

Asset Management: Pavement Conditions Annual Report

Pavement Conditions

WSDOT introduces measures for long-term pavement sustainability

WSDOT continues to feel the consequences of reduced funding for pavement preservation. While the agency met its goal, with 90.5 percent of state highway pavement in fair or better condition in 2011 (the latest available data), this is a drop of 2.2 percent from 2010, when 92.7 percent was fair or better. WSDOT maintains pavement on 18,622 lane miles of state highways, and 2,000 lane miles of ramps and special use lanes. The agency's pavement management system is recognized as one of the best in the nation. New performance measures are being used by WSDOT to manage the preservation of its pavement, as shown in the dashboard below. This article also introduces new federal performance requirements in the Moving Ahead for Progress in the 21st Century Act (MAP-21) for pavement management (see pp. ix-x for an overview of MAP-21).

Pavement conditions in 2011

Bituminous surface treatments (BST), also known as chip seal, pavement condition data was not evaluated for the 2011 pavement condition survey due to budget reductions. The state's roadways consist of three pavement types. Chip seal pavement makes up 28 percent of state road lane miles, asphalt (hot mix asphalt and warm mix asphalt) makes up 59 percent, and concrete makes up 13 percent

(see table on p. 12). Chip seal pavement on state roads increased by 382 lane miles between 2010 and 2011. It is expected to continue to rise because much of the asphalt pavement that is due for rehabilitation will be replaced with chip seal, which is more cost effective than asphalt under the right conditions. See the *Gray Notebook* 44, pp. 12-13 for a comparison of chip seal and asphalt pavement. It is undetermined at this time if chip seal pavement will be evaluated for the 2012 and future condition surveys.

Survey determines rehabilitation priorities

The annual condition survey determines when pavement is due for rehabilitation or replacement. It measures the cracking, rutting and roughness on 0.1 mile segments of roadway. The lowest rated score between the three measures is used to rate a pavement segment as very good, good, fair, poor, or very poor. A good condition pavement is smooth with few defects while a poor condition pavement is characterized by cracking, patching, rutting and roughness, shown in the photos on p. 12. Pavement segments are prioritized for rehabilitation based on the condition survey.

Without pavement condition data for chip seal, resurfacing is programmed on a scheduled basis rather than based on remaining service life. This runs the risk of replacing chip seal before the end of its useful service life on some segments.

Pavement performance measures dashboard

Performance measure ¹	Previous year	Current year	Goal	Goal met	Progress	Comments
Percent of pavement in fair or better condition <small>(Annual measure: calendar years 2010 & 2011)</small>	92.0% ²	90.5%	90.0%			Reduction from previous year; chip seal not rated in 2011 (pp. 11-12).
New pavement performance measures						
Average years and percent of Remaining Service Life ³ of asphalt and chip seal pavement <small>(Annual measure: fiscal years 2011 & 2012)</small>	6.11 yrs 52.2%	6.09 yrs 51.9%	40% to 60%			Indicates average remaining life of flexible pavement: about 52% of the average life remains (p. 13).
Asset Sustainability Ratio ⁴ of asphalt and chip seal pavement <small>(Annual measure: calendar years 2011 & 2012)</small>	0.79	0.70	1.0	-		Measures the years of service life replenished divided by the service life consumed annually. (pp. 13-14).
Deferred Preservation Liability ⁵ of all pavement (asphalt, chip seal and concrete) <small>(Annual measure: fiscal years 2011 & 2012)</small>	\$176 million	\$220 million	\$0	-		Measures the accumulated agency cost of deferred pavement rehabilitation. (p. 14).

Notes: 1 All measures are for WSDOT state highway pavement. 2 For comparison purposes, the 2010 pavement condition for all pavement types was 92.7 percent fair or better. 3 Remaining Service Life is the years and percent left of a pavement segment's remaining useful life before rehabilitation or replacement is necessary. 4 Asset Sustainability Ratio compares the years of useful pavement life replenished in a given year through rehabilitation compared to the amount consumed. 5 Deferred Preservation Liability is the cost in current dollars to fund the backlog of past due pavement rehabilitation work. The project trend for all measures is unfavorable.

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Pavement conditions trend downward as preservation funding declines

Pavement conditions drop to 90.5 percent in fair or better condition in 2011

Washington's state highway pavement conditions met the Governor's Cabinet Strategic Action Plan goal of maintaining 90 percent of roads in fair or better condition in 2011. However, pavement condition has dropped from 2010 levels, when 92.7 percent of all pavement and 92 percent of asphalt and concrete pavement were in fair or better condition, shown in the table on p. 12. Despite the drop, average pavement conditions continued to be good in Washington, with 90.5 percent of asphalt and concrete pavement rated fair or better in 2011.

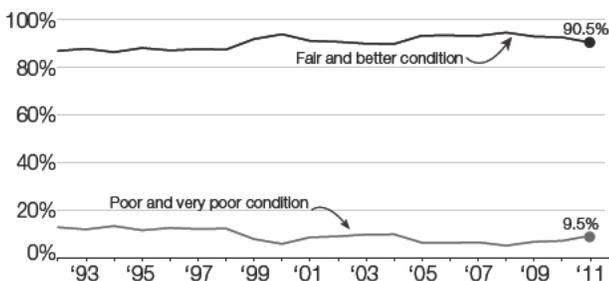
The percent of asphalt and concrete pavement in poor or very poor condition worsened by 2.2 percentage points, with 9.5 percent in poor condition in 2011, compared to 7.3 percent in 2010 for all pavement and 8 percent in 2010 for asphalt and concrete pavement. The total lane miles of asphalt and concrete pavement in poor or very poor condition increased by 11.5 percent from 1,029 lane miles in 2010 to 1,147 in 2011.

Some 9.5 percent of asphalt and concrete pavement were in poor condition in 2011

Pavement in fair or better condition trends downward
Pavement conditions in 2011 continue a slight yet steady decline since 2008 in the percent of pavement in fair or better condition, shown in the graph below. The condition of all WSDOT's pavement types has been declining since 2008 when 94.7 percent was in fair or better condition. The trend is similar for asphalt and concrete pavement (excluding chip seal for comparison purposes), which has been declining since 2005 when 94.3 percent was in fair or better condition. Pavement in fair or better condition has not dropped below 90.5 percent since 2004 for all pavement (and since 1997 for asphalt and concrete).

State highway pavement condition

1993 through 2011; All pavement types; Chip seal pavement excluded for 2011



Data source: WSDOT Materials Lab.

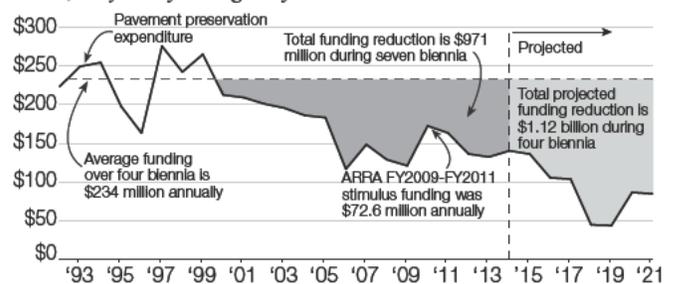
Note: 2011 condition data does not include chip seal pavement due to reduced funding. Data for 2001-2010 include all pavement types.

Funding for pavement preservation declines

Investment in the preservation of WSDOT's pavement has been declining steadily since 1999 with reductions accumulating to \$971 million during the last seven biennia. Pavement preservation funding is projected to continue to decline, shown in the graph below. At planned funding levels, the reduction during the next four biennia is projected to be \$1.12 billion.

WSDOT historic and projected pavement preservation funding

FY1993 through FY2021; Annual dollars in millions; Constant 2012 dollars; Projected funding as of December 2012

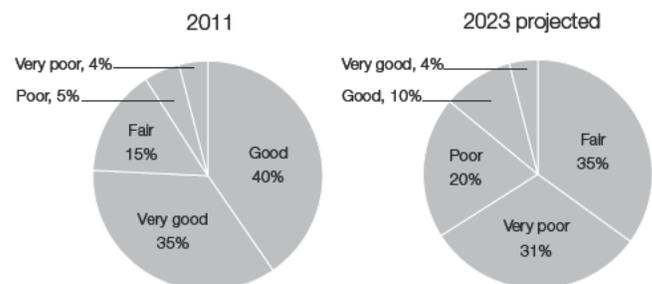


Data source: WSDOT Materials Lab.

WSDOT is at the forefront of implementing cost saving methods to make the state's roads last longer and cost less. However, if the investment in pavement preservation continues to decline, the backlog of pavement rehabilitation will continue to grow. By 2023 more than half of the state's pavement network is projected to be in poor or very poor condition if planned funding levels persist, as shown in the pie charts below. Continued funding is necessary to minimize the more costly alternative of replacing pavement.

WSDOT pavement condition

2011 and 2023; Conditions in 2011 exclude chip seal pavement



Data source: WSDOT Materials Lab.

Note: Projection for fiscal year 2023 based on all pavement types and agency budget assumptions.

