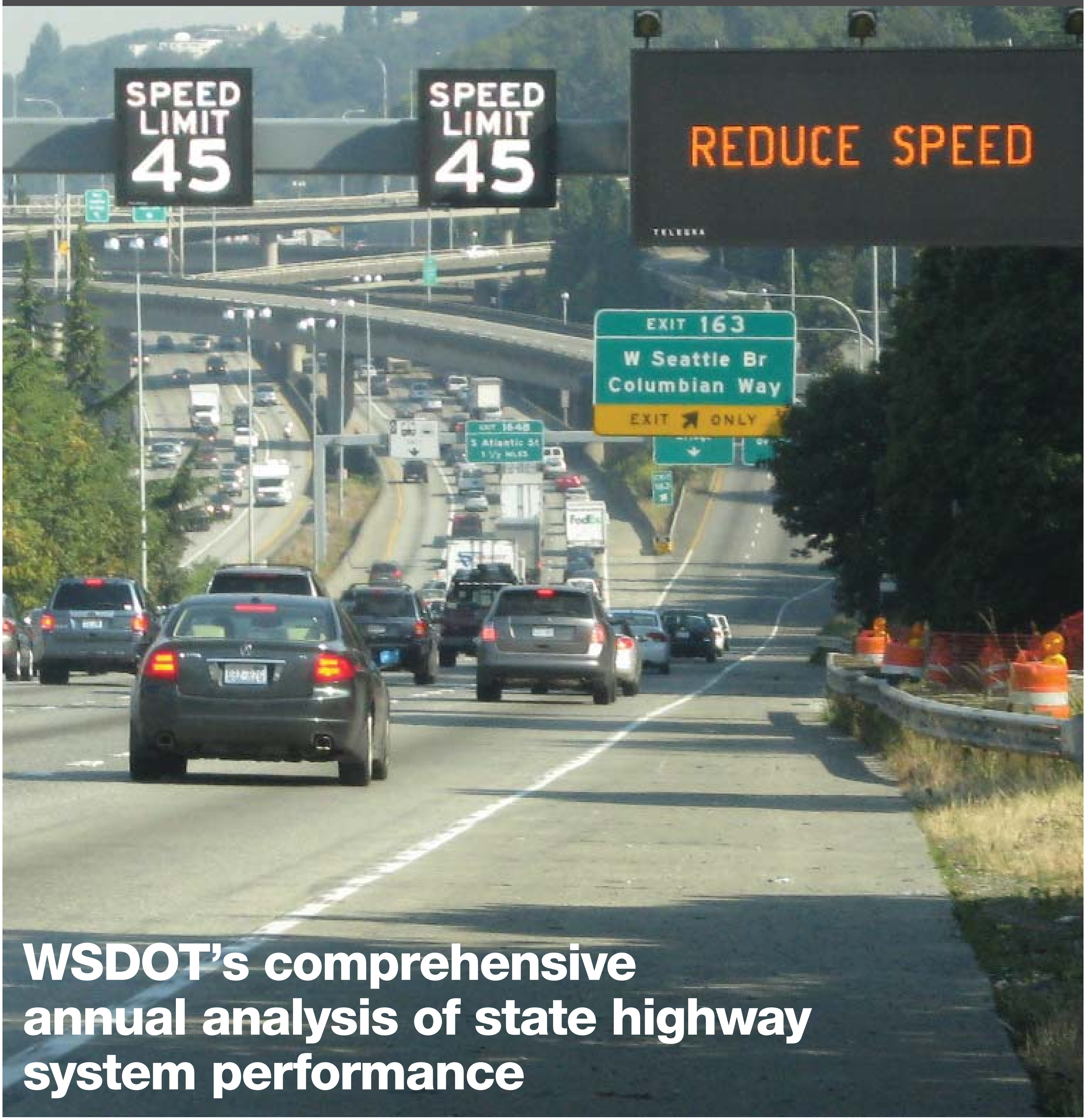
Washington State
Department of Transportation

The 2012
Congestion Report

Published August 26, 2012 | 11th edition | Paula J. Hammond, P.E., Secretary of Transportation



WSDOT's comprehensive annual analysis of state highway system performance

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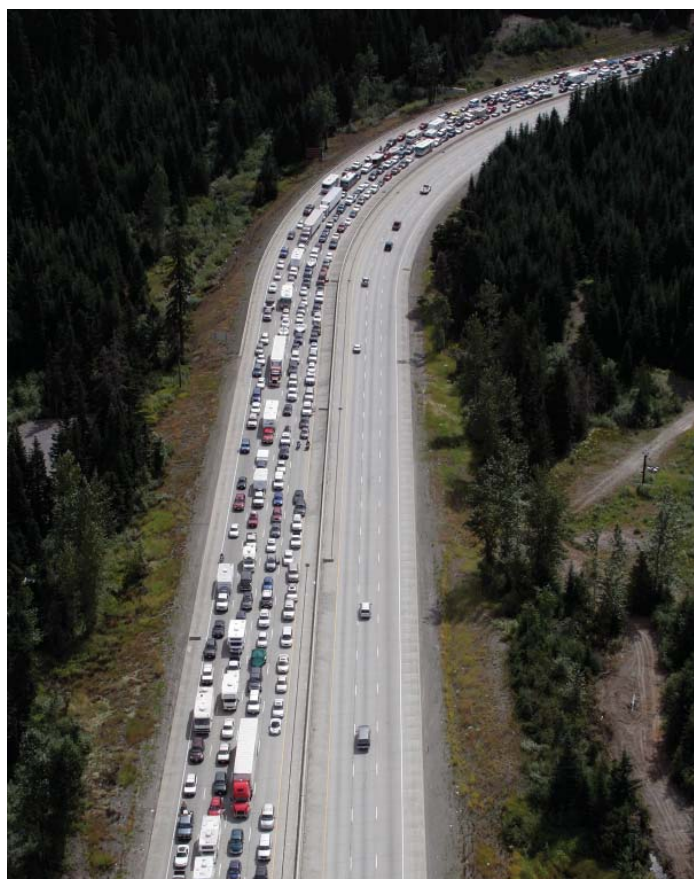

The 2012 Congestion Report compares data from 2009 and 2011.

Moving Washington: WSDOT's strategy for addressing congestion

The mission of the Washington State Department of Transportation is to keep people and business moving by operating and improving the state's transportation systems vital to our taxpayers and communities. Washington State Department of Transportation (WSDOT) is fighting congestion using its foundational strategy called *Moving Washington* – a three-pronged strategy comprised of operating the transportation system efficiently, managing travel demand, and strategically adding capacity by delivering projects. It is the agency's goal to create a safe, reliable and sustainable transportation network that spurs economic productivity by providing access to jobs and essential activities of life. WSDOT's strategies for *Moving Washington* are discussed in this report.

WSDOT is keen to use innovative approaches and expand its ability to analyze highway system performance on a statewide basis. As part of this effort, WSDOT has purchased private sector probe-based speed data to help with system performance analysis, project prioritization, planning, design, construction, and Before and After project evaluations and communication.

WSDOT's 2012 *Congestion Report* is the agency's 11th annual analysis of travel statewide with an emphasis on the major freeways in the Puget Sound region and assessment of WSDOT's congestion relief projects and strategies. The information presented herein allows WSDOT and its partners to focus on strategies that work. The reader will notice some changes from previous editions of the *Congestion Report*. The most notable change in this edition is the new cover. Other evolving changes include identifying the economic benefits of the various strategies and a focus on a *Moving Washington* corridor-based performance analysis. Another aspect of this effort is the enhanced visualization of WSDOT's corridor-based reporting approach using tools such as Geographic Information Systems.

Moving Washington strategies are having an impact. Four Before and After studies highlighted in this report show that the strategies work. We have more work to do – most congestion performance metrics are trending higher in 2011 than the previous two years, but are still well below pre-recession levels. Congestion levels in 2011 show some measurable increases compared to 2009; when compared to 2010, these increases are mostly marginal. When measured at maximum throughput speed, the 2011 delay on state highways was 16 percent greater than it was in 2009, and 3 percent higher than in 2010. Annual vehicle miles traveled saw a less than 1 percent increase on all roads and held steady on state highways in 2011 when compared to 2009. When compared to 2010, annual vehicle miles traveled saw a slight decrease in 2011 on all roads (by 0.4 percent) and on state highways (by 1 percent).

As the economy continues to improve, it will be accompanied by increased travel demand. WSDOT stands ready to address these challenges. Looking to the future, major projects, including the Alaskan Way Viaduct, SR 520 Floating Bridge, Columbia River Crossing, and projects in the I-5 and I-405 corridors are in the works. Variable time-of-day tolling on SR 520 and Smarter Highways, using technologies such as Active Traffic Management, were implemented on the central Puget Sound region's busiest corridors. The *Gray Notebook* 46 semi-annual travel time trends report includes the traffic effects of the SR 520 variable time-of-day tolling project, which began operations on the SR 520 Lake Washington floating bridge in December 2011.

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WSDOT's Congestion Working Group met on May 9, 2012. WSDOT staff engaged in lively discussions of new methods to quantify congestion impacts with visiting experts from Texas Transportation Institute and INRIX.

Congestion analysis is a complex and collaborative effort, requiring the input of multiple partners and the expertise of various disciplines. The work of many people goes into the data collection, processing, analysis, writing, editing, and production of WSDOT's annual *Congestion Report*. This list of contributors reflects the efforts of data analysts, engineers, planners, project leads, senior managers and executives. Information is reported on a preliminary basis and available for internal management use; it is subject to correction and clarification. Online versions of this publication are available at www.wsdot.wa.gov/accountability.

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OPERATE EFFICIENTLY · MAINTAIN and KEEP SAFE · ADD CAPACITY STRATEGICALLY · MANAGE DEMAND
RELIABLE · RESPONSIBLE · SUSTAINABLE
MOVING WASHINGTON

In Executive Summary:

Measuring Delay and Congestion Annual Report

About the cover...

The 2012 *Congestion Report* introduces a new look, with a single cover photo. To commemorate this event, we chose a photo of an ATM. We're not talking about an Automated Teller Machine, but the other one - the ATM pictured on our cover illustrates the first Active Traffic Management system in the state of Washington. Located on I-5 approaching Seattle, the signs alert drivers to reduce speeds in times of heavy congestion, in an effort to keep traffic flowing more efficiently. Active traffic management is a key element of WSDOT's *Moving Washington* program to fight congestion. High-tech overhead traffic management signs can display not only variable speed limits, but other vital information about lane closures and traffic conditions ahead. This enables motorists to modify their driving well in advance of encountering traffic incidents, leading to Smarter Highways.

Congestion Report Dashboard of Indicators

2012 *Congestion Report* Dashboard of Indicators *Dollar values are inflation-adjusted, measured in 2011 dollars*	2007	2008	2009	2010	2011	Difference '10 vs. '11	Difference '09 vs. '11
Demographic and economic indicators							
State population (thousands)	6,525	6,608	6,672	6,725	6,768	0.6%	1.4%
Population density (persons per square mile)	98.1	99.3	100.3	101.2	101.8	0.6%	1.5%
Gasoline price per gallon (annual average)	$3.18	$3.54	$2.68	$3.10	$3.72	20.0%	38.8%
Washington unemployment rate (annual)	4.6%	5.4%	9.4%	9.9%	9.2%	-0.7%	-0.2%
Washington rate of annual economic growth[1]	5.2%	0.8%	-2.8%	1.8%	2.0%	0.2%	4.8%
Washington real per capita income[2]	$45,287	$45,816	$43,675	$43,761	$44,350	1.3%	1.5%
System-wide congestion indicators							
Vehicle miles traveled							
All public roads vehicle miles traveled (VMT), in billions	56.964	55.447	56.461	57.191	56.965	-0.4%	0.9%
All public roads per capita VMT, in miles	8,780	8,417	8,467	8,505	8,417	-1.0%	-0.6%
State highways VMT, in billions	31.970	30.742	31.456	31.764	31.455	-1.0%	0.0%
State highways per capita VMT, in miles	4,928	4,667	4,717	4,724	4,648	-1.6%	-1.5%
System congestion							
Total state highway lane miles	18,425	18,500	18,571	18,630	18,642	0.1%	0.4%
Lane miles of state highway system congested	1,032	962	966	1,025	1,007	-1.8%	4.2%
Percent of state highway system congested[3]	5.6%	5.2%	5.2%	5.5%	5.4%	-0.1%	0.2%
Delay on state highways							
Total vehicle hours of delay, in millions of hours[4]	35.1	34.8	28.1	31.7	32.5	3%	16%
Annual hours of per capita delay on state highways[4]	5.4	4.9	4.2	4.7	4.8	2%	14%
Cost of delay on state highways (2011 dollars in millions)							
Measured at maximum throughput speeds[4]	$842	$835	$674	$760	$780	3%	16%
Measured at posted speeds	$1,230	$1,200	$1,046	$1,126	$1,142	1%	9%
Corridor-specific congestion indicators							
Congestion on 52 commute routes in the central Puget Sound region							
Annual Maximum Throughput Travel Time Index (MT^3I)[5]	1.45	1.25[6]	1.30	1.37	1.35	-1.4%	3.8%
Number of commute routes with $MT^3I > 1$[5]	46	41[6]	43	45	44	N/A	N/A
WSDOT congestion relief projects							
Number of completed Nickel and TPA mobility projects as of December 31 of each year (cumulative)	33	43	65	73	82	9	17
Cumulative project value (dollars in millions)	$963	$1,289	$2,212	$2,596	$2,802	$206	$590

Data source: Washington State Office of Financial Management; Economic and Revenue Forecast Council; Bureau of Economic Analysis, U.S. Department of Energy - Energy Information Administration; Bureau of Labor Statistics – Consumer Price Index; WSDOT State Highway Log.

Notes: Analysis in the 2012 *Congestion Report* examines 2009 and 2011 annual data; five years of data are provided here for information only. All dollar values are inflation-adjusted using the Consumer Price Index (CPI). 1 Measured as the percent change in annual Washington Real Gross Domestic Product (GDP). 2 Measured as total statewide personal income in chained dollars divided by state population. 3 Based on below 70% of posted speed. 4 Based on maximum throughput speed threshold (85% of posted speed). 5 MT^3I greater than one means the commute route experiences congestion (for definition see p. 13). 6 2008 data not available for four of the 52 routes. For more information see gray box on p. 15 of the 2009 *Congestion Report*.

Measuring Delay and Congestion Annual Report

2012 *Congestion Report* Executive Summary: Looking at 2011 data

The 2012 *Congestion Report* examines 2011 calendar year data focusing on the most traveled commute routes in the central Puget Sound region, and where data is available, around the state. The *Congestion Report*'s detailed analysis shows where and how much congestion occurs, and the trends on the state highway system.

Calendar year 2011 congestion higher than 2009

The downward congestion trend in Washington came to a halt in 2009, as 2010 and 2011 data exhibit slight to moderate increases in delay and vehicle miles traveled (VMT) on state roadways. Statewide congestion data for the past five years shows that 2009 was the least congested year for Washington state. With the recovering economy and stabilization of gas prices, congestion on the state highway system was on the rise beginning in 2010, and continued to see increases in 2011.

In 2011, travel delay on state highways, when measured at maximum throughput speeds, is 3% higher than 2010 and 16% higher than 2009. In the central Puget Sound region, 73% of the monitored commute routes (38 routes out of 52 total) have shown modest changes in average travel times – within a two minute range. About half of these commutes showed a modest change in 95% reliable travel times, while 21% (11 routes out of 52) saw improvement and 27% (14 routes) saw a worsening in 95% reliability, beyond two minute fluctuations.

2012 *Congestion Report* Executive Summary of measures and results

Trend is moving in a favorable direction. Trend is holding. Trend is moving in an unfavorable direction.

	Trend	Page
Statewide indicators: Percent system congested, hours of delay, and vehicle miles traveled		
Total statewide delay Statewide delay, relative to both posted speeds and maximum throughput speeds (calculated at 85% of posted speed), increased by 9% and 16%, respectively. The increase in delay indicates that many highways across the state became more congested between 2009 and 2011. The statewide delay, relative to posted speeds and maximum throughput speeds, rose slightly in 2011 compared to 2010 by 1% and 3%, respectively.	Total statewide vehicle hours of delay increased by 16% between 2009 and 2011 relative to maximum throughput speeds.	18
Per person delay Statewide, delay increased from about 4.2 hours per person annually in 2009 to 4.8 hours per person annually in 2011, when measured using maximum throughput speeds. Statewide per capita delay in 2010 was 4.7 hours per person annually.	Per person delay increased by 14% between 2009 and 2011 relative to maximum throughput speeds.	19
Percent of the system delayed Roughly 11.5% of state highways (in lane miles) were delayed in 2009, meaning traffic flow dropped below 85% of posted speeds. This metric improved to 11.3% in 2011. As expected, most of the traffic delay on state highways is in urban areas.	The percent of state highways with delay decreased between 2009 and 2011.	19
Percent of the system congested Roughly 5.2% of state highways (in lane miles) were congested in 2009, meaning traffic flow dropped below 70% of posted speeds. This measure rose to 5.4% in 2011. As expected, most of the congested state highways are in urban areas.	0.2% more state highways are congested, up from 2009 (5.2%) to 2011 (5.4%).	19
Vehicle miles traveled (VMT) Between 2009 and 2011, total VMT increased by 0.9% on all public roads and remained steady on state highways. Per person VMT decreased statewide by 0.6% on all public roads and by 1.5% on state highways.	Total VMT on all public roadways increased by 0.9% between 2009 and 2011.	22
Central Puget Sound corridors: Hours of delay and vehicle miles traveled		
Vehicle hours of delay on major central Puget Sound region corridors Between 2009 and 2011, vehicle hours of delay relative to the posted speeds (60 mph) and maximum throughput speeds increased by approximately 0.5% and 9%, respectively. Most of the surveyed corridors saw an increase in delay.	Travel delay in the central Puget Sound area is up 9% relative to maximum throughput speeds.	21
Vehicle miles traveled (VMT) remained steady in the central Puget Sound area in 2011 On selected major Puget Sound region corridors, VMT remained steady in 2011 compared to 2009. Most major corridors except I-90 saw no significant percent change in VMT.	VMT in the central Puget Sound area remained steady in 2011 compared to 2009.	21

Executive Summary of measures and results, *continued*

2012 *Congestion Report* Executive Summary of measures and results

Trend is moving in a favorable direction. Trend is holding. Trend is moving in an unfavorable direction.

	Trend	Page
Central Puget Sound corridors: Throughput productivity		
Throughput productivity compares the observed average vehicle flow (vehicles per hour per lane – vphpl) in each commute direction for a selected location to the observed highest average five minute vehicle flow at that location. Between 2009 and 2011, for 16 selected Puget Sound monitoring locations, six showed improvements in vehicle throughput, while eight worsened, one did not change, and one did not experience any productivity loss.	Between 2009 and 2011, eight out of 16 monitored locations either improved or remained the same while eight got worse.	24-26
Travel times analysis: 40 high-demand Puget Sound commute routes		
Average peak travel times Between 2009 and 2011, 27 of 40 surveyed high-demand commute routes saw changes in average peak travel time no more than two minutes. Thirteen routes changed by more than two minutes: four showed shorter travel times and nine routes saw longer travel times.	Average peak travel times on 27 of 40 routes changed by less than two minutes between 2009 and 2011, nine worsened, four improved.	28-31
Duration of congested period The duration of congestion—defined as the period of time in which average speeds fall below 45 mph—improved on 16 routes between 2009 and 2011, with improvements ranging from five minutes to one hour 35 minutes. The duration of congestion was unchanged on two routes, and average speeds on two routes did not fall under the 45 mph threshold. The remaining 20 routes have a worsened duration of congestion ranging from five minutes to one hour 45 minutes.	Between 2009 and 2011, the duration of congestion worsened on 20 routes, improved on 16 routes and was unchanged on two; two routes had no congestion.	29-31
95% reliable travel times Between 2009 and 2011, 18 of the 40 high-demand commutes saw modest changes (less than or equal to two minutes) in 95% reliable travel time. Thirteen commutes saw reliable travel times worsen between three and 11 minutes, while reliable travel times improved on nine commutes ranging from three minutes to ten minutes.	Reliable travel times improved on nine commutes, saw no significant change on 18, and worsened on 13, when comparing 2011 to 2009.	36-38
Travel time analysis: 12 additional Puget Sound commutes		
In addition to the 40 high-demand commute routes, WSDOT tracks 12 other commutes in the central Puget Sound region where data is available. Average travel times for 11 of 12 routes saw a negligible change between 2009 and 2011. In terms of the 95% reliable travel time, nine of the 12 routes saw modest changes (within a two minute range), while travel times were seven minutes longer on one route and shorter on the remaining two routes by three minutes.	95% reliable travel times deteriorated on one of 12 commutes. Average travel time change between 2009 and 2011 were negligible on 11 of 12 routes.	42
Travel time analysis: Spokane commutes		
Average travel times on I-90 EB and I-90 WB between Argonne Road and Division Street have shown modest changes (less than a minute). 95th percentile travel times improved eastbound by 24% and deteriorated westbound by 47%.	95th percentile reliable travel time deteriorated on westbound by 47%.	43

Measuring Delay and Congestion Annual Report

Executive Summary of measures and results, *continued*

2012 Congestion Report Executive Summary of measures and results

Trend is moving in a favorable direction. Trend is holding. Trend is moving in an unfavorable direction.

