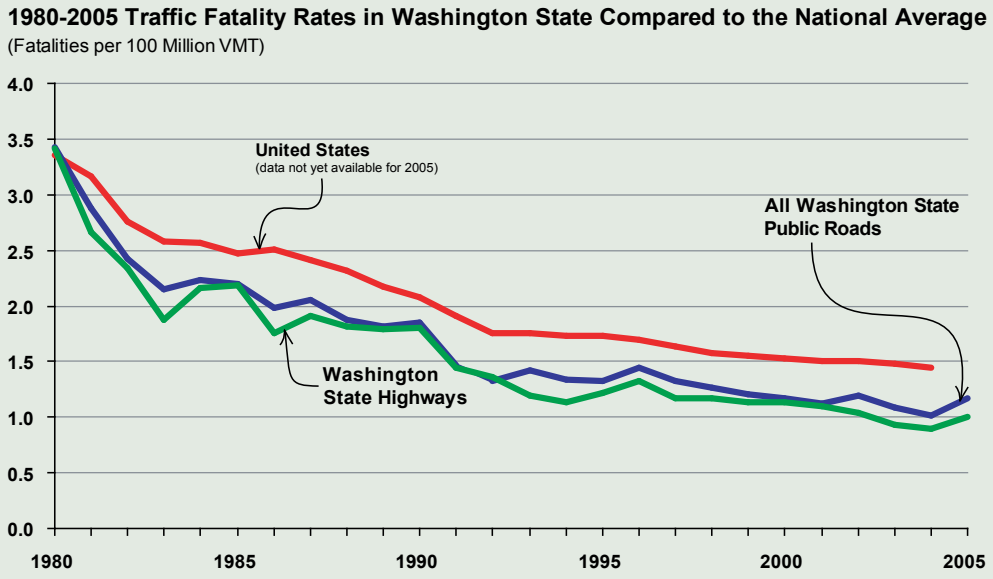
WSDOT is working to continually improve the safety management process through approaches that are proactive. A proactive approach improves potentially problematic areas before severe collisions and the damages associated with them occur.

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

Figure 34. U.S. Fatality Rate vs. Washington State Trend Line

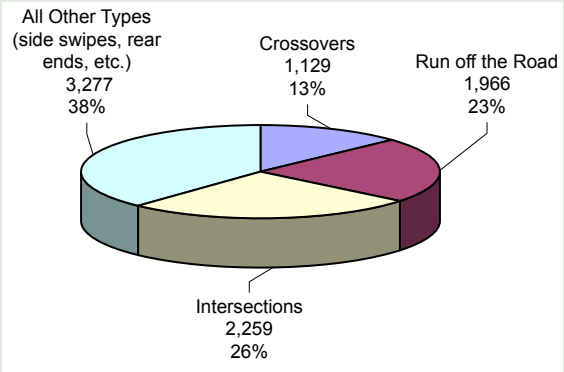


Sources: US Fatalities/VMT: NHTSA Traffic Safety Facts; WA Fatalities: FARS; State Highway Fatalities: WSDOT-TDO, 2005 Annual State Highway Collision Data Summary; WA VMT WSDOT-TDO

Since 1980, the United States fatalitiy rate has declined 56 percent. During this same period, Washington State has experienced an even greater decrease: 70 percent for all public roads and 74 percent for State highways.
Federal law 23 USC section 409 prohibits the discovery or admission into evidence of "reports, surveys, schedules, lists or data" compiled for the purpose of highway safety improvement projects that might qualify for Federal safety improvement funding.

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 (see Figure 36).

Figure 35. Total Fatal and Disabling Collisions, 1999-2005



Federal law 23 USC § 409 prohibits the discovery or admission into evidence of "reports, surveys, schedules, lists, or data" compiled or collected for the purpose of highway safety improvement projects that might qualify for federal safety improvement funding.