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Percent of pavement in fair or better condition decreases in 2011

State highway pavement conditions in 2010 and 2011¹

Total lane miles; Vehicle miles traveled (VMT) in billions; Funding and lane miles programmed for rehabilitation by biennium with dollars in millions

Pavement type	2011 lane miles and percent of total lane miles ²	2011 annual VMT ³ in billions	Condition rating (Target is 90% fair or better)			Funding and lane miles programmed for rehabilitation	
			Category ⁴	2010	2011	2011-2013 biennium ⁵	2013-2015 biennium ⁶
Chip seal (BST) pavement <i>Six to eight years of service life⁷</i>	5,181 (28%)	1.56 (5%)	Good/very good	78.8%		\$83.75 (31%) 1,927 lane miles	\$88.19 (30%) 1,802 lane miles
			Fair	15.9%	not evaluated ¹		
			Fair or better	94.7%			
			Poor/very poor	5.3%			
Asphalt pavement <i>Ten to 16 years of service life⁷</i>	11,028 (59%)	21.28 (68%)	Good/very good	78.7%	75.7%	\$131.49 (49%) 630 lane miles	\$170.17 (57%) 562 lane miles
			Fair	13.6%	14.8%		
			Fair or better	92.3%	90.5%		
			Poor/very poor	7.7%	9.5%		
Concrete pavement <i>Fifty years of service life⁷</i>	2,413 (13%)	8.61 (27%)	Good/very good	72.6%	75.3%	\$53.00 (20%) 96 lane miles	\$38.64 (13%) 55 lane miles
			Fair	17.9%	15.4%		
			Fair or better	90.5%	90.7%		
			Poor/very poor	9.5%	9.3%		
Total - all pavement for 2010	18,622 (100%)	31.45 (100%)	Good/very good	78.0%		\$268.24 (100%) 2,653 lane miles	\$297.01 (100%) 2,419 lane miles
			Fair	14.6%	not evaluated ⁷		
			Fair or better	92.7%			
			Poor/very poor	7.3%			
Total - asphalt and concrete pavement for 2010 and 2011	13,441 (72%)	29.89 (95%)	Good/very good	77.8%	75.6%	\$184.49 (69%) 726 lane miles	\$208.81 (70%) 617 lane miles
			Fair	14.2%	14.9%		
			Fair or better	92.0%	90.5%		
			Poor/very poor	8.0%	9.5%		

Data source: WSDOT Materials Lab and Statewide Travel and Collision Data Office (STCDO).

Notes: 1 Chip seal pavement condition was not evaluated in 2011 due to funding reduction. 2 Lane miles data is from the State Highway Log Planning Report 2011 (v-13). 3 Vehicle miles traveled data is from the WSDOT Geographic Information System & Roadway Data Office and excludes ramps, collector-distributors and frontage roads. 4 Fair or better includes very good, good, and fair and may not add due to rounding. WSDOT's strategic goal is 90 percent fair or better condition. 5 Dollars and lane miles for the 2011-2013 biennium is from *Gray Notebook* 44. 6 Dollars for the 2013-2015 biennium are approximations and do not include other planned improvements, such as safety enhancements. These numbers are from WSDOT Transportation Executive Information System (TEIS) Version 12GOV002. Lane miles for the 2013-2015 biennium are taken from WSDOT Capital Program Management System (CPMS) on November 15, 2012, TEIS Version 13DOT000 and includes approved projects. 7 Pavement service life varies depending on traffic condition and climate.



Asphalt pavement in good condition.



Asphalt pavement in fair condition: wear in wheelpath and transverse crack across the road.



Asphalt pavement in very poor condition: past due for rehabilitation, will require costly repair.

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Remaining Service Life of pavement is expected to drop below target levels

WSDOT introduces new measures to manage pavement preservation sustainably

Looking at pavement condition as a stand-alone performance measure provides only a snapshot in time, instead of the whole picture. WSDOT is using three new performance measures to evaluate the long-term preservation of pavement. These are Remaining Service Life, Asset Sustainability Ratio, and Deferred Preservation Liability.

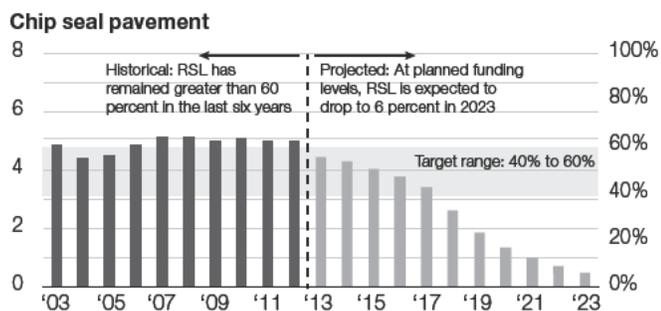
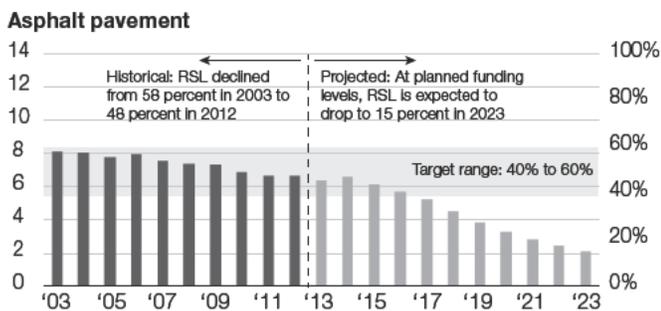
Remaining Service Life of pavement meets target range in 2012, expected to decline in next decade

Remaining Service Life (RSL) measures the expected life of pavement by measuring the number of years before rehabilitation is required for any given pavement section. RSL is expressed as the average number of years remaining, and as a percent of the original life. The statewide average RSL is an important aspect of this performance measure.

WSDOT's flexible road network (state-owned roads with asphalt and chip seal pavement) had an average Remaining Service Life of 48 percent for asphalt pavement and 61 percent for chip seal pavement in fiscal year 2012 (July 1, 2011 through June 30, 2012).

Statewide average Remaining Service Life of WSDOT asphalt and chip seal pavement is declining

FY2003 through FY2023; Remaining Service Life (RSL) in years remaining and as a percent of the original life



Data source: WSDOT Materials Lab.

Note: The statewide average 100 percent Remaining Service Life is 14 years for asphalt pavement and eight years for chip seal pavement.

When a road is constructed (or reconstructed) it is typically in excellent condition, with a full service life. After a period of years, the pavement structure will wear and reach a point where intervention (rehabilitation) is necessary. Sometimes intervention can be delayed through maintenance, such as crack sealing or patching. When pavement is rehabilitated, years are added back to the Remaining Service Life. Newly resurfaced asphalt pavement may have an expected life of 16 years in western Washington and 12 years in eastern Washington, depending on climate and traffic conditions. After 10 years, the western Washington pavement would have six years of RSL and the eastern Washington pavement would have two years of RSL.

The statewide average Remaining Service Life over the previous 10 years and projections for the next 10 years (at planned funding levels) are shown in the graphs to the left for asphalt and chip seal pavement. The RSL target is between 40 percent and 60 percent, or about half of the remaining years of service life. From an asset management perspective, the target means the agency is not spending too much money on rehabilitating roads with adequate service life left, and is not depleting the asset by letting a backlog of roads go past due for rehabilitation.

The Remaining Service Life of the state's flexible pavement is expected to decline far below target levels in the next decade, if the agency's funding continues as planned. Asphalt pavement

The Remaining Service Life of the state's flexible pavement is expected to decline far below target levels in the next decade with planned funding

is expected to trend down to an average of two years of service life left (15 percent of RSL) in FY2023, far below the minimum target. Chip seal follows a similar trend, with a drop to less than one year of average RSL in FY2023. Once the statewide average RSL reaches critical levels below 40 percent, it will be expensive to fix the many lane miles of pavement that need rehabilitation.

Concrete pavements are managed separately and do not have a cyclical resurfacing process. The RSL performance indicator for concrete will be developed in the future.

Pavement replenishment not keeping up with wear according to the Asset Sustainability Ratio

The Asset Sustainability Ratio measures how well WSDOT's pavement replenishment is keeping up with pavement wear. It explains how much life was put back into the pavement system during the year to replenish the service life that was consumed. WSDOT replenished 70 percent of the lane mile years of flexible pavement (asphalt and chip seal) consumed during 2012, with

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Deferred pavement preservation backlog reached \$220 million in FY2012

11,263 total lane mile years replenished out of about 16,000 lane mile years consumed. This means the years of service life added back into the flexible road network through rehabilitation was about 70 percent of the service life used in 2012.

Replenishment is calculated every year by multiplying the lane miles of rehabilitated flexible pavement by the number of years of expected life added to each rehabilitated lane mile. The service life consumed is equal to the number of lane miles on the network, about 16,000; after one year of wear there has been about 16,000 lane mile years of pavement life consumed. The Asset Sustainability Ratio is the ratio of lane mile years replenished to lane mile years consumed.

WSDOT replenished 70 percent of the lane mile years consumed in 2012

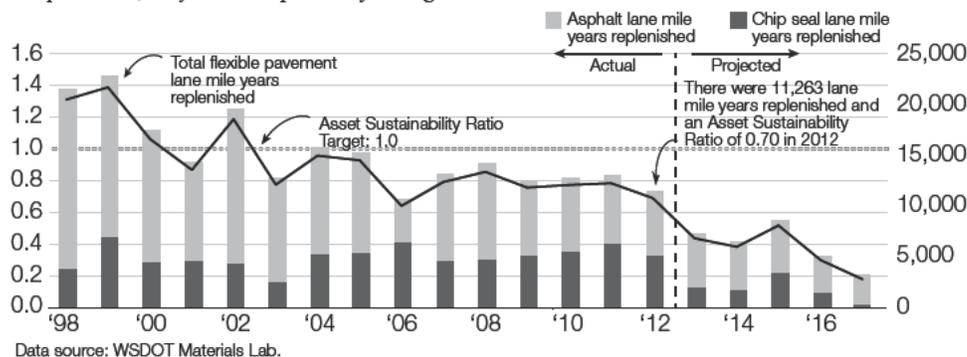
An illustration of the historic and projected Asset Sustainability Ratio for the state's flexible pavement is shown in the graph below. The Asset Sustainability Ratio has been declining over the past decade. At the agency's planned funding levels, the drop is expected to continue and reach a ratio of 0.22 in 2022. Meaning, 22 percent of the lane mile years consumed are expected to be replenished in 2022. The downward trend in the Asset Sustainability Ratio follows the same drop in planned pavement preservation funding and in Remaining Service Life.