	Trend	Page
HOV lane performance		
HOV lane reliability standard The reliability standard requires the HOV lane to maintain a speed of 45 mph for 90% of the peak hour. In 2009, eight of 14 HOV commute corridors met the reliability standard; seven of 14 corridors met the standard in 2011. Of the seven that did not, five are during the evening peak commutes and two are during the morning peak commutes.	In 2011, the HOV lane reliability standard was met on one less corridor than 2009.	46
Person throughput Most HOV lanes continue to be more effective at moving more people during peak periods than general purpose (GP) lanes. At the monitoring locations, the average HOV lane carries about 34% of the people on the freeway in the morning and evening peak periods. At eight of the ten monitoring locations, HOV lanes moved more people than the average adjacent GP lanes.	In 2011, the HOV lanes carried more people than the adjacent GP lanes at one more location than 2010.	48
HOV lane travel times Average travel times and 95% reliable travel times are almost always faster in HOV lanes than in general purpose (GP) lanes. In 2011, average HOV lane travel times performed better than GP lane travel times on 40 of 46 routes and were unchanged on the remaining six routes. Forty-five HOV routes provide better reliability (95% reliable travel time) than their respective GP counterparts and one remained the same.	In 2011, 40 routes showed travel time benefit for HOV compared to adjacent GP lanes. Six of the routes remained on par.	49-53
Ongoing tracking of performance for operational strategies		
Operate efficiently: Incident Response (IR) annual report Between 2009 and 2011, statewide average incident clearance time improved by 6%. The Incident Response program in 2011 has provided an annual economic benefit of $72 million.	Average incident clearance time improved by 6%.	69
Travel time analysis: January-June 2012 semi-annual report		
The trends described in the article result from a comparison of traffic conditions in the first six months of 2012 to those from the same time periods in 2010 and 2011. On non cross-lake routes, vehicle volume changes were noticeable, while travel time changes were modest. Cross-lake routes using SR 520 saw major reduction in vehicle volumes and improvement in average and reliable travel times as a result of the SR 520 tolling, which began at the end of December, 2011. On the other hand, cross lake routes using I-90 saw vehicle volume increases up to 10% and reliable travel times changes were more mixed.	Travel time changes, for ten non cross-lake commute routes monitored, were modest between 2011 and 2012. Routes using SR 520 saw improved reliability, while I-90 saw mixed results.	35
Additional performance analyses for the 40 high-demand Puget Sound commute routes		
Range of percentiles reliability analysis Reliability percentile analysis looks at travel times at the 50th percentile (median), 80th percentile, 90th percentile, and 95th percentile values for the 40 high demand routes. The percentile analysis also provides a way to track changes in travel times over the years at a finer level, in order to evaluate operational improvements.		37-38
Percent of days when speeds were less than 36 mph — Stamp graphs The most visual evidence of how peak periods changed in 2011 can be seen in the graphs on pp. 40-41. These stamp graphs, comparing 2009 and 2011 data, show the percent of days annually that observed speeds were below 36 mph (threshold for severe congestion).		39-41
Travel time comparison graphs The bar graphs on pp. 57-59 show four of the travel time performance indicators during the peak five minutes interval for weekdays: travel times at posted speeds, travel time at maximum throughput speeds (50 mph), average peak five minute travel times, and 95% reliable travel times. For each of the surveyed high-demand commutes, both general purpose (GP) and high occupancy vehicle (HOV) travel times are shown. The graphs also illustrate the travel time advantages HOV lane users have compared to GP lane users.		58-60

In Introduction:

Introduction

Congestion increasing since 2009, still below pre-recession levels

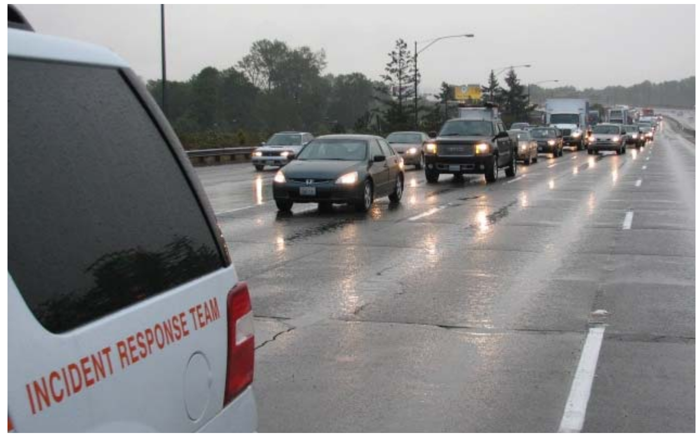
The trends of increasing congestion and delay that prevailed from 2009 through 2010 appear to have leveled off in 2011. Between 2009 and 2011, travel delay on state highways saw a substantial increase, while vehicle miles traveled held steady. Statewide congestion data for the past five years indicate that 2009 was the least congested year for Washington. Many indicators of economic growth and activity are still lagging statewide from pre-recession levels; however, 2011 began to show some promise with reduced unemployment rates and an uptick in Washington real personal income.

Trends in this year's report show that most congestion performance metrics for 2011 compared to 2009 show some measurable increases. However, when compared to 2010 these increases are mostly marginal.

- In 2011, delay on state highways when measured at maximum throughput speed was 16% greater than in 2009, and 3% higher than in 2010. Similar trends were seen when the delay metric was calculated at posted speed limits.
- Each Washingtonian spent 14% more time in traffic in 2011 than in 2009, but only 2% more than in 2010; again, the per person delay trends were similar when calculated at posted speed threshold.
- Compared to 2009, annual vehicle miles traveled (VMT) saw a modest increase in 2011 on all roads (by 0.9%) and held steady on state highways.
- Compared to 2010, annual VMT saw a modest decrease in 2011 on all roads (by -0.4%) and on state highways (by -1.0%).

The 2011 vehicle miles traveled in Washington is back to 2009 levels, which suggests that the higher fuel prices in 2011 compared to 2010 have caused Washingtonians to carefully consider travel options in terms of transportation costs.

Variable speed limit signs help move drivers on SR 520.



An Incident Response team helps manage a traffic backup and clear lanes quickly and safely.

Numerous factors influence congestion in our state

As Washington's economy recovers, economic growth will result in more people spending more time on the road as they drive to work, to school, to shopping centers or on errands. Congestion metrics demonstrate these signs as the leading performance indicators showed an increase in 2011 compared to 2009 and 2010, even though the magnitude of this increase is within pre-recession levels. The Federal Highway Administration's (FHWA) Office of Operations acknowledges that roughly half of the congestion experienced by Americans happens virtually every day – it is "recurring." This type of congestion occurs when the number of vehicles exceeds the roadway capacity. The other half of congestion is caused by temporary disruptions that take away part of the roadway's capacity from use – or "nonrecurring" congestion. The three main causes of nonrecurring congestion are incidents, ranging from a flat tire to an overturned hazardous material truck (25% of congestion), weather (15% of congestion), and work zones (10% of congestion).

Although congestion can be used as an indicator of economic growth, it also has negative economic consequences. Delay costs money – for example, drivers waste fuel in stop-and-go traffic and businesses suffer lost productivity due to shipments arriving late at their destination. When estimated against posted speeds, statewide travel delay cost drivers and businesses in Washington $1.142 billion in 2011; the cost of this delay in 2009 and 2010 was $1.046 billion and $1.126 billion, respectively. When measured at maximum throughput speed, delay remains expensive. It cost drivers and businesses $780 million in 2011 – 16% more than the $674 million cost in 2009 and 3% more than the $760 million cost in 2010.

WSDOT's congestion measurement principles in action

Moving Washington: WSDOT takes a balanced approach to fight congestion

Congestion is a complex problem with no single solution. For this reason, WSDOT instituted *Moving Washington – A balanced approach to fight congestion*; its principles are to operate the system efficiently, manage demand, and add capacity strategically. By strategically adding capacity, WSDOT targets bottlenecks and chokepoints in the transportation system. WSDOT understands that adding capacity cannot be the only solution to the congestion problem, especially in an year of limited resources. That is why WSDOT uses operational strategies such as ramp metering, Active Traffic Management, Incident Response, variable message signs, and synchronizing arterial signal systems, etc., to maximize the efficiency of the existing transportation system. WSDOT manages demand by providing alternatives to drive-alone commutes between and within modes of travel and encouraging the traveling public to use them. Performance results show that *Moving Washington* strategies and projects are making a difference around the state to relieve congestion. For details, see pp. 62-81.

WSDOT's *Congestion Report* presents detailed analysis for current and baseline years

The *Congestion Report*'s detailed analysis shows where and how much congestion occurs, and whether it has grown on state highways. The report focuses on the most traveled commute routes in the central Puget Sound region, and where data is available, around the state. WSDOT and University of Washington experts use a two-year span to more accurately identify changes and trends seen on the state highway system that may be missed looking at a one-year comparison. For the 2012 *Congestion Report*, calendar year 2011 is the current analysis year data, while 2009 data is the baseline for comparison.

WSDOT's congestion measurement principles

- Use real-time measurements (rather than computer models) whenever and wherever possible.
- Use maximum throughput as the basis for congestion measures.
- Distinguish between and measure both congestion due to incidents (non-recurrent) and congestion due to inadequate capacity (recurrent).
- Show how reducing non-recurrent congestion from incidents will improve the travel time reliability.
- Demonstrate both long-term trends and short-to-intermediate-term results.
- Communicate possible congestion fixes using an "apples-to-apples" comparison with the current situation. For example, "If the trip takes 20 minutes today, how many minutes less will it be if WSDOT improves the interchange?"
- Use "plain English" to describe measurements and results.

Key congestion performance measures

Measure	Definition
Average peak travel time	The average travel time on a route during the peak five-minute interval for all weekdays of the calendar year.
95% reliable travel time	Travel time with 95% certainty (i.e. on-time 19 out of 20 work days).
Maximum throughput travel time index (MT^{3}I)	The ratio of average peak travel time compared to maximum throughput speed travel time.
Percent of days when speeds are less than 36 mph	Percent of days annually that observed speeds for one or more five-minute interval is less than 36 mph (severe congestion) on key highway segments.
Vehicle throughput	Measures how many vehicles move through a highway segment/spot location in an hour.
Lost throughput productivity	Percentage of a highway's lost vehicle throughput due to congestion when compared to the maximum five-minute weekday flow rate observed at a particular location of the highway for that calendar year.
Delay	The average total daily hours of delay per mile based on the maximum throughput speed of 50 mph measured annually for weekdays as cumulative (total) delay.
Percent of the system congested	Percent of total state highway lane miles that drop below 70% of the posted speed limit.
Duration of congestion	The time period in minutes when speeds fall below 45 mph.
HOV lane reliability	An HOV lane is deemed "reliable" as long as it maintains an average speed of 45 mph for 90% of the peak hour.
Person throughput	Measures how many people, on average, move through a highway segment during peak periods.
Before and After analysis	Before and After performance analysis of selected highway congestion relief projects and strategies.
Average incident clearance time (Statewide)	Operational measure defined as the time from notification of the incident until the last responder has left the scene for all incidents responded to by WSDOT Incident Response personnel statewide.

Introduction

How WSDOT's congestion performance measures work

WSDOT collects real-time data for 52 commute routes in the Puget Sound region, two commute routes in Spokane, and on other highways statewide. In the Puget Sound region alone, data is collected from about 6,800 loop detectors embedded in the pavement throughout 235 centerline miles (1,300 lane miles). The data collected from these detectors are quality controlled using a variety of software processes. WSDOT uses this data to analyze system performance using a variety of performance measures. In tracking and communicating performance results, WSDOT adheres to congestion measurement principles including the use of accurate, real-time data rather than modeled data, and uses language and terminology that is meaningful to the public ("plain English"). See p. 13 for a list of performance measures and principles.

2012 semi-annual travel time trends report

WSDOT publishes two semi-annual travel time trends reports each year in addition to the annual *Congestion Report*.

The first 2012 semi-annual analysis provides up-to-date information about central Puget Sound region travel trends due to changes in the economy, and ongoing congestion relief strategies and projects under the state's *Moving Washington* program to fight congestion. Specifically, this report focuses on a sample of 18 key commute routes in the central Puget Sound region. These results supplement the annual *Congestion Report*, which takes a more comprehensive look at the state's congestion trends, as well as those of the central Puget Sound region. See the gray box on p. 35 for a summary of the semi-annual travel time trends for the first half of 2012.

Measures that matter to drivers: speed, travel time, and reliability

Reliability matters to drivers because it is important to be on time all the time. Travel times and reliable travel times are important measures to commuters and businesses in Washington. Measuring the time to get from point A to point B is one of the most easily understood congestion measures, and is one that matters to drivers whenever they make a trip.

WSDOT's *Congestion Report* examines 52 commute routes that are regularly monitored in the Puget Sound region and reports in detail on 40 high-demand routes, as well as two Spokane commute routes, and travel times for high occupancy vehicle (HOV) lanes. The metrics used in the travel time analysis include the average peak travel time, the 95% reliable travel time, the duration of congestion, and the percent of weekdays when average travel speeds are below 36 mph. The performance of an individual route compares data with the current analysis year to the baseline year.

With the 2009 *Congestion Report*, WSDOT introduced expanded reliability analysis looking at a range of travel time percentiles. This analysis allows WSDOT to examine travel time changes at a finer level of detail and better evaluate its operational strategies.

Real-time travel times for Olympia, Spokane, Vancouver, and key commutes around the Puget Sound region are available to the public and updated every five minutes on the WSDOT website at: www.wsdot.wa.gov/traffic/seattle/traveltimes/.

Measuring vehicle miles traveled (VMT)

WSDOT examines vehicle miles traveled (VMT) as a volume metric for each commute route: VMT is calculated for peak hours for the commute routes and all-day VMT is reported as part of the statewide metric. WSDOT continues to examine factors such as the use of public transportation, population change, employment rates, taxable retail sales, real personal income, and fuel prices as they relate to volume and travel time changes.

VMT allows WSDOT to quantify travel along a route. Because traffic volumes vary along a route, each location's traffic volume is multiplied by the representative length of the route, and these values are added up to obtain a route's total VMT. WSDOT uses this measure to better understand the number of trips taken on certain commute routes and the total miles traveled on state highways. This helps WSDOT predict future demands and establish improvement needs.

Traffic volume is a vehicle count at a given roadway location. It is measured by a detector in each lane at the location. WSDOT has loop detectors spaced at roughly half-mile intervals throughout the central Puget Sound freeway network and at various locations on the highway system statewide.

WSDOT uses maximum throughput as the basis for congestion performance measurement

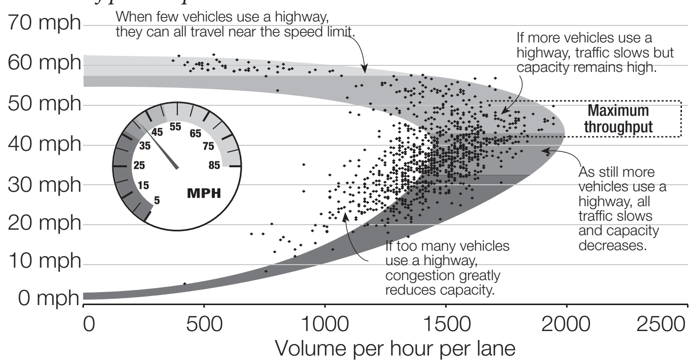
To operate the highway system as efficiently as possible, the speed at which the highest number of vehicles can move through a highway segment (maximum throughput) is more meaningful than posted speed as the basis of measurement. WSDOT aims to provide and maintain a system that yields the most productivity and efficiency, rather than a system that is free flowing but where fewer vehicles can pass through a segment during peak travel periods.

Maximum throughput is achieved when vehicles travel at speeds between 42 and 51 mph (roughly 70% to 85% of a posted 60 mph speed). At maximum throughput speeds, highways are operating

How WSDOT's congestion performance measures work, *continued*

Understanding maximum throughput: An adaptation of the speed/volume curve

I-405 NB at 24th NE, 6 a.m. - 10 a.m. weekday volume in May 2010
Speed limit 60 mph; Maximum throughput speed ranges between 70% and 85% of posted speed



Data source: WSDOT Northwest Region Traffic Office.

at peak efficiency because more vehicles are passing through the segment than at posted speeds. This happens because drivers at maximum throughput speeds can safely travel with a shorter distance between vehicles than they can at posted speeds.

Maximum throughput speeds vary from one highway segment to the next depending on prevailing roadway design (roadway alignment, lane width, slope, shoulder width, pavement conditions, presence or absence of median barriers) and traffic conditions (traffic composition, conflicting traffic movements, heavy truck traffic, etc.). The maximum throughput speed is not static and can change over time as conditions change. Ideally, maximum throughput speeds for each highway segment should be determined through comprehensive traffic studies and validated by field surveys. For surface arterials (interrupted flow facilities), maximum throughput speeds are difficult to predict because they are influenced by interruptions in flow due to the conflicting traffic movements at intersections.

WSDOT uses the maximum throughput standard as a basis for measurement to assess travel delay relative to a highway's most efficient condition at optimal flow speeds (85% of posted speed). The terms maximum throughput and optimal flow speed are used interchangeably in this report. For more information on changes in travel delay performance, please see p. 18.

WSDOT also uses maximum throughput as a basis for evaluating the system through the following measures:

- Total delay and per capita delay
- Percent of the system that is delayed and congested
- Lost throughput productivity
- Maximum Throughput Travel Time Index—MT³I (For a more detailed discussion of this measure, please see p. 29)
- Duration of the congested period
- Commute congestion cost

WSDOT state highway speed thresholds for congestion measurement

Measure	Threshold	Description
Posted speed	60 mph	Vehicles are moving through a highway segment at the posted speed, but to travel safely at higher speeds and allow sufficient stopping distance, drivers must maintain more space between vehicles. Fewer vehicles can pass through the segment in a given amount of time and the segment is not operating at maximum efficiency.
Maximum throughput speeds (optimal flow speeds)	70%-85% of posted speed (About 42-51 mph)	Vehicles are moving slower than the posted speed and the number of vehicles moving through the highway segment is higher. These speed conditions enable the segment to reach its maximum productivity in terms of vehicle volume and throughput (based on the speed/volume curve). This threshold range is used for highway system deficiency analysis.
Duration of congested period (urban commute routes)	Duration of time vehicle speeds drop below 75% of posted speeds (45 mph)	The average weekday peak time period (in minutes) when average vehicle speeds drop below 75% of posted speeds (about 45 mph). Drivers have less than optimal spacing between cars, and the number of vehicles that can move through a highway segment is reduced. The highway begins to operate less efficiently under these conditions than at maximum throughput.
Percent of state highway system delayed	Less than 85% of posted speeds	Percent of total state highway lane miles that drop below 85% of the posted speed limit.
Percent of state highway system congested	Less than 70% of posted speeds	Percent of total state highway lane miles that drop below 70% of the posted speed limit.
Severe congestion	Less than 60% of posted speed (less than 36 mph)	Speeds and spacing between vehicles continue to decline on a highway segment and highway efficiency operates well below maximum productivity.

How WSDOT's congestion performance measures work, *continued*

Measuring total delay and per person delay

Delay can be defined in different ways with posted speed or maximum throughput speeds. WSDOT uses maximum throughput speeds, rather than posted speeds, to measure delay relative to the highway's most efficient operating condition. WSDOT measures travel delay statewide and on five major commute corridors in the central Puget Sound region. In addition to measuring total hours of delay, WSDOT also evaluates annual per person delay and the cost of delay to drivers and businesses.

Measuring the percentage of the highway system that is delayed

This measure allows WSDOT to assess the percentage of its system that is operating below maximum throughput speed, creating delay for the traveling public. The metric is calculated for an average weekday by dividing the number of lane miles where speeds drop below 85% of posted speeds by total lane miles. It allows differentiation between delayed lane miles in urban and rural areas of the state.

Measuring the percentage of the highway system that is congested

This measure allows WSDOT to evaluate what percentage of the system that the agency manages is congested. It is calculated for an annual average weekday by dividing the number of lane miles where speeds drop below 70% of posted speeds by total lane miles. This measure also differentiates between the portion of congested lane miles in urban versus rural areas of the state.

Evaluating vehicle throughput productivity

Highways are engineered to move specific volumes of vehicles based on the number of lanes and other design aspects. Highways are not necessarily operating at their maximum efficiency when all vehicles are moving at 60 mph (the typical urban highway posted speed limit in Washington). As congestion increases, speeds decrease, and fewer vehicles pass through the corridor. Throughput productivity may decline from a maximum of about 2,000 vehicles per hour per lane traveling at speeds between 42 and 51 mph (100% efficiency) to as low as 700 vehicles per hour per lane (35% efficiency) at speeds less than 30 mph.

Measuring travel time reliability

WSDOT uses the 95th percentile reliable travel time as its key reliability metric for all the monitored 52 Puget Sound area commute routes. Travel time reliability is directly proportional to the travel time percentile value: the higher the percentile, the higher the reliability requirement for the commute. For example, 95th percentile travel times are more reliable than 90th percentile travel times. A benefit to using percentile measures is they are not affected by outlier values, generally the longest travel times. Using a range of percentiles – from the 50th (median) to the 95th – allows WSDOT to track changes in reliable travel times over the years at a finer level in order to evaluate operational improvements more accurately. Changes in the 80th and 90th percentiles are likely to represent travel times that are the result of routine incidents and other factors that the agency can influence with operational strategies. See pp. 37-38 for detailed reliability data and pp. 66-73 for more on operational strategies such as high occupancy toll (HOT) lanes, tolling, Active Traffic Management, Intelligent Transportation Systems (ITS), and Incident Response.