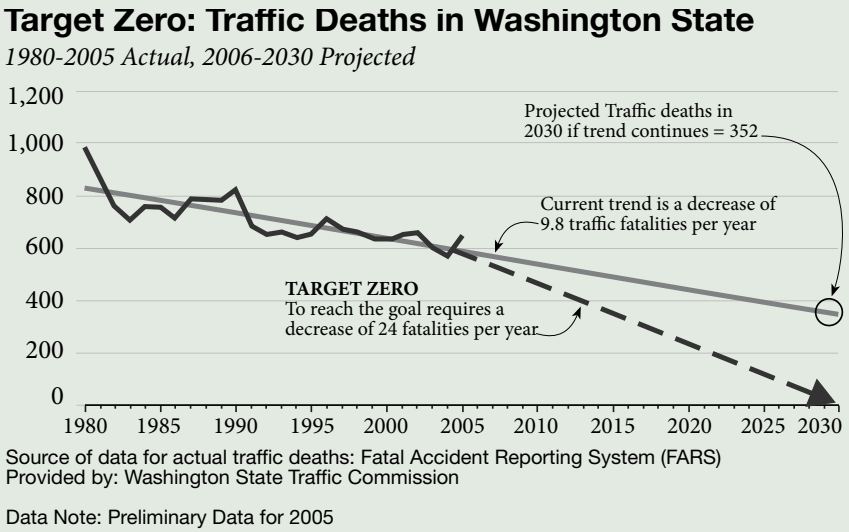
Collisions are the leading cause of death in the United States for people from age 3 to 33. We understand that many of the deaths can be reduced by changes in driver behavior, vehicle design and roadway improvements. Our desire is to improve the quality of life in this state by doing our best to ensure 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 enforcement and engineering components of the "four Es".

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

Figure 36. Target Zero: Traffic Deaths in Washington State



Source of data for actual traffic deaths: Fatal Accident Reporting System (FARS)
Provided by: Washington State Traffic Commission

Data Note: Preliminary Data for 2005

Federal law 23 USC § 409 prohibits the discovery or admission into evidence of "reports, surveys, schedules, lists, or data" compiled or collected for the purpose of highway safety improvement projects that might qualify for federal safety improvement funding.

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 the numbers of alcohol and drug 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, tailgate, street race, drive 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.

Preliminary data 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.

Engineering

Highway safety improvements are WSDOT's main "Target Zero" focus. Focus areas for roadway improvements in the 2000 plan include a reduction in disabling 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 improvement strategies previously shown above, activities in the plan included upgrading bridge rail and guardrail, installing or upgrading traffic signal systems, installing pedestrian-related improvements such as school advance warning signs, crosswalks, and islands, and upgrading standard roadway intersections to freeway style interchanges.

Where to Invest Next

WSDOT is working with national research groups to help improve risk assessment techniques and identify cost-effective solutions to reduce the severity of collisions.

WSDOT's method for evaluating roadways for safety upgrades combines frequency and severity of collisions at locations in a weighted manner. This procedure identifies a significant portion of locations of safety upgrades. However, what is not apparent from the process is the cause of turnovers

of collision locations from year to year. One main issue underlying the turnover rate is the reliability of predictions of collision risk.

Reducing and Preventing Injury Collisions

As strategies 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 when the improvement has impacts to property or environmentally sensitive areas. The success of this program shows that by spending money more strategically, through the application of the appropriate standards, WSDOT 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. 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 initiatives.

  These focus areas enables WSDOT to address potentially hazardous situations before they become a problem:

  – Identify corridors with geometric and roadside elements that contribute to incident probability and increased collision severity.

  – Identify improved signalization, channelization, and roundabout opportunities to reduce collision risk.

  – Identify at-grade intersections in high-speed multi-lane divided highway locations exhibiting high collision potential.

Efforts to Reduce Fatalities and Disabling Injuries on State Highways

Based on analysis of the county-by-county data (see Figure 37), recommendations for reducing fatality rates focus on making improvements through a series of cost effective approaches:

1. Targeting known locations with recurring collisions
2. Improving short sections of corridors that have collision rates above the average for the roadway type
3. Making lower cost safety improvements (like rumble strips or guardrail upgrades) on routes where there are a large number of crashes throughout the corridor which are not concentrated in a particular spot or short segment.