The target for the Asset Sustainability Ratio is 1.0, meaning the agency is replenishing the same amount of service life into the road network as it is consuming each year. If the ratio is less than 1.0, fewer lane mile years are being put into the network than were consumed by wear and aging. Many consecutive years of an Asset Sustainability Ratio less than 1.0 will decrease the network's overall Remaining Service Life, because the level of pavement preservation is not sustainable.

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WSDOT Asset Sustainability Ratio for flexible pavement

1998 through 2022; Asset Sustainability Ratio and replenishment in lane mile years for asphalt and chip seal pavement; Projections at planned funding levels



Deferred Preservation Liability shows cost of past due pavement work increasing

WSDOT's \$220 million of deferred pavement preservation liability in FY2012 was \$44 million worse than in FY2011, when

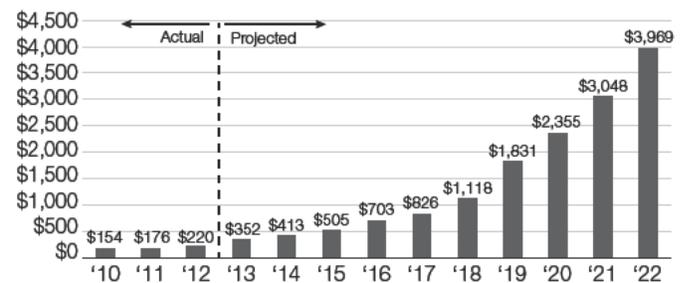
WSDOT's \$220 million of rehabilitation backlog in FY2012 was \$44 million worse than in FY2011

\$176 million was necessary to fund the backlog of pavement rehabilitation work that was past due. It is expected WSDOT will have nearly \$4 billion in deferred

preservation liability in FY2022 if the agency's budget assumptions and planned funding levels continue; see graph below. The accrued Deferred Preservation Liability is an estimate of the funding necessary to address the backlog of deferred pavement rehabilitation.

WSDOT Deferred Preservation Liability

FY2010 through FY2022; Funding necessary to address deferred pavement rehabilitation for all pavement types; Dollars in millions; Projections based on planned funding levels



Data source: WSDOT Materials Lab.

If funding does not allow for an adequate Asset Sustainability Ratio, some pavement preservation is deferred, incurring a future financial liability. Consequences of deferring pavement preservation become more severe as pavement ages. As rehabilitation is deferred, pavement can undergo more severe damage,

requiring more costly repair or reconstruction than if addressed earlier and impacting road maintenance. Higher costs for past due repairs are included in the Deferred Preservation Liability.

The future rise in Deferred Preservation Liability matches the loss of Remaining Service Life and Asset Sustainability Ratio. Together these measures indicate an unfavorable trend of deterioration that means pavement will be more costly to rehabilitate in the future if planned funding levels continue.

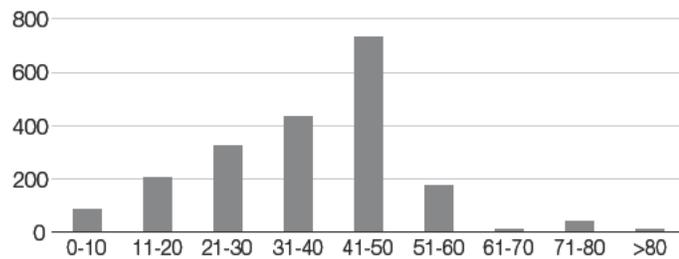
Crack and seat concrete pavement rehabilitation saves time and money

Concrete pavement management more costly

Concrete pavement does not perform in the same way as flexible pavement (asphalt and chip seal). Flexible pavement is typically managed in a cyclical manner, with resurfacing planned over the life of the pavement. Concrete pavement is substantially more costly to construct, but usually requires little rehabilitation over a longer pavement life (more than 50 years). Sixty two percent of WSDOT's concrete pavement lane miles have never been rehabilitated. However, when the age of concrete pavement begins to exceed 50 years, plans need to be implemented for eventual reconstruction. Nearly half (48 percent) of WSDOT's concrete pavement lane miles is more than 40 years old, and 70 percent is more than 30 years old. The age of WSDOT's concrete pavement by number of lane miles is shown in the graph below.

Lane miles of concrete pavement by age group

Age of concrete pavement in years in 2011



Data source: WSDOT Materials Lab.

Note: Lane miles of concrete pavement by age exclude concrete bridges, which are maintained separately from concrete pavement roadways.

WSDOT evaluates new method for concrete pavement reconstruction: crack and seat with an asphalt overlay

WSDOT is evaluating a new method of rehabilitating concrete pavement in poor condition, called “crack and seat and asphalt overlay.” This rehabilitation process fractures the existing concrete roadway in place, turning it into a new flexible base upon which a thick asphalt pavement overlay is placed.

Concrete pavement reconstruction is normally achieved by completely removing the concrete slab in addition to the aggregate base layers, and replacing it with an asphalt or concrete pavement surface. With crack and seat and asphalt overlay, the existing structure remains in place, resulting in substantial cost savings due to reduced material removal and replacement costs and reductions in traffic delays due to shorter construction periods.

State's first crack and seat project saves time, money

In 2011, WSDOT completed its first project with crack and seat and asphalt overlay on I-5 in Skagit County. This project restored

12.5 miles of divided highway from Joe Leary Slough to Nulle Road in Skagit County. Awarded under a design build contract, WSDOT saved more than 38 percent in initial construction costs and is expected to save at least 23 percent in life-cycle costs over a 50-year period.

The cost savings for crack and seat and asphalt overlay is substantial, and is anticipated to be an important alternative to

WSDOT's first crack and seat overlay project saved more than \$400,000 per lane mile

reconstruct concrete pavement as WSDOT's concrete network ages. The typical cost for concrete reconstruction is approximately \$2.5 million per lane-mile.

Asphalt reconstruction is more than \$1 million per lane-mile. The crack and seat and asphalt overlay cost of the Skagit County I-5 project was less than \$600,000 per lane-mile, a savings of more than \$400,000 per lane-mile. As a result of the cost savings from the Skagit County I-5 project, other suitable locations in Washington are being considered for the crack and seat and asphalt overlay method.

Local agency pavement management

County road conditions decline in 2012

Conditions on county roads have deteriorated slightly over time. County arterial pavement conditions have dropped steadily from 95 percent in fair or better condition in 2006, to 89 percent in 2012, a decline of six percentage points.

County collector road conditions were steady in previous reporting years and dropped by 3 percent from 95 percent in fair or better condition in 2010 to 92 percent in 2012. City condition data for 2012 is incomplete due to legislatively modified reporting requirements. County pavement condition ratings and city ratings for past years are reported in the table on the next page.

WSDOT reports local agency conditions to Legislature

City and county agencies collectively manage a large network of more than 117,000 lane miles of roadway, about 75 percent of which are paved with concrete, asphalt or chip seal. WSDOT reports the overall condition of the state's local agency pavement network to the state Legislature, using condition data that is mostly provided by cities and counties and by assisting smaller cities with data collection. County road pavement data on the collector and arterial system is gathered and reported by the County Road Administration Board and updated by the counties every two years.

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Local agency pavement, federal legislation to set national pavement measure

Cities forego pavement condition reporting for 2012

Cities with populations above 25,000 normally collect and report their pavement conditions to WSDOT. Since 2005, WSDOT has assisted small cities (populations below 25,000) with gathering, analyzing and reporting pavement condition data using WSDOT’s automated data collection vehicle to survey federally classified arterials and collectors.

In 2011, the Legislature modified reporting requirements to allow cities to forego pavement condition data collection and reporting for the 2011-2013 biennium. As a result, cities with populations above 25,000 did not report pavement conditions to WSDOT for 2012. Therefore, WSDOT’s data set for city pavement condition is incomplete and does not accurately compare to previous reporting cycles.

Local agencies still face several challenges in managing the preservation of pavement assets as funding priorities are shifted due to reduced funding. See *Gray Notebook* 44, p. 16, for the top pavement management issues faced by local agencies.

WSDOT collects and reports city pavement condition ratings differently than overall state pavement conditions. City pavement condition measures include the Pavement Condition Index (PCI) and five pavement condition score groups: failed, poor, fair, good, and excellent. This rating system provides WSDOT with a good indicator of the overall system condition.

Percent of local agency pavement in fair or better condition¹

For 2006, 2008, 2010 and 2012² calendar years

Year	City		County	
	Arterial ³	Collector ⁴	Arterial ³	Collector ⁴
2006	83%	75%	95%	95%
2008	82%	75%	94%	96%
2010	81%	76%	91%	95%
2012	Incomplete data ²		89%	92%

Data source: WSDOT Highways and Local Programs.

Notes: 1 Condition data for counties is reported by the County Road Administration Board. Cities with populations over 25,000 self-report condition data. Small cities (under 25,000) data is collected by WSDOT.

2 The 2011 Legislature modified pavement condition reporting requirements for cities in RCW 46.68.113 (2011 c 353 §7), resulting in incomplete pavement condition reporting for 2012. 3 An arterial is a road that connects a city or county to a state route or freeway, and can include the freeway system and state routes. 4 A collector is a road that provides direct access to local roads and driveway access to abutting properties or distributes trips to and from the arterial system.