WSDOT examines high occupancy vehicle (HOV) lane performance

WSDOT uses several measures to evaluate HOV lane performance. WSDOT and the Puget Sound Regional Council (PSRC) adopted a reliability standard for HOV lanes which states that for 90% of the peak hour, HOV lanes should maintain an average speed of 45 mph. This is the basis for WSDOT's HOV reliability measure. WSDOT also measures person throughput to gauge the effectiveness of HOV lanes in carrying more people compared to general purpose (GP) lanes, and reports HOV lane travel times compared to GP lane travel times.

Using Before and After analyses of congestion relief to review the state's strategies

As of December 2011, WSDOT completed 325 out of 421 projects funded by the 2003 and 2005 gas tax packages, of which 82 were congestion relief projects. To measure how well these investments are mitigating congestion, WSDOT has implemented Before and After project studies to analyze impacts on travel times and delay. On highway segments without in-pavement loop detectors, data is collected using automated license plate recognition cameras, blue tooth readers, or moving test vehicles. Before and After performance evaluations will be expanded to key congestion relief projects to evaluate the benefits of *Moving Washington* strategies and projects that operate efficiently, manage demand, and add capacity strategically. For more information on *Moving Washington*, see pp. 62-81.

WSDOT quantifies Incident Response benefits

WSDOT uses several measures to evaluate the performance of its Incident Response (IR) program. Beginning this year, WSDOT is quantifying the annual economic benefits provided by the Incident Response program. For details on this tool for managing non-recurrent congestion, see pp. 69-73.

In Travel Delay and VMT:

Statewide Congestion Indicators Travel Delay

Statewide travel delay costs add up for Washington

State's 2011 travel delay estimate is higher than previous two years; below pre-recession levels

Washingtonians spent more hours delayed in congestion in 2011 than in 2009. Between 2009 and 2011,

- Average weekday delay relative to the system's maximum throughput (optimal) speeds increased 16%, while
- Delay relative to posted speed increased 9%.

Compared to 2010, delay in 2011 grew marginally,

- By 3% at maximum throughput speed, and
- By 1% at posted speed.

WSDOT is exploring other ways to capture statewide delay, for possible inclusion in the 2013 *Congestion Report*.

Delayed travel cost Washington drivers and businesses $1.142 billion in 2011

Travel delay is estimated relative to both the posted speed limit and the maximum throughput speeds (85% of posted speed limit). For both methods, WSDOT measures the sum of vehicle delay in hours across an average 24 hour weekday to demonstrate the extent, severity, and duration of congestion.

- When compared to maximum throughput speeds, cost of delay for drivers and businesses in 2011 was $780 million, compared to $674 million in 2009 and $760 million in 2010. In 2011, the cost of delay saw a net increase of $106 million and $20 million, compared to 2009 and 2010 respectively.
- When compared to posted speeds, statewide travel delay cost drivers and businesses in Washington $1.142 billion in 2011 compared to $1.046 billion in 2009; the cost of delay in 2010 was $1.126 billion.

Calculating the cost of delay

The cost of delay is calculated by applying monetary values to the estimated hours of delay incurred by passenger and truck travel plus additional vehicle operating costs. The value of time for passenger trips is assumed to be half of the average wage rate.

Delay imposes costs for the lost time of travelers, higher vehicle operating costs from such things as wasted fuel, and other effects of stop and go driving. Truckers, shippers and customers also bear large costs from traffic delay. It is generally recognized that delay has a variety of direct and indirect impacts, including:

- Increased travel time for personal travel,
- Increased travel time for business travel,
- Increased vehicle operating expense,
- Direct shipper/recipient productivity lost,
- Indirect (downstream) productivity lost,
- Local income/economy suffered from lost opportunities to attract new businesses, and
- Increased vehicle emissions due to stop and go conditions.

Marginal changes in general economy mirror statewide travel delay trends

WSDOT's travel delay performance measures return to higher values in 2010 and 2011 following a drop between 2008 and 2009. 2009 marks the least congested year when looking at the past five years of data. All 2011 metrics are higher than 2009 and 2010 but still lower than 2008 levels, including the hours of delay statewide, hours of delay per person, and the cost of delay to drivers and businesses.

Estimated travel delay and cost of delay on all state highways

2007 - 2011; Average weekday delay comparison (daily and annual) and estimated cost of delay on state highways (annual)

	Daily average vehicle hours of delay (weekdays)		Total annual weekday vehicle hours of delay (in thousands)		Annual cost of delay on state highways (in millions of 2011 dollars)	
Actual travel compared to:	Maximum throughput speeds	Posted speeds	Maximum throughput speeds	Posted speeds	Maximum throughput speeds	Posted speeds
2007	140,370	204,850	35,090	51,210	842	1,230
2008	139,098	199,980	34,775	49,950	835	1,200
2009	112,340	174,260	28,080	43,565	674	1,046
2010	126,580	187,650	31,650	46,910	760	1,126
2011	129,990	190,350	32,500	47,590	780	1,142
%Δ (2011 vs. 2009)	16%	9%	16%	9%	16%	9%
%Δ (2011 vs. 2010)	3%	1%	3%	1%	3%	1%

Data source: WSDOT Urban Planning Office.

Notes: Maximum throughput speeds are calculated at 85% of posted speeds. Inflation adjusted using the Consumer Price Index (CPI).

WSDOT measures per capita delay, system wide congestion and delay

Annual statewide per capita delay

2007 - 2011; Annual delay in hours

Actual travel compared to:		Maximum throughput speed [1]		Posted speed	
Year	State population[2]	Annual delay[2]	Delay per capita	Annual delay[2]	Delay per capita
2007	6,488	35,090	5.4	51,212	7.9
2008	6,588	34,775	4.9	49,950	7.6
2009	6,668	28,085	4.2	43,565	6.6
2010	6,725	31,650	4.7	46,910	7.0
2011	6,768	32,500	4.8	47,590	7.0
% Change:					
2011 vs. 2009	1.5%	16%	14%	9%	6%
2011 vs. 2010	0.6%	3%	2%	1%	0%

Data source: WSDOT Urban Planning Office.

Notes: 1 Maximum throughput speeds are calculated at 85% of posted speeds. 2 Measured in thousands.

2011 statewide per capita delay increases 14% from 2009

On a per person basis, Washingtonians experienced more hours delayed in congestion in 2011.

- When measured at maximum throughput speeds, per person delay was 14% more in 2011 (4.8 hours of delay/person/year) compared to 2009 (4.2 hours of delay/person/year). The 2011 per person delay was 2% higher compared to 2010 (4.7 hours of delay/person/year).
- When measured at posted speeds, per person delay was 6% more in 2011 (7.0 hours of delay/person/year) compared to 2009 (6.6 hours of delay/person/year). The 2011 per person delay remained the same compared to 2010 (7.0 hours of delay/person/year).

Rural Washington's state highway miles delayed drops

When measured at 85% of posted speed, the percent of state highway lane miles that experienced delay in 2009 and 2011 are 11.5% and 11.3%, respectively. The percent of state highway lane miles delayed in 2010 was 11.6%, as shown in the table to the right.

Between 2009 and 2011, the percent of the system delayed in urban areas remained steady at 10%, while the percent of the system delayed in rural area decreased from 1.5% to 1.3%.

Definition: *The percent of state highway lane miles delayed was calculated by dividing delayed lane miles by total lane miles. Delay means the roadway's operational speed drops below 85% of its posted speed limit.*

Percent of state highway miles congested holds steady in rural Washington

When measured at 70% of posted speed, the percent of state highway lane miles that experienced congestion in 2011 and 2009 was 5.4% and 5.2%, respectively. The percent of state highway lane miles congested in 2010 was 5.5% – as shown in the table below.

Between 2009 and 2011, the percent system congested in urban areas increased from 4.7% to 4.9%, while the percent system congested in rural area remained steady at 0.5% for both 2009 and 2011.

Definition: *The percent of state highway lane miles congested was calculated by dividing congested state highway lane miles by total state highway lane miles. Congestion means the roadway's operational speed drops below 70% of its posted speed limit.*

Percent of the state highway system that is delayed or congested

2007 - 2011; By percent of total state highway system

	% of system delayed			% of system congested		
	All	Urban	Rural	All	Urban	Rural
2007	12.5%	10.9%	1.6%	5.6%	5.1%	0.5%
2008	11.6%	10.1%	1.5%	5.2%	4.7%	0.5%
2009	11.5%	10.0%	1.5%	5.2%	4.7%	0.5%
2010	11.6%	9.8%	1.8%	5.5%	4.9%	0.6%
2011	11.3%	10.0%	1.3%	5.4%	4.9%	0.5%

Data source: WSDOT Urban Planning Office.

Note: The percent of the system delayed uses 85% of posted speed as the threshold; the percent of the system congested uses 70% of posted speed as the threshold.

Where regions figure in our statewide delay

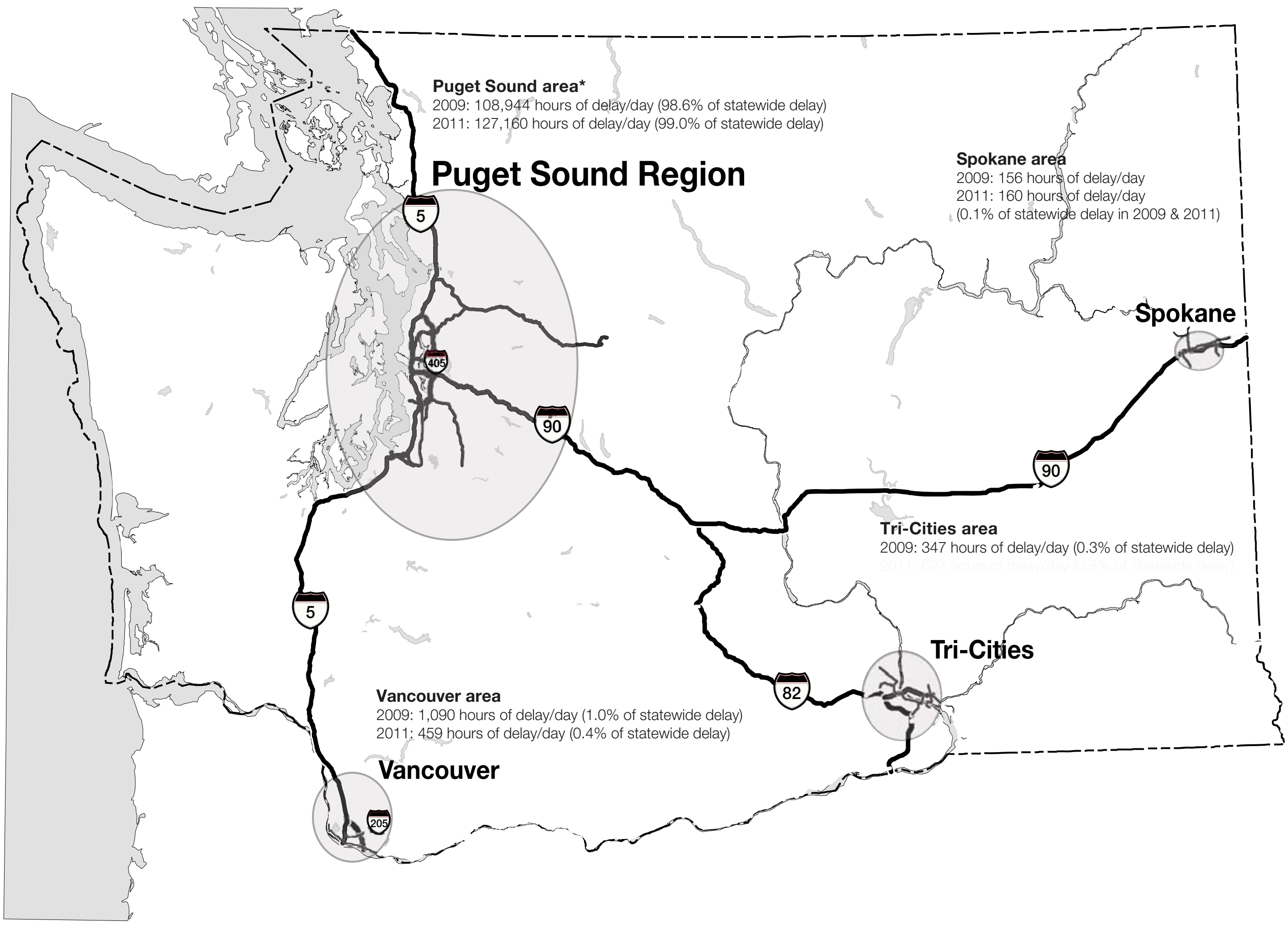
Five years of delay data by region, presented in the schematic and the table on the following page, indicate that the central Puget Sound region contributes 99% of statewide travel delay. Other urban areas of the state, such as Spokane, Tri-Cities, and Vancouver together contribute the remaining 1% of statewide delay. The size of the shaded circle indicates delay magnitude. Based on this observation, WSDOT is exploring ways to better capture the central Puget Sound region delay by using data from various sources including but not limited to existing traffic loops, blue tooth reader data, Automated License Plate Reader (ALPR) data, and private sector probe data.

Statewide Congestion Indicators
Travel Delay

Statewide travel delay and VMT: Distribution by urban area

Schematic representation of statewide delay distribution on the state highway system
Delay estimates for major urban areas, 2009 compared to 2011

Proportional representation of statewide delay distribution on the state highway system
Delay estimates for major urban areas, 2009 and 2011; Size of the shaded area illustrates delay magnitude



Data source: WSDOT Urban Planning Office.

Notes: The delay depicted on state highways is based on speeds at 85% of posted speeds, for these four urban areas only. These conditions do not reflect the impact of congestion associated with local roads, and additional impacts associated with ramps, interchanges, weather, special events, construction, collisions, and incidents.

* The Puget Sound area consists of King, Pierce, Kitsap, and Snohomish counties.

Delay and vehicle miles traveled (VMT) on state highways by urban area
2007 - 2011; Delay in hours

	2007		2008		2009		2010		2011	
Urban area	**VMT**	**Delay**	**VMT**	**Delay**	**VMT**	**Delay**	**VMT**	**Delay**	**VMT**	**Delay**
Puget Sound Region	44,585,515	137,013	43,163,152	135,600	43,871,168	108,944	44,128,145	123,000	43,810,199	127,160
Spokane	4,363,190	283	4,186,710	287	4,282,691	156	4,383,801	390	4,275,415	160
Tri-Cities	3,089,714	245	2,979,417	243	3,145,678	347	3,262,005	620[1]	3,288,322	627[1]
Vancouver	3,989,308	707	3,822,662	728	3,887,984	1,090	3,927,146	630	3,899,728	459
Total	**56,027,727**	**138,248**	**54,151,941**	**136,858**	**55,187,520**	**110,537**	**55,701,097**	**124,640**	**55,273,665**	**128,406**

Data source: WSDOT Urban Planning Office, WSDOT Statewide Travel and Collision Data Office.

Note: 1 The significant increase may be due to the influx of people working on the Hanford Cleanup project.

Following central Puget Sound travel delay and vehicle miles traveled trends

Central Puget Sound area freeway corridor travel takes longer in 2011 than in 2009

Central Puget Sound area travel delays followed statewide delay trends from 2009 and 2011, leaving motorists behind the wheel for even longer in 2011 than in 2009. During this two-year period,

- Vehicle hours of delay relative to the maximum throughput speeds increased by 9%, and
- Delay relative to posted speed limit increased by less than 1%.

When comparing 2011 and 2010

- Vehicle hours of delay relative to the maximum throughput speeds remained steady, while
- Delay relative to posted speed limit decreased by 2%.

The I-90 and SR 167 corridors experienced the largest percentage increases in delay from 2009 to 2011, relative to both maximum throughput speed and posted speed. I-90 saw an increase in vehicle hours of delay from 2009 to 2010, and a larger increase from 2010 to 2011. Nearly all of the increased delay on the I-90 corridor from 2009 to 2011 occurred between Bellevue and Seattle on Mercer Island, mostly in the westbound direction. Some of the eastbound delay increase could also be associated with Stage 2 of the WSDOT I-90 – Two Way Transit and HOV Operations Project, which began in mid-2010 and continued through 2011. The project involved the construction of an HOV lane alongside existing eastbound general purpose lanes from mid-Mercer Island to Bellevue Way. During the project, existing GP lanes and shoulders were adjusted and restriped to accommodate different phases of the construction.

SR 167 also experienced higher vehicle hours of delay from 2009 to 2010. However, delay then declined from 2010 to 2011. During that period, Stage 2 of the I-405/I-5 to SR 169 project was completed. The project provided congestion relief on the I-405 segment in the Tukwila and Renton area. This project had potentially beneficial effects for SR 167 traffic as well, particularly

Major central Puget Sound freeways: average weekday delay comparison
2007 - 2011; Vehicle hours of delay per day

State route	Relative to posted speed (60 mph)							Relative to maximum throughput speed (50 mph)						
						%Δ 2011							%Δ 2011	
	2007	2008	2009	2010	2011	vs. 2009	vs. 2010	2007	2008	2009	2010	2011	vs. 2009	vs. 2010
I-5	20,167	15,696	14,811	13,981	14,190	-4.2%	1.5%	10,568	7,324	6,684	6,395	6,849	2.5%	7.1%
I-90	2,141	1,433	1,209	1,240	1,350	11.7%	8.8%	659	282	212	255	388	83.6%	52.3%
SR 167	2,734	2,084	1,551	1,982	1,887	21.6%	-4.8%	1,138	618	350	608	536	53.0%	-11.8%
I-405	12,966	11,754	9,183	10,094	9,925	8.1%	-1.7%	7,654	6,864	4,478	5,603	5,413	20.9%	-3.4%
SR 520	3,577	2,781	2,396	2,659	1,925	-18.5%	-26.6%	2,180	1,518	1,334	1,417	1,058	-20.7%	-25.3%
Total	**41,585**	**33,748**	**29,150**	**29,956**	**29,304**	**0.5%**	**-2.2%**	**22,199**	**16,606**	**13,058**	**14,278**	**14,245**	**9.1%**	**-0.2%**

Data source: WSDOT Urban Planning Office.

Notes: The article on delay examines individual corridors while the travel time analysis (pp. 28-43) examines commutes, which include multiple corridors. 2009 data was re-calculated to match 2011 segment definitions; therefore, the 2009 numbers above do not match the 2010 *Congestion Report*.

Major central Puget Sound freeways: vehicle miles traveled (VMT)
2007 - 2011; In thousands

State route	2007	2008	2009	2010	2011	%Δ 2011 vs. 2009	%Δ 2011 vs. 2010
I-5	7,744	7,583	7,676	7,640	7,675	0.0%	0.5%
I-90	1,580	1,414	1,511	1,433	1,536	1.6%	7.1%
SR 167	947	921	947	951	947	0.0%	-0.4%
I-405	3,507	3,500	3,616	3,653	3,616	0.0%	-1.0%
SR 520	1,019	932	901	939	901	0.0%	-4.0%
Total	**14,797**	**14,350**	**14,749**	**14,616**	**14,675**	**0.0%**	**0.4%**

Data source: WSDOT Urban Planning Office.

Notes: The delay article examines VMT for all weekdays, while travel time analysis looks at VMT for weekdays during AM peak (5 a.m. - 10 a.m.) and PM peak (2 p.m. - 8 p.m.) periods. The reported VMT numbers are only a partial representation for reasons such as only GP lanes are analyzed, data station malfunction, work zone traffic diversion, etc. To make accurate comparisons, the 2009 data was recalculated for this report.

Statewide Congestion Indicators
Travel Delay

Vehicle miles traveled on public roads, state highways see moderate changes

northbound traffic heading toward the interchange connecting with the enhanced I-405 segment. Over 90% of the reduction in vehicle hours of delay on SR 167 from 2010 to 2011 occurred in the northbound direction within 1.5 miles of the I-405 interchange. (Because the lengths and widths of these corridors are different, it is not meaningful to compare and rank the corridors.)

In both of these cases, while the two-year percentage change in delay was large, the change was relative to the baseline year 2009, which was a low point in recent years from a travel delay perspective. Even with the large percentage increase, 2011 delay levels on these two corridors are still well below the delays in 2007 prior to the economic downturn. This is the case for the other Puget Sound area corridors as well.

Statewide vehicle miles traveled "idle" from 2009 to 2011

Relative to 2009, not many more drivers hit the road in 2011. The average annual vehicle miles traveled (VMT) on all public roadways in Washington increased by 0.9% in 2011 (56.965 billion) compared to 2009 (56.461 billion). The 2011 annual VMT decreased by 0.4% compared to 2010 for all public roadways (57.191 billion).

The VMT on state highways in 2011 (31.455 billion) remained steady compared to 2009 (31.456 billion) and decreased by 1% compared to 2010 (31.764 billion).