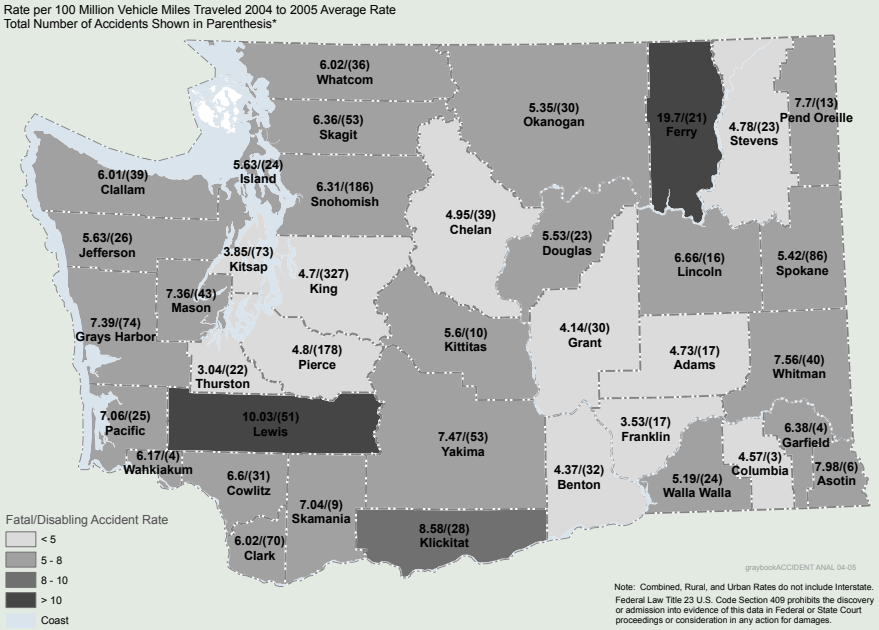
Statewide low-cost highway improvements are saving lives almost as soon as they are implemented. These low-cost improvements include centerline rumble strips, cable median barriers, guard rails, and improved lighting and pavement markings. The costs for these highway improvements range from $40,000-$200,000 per mile, depending on the type of improvement

Using this three-prong approach, WSDOT intends to take action against the factors within its control to help reduce fatal and disabling collision rates.

Risk Reduction

Risk reduction identifies locations where fewer collisions have occurred but the potential for collision frequency or severity is above average. The potential risk is high due to traffic volumes, and crossing into another lane or leaving the roadway would result in a severe collision. These projects are prioritized based on the potential societal cost of collisions that would be eliminated and the cost of the proposed project.

Figure 37. Combined Fatal and Disabling Accident Rate on State Highways by County



Federal law 23 USC § 409 prohibits the discovery or admission into evidence of "reports, surveys, schedules, lists, or data" compiled or collected for the purpose of highway safety improvement projects that might qualify for federal safety improvement funding.

Special Safety Initiatives

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

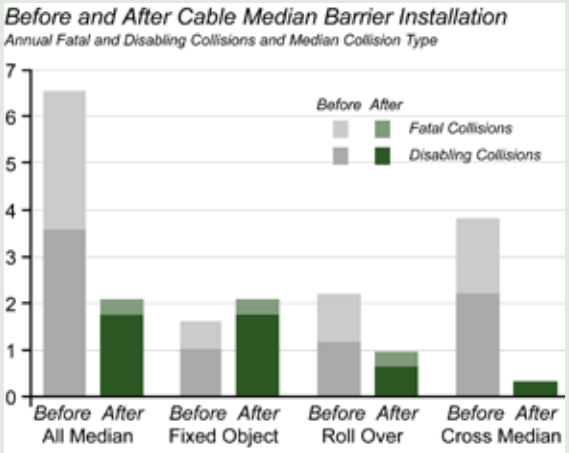
- Install shoulder rumble strips, or stripes (rumble stripes are thick and make a noise, plus they are reflective at night) on rural multi-lane highways to alert sleepy drivers
- Replace guardrail installed prior to 1970 with new guardrail to meet current standards
- Install guardrail to strengthen non-standard bridge rails built before 1968 (see Photo 29).
- Install median cross-over protection on medians narrower than 50 feet wide to prevent vehicles from driving through (see Figure 38).
- Install centerline rumble strips on two lane rural highways.
- Place guard rail around mounded soil (redirectional landforms) at bridge piers.

Photo 29.

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.

Figure 38. Severe Collisions



Federal law 23 USC § 409 prohibits the discovery or admission into evidence of "reports, surveys, schedules, lists, or data" compiled or collected for the purpose of highway safety improvement projects that might qualify for federal safety improvement funding.

» Add passing lanes as a safety strategy on two lane rural highways

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.

Research is underway to identify the locations of above average collisions and risk and identify cost effective solutions to reduce the severity of collisions. 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 any new rest areas are built in partnership between the department and another organization.