New federal legislation has the potential to impact pavement management

The new federal Moving Ahead for Progress in the 21st Century Act (MAP-21) includes the implementation of the National Highway Performance Program. MAP-21 will require every state to direct infrastructure investments toward the achievement of performance targets (see overview on pp. ix-x). Pavement targets are an important aspect of national performance reporting. MAP-21 includes funding penalties if a state’s targets are not met over a given period of time.

Expansion of the National Highway System

The MAP-21 performance reporting applies only to roads that are part of the National Highway System (NHS), which is a national collection of roadways that are designated as important to the nation’s economy, defense, and mobility. The NHS expanded in size by one third in 2012 due to a substantial national revision.

In Washington state, NHS roadways make up 61 percent of WSDOT’s mainline miles (11,424 NHS lane miles out of 18,622 WSDOT lane miles). Another 3,336 lane miles of local agency roads are on the NHS. This will be an essential factor in interpreting Washington’s data for MAP-21 pavement performance measures, as local agency roads will make up 23 percent of NHS lane miles that will be reported by WSDOT.

International Roughness Index is anticipated to be the MAP-21 national performance measure for pavement

It is expected that MAP-21 will use the International Roughness Index (IRI) as the initial pavement performance measure. The IRI has the advantage of being well known, well documented, and having an existing standard method of measurement. All states currently report IRI data to the Federal Highway Administration (see next page), which it uses as an indicator of overall road health. Yet, comparing values between states can be difficult due to the technical factors involved in collecting and interpreting the data.

WSDOT’s experience is that roughness tends to be a delayed performance indicator. By the time roughness reaches an unacceptable threshold, rehabilitation should have already been performed to improve the pavement condition that contributed to roughness (cracking, rutting, or surface deterioration).

WSDOT recommends additional measures be considered for pavement performance. Research and development is expected to occur over the next several years to create methods for calculating and comparing additional performance measures equally between the states.

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International Roughness Index deems 10 percent of state roads are too rough

WSDOT reports International Roughness Index

Rough roads carry 8.3 percent of vehicle miles traveled on Washington state highways in 2011

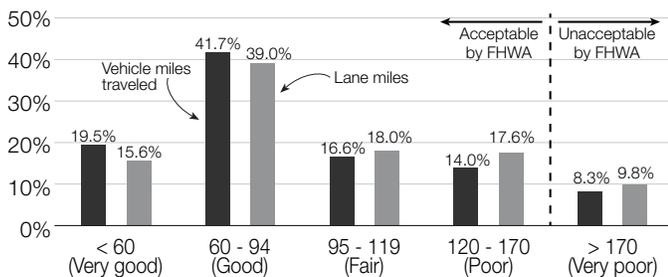
Statewide, 8.3 percent of vehicle miles traveled on WSDOT's pavement network in 2011 were on roads in unacceptable condition according to Federal Highway Administration (FHWA) International Roughness Index criteria. This is a slight increase, up 1.2 percent from 7.1 percent in 2010. FHWA requires reporting on the vehicle miles traveled by IRI categories. The graph below shows the percent of vehicle miles traveled and the percent of lane miles by each of the FHWA roughness categories.

Rough roads make up 9.8 percent of lane miles on state highways in 2011

In terms of lane miles on the state's pavement network, 9.8 percent of lane miles were in unacceptably rough condition in 2011, using FHWA criteria. The IRI may become a national measure of pavement performance in MAP-21 with federal funds to states penalized if targets (yet to be determined) are not met.

Percent of vehicle miles traveled and lane miles for WSDOT pavement by International Roughness Index

All pavement types for 2011; International Roughness Index (IRI) categories by the Federal Highway Administration; IRI in inches per mile



Data source: WSDOT Materials Lab.

WSDOT Pavement Notebook is available online

The Pavement Notebook presents performance reports for the WSDOT road network that are more in-depth and comprehensive than what can be covered in the *Gray Notebook* and are accessible online. Reports include: statewide pavement performance (including breakdowns by county and legislative district); average pavement life; statewide International Roughness Index statistics; and lane miles paved by year.

The Pavement Notebook performance reports are produced by the Pavements Branch of the State Materials Lab and can be accessed at <http://www.wsdot.wa.gov/Business/MaterialsLab/Pavements/PavementNotebook.htm>

How WSDOT measures pavement performance

Pavement performance can be defined and measured in different categories that each contribute toward evaluating the overall performance of a road network's pavement.

- **Structural performance** rates the condition of the pavement structure and is typically quantified by the amount of rutting or cracking on the pavement surface. How conditions should be measured and quantified is one of the most difficult categories for states to reach agreement on.
- **Functional performance** relates to how well the pavement is functioning for the road users. It is typically quantified by the road roughness (expressed as the International Roughness Index) and rutting in the pavement surface. Automated equipment measures roughness and rutting. All states must report roughness performance to the Federal Highway Administration.
- **Safety performance** measures road condition safety and is quantified by surface friction measurements (Skid Number or International Friction Index) and accident rates.
- **Economic performance** is relatively new and evolving and considers how efficiently an agency is providing the road infrastructure. It is quantified by cost factors and used to evaluate the life-cycle cost of the pavement structure.
- **Network sustainability** evaluates the long-term stewardship of pavement in terms of operating and maintaining the asset sustainably.

No single indicator can be used to effectively manage the decisions that are involved in preserving the road infrastructure. The best performance indicators for one state may not be the best for another, as each state will have their own processes, reporting requirements, and legislative mandates.

WSDOT evaluates structural and functional performance with the annual pavement condition survey. The survey rates structural performance using a cracking index and a rutting index. Functional performance is evaluated using IRI and the rutting index. A pavement is considered due for rehabilitation when any of the indexes reaches a threshold value. Safety conditions related to friction are measured every two years (half of the state every year) and low skid measurements are reported to region offices for corrective action according to a 1994 WSDOT Directive. Economic performance measures in use by WSDOT were reported in *Gray Notebook* 44, p. 14. This article has introduced three performance measures for network sustainability (see pp. 13-14).

Pedestrian and Bicyclist Safety System Safety Annual Report

Washington retains top rank for the most bicycle friendly state

WSDOT improves walking, biking conditions

The Pedestrian and Bicycle Program has improved more than 80 known pedestrian risk locations since 2005. To date, 177 schools across the state have participated in the Safe Routes to School Program, enhancing safety for approximately 77,000 children.

WSDOT offers two funding programs to help local agencies improve conditions for walking and bicycling: The Safe Routes to School and the Pedestrian and Bicycle programs.

In 2012, WSDOT provided two webinars to familiarize applicants with the grant programs, and reached about 400 people around the state. The programs received \$160 million in requests, and awarded \$26 million to 48 projects in 2012. Future state and federal funding for both programs is subject to approval by the 2013 state Legislature for the 2013-2015 biennium.

Biking and walking rise in Washington; safety targets prove challenging

WSDOT is committed to improving conditions for walking and biking, and continues to track its progress toward the goals set in the Washington State Bicycle Facilities and Pedestrian Walkways Plan. The state and federal goal is to double the percentage of total trips made on foot

Biking and walking in Washington has increased 10 percent or by bicycle in Washington by 2027. WSDOT conducts an annual count of pedestrian and bicyclist activity

as an indicator of the percent of trips made on foot or by bicycle. The 2012 counts show that walking and biking have increased 10 percent since 2008. The state also aims to reduce by 5 percent each year the number of bicyclists and pedestrians killed or seriously injured in traffic collisions.

Fatalities per year compared to goal of reducing fatalities by five percent each year 2007 through 2011 data; Goal projected from 2007 baseline

	2007	2008	2009	2010	2011	2012	2013
Pedestrian	60	63	59	61	66	n/a	n/a
Bicyclist	14	9	9	6	11	n/a	n/a
Combined goal¹	n/a	70	67	63	60	57	54

Data source: National Highway Traffic Safety Administration Fatality Analysis Reporting System. 2011 data is preliminary.

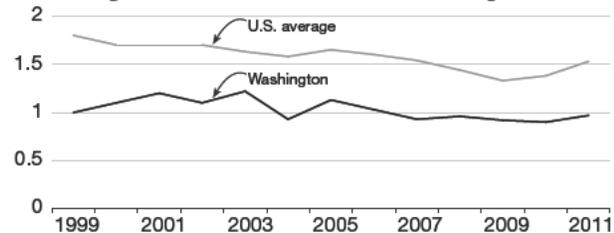
Fatality rates rise; lower than national average

The National Highway Traffic Safety Administration lists the pedestrian and bicyclist fatality rates relative to

population for each state in the country. Between 2010 and 2011, Washington's pedestrian fatality collision rate rose from 0.90 to 0.97 pedestrian fatalities per 100,000 people. This represents five more pedestrian fatalities than in 2010, an 8 percent increase. Washington's pedestrian fatality rate is 37 percent lower than the national average.

Pedestrian fatality rate

1999 through 2011; Per 100,000 residents in Washington



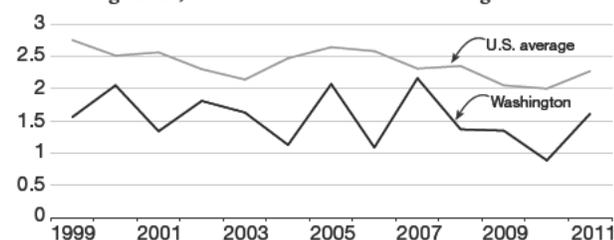
Data source: National Highway Traffic Safety Administration Fatality Analysis Reporting System (FARS).

Note: 2011 data is preliminary.

Washington also saw a rise in the bicyclist fatality collision rate: 0.89 bicyclists per million people in 2010, and 1.61 bicyclists per million people in 2011. This represents five more bicyclist fatalities in 2011 than in 2010, and an increase of 83 percent. Bicyclist fatality collision rates often fluctuate significantly due to the small overall number of fatalities. The state's bicyclist fatality rate is 29 percent lower than the national average.