Per person vehicle miles traveled match record low

In 2011, per person VMT matched the 2008 record low of 8,417 on all public roads and 4,648 on state highways; these are the lowest observed per capita VMT values in over two decades. This does not mean the VMT is at its lowest, but rather the 2011 ratio between VMT and statewide population is the lowest recorded in the past 24 years.

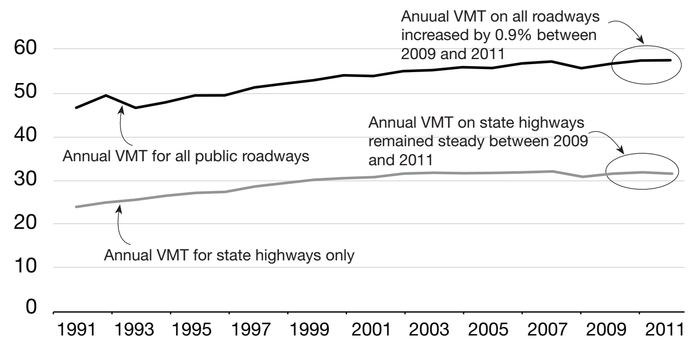
The VMT on all public roads shows that the average Washingtonian drove 50 fewer miles in 2011 than in 2009, and 88 fewer miles than in 2010. Similarly, for VMT exclusively on state highways, Washingtonians drove 69 fewer miles in 2011 than in 2009 and 76 fewer miles than in 2010.

Annual and per capita VMT on all public roads and state highways
2007 – 2011; Population in thousands

	Annual vehicle miles traveled (billions)		Per capita vehicle miles traveled	
Year (population)	State highways	All public roads	State highways	All public roads
2007 (6,488)	31.970	56.964	4,928	8,780
2008 (6,588)	30.742	55.447	4,667	8,417
2009 (6,668)	31.456	56.461	4,717	8,467
2010 (6,725)	31.764	57.191	4,724	8,505
2011 (6,768)	31.455	56.965	4,648	8,417
%Δ 2011 vs. 2009	0.0%	0.9%	-1.5%	-0.6%
%Δ 2011 vs. 2010	-1.0%	-0.4%	-1.6%	-1.0%

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

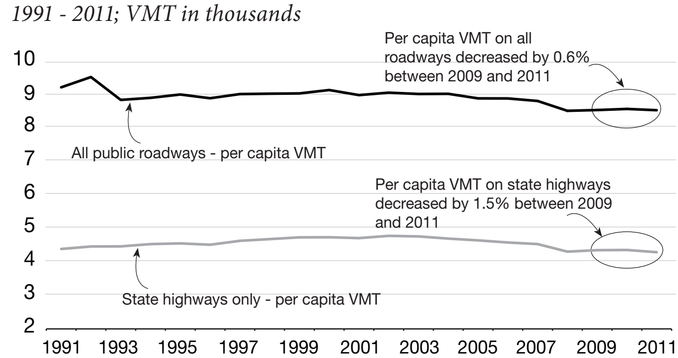
Annual vehicle miles traveled (VMT) statewide
1991– 2011; VMT in billions



Data source: WSDOT Statewide Travel and Collision Data Office.

The per capita (per person) VMT decreased by 0.6% between 2011 (8,417 VMT per capita) and 2009 (8,467 VMT per capita). A similar trend was observed between 2010 and 2011 (8,505 VMT per capita) with a 1% decrease in per capita VMT. The per person VMT measured exclusively for state highways showed a decrease of 1.5% in 2011 (4,648 VMT per capita) compared to 2009 (4,717 VMT per capita). The 2010 per capita VMT on state highways is recorded at 4,724 vehicle miles traveled.

Annual per capita vehicle miles traveled (VMT)
1991 - 2011; VMT in thousands



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

In Throughput Productivity:

Throughput Productivity

Half of sampled locations experience throughput productivity losses

The Puget Sound monitoring locations continued to show throughput productivity below 100% during peak periods. Of the 16 locations monitored (eight in each direction), two locations were unchanged in loss of throughput, six locations showed improvements ranging from 1% to 41%, and eight locations changed for the worse.

When a highway is congested, it serves fewer vehicles than it was designed to carry. Throughput productivity measures the percentage of a highway's capacity lost to congestion.

Under ideal conditions, the maximum throughput of vehicles on a freeway segment can be as high as 2,000 vehicles per hour per lane (vphpl). Under congested conditions, traffic volume can be as low as 700 vphpl.

Definition: *Throughput productivity is measured by the difference between the highest average five minute flow rate observed during the year and the flow rate that occurs when vehicles travel below the maximum throughput speeds (50 mph).*

WSDOT uses highest observed optimal flow rate to determine throughput productivity

For each location capacity varies depending on prevailing traffic conditions and roadway design. WSDOT uses the highest average five-minute flow rate recorded in the analysis year as the basis for measuring throughput productivity lost to congestion. By using this threshold throughput for each monitoring location, throughput analysis more realistically determines the loss in productivity owed specifically to changes in traffic conditions. The graphs on pp. 25-26 show throughput productivity for each direction of travel for eight locations, a total of 16 locations (eight in each direction).

Three locations had no loss in throughput productivity in 2011, compared to one location in 2009. I-405 southbound at SR 169 in Renton showed the greatest gain, with no loss in vehicle throughput in 2011 compared to a 41% loss in throughput productivity in 2009. Travel performance at that location benefited from WSDOT projects completed in the southern segment of I-405, including stages 1 and 2 of the I-405/I-5 to SR 169 project. That project added another general purpose lane in each direction between the I-5 Southcenter interchange and SR 169, as well as a new interchange to relieve congestion at nearby interchanges and improve overall access to and from the Renton area. (See p. 60 of the 2011 *Congestion Report*.) Westbound SR 520 at Montlake, and eastbound I-90 at SR 900, also had no loss of throughput productivity in 2011.

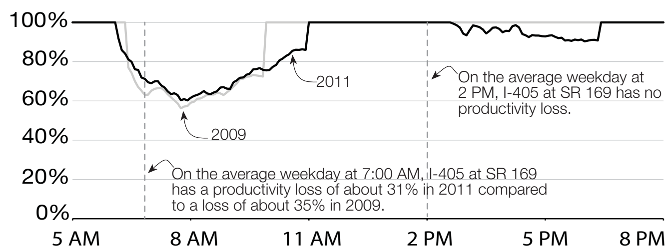
I-5 at I-90 in Seattle worsened in both directions, with a slight 1% change in the northbound morning commute and a 14% change for the worse in the southbound afternoon commute.

How to read the vehicle throughput productivity graphs

Throughput productivity can be measured in duration and in severity, and is shown as a percentage of the achievable 100% throughput capacity. The example below shows morning loss of throughput productivity in 2011 (black line) began earlier than in 2009 (gray line); however, it was slightly less severe (the highway operated at about 69% of capacity in 2011, compared to 65% in 2009 at 7 a.m.) – for an overall increase in relative throughput of four percentage points.

Vehicle throughput productivity: example

Based on the highest average five minute flow rates observed on I-405 at SR 169 (MP 4.0), for the northbound commute direction of traffic in 2009 and 2011



Change in loss of vehicle throughput at select Puget Sound locations

2009 compared to 2011; Maximum loss of vehicle throughput

	Northbound/Eastbound commute direction			Southbound/Westbound commute direction		
Location description	**2009**	**2011**	**%Δ**	**2009**	**2011**	**%Δ**
I-5 at S 188th Street, near SeaTac (MP 153.0)	14%	14%	0%	16%	19%	3%
I-5 at I-90 (MP 164.0)	22%	23%	1%	11%	25%	14%
I-5 at NE 103rd Street, near Northgate (MP 172.0)	18%	16%	-2%	12%	21%	9%
I-90 at SR 900, in Issaquah (MP 16.5)	0%	0%	0%	9%	15%	6%
SR 167 at 84th Avenue SE (MP 21.5)	6%	12%	6%	13%	15%	2%
I-405 at SR 169, in Renton (MP 4.0)	44%	40%	-4%	41%	0%	-41%
I-405 at NE 160th Street, in Kirkland (MP 22.5)	20%	16%	-4%	23%	26%	3%
SR 520 at Montlake (MP 1.5)	27%	26%	-1%	6%	0%	-6%

Data source: Washington State Transportation Center (TRAC). Data analysis: WSDOT Urban Planning Office and Strategic Assessment Office.

Note: Negative values in delta columns indicate the vehicle throughput increased in 2011 compared to 2009.

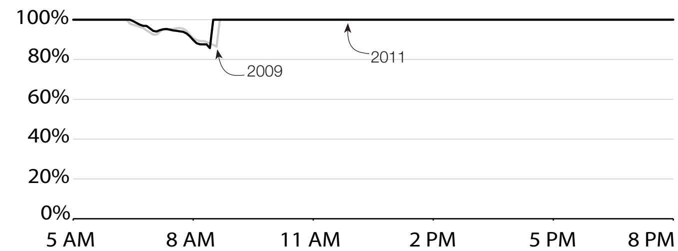
Measuring vehicle throughput productivity on Puget Sound area freeways

Throughput productivity at selected Puget Sound freeway locations by commute direction

Based on the highest observed five minute flow rates; 2009 and 2011; Vehicles per hour per lane (vphpl)

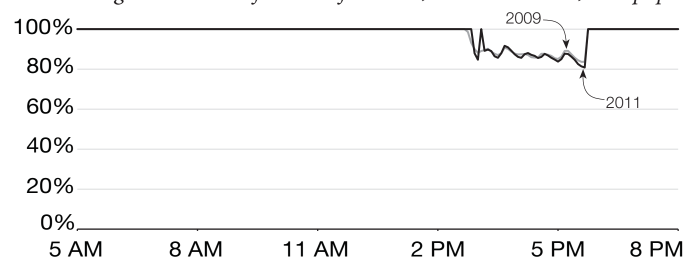
NB I-5 at S 188th Street (MP 153.0)

Based on highest observed five min. flow rate, northbound = 1,945 vphpl



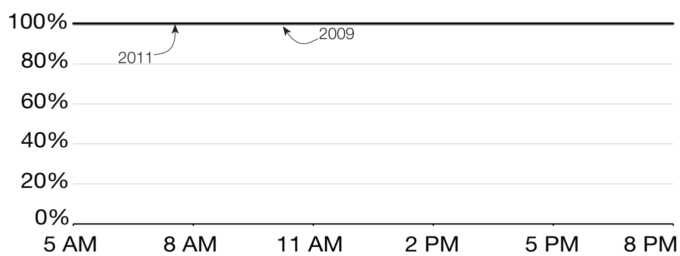
SB I-5 at S 188th Street (MP 153.0)

Based on highest observed five min. flow rate, southbound = 1,690 vphpl



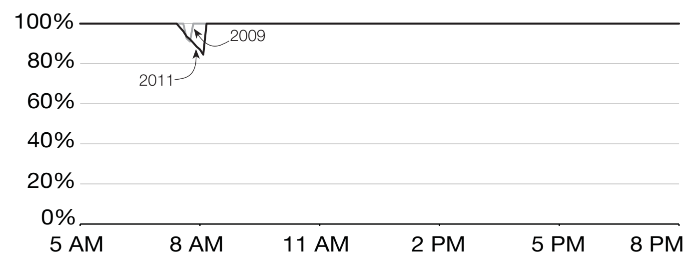
EB I-90 at SR 900 (MP 16.5)

Based on highest observed five min. flow rate, eastbound = 1,675 vphpl



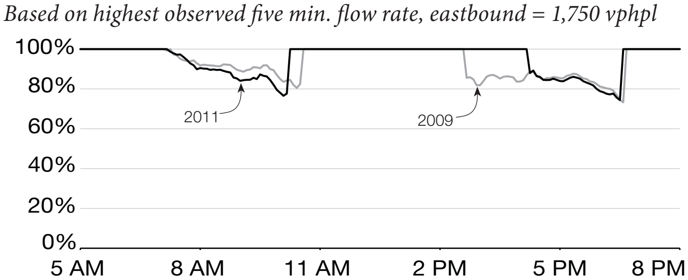
WB I-90 at SR 900 (MP 16.5)

Based on highest observed five min. flow rate, westbound = 1,630 vphpl



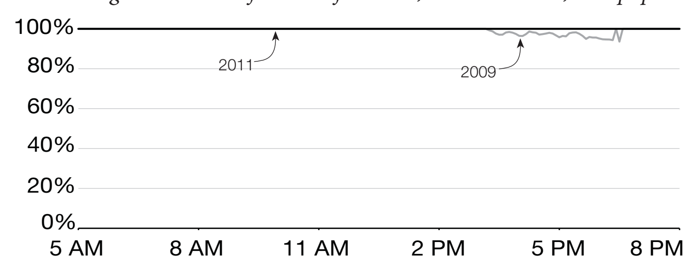
EB SR 520 at Montlake (MP 1.5)

Based on highest observed five min. flow rate, eastbound = 1,750 vphpl



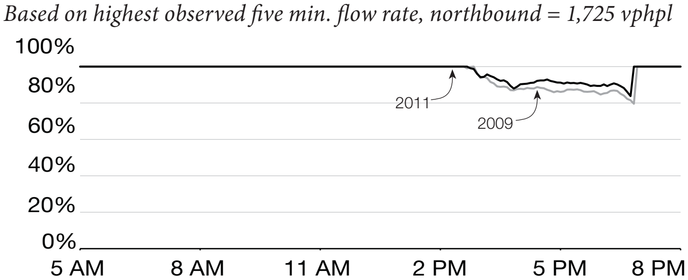
WB SR 520 at Montlake (MP 1.5)

Based on highest observed five min. flow rate, westbound = 1,705 vphpl



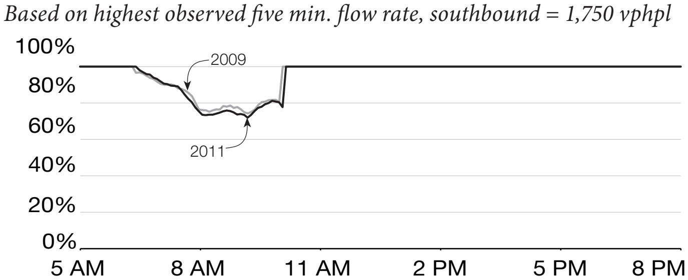
NB I-405 at NE 160th Street (MP 22.5)

Based on highest observed five min. flow rate, northbound = 1,725 vphpl



SB I-405 at NE 160th Street (MP 22.5)

Based on highest observed five min. flow rate, southbound = 1,750 vphpl



Data source: WSDOT Urban Planning Office.

Throughput Productivity

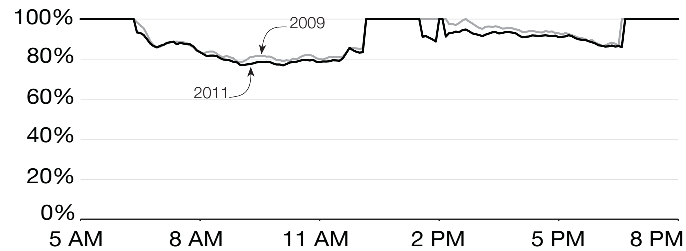
Measuring vehicle throughput productivity on Puget Sound area freeways

Throughput productivity at selected Puget Sound freeway locations by commute direction

Based on the highest observed five minute flow rates; 2009 and 2011; Vehicles per hour per lane (vphpl)

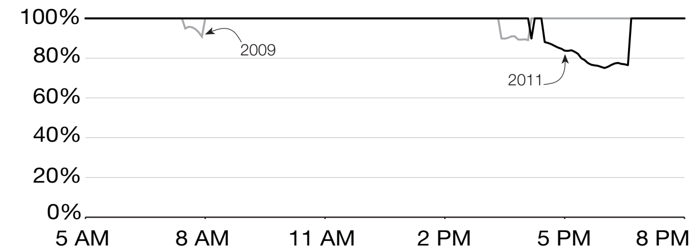
NB I-5 at I-90 (MP 164.0)

Based on highest observed five min. flow rate, northbound = 1,725 vphpl



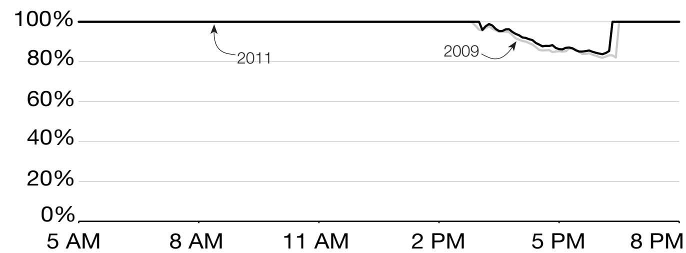
SB I-5 at I-90 (MP 164.0)

Based on highest observed five min. flow rate, southbound = 1,565 vphpl



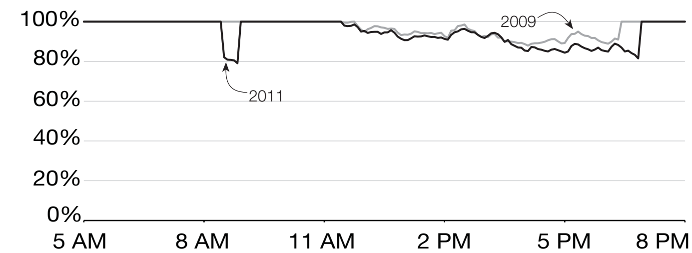
NB I-5 at NE 103rd Street (MP 172.0)

Based on highest observed five min. flow rate, northbound = 1,565 vphpl



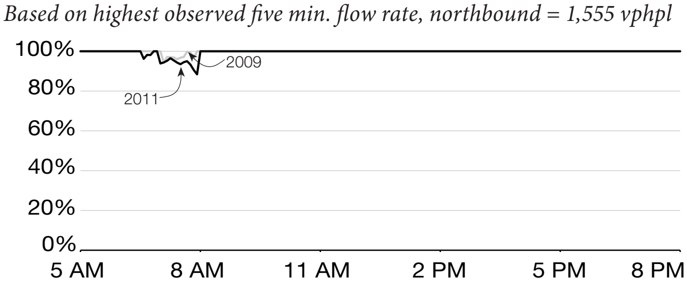
SB I-5 at NE 103rd Street (MP 172.0)

Based on highest observed five min. flow rate, southbound = 1,530 vphpl



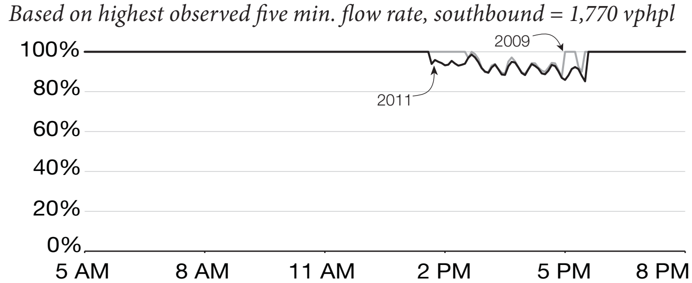
NB SR 167 at 84th Avenue SE (MP 21.5)

Based on highest observed five min. flow rate, northbound = 1,555 vphpl



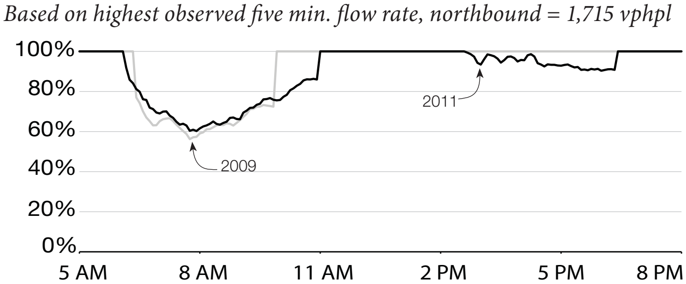
SB SR 167 at 84th Avenue SE (MP 21.5)

Based on highest observed five min. flow rate, southbound = 1,770 vphpl



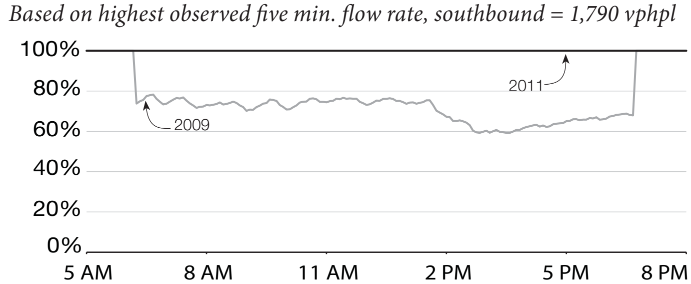
NB I-405 at SR 169 (MP 4.0)

Based on highest observed five min. flow rate, northbound = 1,715 vphpl



SB I-405 at SR 169 (MP 4.0)

Based on highest observed five min. flow rate, southbound = 1,790 vphpl



Data source: WSDOT Urban Planning Office.

In Travel Times:

Travel Time Analysis

Analyzing travel times on major Puget Sound area commute routes

WSDOT uses the following performance measures to develop its travel time analysis for general purpose freeway lanes:

- Average travel time
- Reliable travel time using multiple percentile thresholds
- Vehicle miles traveled (VMT) for traffic volume
- Average duration of the congested period
- Maximum Throughput Travel Time Index (MT^3I)

These measures are reported in the travel time tables on pp. 30-31 and pp. 37-38. In addition to these measures, the travel time analysis includes the percent of days with severe congestion, which WSDOT defines as when speeds are below 36 mph (see the stamp graphs on pp. 40-41). The 2012 *Congestion Report* also includes an analysis of HOV lane travel times beginning on p. 46.