Project priorities in this category are determined by their cost effectiveness, based on an anticipated number of rest area users served. Cost effectiveness considers the benefits of reduced collisions due to driver inattention or sleepiness, and includes the construction, operation, and maintenance costs of the facility.

Quick Facts

» Statewide, 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:

» Rest rooms 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

Intersection improvement projects are identified for locations where traffic volumes are growing and/or minor collisions are beginning to occur (see Photo 30). These projects improve safety by:

» Adding turn lanes or turn pockets to reduce rear-end collisions with left or right turning vehicles

» Adding signals or roundabouts as traffic volumes grow.

Photo 30. SR 28 35th Street NW to 31st Street NW

» Adding a bridge to separate cross road traffic from mainline traffic

These locations are prioritized based on traffic volumes, and collisions as defined by national traffic engineering manuals and the cost of the proposed project. Intersection improvement projects 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 (see Photo 31). 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. Their use on the public roadway system is replacing the traditional approach of stop signs and traffic signals. National studies from the Insurance Institute for Highway Safety show that fatality collisions at 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. Table 11 shows a comparison of the number of fatal and disabling injury collisions and evident injury collisions before and after installation of roundabouts.

Photo 31. Roundabout at the intersection of SR 903 and Bullfrog Road Near Cle Elum.

Table 11. 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

[1]This was a disabling collision. There have been no fatality collisions in any of the nine intersections after installation of the roundabouts.
[2]An 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)

Federal law 23 USC § 409 prohibits the discovery or admission into evidence of "reports, surveys, schedules, lists, or data" compiled or collected for the purpose of highway safety improvement projects that might qualify for federal safety improvement funding.

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 have cautioned that the "learning curve" for motorists can cause increases minor crashes at multi-lane roundabouts during the "educating motorist" years, usually a period of one to two 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 (see Figure 39). 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.

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.

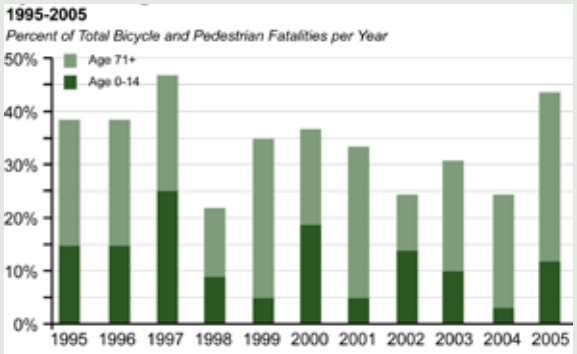
Locations are identified where pedestrians are at higher risk such as around schools (see Photo 32), senior centers, and transit facilities. These locations are identified by WSDOT in coordination with local pedestrian bicycle advocacy groups.

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.

Figure 39. Washington State Pedestrian and Bicycle Fatalities by At-Risk Age



Federal law 23 USC § 409 prohibits the discovery or admission into evidence of "reports, surveys, schedules, lists, or data" compiled or collected for the purpose of highway safety improvement projects that might qualify for federal safety improvement funding.

Photo 32. 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.

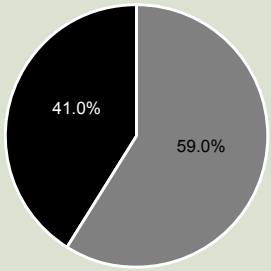
Prioritization Process

One of the primary goals of priority programming is to maximize return on investment dollars. This helps ensure that transportation dollars are being spent in those areas with the highest benefit and lowest cost.

The prioritization approach for this HSP update will include a combination of Safety strategies from low cost safety Initiatives to moderate, and maximum fixes. Projects solutions under these strategies are based on available funding, and project benefits, and in some cases the solutions chosen are a first step towards a future, more permanent and costly fix that may be warranted as additional funding becomes available.

Safety: Funded vs. WTP Unfunded Targets

	Funded ($ in millions)	WTP Unfunded Targets ($ in millions)
Safety Total	$2,094	$3,011
Highway System Plan Total	$15,625	$33,114



Performance Measures

WSDOT 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 collisions do occur, and our goal is that those involved make a full and complete recovery.

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 collisions
- Crossover head on collisions
- Recurring congestion related crashes
- Run off the road collisions
- Enter at angle collisions
- Same direction/Rear end collisions
- Bicycle/Pedestrian Vehicle collisions
- Fixed object collisions
- Driver fatigue collisions