Bicyclist fatality rate

1999 through 2011; Per million residents in Washington



Data source: National Highway Traffic Safety Administration Fatality Analysis Reporting System (FARS).

Note: 2011 data is preliminary.

Washington ranks No. 1 'Bicycle Friendly State' five years in a row

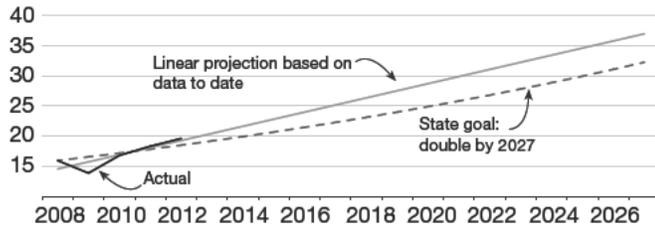
For the fifth consecutive year, the League of American Bicyclists named Washington as first in the nation in its "Bicycle Friendly State" ranking. In its announcement the league noted, "With support from the highest levels of government, (Washington) leads the nation in creating new bicycle infrastructure and using federal funds for bicycle and pedestrian projects."

Pedestrian and Bicyclist Safety System Safety Annual Report

Bicycling and walking in urban areas increasing; fatalities are also on the rise

Walking and biking in Washington increase 10 percent
 During the annual Washington State Bicycle and Pedestrian Documentation Project, volunteers counted more than 20,000 bicyclists and more than 40,000 pedestrians at 200 locations in 38 cities. Walking and biking increased 7 percent from 2011 to 2012 in Washington. These activities have increased 10 percent in five years. If walking and biking continue to increase at the annual rate tracked by WSDOT, Washington will exceed the state goal of doubling this activity before the 20-year target in 2027.

Washington state walking and biking trends
 2008 through 2011; Bicyclist and pedestrian counts at select locations; 20-year forecast



Data source: Washington State Office of Financial Management and WSDOT Statewide Travel and Collision Data Office.

Notes: Projection based on counts from locations that were included in all years of the study. Data collection process consistent with guidance from the National Bicycle and Pedestrian Documentation Project and the Federal Highway Administration.

The highest numbers of bicyclists were observed on trails and bridges and in downtown areas. Pedestrian counts were highest near universities, in downtown areas, near transit stations, and in neighborhoods with mixed residential and commercial development.

Bicyclists' use of helmets related to local laws

In 2012, WSDOT collected data for helmet use during the annual bicycle and pedestrian counts. Overall, 85 percent of bicyclists observed wore helmets. In the 24 jurisdictions where helmets are required by law (there is no statewide law), 90 percent of observed bicyclists wore them, compared to 63 percent in jurisdictions without helmet laws. Currently, more than half of the state population lives in areas with local laws requiring use of a helmet while bicycling.

WSDOT's strategies to reach state goals

Factors leading to serious injuries or fatalities of bicyclists and pedestrians include weather, roadway design, and the behavior of drivers, bicyclist or pedestrian. These factors may occur individually or in combination. In some cases, improvements like sidewalks and crosswalks may not be enough to ensure public safety. Additional infrastructure, enforcement, and public education may be necessary.

The Washington State Bicycle Facilities and Pedestrian Walkways Plan identified five priority focus areas to reach the statewide goal of reducing bicyclist and pedestrian collisions, while increasing mobility:

- Invest in bicycle and pedestrian connections in urban areas,
- Reduce motor vehicle speeds (urban roads with speeds >35 mph),
- Build dedicated facilities to separate bicyclists and motorists,
- Create more visible crossings, and
- Prioritize the needs of at-risk populations.

Strategy: Invest in urban bicycle, pedestrian connections

The majority of biking and walking occurs in urban areas, and these activities are on the rise. Statewide counts show that biking and walking increased in downtown areas and mixed-use neighborhoods; and targeted promotion in urban areas encourages more walking and biking. Additionally, more than 85 percent of collisions involving pedestrians or bicyclists occurred in urban areas between 2009 and 2011 (including but not limited to city streets and main street highways combined). Enhancing facilities for pedestrians and bicyclists in urban areas such as improved crossings, connections and trail systems can improve safety and

Forty-seven percent of bicyclist and pedestrian fatalities occurred on state highways

help reach the statewide goal of decreasing bicycle and pedestrian collisions while increasing walking and biking.

From 2009 to 2011, 47 percent (104) of fatal pedestrian and bicyclist collisions occurred on state highways. Thirty-six percent (80) occurred on city streets, and 17 percent (38) occurred on county roads.

Pedestrian and bicyclist collisions by road type

2009 through 2011	Collisions (fatalities)	Percent of incidents	Centerline miles (percent of system)
State highways (fatalities)	1,840 (104)	19% (47%)	7,044 (11%)
<i>Main street highways¹ (fatalities)</i>	1,039 (27)	56% (26%)	600 (9%)
City streets (fatalities)	6,954 (80)	72% (36%)	16,654 (26%)
County roads (fatalities)	888 (38)	9% (17%)	39,907 (63%)
Total collisions² (fatalities)	9,682 (222)	100% (100%)	63,605 (100%)

Data source: National Highway Traffic Safety Administration Fatality Analysis Reporting System (FARS); 2011 data is preliminary.

Notes: 1 Main street highways are a subset of all state highways, and percents are relative to total on all state highways. 2 This table does not include 19,651 miles of miscellaneous roads, such as those on park lands (there were 33 collisions and no fatalities in 2009-2011).

Pedestrian and Bicyclist Safety System Safety Annual Report

More than a third of pedestrian fatalities and serious injuries occur in crosswalks

A joint research project between WSDOT and the University of Washington found that there are about 600 miles of city main streets that operate as state highways in more than 180 cities. These city main street highways account for 9 percent of the state highway system. Between 2009 and 2011, these routes experienced 26 percent of bicyclist and pedestrian fatalities on state highways (27 of 104 highway fatalities). In 2011, the state Legislature passed the Complete Streets bill, including the creation of an unfunded grant program. When this grant program is funded, WSDOT will work with local jurisdictions to meet today's transportation needs on these main street highways. See *Gray Notebook* 44, p. 8.

Strategy: Reduce motor vehicle speeds in cities

Speed is a major factor contributing to the severity of injuries sustained in collisions between vehicles and pedestrians. A report titled "A Guide for Reducing Collisions Involving Pedestrians" by the National Cooperative Highway Research Council states that a pedestrian who is hit by a vehicle traveling at 40 mph has an 85 percent chance of being killed; at 20 mph, the fatality rate is only 5 percent. The posted speed limits were 35 mph or greater for more than 65 percent of pedestrian and bicyclist fatalities that occurred between 2002 and 2011 on city streets operating as state highways. WSDOT's research on main street highways helps guide roadway engineers toward designs that reduce vehicle speeds.

Strategy: Create more visible crossings

Between 2001 and 2011, 71 percent of intersection-related pedestrian fatal- and serious-injury collisions happened in marked or unmarked crosswalks (35 percent of all pedestrian fatalities and serious injuries). Twenty-one percent of intersection-related bicyclist fatal- and serious-injury collisions occurred in crosswalks. Treatments such as high visibility pavement markings, curb

extensions and flashing beacons increase the visibility of legal crossings.

A growing body of research shows that a 69 percent reduction in all collisions can be achieved by installing a pedestrian hybrid beacon, coupled with at least 94 percent of motorists yielding to pedestrians. A pedestrian hybrid beacon is a pedestrian-activated signal located

on the roadside or on mast arms over mid-block pedestrian crossings. In addition, raised medians can reduce collisions by 40 percent, and by as much as 69 percent at unsignalized intersections. WSDOT projects incorporate median refuge islands, when appropriate, to help pedestrians safely cross the street. WSDOT plans to install the first pedestrian hybrid beacons on a Washington state highway by 2014 on SR 104 in Edmonds, with funding from WSDOT's Pedestrian and Bicycle Program.

Pedestrian serious injury and fatality collision locations 2001 through 2011

Location	Intersection		Non-intersection		Driveway	
	Count	Percent	Count	Percent	Count	Percent
Marked crosswalk	905	55%	74	4%	16	6%
Unmarked crosswalk ¹	279	17%	25	1%	54	20%
Sidewalk	43	3%	63	3%	34	13%
Roadway	331	20%	1,400	71%	119	44%
Shoulder	19	1%	224	11%	13	5%
Other/Unknown	81	5%	177	9%	35	13%
Total	1,658	-	1,963	-	271	-

Data source: National Highway Traffic Safety Administration.

Note: 1 Crosswalks occur at all intersections except those with signs prohibiting pedestrians from crossing at that location. Crosswalks can also occur at non-intersection locations.

Strategy: Build dedicated facilities

More than 15,000 bicycle/motor vehicle collisions were reported in Washington from 2001 to 2011. Based on a review of recent research, WSDOT estimates that 40 to 60 percent more collisions involving bicyclists went unreported during that time.

Evaluating fatal and serious injury bicycle collisions by location in Washington state shows where bicycle collisions occurred with respect to the roadway for both intersection and non-intersection locations. Seventy percent of bicyclist fatal and serious injury collisions occurred within the roadway (including on designated bike routes), while bicyclists were obeying the rules of the road. This includes collisions where drivers were following too closely, exceeding safe speeds, or turning into or out of driveways, and where bicyclists were hit by an opening car door while riding next to parked cars. Another 9 percent occurred on the shoulder, and 15 percent occurred while the bicyclist was crossing the roadway. In each case, bicyclists were obeying the rules of the road.