Most routes show little change in travel time

The 2012 *Congestion Report* describes weekday conditions on 40 high-demand Puget Sound area commute routes. Of those 40 routes, 27 saw changes in average peak travel time of two minutes or less between 2009 and 2011. Thirteen routes experienced travel time changes of more than two minutes during that period: four of these routes had shorter travel times, and nine routes had longer travel times.

WSDOT projects help reduce travel times

Among trips that saw travel time improvements from 2009 to 2011, the evening commutes on eastbound SR 520 from Seattle to Redmond, and from Bellevue to Redmond, experienced two of the three largest double-digit percentage decreases. Travel times dropped by 16% and 21%, respectively, over the two-year period. Both trips include the eastern part of the SR 520 corridor from I-405 to Redmond (SR 202), an area that was the focus of a multi-phase WSDOT project to expand capacity and address chronic chokepoints. The SR 520 West Lake Sammamish Parkway to SR 202 project, completed in December 2010, added two lanes in each direction between SR 202 and the West Lake Sammamish Parkway and improved merging conditions at SR 202. (The full extent of the travel time improvement on eastbound SR 520 could be larger; because some data was unavailable due to construction, the estimated travel time improvements are based on shortened trips that lead up to, but do not include, the segment where construction took place.)

Another route that saw a significant improvement in travel time was the southbound I-405 route from Bellevue to Tukwila during the AM commute. This route saw an 18% reduction in travel time in 2011, following the completion in 2009 and 2010 of a series of WSDOT projects on the southern half of the I-405 corridor, including stages 1 and 2 of the I-405/I-5 to SR 169 project, which added lanes in both directions. The project details are published on p. 56 of WSDOT's 2010 *Congestion Report* and p. 60 of the 2011 *Congestion Report*. On that same corridor in the northbound direction, the trip from Tukwila to Bellevue continues to retain the travel time improvements that were first documented following the January 2009 opening of a new northbound auxiliary lane near I-90, as part of the I-405 South Bellevue Widening Project, discussed on p. 43 of the 2009 *Congestion Report*. The average travel time on the AM trip from Tukwila to Bellevue was reduced by 35% in 2009 compared to the previous year, and that improvement has been maintained in subsequent years.

The largest increase in travel times was a seven-minute change on the AM commute on northbound I-5 from Federal Way to Seattle, from 35 to 42 minutes. This trip had the third largest increase in the Maximum Throughput Travel Time Index (MT^3I) during the two-year period from 2009 to 2011, while the subset trip from SeaTac to Seattle had the second largest increase in MT^3I. In recent years, travel time changes on the Federal Way route have subtly reflected the broader economic conditions of the region, including the economic downturn and the slow economic recovery. This trip saw a substantial decrease in average peak travel times from 2007 to 2008 (from 47 minutes to 40 minutes), and reached a low in 2009 at 35 minutes. Since then, average peak travel times on this route increased to 39 minutes in 2010, and then up to 42 minutes in 2011. Peak travel times are now just above 2008 levels. The distribution of travel times has shifted as well, with outlier travel time values at the 80th, 90th, and 95th percentile levels all trending upward during the two-year period from 2009 to 2011.

The largest percentage increase in travel time (and the largest increase in MT^3I) was observed on the evening trip from Redmond to Bellevue via SR 520 and I-405. Average peak travel times on the six-mile route were up 23%, from approximately 11 to 14 minutes, while 95th percentile travel times were up as well, from 25 to 30 minutes. Travel time changes on this trip were primarily affected by afternoon peak period congestion on the southbound I-405 segment of the route approaching downtown Bellevue, an area that combines merging traffic from eastbound and westbound SR 520 with southbound I-405 traffic coming from Kirkland and other locations to the north.

The eastbound trip from Seattle to Bellevue on I-90 (AM commute) had the second largest percentage increase in travel time; the average peak travel time was up 19%, from 14 to 17 minutes, and the 95th percentile travel time was up by 26%. The increase in congestion on this route might be due in part to HOV lane

Analyzing travel times on major Puget Sound area commute routes, *continued*

construction between 80th Ave SE on Mercer Island and Bellevue Way as part of the I-90 – Two Way Transit and HOV Operations Project, which began in mid-2010 and continued throughout 2011.

Duration of congestion shows mixed results

WSDOT defines a trip's duration of congestion (see p. 15) as the period of time during which average trip speeds fall below 45 mph (75% of posted speed). The 45 mph threshold is only used in calculating the duration of congested periods. The results presented in the 2011 *Congestion Report* – comparing duration of congestion between 2008 and 2010 – did not show a consistent trend. These mixed results continued when comparing the 2009 to 2011 data: the duration of congestion increased on 20 routes and decreased on 16, while two routes showed no change and another two routes did not regularly drop below an average speed of 45 mph in either year.

Of the trips showing a longer duration of congestion in 2011, four routes were not previously experiencing a period of congested conditions in 2009. On two of those routes (morning commutes from Issaquah to Seattle via I-90, and Redmond to Bellevue via SR 520) peak travel time did not change significantly, and congestion increased only slightly, resulting in brief periods of congestion in 2011 (15 minutes and ten minutes, respectively). The evening commute from Seattle to Issaquah on I-90 experienced congestion for 35 minutes in 2011 compared to zero minutes in 2009. Another route on eastbound I-90, Seattle to Bellevue morning commute, experienced congestion for one hour 35 minutes, up from 25 minutes in 2010 and zero minutes in 2009. Both routes traverse eastbound I-90 on Mercer Island, a roadway that was affected by the I-90 – Two Way Transit and HOV Operations Project during 2010 and 2011.

Five routes had no measurable duration of congestion in 2011. Two of these routes, Bellevue to Seattle via I-90 and Seattle to Issaquah (both AM), did not experience a period of congestion in 2009, either. The other three routes with no congestion in 2011 had periods of congestion ranging from ten minutes to one hour in 2009. These routes are Bellevue to Tukwila on I-405 in the AM commute, and Seattle to Federal Way and Seattle to SeaTac in the PM commute. Travelers on these routes likely still experience weekday congestion at some points during their trips; however, the average speed of the entire trip (which is the basis for the duration of congestion) did not drop below 45 mph.

Examining travel time data in detail: Bellevue to Seattle evening commute via SR 520

In 2011, the evening commute from Bellevue to Seattle on SR 520 held the distinction of being the route with the worst travel time relative to its length. Of the 40 congested commutes monitored by WSDOT, the Bellevue to Seattle evening route via SR 520 had the highest ratio of peak average travel time to maximum throughput travel time (the MT³I value) at 2.24. This is the third consecutive year that this route has held the top spot among the worst travel times (length-adjusted); this followed a five-year period when the Tukwila to Bellevue AM commute on I-405 held that position. The SR 520 route showed a two-minute increase in travel time during the two-year period from 2009 to 2011; the total duration of congestion dropped by 40 minutes, though it remains at a high four hours five minutes (second longest duration of congestion among the 40 high-demand commutes).

For more information on the impacts of tolling on SR 520, which began in December 2011, refer to p. 67 of this report. More up-to-date information on the impacts of SR 520 tolling on Puget Sound region commutes during the first half of 2012 are presented in *Gray Notebook* 46, pp. 21-23.

How WSDOT compares travel times on different routes: Calculating MT³I

To accurately compare travel times on routes of different lengths, WSDOT uses an index to compare the maximum throughput travel time. For instance, the I-405/SR 520/I-5 Bellevue to Seattle and the I-90/I-5 Issaquah to Seattle evening commutes (shown in the travel time table on p. 31) both had average travel times of 28 minutes. At a glance, the routes appear roughly equal. However, the first route is 10 miles long and the second is 15 miles; this difference means that using average travel times alone is not a meaningful comparison.

The Maximum Throughput Travel Time Index (MT³I) incorporates the expected travel time under maximum throughput conditions, taking into account the length of the route. An MT³I of 1.0 would indicate a highway operating at maximum efficiency. As the MT³I value increases, travel time performance deteriorates. In this example, the Bellevue to Seattle via SR 520 evening commute has an MT³I of 2.24, which means that the commute takes two-and-a quarter times longer than it would normally take at the maximum throughput speed.

The other example, Issaquah to Seattle via I-90 evening route, has an MT³I of 1.49, which means that the commute route takes 50% longer than at the maximum throughput speed. The Bellevue to Seattle via SR 520 evening route is the slower commute of the two – and is currently the worst of the 52 monitored Puget Sound commute routes.

Travel Time Analysis

Analyzing travel times on major Puget Sound area commute routes, *continued*

Morning commutes: Changes in travel time performance on 19 AM high-demand commute routes

Morning (AM) peak is between 5 a.m. and 10 a.m.; 2009 morning peak vs. 2011 morning peak of commuter rush (individual peak times vary) for an annual average weekday; Length of route in miles; All travel times in minutes; Peak of commuter rush and duration of congestion expressed in hours and minutes

Route	Direction of travel	Length of route	Peak time of commuter AM rush	Travel time on the route at: Posted speed	Travel time on the route at: Maximum throughput speed	Average travel time at peak of AM rush: 2009	Average travel time at peak of AM rush: 2011	Average travel time at peak of AM rush: %Δ	Maximum throughput travel time MT³ Index: 2009	Maximum throughput travel time MT³ Index: 2011	VMT during peak period: %Δ in VMT	Duration of congestion (how long is average speed below 45 mph): 2009	Duration of congestion: 2011	Duration of congestion: Δ
To Seattle														
I-5 Everett to Seattle	SB	24	7:30	24	28	42	42	2%	1.46	1.49	-1%	1:40	2:00	0:20
I-5 Federal Way to Seattle	NB	22	7:35	22	27	35	42	18%	1.32	1.56	-1%	1:45	2:45	1:00
I-90/I-5 Issaquah to Seattle	WB/NB	15	7:45	15	19	22	22	0%	1.17	1.17	1%	*	0:15	0:15
SR 520/I-5 Redmond to Seattle	WB/SB	13	7:45	13	16	20	20	1%	1.23	1.24	0%	0:45	0:45	0:00
I-5 SeaTac to Seattle	NB	13	8:30	13	16	22	26	19%	1.39	1.65	0%	2:30	3:15	0:45
I-405/I-90/I-5 Bellevue to Seattle	SB/WB/NB	10	8:40	10	12	13	14	5%	1.09	1.11	2%	*	*	*
I-405/SR 520/I-5 Bellevue to Seattle	NB/WB/SB	10	7:50	10	12	17	17	2%	1.35	1.39	-1%	1:25	1:30	0:05
To Bellevue														
I-5/I-405 Everett to Bellevue	SB	24	7:25	24	28	42	46	8%	1.48	1.60	-2%	2:00	2:30	0:30
I-405 Lynnwood to Bellevue	SB	16	7:30	16	19	33	37	12%	1.70	1.90	-2%	2:25	2:55	0:30
I-405 Tukwila to Bellevue	NB	13	7:45	13	16	25	25	0%	1.55	1.56	1%	3:20	3:30	0:10
I-5/I-90/I-405 Seattle to Bellevue	SB/EB/NB	11	8:45	11	13	14	17	19%	1.09	1.31	0%	*	1:35	1:35
I-5/SR 520/ I-405 Seattle to Bellevue	NB/EB/SB	10	8:45	10	12	21	21	3%	1.67	1.72	-1%	2:35	2:30	-0:05
I-90/I-405 Issaquah to Bellevue	WB/NB	9	7:45	9	11	15	14	-7%	1.29	1.19	0%	1:55	0:20	-1:35
SR 520/I-405 Redmond to Bellevue	WB/SB	6	7:50	6	7	7	8	14%	1.01	1.16	1%	*	0:10	0:10
Other														
I-405 Bellevue to Tukwila	SB	13	7:40	13	16	20	16	-18%	1.26	1.04	2%	0:30	*	-0:30
I-405/SR 520 Bellevue to Redmond	NB/EB	5	9:55	5	7	8	8	-4%	1.23	1.18	-2%	1:15	1:15	0:00
SR 167 Auburn to Renton	NB	10	7:35	10	12	15	17	11%	1.29	1.43	-1%	1:50	2:10	0:20
I-5/I-90 Seattle to Issaquah	SB/EB	16	8:45	16	19	17	20	16%	0.93	1.08	1%	*	*	*
I-5/SR 520 Seattle to Redmond	NB/EB	13	8:45	13	16	24	24	1%	1.49	1.51	-1%	2:20	2:15	-0:05

Data source: WSDOT Strategic Assessment Office, WSDOT Northwest Region Traffic, and Washington State Transportation Center (TRAC) at the University of Washington.

Notes: The symbol "Δ" is used to denote change in a variable. Commute lengths and travel time values have been rounded to integer values for publication only. All the calculations are performed before the values are rounded to their respective integers. %Δ and MT³ Index values cannot be reproduced as published using the integer values in the table. Data quality review for 2009 data was updated using revised methodology first used in the 2011 *Congestion Report*. * Indicates that the average speed for the route did not fall below 45 mph (75% of posted speed) on a route.

Analyzing travel times on major Puget Sound area commute routes, *continued*

Evening commutes: Changes in travel time performance on 21 PM high-demand commute routes

Evening (PM) peak is between 2 p.m. and 8 p.m.; 2009 evening peak vs. 2011 evening peak of commuter rush (individual peak times vary) for an annual average weekday; Length of route in miles; All travel times in minutes; Peak of commuter rush and duration of congestion expressed in hours and minutes.

Route	Direction of travel	Length of route	Peak time of commuter PM rush	Travel time on the route at: Posted speed	Travel time on the route at: Maximum throughput speed	Average travel time at peak of PM rush: 2009	Average travel time at peak of PM rush: 2011	Average travel time at peak of PM rush: %Δ	Maximum throughput travel time MT³ Index: 2009	Maximum throughput travel time MT³ Index: 2011	VMT during peak period: %Δ in VMT	Duration of congestion (how long is average speed below 45 mph): 2009	Duration of congestion: 2011	Duration of congestion: Δ
From Seattle														
I-5 Seattle to Everett	NB	24	16:30	24	29	41	36	-12%	1.43	1.26	1%	2:50	2:05	-0:45
I-5 Seattle to Federal Way	SB	22	16:40	22	27	32	29	-8%	1.19	1.10	-1%	1:00	*	-1:00
I-5 Seattle to SeaTac	SB	13	16:40	13	16	18	17	-6%	1.17	1.10	-1%	0:10	*	-0:10
I-5/I-90/I-405 Seattle to Bellevue	SB/EB/NB	11	17:25	11	13	16	18	10%	1.29	1.41	-1%	0:35	1:25	0:50
I-5/SR 520/I-405 Seattle to Bellevue	NB/EB/SB	10	17:30	10	12	20	20	-2%	1.64	1.61	0%	2:55	2:45	-0:10
I-5/SR 520 Seattle to Redmond	NB/EB	13	17:35	13	16	25	21	-16%	1.56	1.30	0%	2:05	1:20	-0:45
I-5/I-90 Seattle to Issaquah	SB/EB	16	17:35	16	19	21	23	6%	1.14	1.21	-1%	*	0:35	0:35
From Bellevue														
I-405/I-5 Bellevue to Everett	NB	23	17:10	23	28	39	40	2%	1.40	1.42	1%	2:50	2:40	-0:10
I-405 Bellevue to Lynnwood	NB	16	17:25	16	19	31	31	-1%	1.63	1.62	1%	3:20	3:00	-0:20
I-405 Bellevue to Tukwila	SB	13	16:50	13	16	31	33	7%	1.92	2.06	0%	5:35	4:45	-0:50
I-405/I-90/I-5 Bellevue to Seattle	SB/WB/NB	10	17:30	10	12	23	25	8%	1.88	2.04	1%	2:25	3:00	0:35
I-405/SR 520/I-5 Bellevue to Seattle	NB/WB/SB	10	17:30	10	12	26	28	8%	2.08	2.24	-1%	4:45	4:05	-0:40
I-405/I-90 Bellevue to Issaquah	SB/EB	9	17:30	9	11	15	16	8%	1.39	1.49	0%	2:00	3:00	1:00
I-405/SR 520 Bellevue to Redmond	NB/EB	5	17:35	5	7	10	8	-21%	1.48	1.17	0%	1:10	0:35	-0:35
Other														
I-5 Everett to Seattle	SB	24	16:20	24	28	38	41	10%	1.33	1.46	-1%	3:10	3:30	0:20
I-90/I-5 Issaquah to Seattle	WB/NB	15	17:25	15	19	24	28	14%	1.31	1.49	2%	0:40	1:40	1:00
SR 520/I-5 Redmond to Seattle	WB/SB	13	17:35	13	16	31	33	5%	1.96	2.05	-1%	4:10	3:35	-0:35
SR 520/I-405 Redmond to Bellevue	WB/SB	6	17:25	6	7	11	14	23%	1.52	1.87	0%	1:40	3:00	1:20
I-5 SeaTac to Seattle	NB	13	17:20	13	16	20	21	7%	1.28	1.36	-1%	0:50	2:10	1:20
SR 167 Renton to Auburn	SB	10	16:45	10	12	14	16	10%	1.23	1.36	1%	1:15	3:00	1:45
I-405 Tukwila to Bellevue	NB	13	17:25	13	16	23	21	-8%	1.41	1.30	1%	2:15	1:10	-1:05

Data source: WSDOT Strategic Assessment Office, WSDOT Northwest Region Traffic, and Washington State Transportation Center (TRAC) at the University of Washington.

Notes: The symbol "Δ" is used to denote change in a variable. Commute lengths and travel time values have been rounded to integer values for publication only. All the calculations are performed before the values are rounded to their respective integers. %Δ and MT³ Index values cannot be reproduced as published using the integer values in the table. Data quality review for 2009 data was updated using revised methodology first used in the 2011 *Congestion Report*. * Indicates that the average speed for the route did not fall below 45 mph (75% of posted speed) on a route.

WSDOT quantifies the cost of commute congestion

WSDOT tracks commute travel times and associated performance measures on 52 high-demand Puget Sound region commute routes. Thirty-eight out of 52 commutes experience congestion on a regular basis. WSDOT is introducing for the first time a new metric called "commute congestion cost" that captures the approximate cost associated with a commute due to congestion. These costs include extra gas used while idling and traveling at slower speeds, and the wasted time of the commuters that could be used productively elsewhere. The daily commute congestion cost helps illustrate the individual's cost of being stuck in congestion. Refer to the I-5 Federal Way to Seattle discussion below.

Quantifying the commute congestion cost for individuals and communities

Commute congestion cost can be quantified at the commute route level (how much value is lost on a particular congested route?) as well as at the individual commuter level (how much does congestion cost a daily commuter?). Commute congestion cost is based on the duration of congestion that represents the time frame during which users can expect to travel at speeds below 45 mph (75% of posted speed) during their daily commute. While daily commuters may build extra time and operating costs into their routines and budgets to account for traveling during congested periods, congestion still represents costs, lost opportunities, and lost productivity that negatively affect individuals and society.

Commute congestion cost is computed for every five-minute interval within the time that a particular commute is experiencing congestion. This methodology is a very conservative estimate of the commute congestion cost as it does not capture the traffic that intermittently experience speeds below 45 mph along a commute that has a higher average speed. Commute congestion cost can be estimated using the equation below:

- *Commute congestion cost = (Average travel time – Travel time at threshold speed)* Traffic volume within the duration of congestion* Extra cost of travel due to congestion*

Putting a dollar value on commute congestion

For example, the average extra time required to travel on I-5 from SeaTac to Seattle during the afternoon commute is 6.75 minutes; the annual weekday volume that experiences congestion on this route is 10,930 vehicles per day (260 weekdays each year); and the cost per hour is $21.90, totaling over $7.0 million each year on this route alone, when compared to traveling at posted speed.

Similarly, the I-5 morning commute between Federal Way and Seattle on an average annual weekday experiences a duration of congestion of two hours and 45 minutes. During this time period more than 15,500 vehicles travel at average speeds below 45 mph. The table below is a breakdown of commute congestion costs measured at two different thresholds: posted speed and maximum throughput speed.

Cost of congestion on I-5 Federal Way to Seattle during the morning commute (22 miles)
2011 data

	Annual commute congestion cost		Daily commute congestion cost	
Threshold	**Commute**	**Individual**	**Commute**	**Individual**
Posted speed	$21,845,204	$1,403	$84,020	$5
Maximum throughput speed	$15,286,692	$982	$58,795	$4

Data source: WSDOT Strategic Assessment Office.

The I-5 Federal Way to Seattle daily morning commute congestion cost per vehicle helps illustrate the idea behind charging a user price to incentivize travelers to use a congested route during less congested, "off-peak" periods that would help in reducing the congestion for all. The commuter who travels during the typical peak period will pay a price that would be approximately equal to the cost of commute congestion. The commute cost offsets the expense of paying for wasted gas and time sitting in traffic. An increasing number of transportation agencies in the nation are leaning towards this type of analysis to understand congestion pricing as a congestion management strategy while generating revenue for transportation improvement projects.

Reviewing commute congestion cost variations between 2009 and 2011

Cumulatively, the commute congestion cost experienced on over 220 directional commute miles on the Puget Sound commute routes (excluding the overlap from commutes) increased by 11% in 2011 compared to 2009 when measured at posted speeds, and increased by 14% when measured at maximum throughput speed. The percent change in traffic volume that experienced congestion increased by 5% from 2009 to 2011.

Commute congestion cost increased along with the traffic volume affected by congestion between 2009 and 2011, but with no significant change in vehicle miles traveled on Puget Sound area commute corridors (see p. 22). This is an indication that congestion severity has increased leading to a higher commute congestion cost for a similar number of vehicle miles traveled.

Factors that affect travel times from 2009 to 2011

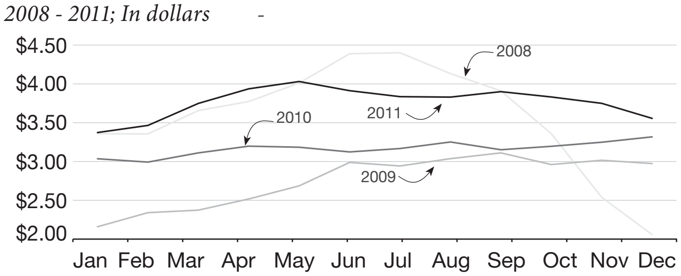
Economic indicators explain Puget Sound area travel time trends: 2009 - 2011

Although the recession that began in December 2007 officially ended in June of 2009, the economic recovery has been slow in Washington, like most of the rest of the country. Many indicators of economic growth and activity are still lagging statewide from pre-recession levels; however, 2011 began to show some improvement. Urban area commute travel time patterns generally follow economic indicator trends, as relatively low congestion levels tend to coincide with periods of economic stagnancy. Between 2009 and 2011 average travel times showed marginal changes on most routes, while the duration of congestion showed mixed results with half of the routes taking longer and the rest shorter or unchanged. The labor market, gasoline prices, productivity, and other economic factors can impact system congestion by influencing commute decisions.

Gasoline prices rise 39% between 2009 and 2011

Between 2009 and 2011, real (adjusted for inflation) fuel prices in Washington rose by 39%. During the second half of 2008, prices dropped rapidly from $4.50 per gallon, until hitting a low of around $2 a gallon in the first quarter of 2009. They then grew steadily throughout 2009, 2010, and the first half of 2011. Prices peaked in May 2011 at about $4 per gallon and decreased during the fourth quarter of 2011 to around $3.50 a gallon. High gasoline prices can play a significant role in commute decisions as people carefully consider travel options in terms of transportation costs.

Average monthly gasoline prices in Washington
2008 - 2011; In dollars

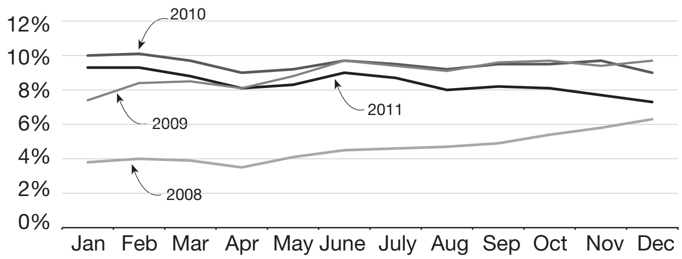


Data source: U.S. Department of Energy's Energy Information Administration (EIA).

Unemployment rates begin to drop in the central Puget Sound region in the second half of 2011

The average unemployment rate in the central Puget Sound counties (King, Kitsap, Pierce, and Snohomish) in 2011 was 8.6%, lower than the statewide unemployment rate of 9.2%. Unemployment rates in the Puget Sound region were low before the recession (under 4% for most of 2007), rose rapidly in the last quarter of 2008 through 2009, and peaked during first quarter of 2010 at above 10%.

Unemployment rate for the Seattle-Bellevue-Everett metropolitan area
2008 - 2011



Data source: Washington State Employment Security Department, Labor Market and Economic Analysis (LEMA).

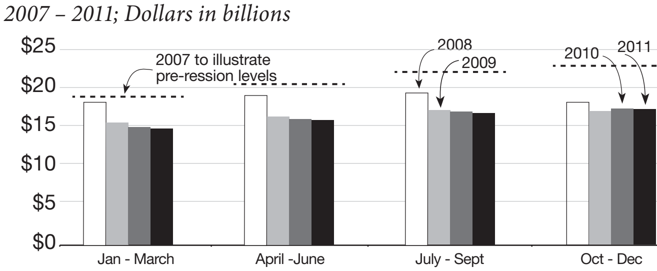
As the economic climate began to improve in 2010, the average unemployment rate did not steadily drop until the second half of 2011, and remained much higher than pre-recession levels in 2011. In the Seattle-Bellevue-Everett metropolitan area the average unemployment rate for 2011 was 8.4%, more than a one percentage point drop from the 2010 average of 9.5%.

Both private and public sector jobs have been slower-than-average to recover since the recession ended. Job losses can impact the travel patterns of many daily commuters, because many people who were previously commuting to jobs during peak times may not be making the same trips during or after the recession. Furthermore, higher regional employment contributes to traffic congestion because the vast majority of peak-period drivers are commuting to or from work.

Inflation-adjusted taxable retail sales in Puget Sound counties decline 1.6% between 2009 and 2011

Between 2009 and 2011, real taxable retail sales were down 1.6% in the Puget Sound region. Consumer confidence – reflected in taxable retail sales – may play a role in the travel behavior of the average consumer. In the Puget Sound region, taxable retail sales remained strong for all of 2007 through most of 2008, until the

Taxable retail sales for select Puget Sound counties
2007 – 2011; Dollars in billions



Data source: Washington State Department of Revenue, Quarterly Business Review, Table 3A.
Note: The four Puget Sound counties include King, Snohomish, Pierce, and Kitsap.

Employment and population trends reflect the struggling regional economy

financial crisis started to take its toll on consumer spending and purchasing behavior in the second half of 2008. Taxable retail sales in 2009 and 2010 remained significantly depressed, at about 12% lower than 2008 levels. In 2011 taxable retail sales remained close to 2010 levels, reflecting the slow economic recovery.

This decline in real taxable retail sales from 2009 to 2011 occurred because the rate of inflation exceeded the nominal amount of taxable retail sales. The nominal (non-inflation-adjusted) measure saw a 2.3% increase in the amount of taxable retail sales.

Washington real personal income increases by 3.8% between 2009 and 2011

Washington's real personal income is a measure of income received by all state residents from all sources in a given year. Between 2009 and 2011, real personal income increased from $292.3 billion in 2009 to $303.4 billion in 2011, a 3.8% increase. Statewide real per capita income also experienced an increase between 2009 and 2011 of 1.6% (from $43,675 in 2009 to $44,350 in 2011). Despite this slight growth, 2011 per capita income remains below pre-recession levels. Closer examination shows that salary income increased in 2011 after having dropped in 2009 and 2010, while non-wage income increased in 2010 and 2011, indicating that on average more people may have looked to alternative means to make ends meet as the labor market remained depressed after the recession.

Cities of Redmond and Sammamish see double-digit job loss along with significant growth in population

According to the state Office of Financial Management, both natural population growth (births minus deaths) and growth due to migration from other states or countries has slowed in Washington due to the slow post-recession economic recovery. Net migration in 2011 was the lowest level in two decades. Individual cities in the central Puget Sound region show relatively small increases in population, with the population growth less than 3% in most cities between 2009 and 2011. Redmond and Renton both had higher population growth rates of around 6% between 2009 and 2011. Kent grew in population by 29%, mostly due to annexation. Growth in population density, a major determinant of traffic congestion, has also slowed in recent years. The central Puget Sound counties had a population density of approximately 596 persons per square mile in 2011, about a 1.7% increase from 2009 population density levels. The average population density for the state of Washington was approximately 102 persons per square mile in 2011.

Population and employment changes for select Puget Sound locations

2009 compared to 2011

Location	Population 2009	Population 2011	Population %Δ	Number of Jobs 2009	Number of Jobs 2011	Number of Jobs %Δ
Seattle	598,539	612,100	2%	473,280	473,921	0%
Bellevue	120,872	123,400	2%	121,144	122,635	1%
Southwestern King County cities						
Auburn	69,059	70,705	2%	39,061	37,400	-4%
Des Moines	29,613	29,680	0%	5,546	5,703	3%
Federal Way	89,001	89,370	0%	28,482	28,811	1%
Kent[1]	91,401	118,200	29%	60,490	61,858	2%
Renton	87,668	92,590	6%	55,446	54,997	-1%
SeaTac	26,643	27,110	2%	26,438	24,828	-6%
Tukwila	18,939	19,050	1%	46,112	42,759	-7%
Total[2]	**412,324**	**422,705**	**3%**	**261,575**	**256,356**	**-2%**
Eastern King County cities						
Issaquah	29,871	30,690	3%	18,247	19,912	9%
Kirkland	48,449	49,020	1%	30,631	31,745	4%
Newcastle	10,343	10,410	1%	1,644	1.992	21%
Redmond	51,985	55,150	6%	90,704	78,893	-13%
Sammamish	45,039	46,940	4%	5,143	4,589	-11%
Total	**185,687**	**192,210**	**4%**	**146,369**	**137,131**	**-6%**
Northern King County and Snohomish County						
Shoreline	52,886	53,200	1%	16,374	16,039	-2%
Snohomish Co.	705,894	717,000	2%	241,569	240,853	0%

Data source: Puget Sound Regional Council, Seattle, WA - Covered Employment Estimates by City. Office of Financial Management - Forecasting Division.

Notes: The symbol "Δ" is used to denote change in a variable. 1 Kent experienced large population growth due to annexation in July 2010; the city grew by approximately 24,000 residents as a result of the annexation. 2 Total population numbers for 2011 were adjusted to reflect actual growth, not growth from annexations.

Most of the cities in the region shed jobs or experienced marginal job growth between 2009 and 2011. Seattle and Bellevue had no substantial change in total jobs. Select cities in southwestern King County lost 2% of their jobs, while cities in eastern King County lost 6%. The largest job loss rates were in the cities of Redmond (13%) and Sammamish (11%). The city of Newcastle had the highest job growth of 21% from 2009 to 2011; total jobs in that city increased from 1,644 to 1,992 over the two-year period.

Fatal collisions prolong travel times; Travel trends update: January - June 2012

Fatal collisions rise slightly in Puget Sound counties and stay about the same statewide

Recurrent congestion is caused by simply having too many cars on the same highway at the same time. Non-recurrent congestion stems from one-time problems such as traffic incidents or bad weather, and can worsen recurrent congestion. Fatality and serious injury collisions are a major cause of non-recurrent congestion, often disrupting traffic for hours while emergency crews care for the injured and police perform investigations. These events have an impact on the reliability of travel times.

In 2011, Washington saw a reduction in fatal collisions compared to 2009 by 7% on all roads and 2% on state highways. However, the four central Puget Sound counties saw a 2% increase in fatal collisions on all roads and 21% increase on state highways. The increase in fatal collisions in the Puget Sound area led to an increase in non-recurrent congestion, thereby negatively impacting the travel reliability on central Puget Sound roads.

Statewide and Puget Sound area fatal collisions
2007 - 2011; Number of fatal collisions and percent change

	On all roads		On state highways	
	Statewide	Puget Sound counties	Statewide	Puget Sound counties
2007	530	204	252	85
2008	481	204	215	74
2009	455	171	213	67
2010	423	169	211	79
2011	424	174	208	81
% Change:				
2011 vs. 2009	-7%	2%	-2%	21%
2011 vs. 2010	0%	3%	-1%	3%

Data source: WSDOT Statewide Travel and Collision Data Office.

Travel time trends update: January – June 2012

The semi-annual travel time analysis provides up-to-date information on travel trends in the central Puget Sound region, and associated changes in economic conditions, as well as ongoing congestion relief strategies and projects under the state's *Moving Washington* program. This analysis is included in the *Gray Notebook* 46. It focuses on a sample of 18 key commute routes in the Seattle area, and supplements the 2012 *Congestion Report*. The following results are derived from a comparison of weekday freeway traffic conditions in the first half of 2012 with the same time period in 2011. Trends are also described, to provide additional context for the short-term patterns.

This is the first semi-annual update to include the traffic effects of the SR 520 Lake Washington Bridge variable time-of-day tolling project, which began operations in December 2011. To learn more about this project, see www.wsdot.wa.gov/Tolling/520/.

Non cross-lake routes saw modest changes in peak and daily volumes during the first half of 2012 vs. 2011

Noticeable differences were observed in year-over-year volume changes when comparing routes that do not cross Lake Washington with those that do cross the lake. On the sampled routes that do not cross Lake Washington, vehicle volumes during the first six months of 2012 were unchanged or somewhat lower during the morning and evening peak commuting periods, compared to the same days in 2011; changes on those routes ranged from 0% to -6%. For more detail see *Gray Notebook* 46, p. 21.

Significant volume changes observed on cross-lake routes

By far the most significant changes in peak period and daily vehicle volumes were observed on the I-90 and SR 520 corridors across Lake Washington, where some traffic changes were anticipated following the start of tolling operations on SR 520. Overall, SR 520 vehicle volumes were down significantly in the first half of 2012 on a year-over-year basis, while I-90 volumes were up somewhat. For more detail see *Gray Notebook* 46, p. 21.

Non cross-lake routes saw modest travel time changes during the first half of 2012 vs. 2011

On most of the sampled routes, travel times changed modestly during the first half of 2012 for the morning and evening peak commuting periods, compared to the same days in 2011. For more detail see *Gray Notebook* 46, p. 22.

Comparing cross-lake travel performance and reliability for the first half of 2012 vs. 2011

Eight commute trips use the I-90 and SR 520 bridges. Two of those trips experienced a three-minute year-over-year improvement in travel times: the two trips were the eastbound morning peak period trip from Seattle to Bellevue via SR 520, and the return trip westbound during the evening peak period. For more detail see *Gray Notebook* 46, p. 23.

Travel time reliability on major Puget Sound commute routes

Travel time reliability percentiles for 40 high-demand Puget Sound region commute routes

Reliability is an important metric for highway users, because it allows them to plan their travel consistently. When drivers know how many minutes they should allow to reach their destination on time – with average road conditions as well as under the worst conditions – they can make more accurate travel plans. A commuter can plan the daily trip to work during peak hours, a parent can plan the afternoon run to the day-care center, a business knows when a just-in-time shipment must leave the factory, and a transit agency can develop reliable schedules.

How reliability percentiles are used

WSDOT starts by identifying the peak five-minute interval with the highest annual average weekday travel time for each morning or evening commute route (based on the 260 weekdays in a calendar year). The average weekday travel time at the peak interval includes fast days (usually holidays) and slow days (such as during snow storms or icy conditions), and so it is only a broad indicator of how many minutes are needed to traverse the route. A traveler who must be sure of reaching a destination on time predictably needs to know how long the trip will take under nearly the worst conditions.

The 95th percentile reliability travel time includes near worst case travel times: it is the travel time that gets drivers to their destination on time, 95 times for every 100 trips. WSDOT also uses 80th and 90th percentile travel times primarily as a tool to track changes in travel times at a finer level. These travel times would factor in routine delays due to a collision or roadwork. The 50th percentile travel time, or median, indicates that half of the days of the year were faster, and half were slower. WSDOT uses the 95th percentile reliable travel time as its key metric for the 40 high-demand Puget Sound commute routes.

Reliability results are mixed for 2011

Changes in the 95th percentile reliable travel times were evenly split between improving and deteriorating reliability: 18 of the 40 high-demand routes showed better 95th percentile travel times (travelers could plan less time) for 2011 compared to 2009, while another 18 routes had worsening reliability (travelers needed to plan more time). Travel time reliability on four routes was unchanged.

Of the 18 routes showing improved reliability from 2009 to 2011, half showed 95th percentile travel times that were more than two minutes shorter. For the 18 routes with worsening reliability, 13 routes showed 95th percentile travel times that increased by more than two minutes. The 95th percentile travel times for the remaining 18 routes changed by two minutes or less for each commute route, including the four that saw no change.

The SR 520 eastbound evening commute from Bellevue to Redmond showed the largest improvement in 95th percentile reliable travel time, dropping 50% from 18 minutes in 2009 to 9 minutes in 2011. The evening commute from Seattle to Redmond, which shares the eastern portion of the SR 520 corridor, also experienced a drop in 95th percentile reliable travel time, from 37 minutes to 32 minutes. As noted on p. 28, these routes were likely affected by the completion of capacity improvements from the SR 520 West Lake Sammamish Parkway to SR 202 project.

Reliability percentiles in plain English

Analyzing reliability based on travel times recorded on 260 weekdays in a calendar year during the peak five-minute interval

	Definition	Why do we measure this?
Average travel time (the Mean)	Average of all the recorded travel times.	Describes the “average” experience on the road that year.
50th percentile travel time (the Median)	Half of recorded travel times were shorter, half longer, than this duration.	The median is not affected by very large times as an average is, so it gives a better sense of actual conditions.
80th percentile travel time	80% of recorded travel times were shorter than this duration.	WSDOT uses this percentile to track changes in reliable travel times over the years at a finer level, to better evaluate operational improvements.
90th percentile travel time	90% of recorded travel times were shorter than this duration.	WSDOT uses this percentile to track changes in reliable travel times over the years at a finer level, to better evaluate operational improvements.
95th percentile travel time	95% of recorded travel times were shorter than this duration.	Allows commuters to plan how much time will be required to make a trip and be on time 19 days a month, on average (late one of 20 days).

Travel time reliability on major Puget Sound commute routes, *continued*

Morning commutes: Change in reliable travel time percentiles for 19 high-demand AM commute routes, 2009-2011

Morning (AM) peak is between 5 a.m. and 10 a.m.; Length of route in miles; All travel times and differences in minutes; Peak of commuter rush expressed in hours and minutes for an annual average weekday

Route	Length of route	Peak of commuter AM rush	Travel times on the route at: Posted speed	Travel times on the route at: Maximum throughput speed	2009 percentiles: Median 50th	2009: 80th	2009: 90th	2009: 95th	2011 percentiles: Median 50th	2011: 80th	2011: 90th	2011: 95th	Difference 2009 vs. 2011: Median 50th	Difference: 80th	Difference: 90th	Difference: 95th
To Seattle																
I-5 Everett to Seattle	24	7:30	24	28	38	52	60	**65**	41	52	61	**68**	3	0	1	**3**
I-5 Federal Way to Seattle	22	7:35	22	27	33	42	48	**53**	40	50	55	**58**	7	8	7	**5**
I-90/I-5 Issaquah to Seattle	15	7:45	15	19	20	24	28	**31**	20	25	28	**32**	0	1	0	**1**
SR 520/I-5 Redmond to Seattle	13	7:45	13	16	19	23	25	**29**	19	23	25	**28**	0	0	0	**-1**
I-5 SeaTac to Seattle	13	8:30	13	16	21	26	29	**31**	24	32	37	**42**	3	6	8	**11**
I-405/I-90/I-5 Bellevue to Seattle	10	8:40	10	12	12	15	18	**21**	12	15	17	**20**	0	0	-1	**-1**
I-405/SR 520/I-5 Bellevue to Seattle	10	7:50	10	12	16	20	23	**26**	17	20	22	**25**	1	0	-1	**-1**
To Bellevue																
I-5/I-405 Everett to Bellevue	24	7:25	24	28	39	53	60	**68**	44	57	65	**70**	5	4	5	**2**
I-405 Lynnwood to Bellevue	16	7:30	16	19	31	43	47	**54**	36	49	54	**57**	5	6	7	**3**
I-405 Tukwilla to Bellevue	13	7:45	13	16	24	30	35	**41**	25	29	30	**31**	1	-1	-5	**-10**
I-5/I-90/I-405 Seattle to Bellevue	11	8:45	11	13	13	15	17	**21**	15	20	24	**26**	2	5	7	**5**
I-5/SR 520/I-405 Seattle to Bellevue	10	8:45	10	12	20	25	28	**30**	20	26	30	**33**	0	1	2	**3**
I-90/I-405 Issaquah to Bellevue	9	7:45	9	11	14	17	19	**23**	13	16	17	**19**	-1	-1	-2	**-4**
SR 520/I-405 Redmond to Bellevue	6	7:50	6	7	7	8	8	**8**	8	9	9	**10**	1	1	1	**2**
Other																
I-405 Bellevue to Tukwilla	13	7:40	13	16	19	22	24	**27**	16	18	20	**21**	-3	-4	-4	**-6**
I-405/SR 520/I-5 Bellevue to Redmond	5	9:55	5	7	7	9	11	**13**	8	9	9	**9**	1	0	-2	**-4**
SR 167 Auburn to Renton	10	7:35	10	12	14	16	18	**22**	16	19	23	**27**	2	3	5	**5**
I-5/I-90 Seattle to Issaquah	16	8:45	16	19	16	18	21	**25**	18	24	26	**29**	2	6	5	**4**
I-5/SR 520 Seattle to Redmond	13	8:45	13	16	24	29	31	**33**	23	29	32	**36**	-1	0	1	**3**

Data source: WSDOT Strategic Assessment Office and Washington State Transportation Center (TRAC) at the University of Washington.

Note: Commute lengths and travel time percentile values have been rounded to integer values for publication purposes only. All the calculations are performed before the values are rounded to their respective integers.