Building dedicated facilities like bike lanes, urban shared-use paths, and bicycle boulevards, and redesigning thoroughfares using "road diets" can increase bicyclist mobility and safety. A road diet



A push-button activated pedestrian hybrid beacon signals drivers to stop on red for pedestrians to cross the street. Source: www.pedbikemages.org / Mike Cynecki

Pedestrian and Bicyclist Safety System Safety Annual Report

WSDOT addresses needs of children and older adults to improve safety for all

restripes the roadway to reduce the number of motor vehicle travel lanes, and adds bicycle lanes and a two-way left turn lane. Recent research shows that bike lanes can significantly reduce bicycle collisions, as can road diets. In Washington, the city of Redmond is using a road diet to install bicycle lanes on SR 202 with funds from WSDOT's Pedestrian and Bicycle Program. WSDOT will monitor collisions on the roadway and conduct a "before and after" analysis of the road to determine how the project affects safety for all users.

Bicyclist serious injury and fatality collision locations 2001 through 2011

Location/Action	Intersection related		Non-intersection	
	Count	Percent	Count	Percent
Marked crosswalk	128	17%	14	2%
Unmarked crosswalk	36	5%	37	5%
Sidewalk	23	3%	56	8%
Designated bike route	52	7%	63	9%
Roadway	485	63%	438	61%
Shoulder	36	5%	94	13%
Other/Unknown	6	1%	14	2%
Total	766	-	716	-

Data source: National Highway Traffic Safety Administration.

Note: WSDOT no longer includes self-reported collision data.

Strategy: Prioritize safety improvements for at-risk groups

WSDOT has identified at-risk groups that experience disproportionately high percentages of fatal and serious injury collisions, including school-aged children and adults older than 65.

Children depend on walking and biking to get around

In 2011, 792 young people ages 5 to 18 were involved in pedestrian and bicycle collisions. Twelve percent of these collisions

Some 792 school-aged children were involved in pedestrian and bicycle collisions in 2011

(95) resulted in death or serious injury. Most school-age children, especially those who are 5 to 15 years old, rely on walking, bicycling, or riding as a passenger in a motor vehicle to get around.

On the state highway system, almost 90 percent of all pedestrian and bicycle collisions occur within one mile of a school and 21 percent of those involve children ages 5 to 18 (this age range represents 18 percent of the population). More than 2,000 schools (70 percent) are located on or near a state highway, and many have school walk routes that must cross these highways so children can access the school grounds. Making investments near schools on the state highway system will improve conditions for the majority of pedestrians and bicyclists on the state highway system.

WSDOT administers the Safe Routes to School Program, which provides funds for improvements, education, and enforcement efforts to help make it safer for children to walk and bike to school. See *Gray Notebook 44*, p. 5.

Student survey documents how children get to school

In 2013, WSDOT is planning to conduct a statewide student travel survey in partnership with the Washington State Department of Health that will measure how students travel to school (bus, walking, biking, family vehicle). The survey will provide a baseline of student transportation mode choice in Washington and information specific to past and existing WSDOT Safe Routes to School projects. The goal is to systematically monitor student transportation choices, track changes, and identify the effectiveness of various programs aimed at shifting transportation choice away from single-family vehicles.

Older adults suffer a high rate of pedestrian fatalities

Adults ages 65 and older represent 13 percent of the population, yet they make up 25 percent of pedestrian fatalities. The National Institute of Aging reports that one in five adults 65 and older does not drive and may be more dependent on walking. This age group saw serious injury and fatal collisions increase by 17 percent from 2010 to 2011.

In 2007, WSDOT studied several pedestrian applications on SR 7 in Spanaway. The research showed that motorist and pedestrian behavior can be difficult to change through engineering improvements alone. While median refuge islands effectively reduced crossing distances for pedestrians, the improvements should be coupled with education and enforcement efforts.

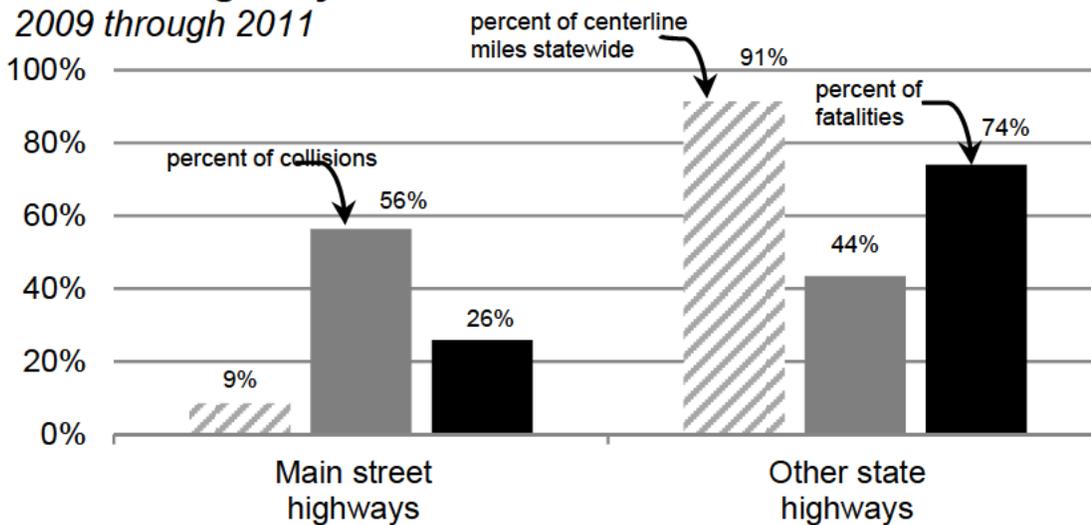
Similar roadway design strategies can improve walking and biking conditions for children and older adults. Examples include increasing signal crossing time, reducing roadway crossing width, providing crossing opportunities with appropriate treatments, reducing traffic speeds in areas frequented by children or older adults, and ensuring facilities are ADA accessible.

New federal law tracks safety of older pedestrians

The federal transportation legislation Moving Ahead for Progress in the 21st Century (MAP-21) (see pp. ix-x) requires states to track trends for pedestrians ages 65 and older. If fatalities and serious injuries per capita for this group increase over a two-year period, the state must incorporate strategies that focus on older pedestrians into their Strategic Highway Safety Plan. WSDOT is a national leader in evaluating roadways to make improvements for older pedestrians, and will continue tracking trends for this at-risk age group.

Pedestrian and bicyclist collisions and fatalities statewide on state highways

2009 through 2011

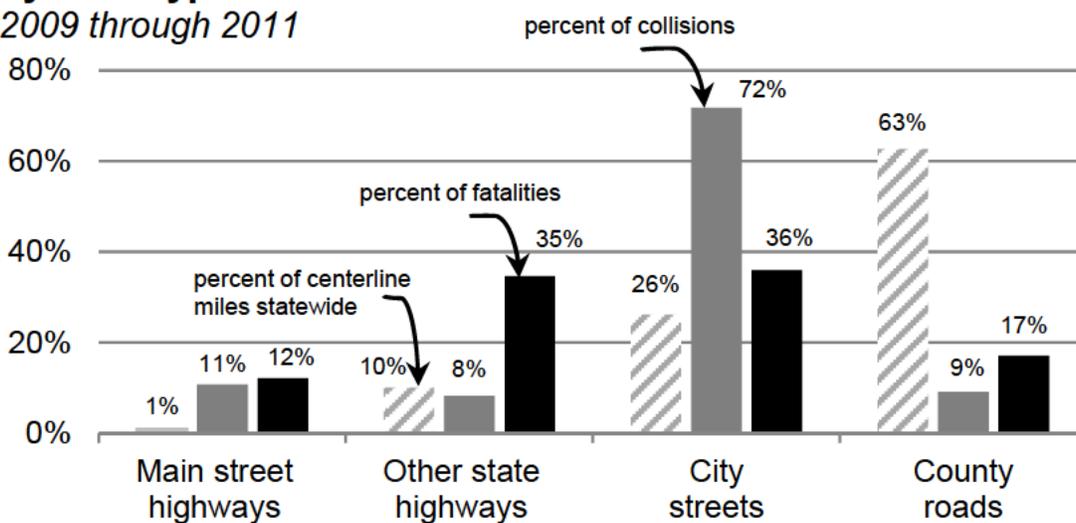


Data source: National Highway Traffic Safety Administration Fatality Analysis Reporting System (FARS); 2011 data is preliminary.

Note: State highways cover 11 percent of all centerline miles statewide (excluding miscellaneous roads), 19 percent of all pedestrian and bicyclist

Pedestrian and bicyclist collisions and fatalities statewide by road type

2009 through 2011



Data source: National Highway Traffic Safety Administration Fatality Analysis Reporting System (FARS); 2011 data is preliminary.

Note: This table does not include 19,651 miles of miscellaneous roads (24 percent of total centerline miles statewide), such as those on park lands (there

Asset Management: Highway Maintenance Annual Report

Highway Maintenance

WSDOT achieves 80 percent of highway maintenance targets in 2012

WSDOT achieved 80 percent of highway maintenance condition targets in 2012. This is 7 percent higher than the 73 percent achieved in 2011, and 15 higher than in 2010. Between 2011 and 2012, 11 asset condition ratings increased, 17 remained unchanged and two dropped to a lower score. The six targets missed in 2012 were also missed in 2011.

Maintenance plays an important role in WSDOT's Asset Management by meeting the daily needs of maintaining and operating the 18,622 lane miles and 2,000 miles of ramps and special use lanes of the state's highway system. WSDOT focuses on preventive maintenance, repairs, and safe operation of the highway infrastructure.