Travel time reliability on major Puget Sound commute routes, *continued*

Evening commutes: Change in reliable travel time percentiles for 21 high-demand PM commute routes, 2009-2011

Evening (PM) peak is between 2 p.m. and 8 p.m.; Length of route in miles; All travel times and differences in minutes; Peak of commuter rush expressed in hours and minutes for an annual average weekday

Route	Length of route	Peak of commuter PM rush	Travel times on the route at: Posted speed	Maximum throughput speed	2009 percentiles: Median 50th	80th	90th	95th	2011 percentiles: Median 50th	80th	90th	95th	Difference 2009 vs. 2011: Median 50th	80th	90th	95th
From Seattle																
I-5 Seattle to Everett	24	16:30	24	29	41	48	52	**58**	35	43	47	**51**	-6	-5	-5	**-7**
I-5 Seattle to Federal Way	22	16:40	22	27	30	36	40	**44**	28	33	37	**40**	-2	-3	-3	**-4**
I-5 Seattle to SeaTac	13	16:40	13	16	17	21	23	**26**	16	19	22	**24**	-1	-2	-1	**-2**
I-5/I-90/I-405 Seattle to Bellevue	11	17:25	11	13	14	21	27	**30**	16	22	26	**31**	2	1	-1	**1**
I-5/SR 520/I-405 Seattle to Bellevue	10	17:30	10	12	19	24	30	**33**	19	25	28	**32**	0	1	-2	**-1**
I-5/SR 520 Seattle to Redmond	13	17:35	13	16	23	31	35	**37**	19	25	28	**32**	-4	-6	-7	**-5**
I-5/I-90 Seattle to Issaquah	16	17:35	16	19	19	26	31	**35**	21	27	31	**35**	2	1	0	**0**
From Bellevue																
I-405/I-5 Bellevue to Everett	23	17:10	23	28	38	46	50	**54**	39	46	50	**54**	1	0	0	**0**
I-405 Bellevue to Lynnwood	16	17:25	16	19	30	38	43	**46**	30	37	41	**44**	0	-1	-2	**-2**
I-405 Bellevue to Tukwilla	13	16:50	13	16	30	38	40	**44**	32	38	41	**44**	2	0	1	**0**
I-405/I-90/I-5 Bellevue to Seattle	10	17:30	10	12	21	31	37	**42**	24	34	36	**39**	3	3	-1	**-3**
I-405/SR 520/I-5 Bellevue to Seattle	10	17:30	10	12	26	29	32	**37**	29	31	34	**37**	3	2	2	**0**
I-405/I-90 Bellevue to Issaquah	9	17:30	9	11	15	17	18	**19**	16	18	19	**20**	1	1	1	**1**
I-405/SR 520 Bellevue to Redmond	5	17:35	5	7	9	12	16	**18**	7	8	9	**9**	-2	-4	-7	**-9**
Other																
I-5 Everett to Seattle	24	16:20	24	28	36	45	50	**53**	39	52	59	**64**	3	7	9	**11**
I-90/I-5 Issaquah to Seattle	15	17:25	15	19	22	28	40	**48**	24	36	43	**47**	2	8	3	**-1**
SR 520/I-5 Redmond to Seattle	13	17:35	13	16	29	40	47	**52**	29	42	49	**55**	0	2	2	**3**
SR 520/I-405 Redmond to Bellevue	6	17:25	6	7	8	15	19	**25**	10	19	27	**30**	2	4	8	**5**
I-5 SeaTac to Seattle	13	17:20	13	16	18	23	28	**36**	19	26	31	**34**	1	3	3	**-2**
SR 167 Renton to Auburn	10	16:45	10	12	13	16	20	**25**	14	19	24	**29**	1	3	4	**4**
I-405 Tukwilla to Bellevue	13	17:25	13	16	22	26	30	**35**	20	26	29	**34**	-2	0	-1	**-1**

Data source: WSDOT Strategic Assessment Office and Washington State Transportation Center (TRAC) at the University of Washington.

Note: Commute lengths and travel time percentile values have been rounded to integer values for publication purposes only. All the calculations are performed before the values are rounded to their respective integers.

Taking a stamp graph view of travel time trends

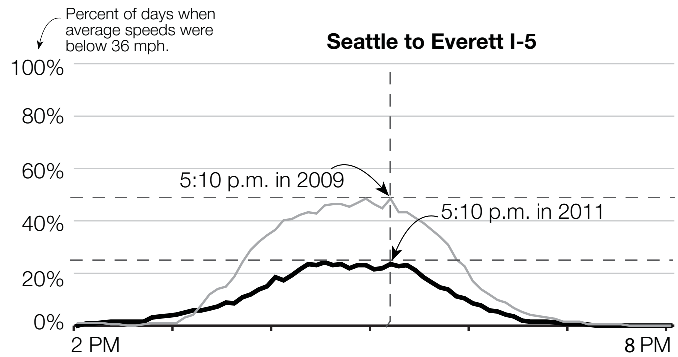
Stamp graphs show the duration and frequency of severe congestion

The best visual evidence to show whether the severity of congestion during the peak period is spreading or contracting can be seen in the "stamp graphs" on the following two pages. The stamp graphs show the frequency of severe congestion on the 40 high-demand central Puget Sound commute routes. These graphs, comparing 2009 and 2011 data, show the percent of days annually with average speeds that fell below 36 mph on key highway segments. The illustrations at right explain how to read stamp graphs.

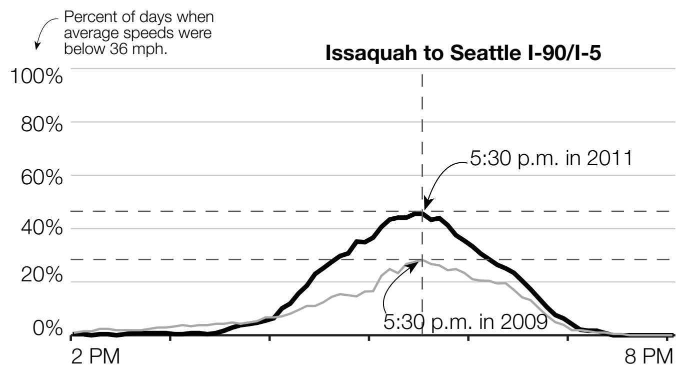
Labor Day weekend traffic clogs I-90. Unusual events like a three-day holiday weekend or snowstorm have significant effects on the day's congestion, but minimal effect on average travel times and highway reliability represented in the stamp graphs because typical conditions on the remaining weekdays in the year outweigh the unusual event.

How to read a stamp graph: Percent of days when average speeds were below 36 mph

How frequently (and when) did the average trip speed drop below 36 mph? How have those conditions changed from 2009 to 2011?



At 5:10 p.m. in 2009, you had about a 49% chance that traffic would be moving less than 36 mph. In 2011, the situation was better (black line below gray line); your chance that traffic would be moving slower than 36 mph was about 24% in 2011.



At 5:30 p.m. in 2009, you had about a 28% chance that traffic would be moving less than 36 mph. In 2011, the situation became worse (black line above gray line); your chance that traffic would be moving slower than 36 mph was about 46% in 2011.

Data source: WSDOT Strategic Assessment Office.

Travel Time Analysis

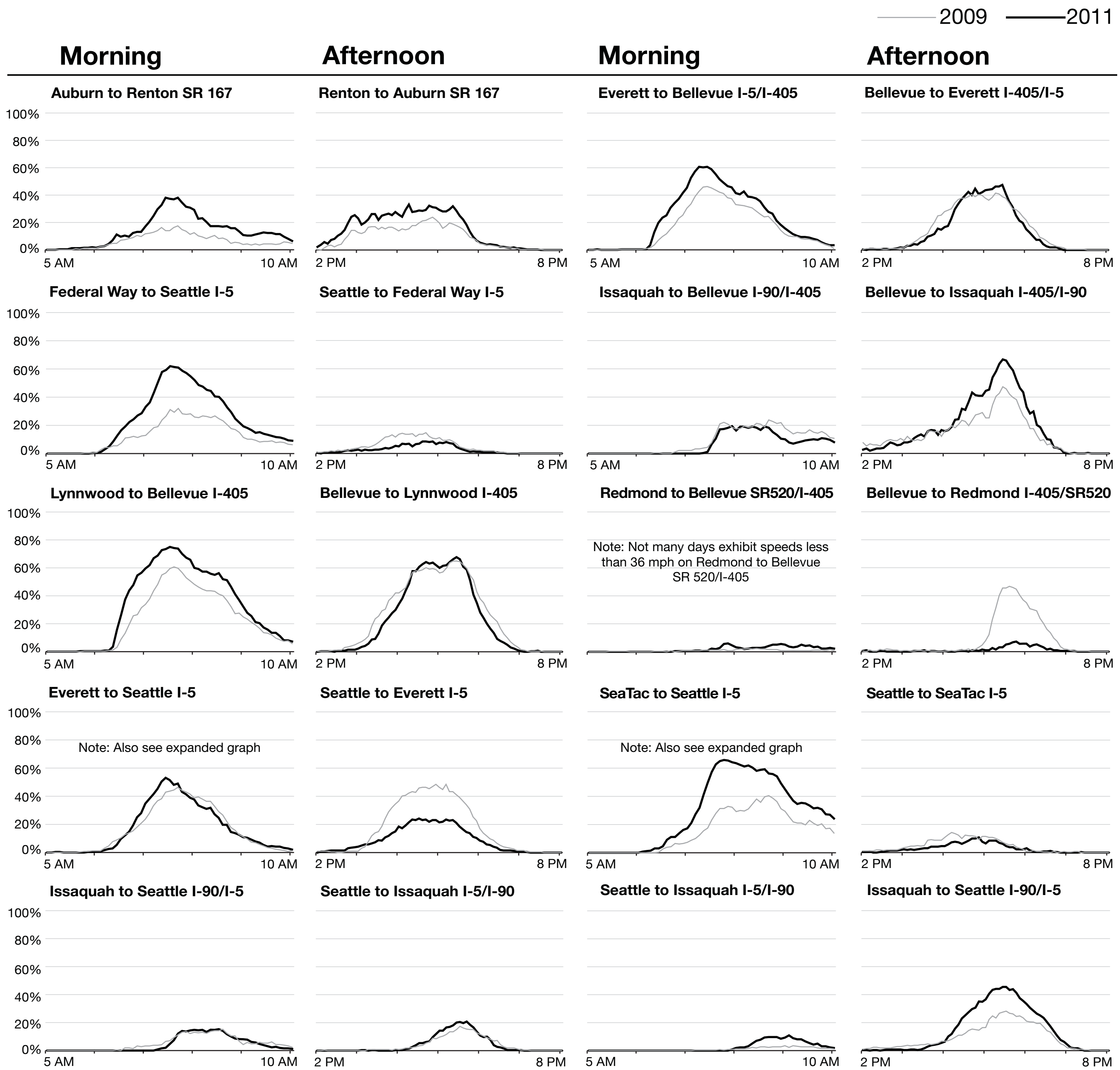
Duration and frequency of severe congestion in peak travel periods

When, where, and how often severe congestion affects commuters

Stamp graphs illustrate how often severe congestion affects commuters in the central Puget Sound region. They show the percent of days annually when average speeds fell below 36 mph. For more information on how to read them, see p. 39.

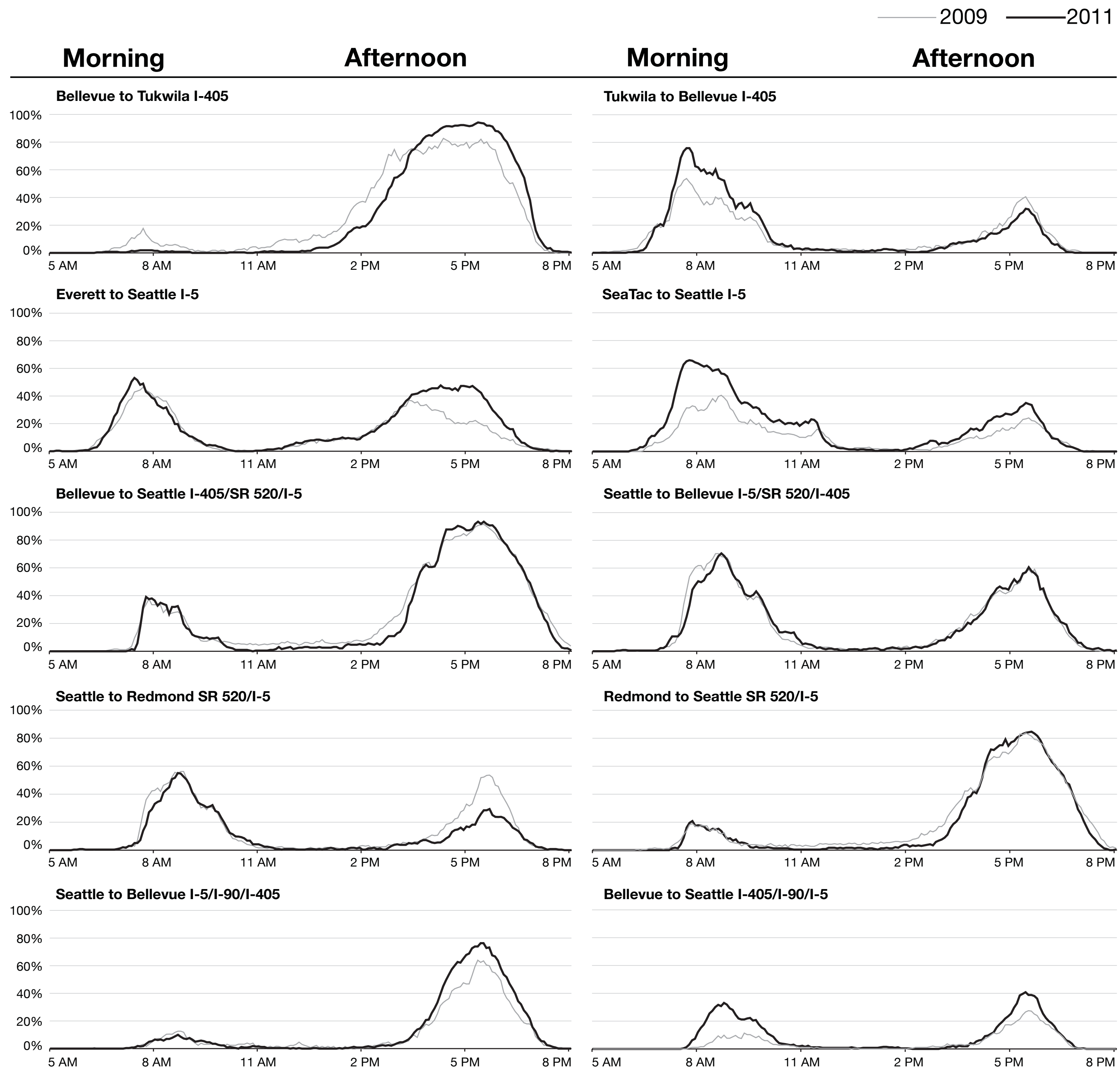
Comparing 2009 and 2011 GP lanes: Percent of days when speeds are less than 36 mph (weekdays only)

For selected Puget Sound commute routes. 0% on graph indicates that the average trip speed did not fall below 36 mph (60% of posted speed)



Duration and frequency of severe congestion in peak travel periods, *continued*

Comparing 2009 and 2011 GP lanes: Percent of days when speeds are less than 36 mph (weekdays only)
For selected Puget Sound commute routes. 0% on graph indicates that the average trip speed did not fall below 36 mph (60% of posted speed)



Twelve additional Puget Sound commute routes show little congestion

WSDOT tracks 12 additional uncongested routes

WSDOT tracks a total of 52 Puget Sound area commute routes annually, representing morning and evening commutes between major population and work centers. Forty of those routes regularly experience congestion (pp. 30-31). The additional 12 routes, listed on this page, represent relatively uncongested routes for which WSDOT tracks travel time and volume data. Seven of these routes are during the morning commute and the remaining five routes are during the evening commute.

Overall morning commutes show little change from 2009 to 2011 in any of the performance metrics tracked. Average travel times saw negligible changes for 11 of the 12 routes; one route, Lynnwood to Bellevue, worsened by three minutes between 2009 and 2011. In terms of the 95th percentile reliable travel time, nine routes showed modest changes (two minutes or less) – all seven of the morning routes and two evening commutes. Of the remaining three evening commutes, two routes showed a decrease in travel time of almost three minutes, while one (southbound I-405 from Lynnwood to Bellevue) worsened by about seven minutes between 2009 and 2011. In terms of vehicle miles traveled (VMT), nine routes (morning and evening) were up between 1% and 5%, while there was no change on two routes (I-5 Seattle to SeaTac and I-5 Seattle to Federal Way) between 2009 and 2011. The I-5 Federal Way to Seattle route was the only one to show a decline in VMT (-1%) between 2009 and 2011. For comparison, the 40 standard commute routes showed an overall change in VMT of +/-2%. Please see pp. 30-31 for more details.

The only route showing congestion (average speed below 45 mph for five minutes or longer) was the evening commute on southbound I-405 from Lynnwood to Bellevue; none of the other routes had any sustained congestion for either 2009 or 2011. On the Lynnwood to Bellevue route, the duration of congestion increased from zero minutes in 2009 to 30 minutes in 2011. This trip also had the largest change in peak average travel time among the 12 additional routes; the corresponding MT³ Index increased from 1.09 to 1.22.

Morning/evening commutes: Changes in travel time performance on 12 additional commute routes

2009 morning (5 a.m. - 10 a.m.) and evening (2 p.m. - 8 p.m.) peak vs. 2011 morning and evening peak of commuter rush (individual peak times vary) for an annual average weekday; Length of route in miles; All travel times in minutes; Peak of commuter rush and duration of congestion expressed in hours and minutes

Route	Length of route	Peak time of commuter rush	Travel time on the route at: Posted speed	Travel time on the route at: Maximum throughput speed	Average travel time at peak of rush: 2009	2011	%Δ	95th percentile reliable travel time: 2009	2011	%Δ	Maximum throughput travel time (MT³ Index): 2009	2011	VMT during peak period: %Δ in VMT	Duration of congestion (how long average speed is below 45 mph): 2009	2011	Δ
Morning (AM)																
I-5 Seattle to Everett	24	8:50	24	29	27	26	-2%	30	30	-0.3%	0.92	0.90	1%	*	*	*
I-5 Seattle to SeaTac	13	7:45	13	16	14	14	-2%	17	16	-7%	0.92	0.91	0%	*	*	*
I-405 Bellevue to Lynnwood	16	9:55	16	19	17	18	4%	18	19	5%	0.89	0.92	2%	*	*	*
SR 167 Renton to Auburn	10	9:40	10	12	10	10	2%	11	11	4%	0.87	0.89	5%	*	*	*
I-90 Bellevue to Issaquah	9	9:25	9	11	9	9	-2%	10	10	-2%	0.87	0.86	2%	*	*	*
I-5 Seattle to Federal Way	22	7:45	22	27	24	23	-0.3%	26	25	-3%	0.88	0.88	0%	*	*	*
I-405 Bellevue to Everett	23	9:55	23	28	25	25	2%	26	27	4%	0.89	0.90	2%	*	*	*
Evening (PM)																
I-405 Lynnwood to Bellevue	16	17:20	16	19	21	24	12%	30	37	21%	1.09	1.22	3%	*	0:30	0:30
SR 167 Auburn to Renton	10	14:45	10	12	11	11	-2%	16	13	-16%	0.98	0.96	3%	*	*	*
I-90 Issaquah to Bellevue	9	17:20	9	11	13	13	-0.1%	18	18	0.3%	1.14	1.14	1%	*	*	*
I-5 Federal Way to Seattle	22	17:10	22	27	29	31	5%	46	43	-6%	1.10	1.15	-1%	*	*	*
I-5/I-405 Everett to Bellevue	24	17:15	24	28	30	32	7%	41	43	7%	1.05	1.12	2%	*	*	*

Data source: WSDOT Strategic Assessment Office, WSDOT Northwest Region Traffic, and Washington State Transportation Center (TRAC) at the University of Washington.

Notes: Commute lengths and travel time values have been rounded to integer values for publication only. All the calculations are performed before the values are rounded to their respective integers. %Δ and MT³ Index values cannot be reproduced as published using the integer values in the table. * Indicates that speed did not fall below 45 mph (75% of posted speed) on a route.

A closer look at Spokane's commutes

Spokane sees shorter commute times

The commute routes that are measured in Spokane are on I-90 from the Division Street interchange to the Argonne Road interchange in the eastbound and westbound directions. Excluding the Division and Argonne interchanges there are five off-ramps and four on-ramps in the eastbound direction and six off-ramps and five on-ramps in the westbound direction. The I-90 corridor through Spokane experiences morning and afternoon congestion that is typically concentrated at the following chokepoints:

- Eastbound I-90 in the Spokane Valley: The three lane highway segment bottlenecks down to two lanes.
- Eastbound and westbound I-90 at the Freya exit: Short weave area combined with high on- and off-ramp volumes.
- Eastbound I-90 at Division exit: High exit volumes with a short off-ramp controlled by a city traffic signal causes back-ups onto the freeway that can take an additional freeway lane during peak periods.

In the 2011 *Congestion Report* and earlier editions, WSDOT reported changes to the average daily traffic volumes for the Altamont Street vicinity in Spokane. Starting in 2012, WSDOT will report average daily traffic volume changes at the Sprague Avenue interchange because permanent traffic counters are at this location. Average daily traffic volumes are holding steady from 2009 to 2011, with a volume of 108,000 vehicles daily near the Sprague Avenue interchange.