The Maintenance Accountability Process (MAP) measures and reports on the performance of 30 highway maintenance activities, as part of asset management. WSDOT uses two metrics, asset condition and task completion. For more information and definitions, refer to *Gray Notebook* 44, p. 17. There are a number of factors that impact the condition of WSDOT's highway assets. These factors include maintenance work performed, the timing and scope of WSDOT's preservation projects, weather conditions, and the amount of new highway projects that add infrastructure to the system.

Maintenance Accountability Process

The table on this page lists maintenance activities in order of priority and their Level of Service (LOS) scores achieved compared to the funded targets, which use a grading scale from A+ to F-, with A+ being the best and F- being the worst. Maintenance activities have different funding levels of service. The planned maintenance tasks and timely preservation projects for each activity are targeted to maintain the specific funded LOS. Funding for preservation projects has decreased and WSDOT has yet to update its targets to reflect this decline.

WSDOT misses six targets in 2012

Four of the 30 activities have been consistently below target at the statewide level since 2009: Structural Bridge Repair, Raised/Recessed Pavement Marker Maintenance, Shoulder Maintenance, and Nuisance Vegetation Control. Two of these activities, Structural Bridge Repair and Raised/Recessed Pavement Marker Maintenance, received funding in the 2009-2011 biennium to address maintenance backlogs.

Urban Tunnels measures its LOS by the number of tunnel closures to vehicles carrying flammable cargo. The LOS annual score rose slightly from a C- in 2011 to C in 2012 missing the target of B. In 2012, WSDOT decided to reduce the duration of closures to such vehicles to lessen the time that the fire suppression system is down. As a result, a greater number of closures was needed to accomplish the required work. Also, the I-90 Two Way Transit Project requires closures to flammable cargo to allow designers to examine the tunnel's component designs. The number of closures to flammable cargo are expected to rise when construction begins, decreasing the LOS score.

Asset condition results for 2012

Level of Service (LOS) target by priority for funded vs. achieved

	Funded target	2012 results
■ = Missed Targets		
Movable & Floating Bridge Operations	B+	A+
Traffic Signal System Operations	C	C+
Snow & Ice Control Operations	A-	A
Keller Ferry Operations	B	B
Urban Tunnel Systems Operations	B	C
Structural Bridge Repair	C	D
Regulatory/Warning Sign Maintenance	C+	C+
Slope Repairs	B	A
Intelligent Transportation Systems	B-	A-
Maintain Catch Basins & Inlets	D+	C
Bridge Deck Repair	C	C+
Guardrail Maintenance	B+	A-
Pavement Striping Maintenance	C	C
Raised/Recessed Pavement Markers	B	C+
Control of Vegetation Obstructions	D+	C
Rest Area Operations	B	B
Sweeping and Cleaning	B+	A
Maintain Ditches	B	B+
Highway Lighting Systems	C+	A-
Guidepost Maintenance	D	D
Maintain Culverts	D+	C-
Pavement Marking Maintenance	C	D
Noxious Weed Control	B	B
Shoulder Maintenance	B-	C+
Guide Sign Maintenance	B-	B
Stormwater Best Management Practices	C	C
Bridge Cleaning & Painting	C	B
Nuisance Vegetation Control	B-	D+
Landscape Maintenance	D+	C-
Litter Pickup	D	D

Percent of targets achieved/exceeded 80%

Data source: WSDOT Maintenance Office.

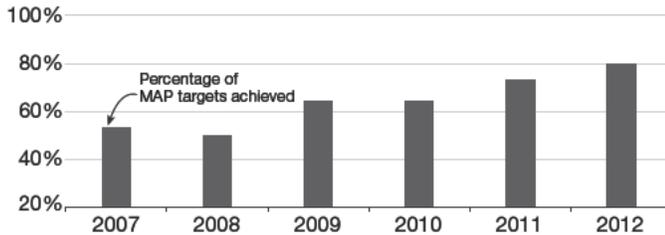
Notes: The 30 maintenance activities are in prioritized order. Stormwater Best Management Practices (BMPs) was changed from Maintain Detention/Retention Basin.

Asset Management: Highway Maintenance Annual Report

Maintenance Accountability Process

Statewide maintenance targets achieved

2007 through 2012; As a percentage of total



Data source: WSDOT Maintenance Office.

Notes: Targets are adjusted periodically based on funding levels and other maintenance priorities. In 2006, Paving and Crack Seal was merged into one activity, changing the total number of activities from 33 to 32. In 2009, in addition to targets being adjusted to better reflect funding levels, the Safety Patrol activity was removed from reporting, changing the total number of activities from 32 to 31. In 2012, the Pavement Patching and Repair activity was removed from reporting, changing the total number of activities from 31 to 30.

Structural Bridge Repair missed its target of C, dropping from a C- in 2011 to D in 2012. This asset measures its condition by the number of “priority one” repairs completed each year. The scope and cost of these repairs vary by type of repair and location. The cost and duration of repairs have resulted in incomplete work, lowering the overall score. Four of the six regions raised their MAP scores, but scores for two regions remain below the target, which lowered the statewide score.

Raised/Recessed Pavement Marker Maintenance (RPM) achieved a LOS score of C+ in 2012 which was the same as in 2011. The reasons for the missed MAP score are twofold: First, the measurements for the MAP score take place during the summer; much of the work is accomplished late summer and early fall. WSDOT is reviewing the best survey period to assess the condition of this asset.

Second, funding for the pavement preservation program is declining. RPM replacement is an element of paving projects. The inventory of repairs and replacement has grown significantly as less paving work is accomplished.

Pavement Marking Maintenance missed its target of C, maintaining its LOS score of D. This low MAP score can be attributed to harsh winter conditions, combined with wet conditions during the spring and early summer, which result in delays. These conditions delayed the ability to apply pavement markers prior to the MAP survey. Progress on this activity was made later in the summer and fall after WSDOT conducted the survey. As in the RPM activity, WSDOT is reviewing the best time of year to assess the condition of the pavement markers.

Shoulder Maintenance, a lower priority activity, missed its target of B- in three out of six regions. This is an improvement over 2011, when four out of six regions missed the target. Fewer preservation dollars drove the decision to exclude shoulder maintenance from pavement rehabilitation projects in order to save money. This has resulted in many highway shoulders continuing to deteriorate, which increases the cost and amount of maintenance needed.

Nuisance Vegetation Control is among the lowest priority maintenance activities. Four regions missed the target of D+ for four consecutive years; the other two regions met the target at times. As a low priority, this activity is impacted when funding resources are not available.

Investments needed to reduce maintenance backlog

Dollars in millions

2013 - 2015	\$22.5
2015 - 2017	\$18.2
2017 - 2019	\$18.8
2019 - 2021	\$8.2
2021 - 2023	\$6.8
Total	\$74.5

Data source: WSDOT Maintenance Office.

Note: Planned investments after the 2011–2013 biennium are not funded. Dollar figures are rounded.

WSDOT uses \$3.5 million in backlog dollars for statewide durable stripe application

WSDOT uses waterborne paint as an annual application for most pavement line striping (edge stripes, lane lines, and centerline stripes). The only exceptions are ramps, intersections, and roundabouts, which may use either paint or a more durable striping material. WSDOT is required to maintain a minimum level of service of C for the roadway striping MAP target. The equipment to apply durable striping in large applications is highly specialized and costly.

WSDOT developed a statewide pilot project for contractor-installed durable striping. This project is intended to assess the durable striping delivered by a contractor, augment the existing striping program, reduce backlog, and meet the MAP target. WSDOT identified locations best suited for durable striping and awarded a contract during summer 2012. Most of the work was completed in fall 2012, leaving only a few locations to be finished in spring 2013. This evaluation will help WSDOT measure and determine the benefits associated over time, along with the longevity of the retroreflectivity (how light is reflected off of a surface and returned to its original source) and daytime visibility of the markings.

Asset Management: Highway Maintenance Annual Report

Results mixed for 2012 task completion and asset condition surveys

The tables below shows both asset condition and task completion performance data, by asset; task completion helps the maintenance program measure the actual work performed. This data

helps provide accountability for the program, but also gives context to the overall influence of maintenance work to asset condition.

Task completion and asset condition for Roadway Maintenance and Operations

2009 through 2012; Level of Service score for selected maintenance activities

Activity or asset	Task completion goals	Performance measures	Goal Met	2009	2010	2011	2012
Pavement ¹	Maintain 90% fair or better condition rating for WSDOT-owned pavement	% of planned work completed		N/A	163%	68%	86%
		Percent in fair or better condition (Target: 90%)	Yes	93%	92.7%	90.5%	N/A
Shoulder Maintenance ²	Completed planned maintenance	% of planned work completed		N/A	N/A	N/A	48%
		Asset condition rating (2011 funded target: B-)	No	C+	C+	C	C+

Data source: WSDOT Maintenance Office.

Notes: 1 The task completion measure improved in 2012 to 86% from 68% in 2011, but still falls short of the planned target. Given the emergent nature of pavement repairs, it is difficult to plan the type of repair work that may be needed in any one season. To help address this challenge, WSDOT coordinates the work needed through the pavement management program. 2 A declining number of paving projects each year, along with the practice of alternating the inclusion of shoulders in pavement projects between overlay (where shoulders are included in the project) and inlay (where shoulders are excluded in the project), requiring higher levels of maintenance for longer period of time. As a lower priority, fewer tasks are planned and accomplished, as higher priority activities take precedence.

Task completion and asset condition for Drainage Maintenance and Slope Repairs

2009 through 2012; Level of Service score for selected maintenance activities

Activity or asset	Task completion goals	Performance measures	Goal Met	2009	2010	2011	2012
Catch Basins	Complete annual inspection and maintenance in NPDES ¹ permit area	% of inspection/maintenance complete		N/A	N/A	N/A	61% ¹
		Asset condition rating (2011 funded target: D+)	Yes	C	C+	C	C
Culverts	Achieve asset condition	% of planned work completed		N/A	92%	77%	77%
		Asset condition rating (2011 funded target: D+)	Yes	D-	D	C-	C-
Stormwater BMPs ²	Complete annual inspection and maintenance in NPDES ¹ permit area	% of inspection/maintenance complete		Will report results in December 2013			
		Asset condition rating (2011 funded target: C)					

Data source: WSDOT Maintenance Office.

Notes: 1 NPDES stands for the National Pollutant Discharge Elimination System. The initial time period for reporting catch basin inspections completed under WSDOT's stormwater permit was March 2011 to March 2012. Data provided is from this time period. Permit compliance (95% catch basins inspected) was not achieved due to delays in funding to purchase specialized trucks and hire maintenance personnel to complete all of this work. Additional trucks were purchased in April 2012 and personnel to operate them were hired shortly thereafter. Subsequent reporting dates for permit compliance are based on fiscal years (July to June). WSDOT is on track to achieve compliance for this activity for the reporting period of June 2012 to July 2013. 2 Stormwater BMPs stands for Stormwater Treatment Facilities Best Management Practice.

Asset Management: Highway Maintenance Annual Report

Results mixed for 2012 task completion and asset condition surveys

Task completion and asset condition for Bridge and Tunnel Maintenance

2009 through 2012; Level of Service score for selected maintenance activities

Activity or asset	Task completion goals	Performance measures	Goal Met	2009	2010	2011	2012
Movable or Floating Bridges	Complete planned maintenance	% of total planned work complete		92%	96%	90%	98%
		Asset condition rating (2011 funded target: B+)	Yes	A+	A-	A	A+
Urban Tunnels	Complete planned maintenance	% of total planned maintenance complete		91%	94%	95%	91%
		Asset condition rating (2011 funded target: B)	No	B+	B+	C-	C ¹
Structural Bridge Maintenance	Achieve asset condition	% of Priority 1 repairs completed		42%	67%	66%	60%
		Asset condition rating (2011 funded target: C)	No	F	C-	C-	D ²
Bridge Deck Maintenance	Completed planned maintenance	% of planned work completed		N/A	N/A	N/A	111%
		Asset condition rating (2011 funded target: C)	Yes	C+	C+	C+	C+

Data source: WSDOT Maintenance Office.

Notes: 1 Preventative Maintenance was completed this reporting period. Design and contract work on the tunnel caused more than the expected number of closures. Additionally, WSDOT shortened the duration of closures, which resulted in an increase to the number of closures. 2 While the task completion of priority one repairs improved from 2011, the overall asset condition declined. The scope and costs of these repairs can vary by type of repair and location. Currently, four of the six regions raised their MAP scores, but scores for Northwest and South Central remain below the target, which lowered the overall asset condition score. WSDOT is evaluating its coordination of the priority one repairs to improve the asset condition.

Task completion and asset condition for Traffic Control Maintenance and Operations

2009 through 2012; Level of Service score for selected maintenance activities

Activity or asset	Task completion goals	Performance measures	Goal Met	2009	2010	2011	2012
Traffic Signal Systems	Complete planned maintenance	% of total planned maintenance complete		44%	79%	90%	88%
		Asset condition rating (2011 funded target: C)	Yes	C	C+	C+	C+
Regulatory Signs	Achieve asset condition	% of planned work completed		N/A ¹	113%	108%	87%
		Asset condition rating (2011 funded target: C+)	Yes	D+	C+	C	C+
ITS ²	Complete planned maintenance	% of total planned maintenance complete		13%	49%	60%	51%
		Asset condition rating (2011 funded target: B-)	Yes	A-	B+	A-	A-
Cable Barrier ³	Complete planned maintenance and repairs	% of planned maintenance and repairs complete		N/A ¹	100%	74%	103%
		Asset condition rating (2011 funded target: A)	No	N/A	A+	A+	A-
Pavement Striping Maintenance	Completed planned maintenance	% of planned work completed		N/A ¹	N/A ¹	N/A ¹	88%
		Asset condition rating (2011 funded target: C)	Yes	C-	D	C	C
Raised/Recessed Pavement Marker	Completed planned maintenance	% of planned work completed		N/A ¹	N/A ¹	N/A ¹	85%
		Asset condition rating (2011 funded target: B)	No	C-	C+	C+	C+ ⁴
Highway Lighting Systems	Completed planned maintenance	% of planned work completed		N/A ¹	N/A ¹	N/A ¹	78%
		Asset condition rating (2011 funded target: C+)	Yes	B+	B-	B+	A-
Guidepost Maintenance	Completed planned maintenance	% of planned work completed		N/A ¹	N/A ¹	N/A ¹	87%
		Asset condition rating (2011 funded target: D)	Yes	D	D+	D	D
Pavement Markers	Achieve asset condition	% of planned work completed		N/A ¹	95%	93%	112%
		Asset condition rating (2011 funded target: C)	No	C	C	D	D ⁵

Data source: WSDOT Maintenance Office.

Notes: 1 The table lists "N/A" where data is unavailable. WSDOT intends to expand its reporting of task completion to cover all 30 activities listed on page 18. 2 ITS stands for Intelligent Transportation System. 3 This activity is a subset of the activity Guardrail Maintenance listed on the table on page 18. 4 See page 19, for the reasons for the missed MAP score. 5 See page 19, for the reasons Pavement Markers maintained a lower MAP score.

Asset Management: Highway Maintenance Annual Report

Maintaining the Highway Transportation System

New infrastructure requires maintenance

WSDOT is finalizing the delivery of the largest construction program in its history. Since 2003, more than 400 construction projects have been completed or are under way with a program value of \$16.3 billion. These projects add many lane miles, bridges, and other infrastructure to the highway system. When these projects are complete, WSDOT's maintenance program will assume the responsibility of operating and maintaining these assets. Routine maintenance activities, such as culvert inspections, re-painting lane lines and guardrail repair must be conducted regardless of the age of the asset. The maintenance backlog will continue to increase if funding and resources are not increased to match the added infrastructure and backlog.

Properly maintained assets, coupled with preservation projects that replace highway assets when they have reached the end of their useful lifespan, result in better asset conditions and lower replacement costs. A continuing challenge and a key element of effective asset management lies in sustaining a good balance between preservation and maintenance. As preservation funding decreases, maintenance will be tasked with keeping the infrastructure functional for longer time spans, at a higher cost. For example, asphalt pavement has a projected life cycle of 10 to 16 years. (See the pavement preservation article on p. 10) WSDOT conducts annual inspections to establish a "due date" for the pavement rehabilitation. The maintenance program maintains the pavement during its lifetime by patching potholes, crack sealing, and similar activities. If preservation funding for an asset is deferred, the cost difference can be anywhere from a few thousand to several million dollars between rehabilitation at the optimum time and rebuilding after the optimum time for rehabilitation has passed. Ultimately, the cost to maintain pavement and other assets increases as the structures age.

Maintenance Customer Survey shows similar results in 2012

WSDOT resumed its previous method of conducting the Maintenance Customer Service surveys in 2012; the fifth in a series (1996, 2000, 2005, 2010, and 2012). The previous surveys were telephone surveys, with the exception of the 2010 survey which used a Web method. As mentioned in *Gray Notebook* 44, p. 20, the Web survey method yielded significant cost savings, yet it also presented challenges including a smaller survey response. Therefore, the results of the 2012 survey will be compared to the 2005 and earlier surveys. These surveys are designed to evaluate customer satisfaction and obtain public input regarding perceptions of maintenance activities and public priorities. WSDOT uses the surveys to help prioritize and align investment decisions

in the Maintenance Program. The full results of this survey can be found on the Maintenance Performance Measures webpage at <http://www.wsdot.wa.gov/Maintenance/Accountability/>.

Key results of the recent customer survey

Some survey questions asked about driver satisfaction with the current level of highway maintenance. Others addressed the individual maintenance activities, and provided some contextual information about highway maintenance and what it takes to maintain the transportation system. The survey indicated that 74 percent of the 750 survey respondents were generally satisfied with the level of highway maintenance, a slight decrease from 78 percent in the 2005 survey.

Respondents were also asked to rate highway maintenance from very poor to excellent. More than half the respondents (51.6 percent) rated Washington's highway maintenance above average or excellent; 40.1 percent of respondents gave WSDOT an average rating. A small percentage rated highway maintenance as fairly poor (6.1 percent) or very poor (2.1 percent). These results are comparable to those found in the 2005 maintenance customer survey. Since 1996, roadway surfaces are still the top improvement desired by 84 percent of respondents, increasing 15% from 2005.

One survey question asked respondents how well WSDOT responds to emergencies, such as mudslides, floods, and the like. Some 61.4 percent rated WSDOT's response to emergencies as above average or excellent. This rating was slightly lower than in 2000. Finally, 2.4 percent of respondents rated WSDOT's response as fairly poor or very poor in 2012, compared to 4 percent in 2005.

2012 Customer survey results: Maintenance activities ranked by importance

Rank	Maintenance activity	Percent satisfied/ extremely satisfied	
		2005	2012
1	Roadway Surfaces	75.6%	63.5%
2	Road Stripes and Pavement Markers	77.6%	71.1%
3	Snow and Ice Removal	71.7%	77.9%
4	Drainage Features	78.5%	75.2%
5	Traffic Signals	77.4%	85.3%
6	Roadway Signs	91.4%	90.2%
7	Guard Rail	87.5%	89.6%
8	Highway Lighting	76.1%	80.7%
9	Rest Areas	72.6%	85.5%
10	Roadside Litter Removal	73.8%	76.7%
11	Roadside Vegetation	70.0%	75.0%

Data source: 2012 Maintenance Customer Survey.