In total, vehicle miles traveled (VMT) increased by an average of 5% from 2009 to 2011. In the AM peak period (7 a.m. - 10 a.m.) VMT increased by 12% and in the PM peak period (3 p.m. - 6 p.m.) it decreased by 1%. VMT has fluctuated along this route, although the 12% increase is the largest change observed since before the 2009 *Congestion Report* (2006 and 2008 data).

In 2011, the AM peak occurred at 7:50 a.m. and the average peak travel time improved by 11% from nine to eight minutes. The PM peak occurred at 5:20 p.m. and the average peak travel time remained at nine minutes, the same as in 2009.

For the AM commute the 95th percentile reliable travel time worsened 47% from 21 minutes to 30 minutes between 2009 and 2011. In other words, commuters needed to plan an extra nine minutes to ensure that they arrived at their destination early or on-time for 95% of their trips (or 19 out of every 20 weekday trips). The PM travel time reliability improved 24%, from 17 minutes to 13 minutes.

The Altamont and Havana bridge deck repair projects reduced the number of lanes on I-90 from three to two during July 2011. The three lanes to two lanes reduction was in place 24/7 for the duration of the contract. However, there does not seem to be an evident impact on travel times.

The U.S. 395 North Spokane Corridor project is helping alleviate the city's congestion by constructing a limited-access highway that redirects commercial traffic and improves travel times in the area.

Morning/evening commutes: Changes in travel time performance on Spokane commute routes

2009 morning (7 a.m. - 10 a.m.) and evening (3 p.m. - 6 p.m.) peak vs. 2011 morning and evening peak of commuter rush (individual peak times vary) for an annual average weekday; Length of route in miles; All travel times in minutes; Peak of commuter rush expressed in hours and minutes

				Travel time on the route at:		Average travel time at peak of commute rush			95th percentile reliable travel time			Commute vehicle miles traveled
Route	Direction of travel	Length of route	Peak of commuter rush	Posted speed	Maximum throughput speed	2009	2011	%Δ	2009	2011	%Δ	%Δ
I-90: Argonne Rd. to Division St.	WB	7.5	7:50	7.5	8.0	8.98	8.03	-11%	20.82	30.58	47%	12%
I-90: Division St. to Argonne Rd.	EB	7.5	17:20	7.5	8.0	8.97	8.93	-0.4%	17.43	13.31	-24%	-1%

Data source: WSDOT Eastern Region Traffic Office.

A closer look at Spokane's commutes, *continued*

New lanes on the U.S. 395 North Spokane Corridor project are adding capacity to the route. Construction of the 10.5-mile project continues to make headway as progress moves from U.S. 2 at Wandermere in the north to I-90 in Spokane in the south.

Spokane sees fewer peak-period collisions

Incidents remained the major cause of normal delay in the corridor. However, there were fewer collisions during the AM and PM commute periods in 2011 compared to 2009.

Spokane area peak-period collisions
2009 - 2011; Number of collisions in January through September

	All collision types		Work zone related	
	2009	**2011**	**2009**	**2011**
6 a.m. - 10 a.m.	36	30	3	1
2 p.m. - 7 p.m.	62	53	21	2

Data source: WSDOT Eastern Region Traffic Office.

Note: Collisions reported for peak AM and PM periods plus one hour preceding each peak period due to influence such collisions may have on congestion during the peak periods.

In HOV Lane Performance:

Half of the HOV peak direction corridors met the performance standard in 2011, improving on the performance of 2010. 46

For the morning period, seven out of ten monitored locations had higher HOV volumes compared to 2009, and six of the ten locations saw increases during the evening period. 47

The average observed HOV violation rate was about 2%. 48

In 2011, per lane HOV throughput was higher than adjacent GP lanes for eight out of ten monitored locations, up from seven of ten lanes in 2010. 48

Of 46 HOV trips on Puget Sound commute routes, 40 were faster than the adjacent GP trips during peak period, and the HOV trips were also more reliable. 49

High Occupancy Vehicle Lanes Performance Analysis

HOV lane performance: Striving to provide speed and reliability

The central Puget Sound region freeway network includes a system of high occupancy vehicle (HOV) lanes that are reserved primarily for travelers who use carpools, vanpools, or buses. This HOV system is designed to offer a faster, more reliable travel option for ridesharing travelers, and contributes to a more efficient overall freeway system by moving more people in fewer vehicles, compared to adjacent general purpose (GP) lanes.

About 310 lane-miles of the planned 320 lane-mile Puget Sound area freeway HOV system have been completed. More information about the HOV lane system can be found at www.wsdot.wa.gov/hov/

The I-5 Everett HOV freeway expansion project added ten miles of new HOV lanes in 2008. Here lupine show off along the west side of I-5 looking north toward the HOV entrance and exit ramps at Broadway.

WSDOT monitors three aspects of Puget Sound area HOV lane performance: 1) overall travel performance and reliability on freeway HOV corridors, 2) the person-carrying performance of HOV lanes as compared to the adjacent general purpose lanes, and 3) travel time performance for HOV lane users.

WSDOT looks to achieve HOV lane performance goals of speed and reliability

The performance and reliability standard for freeway HOV lanes adopted by WSDOT and the Puget Sound Regional Council (PSRC) states that travelers in the HOV lane should be able to maintain an average speed of 45 mph or greater 90% of the time during the peak hours of travel. Each year, WSDOT evaluates the extent to which each freeway HOV corridor in the central Puget Sound region meets that standard.

Seven of 14 HOV corridors meet performance reliability standards in 2011

Seven of 14 monitored HOV peak-direction corridors met the state performance standard in 2011; the same overall results were also observed in 2010. During 2011, six of the 14 HOV peak-direction corridors had a higher degree of compliance with the standard compared to 2010. Five corridors had little or no change (+/- 1% or less), and three had a decrease in performance. These results represent a continuation of a recent pattern of improved HOV lane performance. Still, a number of HOV corridors continue to experience reduced performance and reliability during the peak periods.

HOV lane speed and reliability performance on major central Puget Sound corridors

2007 - 2011; Goal is to maintain 45 mph for 90% of peak hour

= Goal not met

Commute routes	2007	2008	2009	2010	2011
Morning peak direction commutes					
I-5, Everett to Seattle SB	35%	60%	**69%**	61%	**64%**
I-5, Federal Way to Seattle NB	33%	67%	**92%**	86%	**72%**
I-405, Lynnwood to Bellevue SB	76%	92%	**94%**	92%	**94%**
I-405, Tukwila to Bellevue NB	31%	49%	**99%**	99%	**98%**
I-90, Issaquah to Seattle WB	99%	100%	**96%**	100%	**100%**
SR 520, Redmond to Bellevue WB	97%	99%	**94%**	94%	**97%**
SR 167, Auburn to Renton NB[1]	96%	99%	**99%**	100%	**99%**
Evening peak direction commutes					
I-5, Seattle to Everett NB	51%	64%	**49%**	55%	**76%**
I-5, Seattle to Federal Way SB	47%	57%	**67%**	77%	**82%**
I-405, Bellevue to Lynnwood NB	53%	58%	**71%**	77%	**74%**
I-405, Bellevue to Tukwila SB	30%	35%	**70%**	74%	**60%**
I-90, Seattle to Issaquah EB	100%	100%	**95%**	99%	**99%**
SR 520, Redmond to Bellevue WB	59%	68%	**71%**	61%	**70%**
SR 167, Renton to Auburn SB[1]	91%	98%	**99%**	99%	**99%**

Data source: Washington State Transportation Center (TRAC).

Notes: HOV reliability performance standards are based on the peak hour, the one-hour period during each peak period when average travel time is slowest. To meet the standard, a speed of 45 mph must be maintained for 90% of the peak hour. Numbers represent the percentage of the peak hour when speeds are above 45 mph. TRAC analyzes performance data for all complete segments of HOV lanes that have a loop detector. In some cases, data cannot be analyzed for the very beginning and ends of the lanes because there are no detectors at the very beginnings and ends of the HOV lanes. NB = Northbound; SB = Southbound; EB = Eastbound; WB = Westbound

1 HOT lanes replaced regular HOV lanes May 3, 2008.

Performance reliability and monitoring HOV lane volumes

The table (left) summarizes the performance of each HOV corridor for the past five years. It shows the percentage of the peak hour that the corridors meet the performance standard during the morning (AM) and evening (PM) peak periods, in the peak direction of travel, when HOV lane performance is most likely to be affected by congestion and other factors. During the PM peak hours, five of the seven peak-direction corridors did not meet the state performance standard in 2011; this is a continuation of a long standing pattern that has been observed during the evening peak periods for the past seven years; the five most recent years are shown in the table at left.

During AM peak travel, there has been a pattern of improvement in HOV lane performance, beginning in 2008. AM peak HOV lane performance in 2011 was similar to that of 2010, with five of the seven peak-direction corridors meeting the state standard.

Peak-hour HOV corridor performance can be affected by high demand for HOV lanes that exceeds available HOV capacity, as well as specific roadway geometry issues that produce bottlenecks, such as lane changing or merging associated with nearby on- and off-ramps. During off-peak hours, HOV corridors generally perform well throughout the Puget Sound freeway network. Even when HOV performance is reduced during the peak hours, HOV lanes generally continue to provide faster travel time and better reliability relative to adjacent general purpose lanes.

Speed and reliability of the HOV lanes are monitored annually and the results are published at http://depts.washington.edu/hov/.

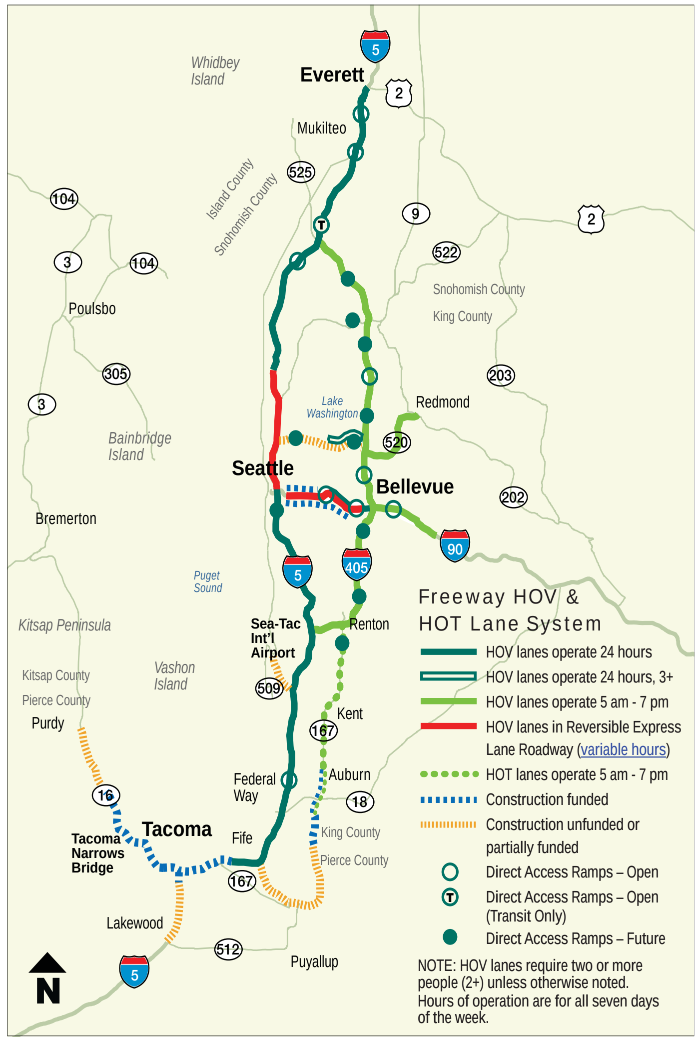
HOV lane performance: User volumes and compliance with passenger requirements

The WSDOT HOV lane monitoring program tracks vehicle volume patterns at ten locations on the central Puget Sound's major freeway corridors. Volumes are measured at each of these locations during the peak periods, for both HOV and general purpose lanes. Metrics include vehicle volumes, vehicle occupancy (the number of persons per vehicle), and compliance with minimum HOV lane vehicle occupancy requirements.

Vehicle volumes in HOV lanes up in 2011

Between 2009 and 2011, overall vehicle volumes at ten monitoring locations showed a slight increase even though they varied considerably from location to location. During the AM peak period, seven of ten locations experienced higher HOV volumes over the past two years, while during the PM peak period, six of ten locations experienced higher HOV volumes. This represents a change from the previous two-year pattern (2010 vs. 2008), where HOV vehicle volumes were generally down for both the

Freeway HOV and HOT lane system



AM and PM peak periods. On the other hand, vehicle volumes in the adjacent GP lanes showed mixed results.

Across all monitoring locations, HOV volumes were up by a little over 1% over the past two years, while GP volumes were up by less than 2%. When HOV and GP volumes are combined, the total peak-period volume across all the monitoring locations was up by less than 2% over the two-year period.

Note that the vehicle volumes analyzed for comparisons of HOV and GP lanes are based on selected spot locations, unlike the travel time analysis for GP lanes (pp. 30-31) which analyzes the aggregate changes in vehicle miles traveled (VMT) based on a series of locations along each commute route.

Keeping an eye on HOV lane occupancy compliance and person volumes

Vehicle occupancy: Numbers and compliance in 2011

Vehicle occupancy (the number of persons per vehicle) was also monitored at the spot locations, to better understand the extent to which the region's travelers comply with the HOV lane occupancy requirement of 2+ persons per vehicle (3+ persons on westbound SR 520 west of I-405). Overall, compliance observed at the monitoring locations is generally high, though the level of compliance can vary considerably from location to location.

Several factors can influence the degree of compliance:

- The position of the monitoring location relative to the start or end of a corridor's HOV segment, where single occupancy vehicles are more likely to be in the HOV lane,
- The presence of a nearby on- or off-ramp, as vehicles using those ramps might affect the mix of vehicles in the HOV lane in the vicinity of the ramp, and
- The enforcement of the occupancy requirement (2+ or 3+).

Even taking these factors into account, there has been a consistently high level of compliance in recent years. The average observed violation rate in 2011 across all HOV sampling locations during the AM and PM peak periods was about 2%.

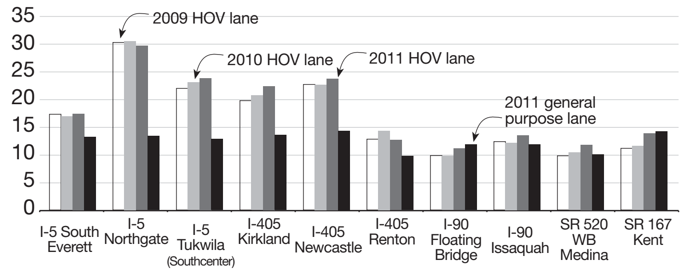
RideshareOnline.com offers tools to help commuters form carpools with those who have similar commutes. Park and ride lots offer convenient meet-up locations.

Eight of ten locations saw increases in person volumes in 2011

A key metric of HOV lane performance involves the ability of the HOV network to efficiently move more travelers. The WSDOT HOV lane monitoring program also estimates the number of people traveling at the same spot locations where vehicle volumes are monitored, to determine how the HOV network is facilitating the efficient movement of more people in fewer vehicles.

Comparison of HOV lane and general purpose lane person throughput

AM and PM peak period volumes; Number of people in thousands



Data source: Washington State Transportation Center (TRAC).

Note: Beginning in 2009, all person volume estimates are based on a more comprehensive transit ridership database that includes more information about private employer bus services.

Person volumes in the HOV lane vary by location; the most successful examples of HOV lane performance are at locations that combine the travel time benefits of the HOV lane with strong transit service. I-5 at Northgate is an example of such a location. In previous years, this location has shown significant HOV lane use and travel time benefits. It is also located on a primary freeway commute corridor toward Seattle that includes significant transit service. In 2011, during the average AM peak period, the southbound HOV lane carried an average of over 13,500 persons, which is 42% of all southbound peak period travelers on this corridor, in only 19% of the vehicles. The HOV lane at this location carries an average of 3.5 persons per vehicle, or about three times the number of persons per vehicle in the adjacent GP lanes. Overall, the Seattle-area network attracts a significant number of ridesharing travelers; across all the monitoring locations, an average of about 34% of the people on the freeway use the HOV lanes during the peak periods. These values have been generally consistent from year to year.

The graph above shows peak period HOV lane usage in recent years, on a person volume basis, at spot locations on the major corridors. The 2011 *Congestion Report* noted that after several years with a general pattern of growth in the number of persons carried by the HOV lane, a general reduction in the number of HOV travelers was observed in 2009. Although 2009 data showed a reduction in HOV travelers, the region has seen a general pattern of growth that continues in 2011 with eight of ten locations showing growth in HOV person volumes compared to the year before.

Transit ridership affects efficiency of HOV lane system

The graph also illustrates another way to track HOV lane performance, which is to compare HOV lane performance to GP performance on a per-lane basis. In 2011, the per-lane HOV person throughput was higher than adjacent GP lanes at eight out of ten locations, up from seven of ten locations in 2010. The 3+ SR 520 westbound location showed sufficient growth in HOV person volumes during the past year to once again exceed adjacent GP per-lane person volume in 2011 after two years of being just below that level.

The only two locations where HOV person volume did not exceed adjacent GP per-lane person volumes in 2011 are the SR 167 HOV/HOT monitoring location in Kent, and the I-90 midspan center roadway location. In both cases, person volumes were up in 2011 compared to both 2010 and 2009, and are nearly equal to the 2011 person volume of the average adjacent GP lane.

HOT lanes are HOV lanes (for carpools of two or more, vanpools and buses) that are also open to toll-paying solo drivers, providing a faster, more reliable trip. To use the HOT lanes, solo drivers must install the Good To Go! pass in their vehicle.

HOV lane performance: Taking transit ridership into consideration

Bus transit ridership is a significant component of the estimated HOV lane person volumes at the monitoring locations. Most of the monitoring locations showed HOV transit ridership growth in the past year. System wide, King County Metro reported overall ridership growth of almost 3% in 2011; annual ridership was second only to the record-setting level in 2008. Metro attributed the change to growth in employment in King County, increasing gas prices, and service expansion, including additional service on the SR 520 corridor.

Sound Transit express bus ridership was up 9% in 2011. Community Transit reported a slight ridership increase in 2011, following a noticeable drop in ridership in 2010 as the recession and shrinking sales tax revenues led to significant cuts in budget and service. WSDOT will continue to monitor changes in transit service levels and ridership, and their effects on HOV lane performance, during 2012.

King County Metro and several other Puget Sound region transit operators provide vans for vanpool participants. Some employers also provide incentives to participants, such as vanpool fee reimbursement.

In March 2012 a new Sound Transit Express bus was the first to use the newly realigned 80th Avenue SE with direct access to the new HOV lane for eastbound I-90.

High Occupancy Vehicle Lanes Performance Analysis

HOV lanes provide better reliability compared to general purpose lanes

HOV lane travel time performance: All HOV routes but one are more reliable than the general purpose lanes

One of the objectives of the HOV lane network is to provide a travel time and travel reliability benefit for freeway users. As noted above in the discussion of performance standards for HOV corridors, even when HOV performance is reduced during the peak hours compared to free-flow conditions, HOV lanes generally continue to provide a travel time and reliability benefit compared to the adjacent GP lanes.

To better understand the effects of the HOV lane network, WSDOT analyzes HOV routes that correspond to the 40 Puget Sound standard GP commute routes that the agency monitors. These related HOV routes comprise all HOV lane segments along each trip. In addition, alternate routes are analyzed on corridors with express reversible lane options (I-5, I-90); alternative scenarios based on 2+ vs. 3+ person carpools are evaluated for travelers on westbound SR 520, which has both 2+ and 3+ occupant HOV lanes.

Of the 46 HOV trips analyzed, 40 are faster during times of peak congestion than the associated GP trip, while the other six trips show no difference between the GP and HOV route options. The latter situation can occur if HOV lanes are not always available on the route, or if there is no congestion on the GP lanes of the route for that peak period and direction of travel. The pattern is similar to that seen in previous years. In addition, the 95th percentile reliable travel times are lower on 45 of 46 HOV trips relative to their GP counterparts, often by a significant degree (the I-90 Seattle to Issaquah morning commute had equal reliability on the HOV lanes as the GP lanes in 2011). This shows that not only average travel times, but also the reliability of travel are generally enhanced when using the HOV route option. (See p. 36 for the definition of the 95th percentile metric.)

Sound Transit's Linda Robson and Zap Gridlock (Sound Transit's mascot) are in the first HOV to use the new ramp at SE 80th Avenue on Mercer Island at the ribbon cutting for the I-90 two-way transit project.

Some of our I-5 express lane entrances are for everyone, others are dedicated to carpool, vanpool and transit. This entrance at Pike Street is transit/carpool only. This is how WSDOT gets the greatest number of people moving in the fewest lanes.

Between 2009 and 2011, of the 46 HOV trips analyzed average travel times for 12 routes improved, 16 routes remained unchanged, and 18 routes worsened. Of the 42 trips analyzed for the 2011 *Congestion Report* (2010 vs. 2008 data), 16 routes improved, 14 routes remained unchanged, and 12 routes worsened. Similarly, HOV lane reliability in 2011 compared to 2009 improved on 21 routes, remained the same on six routes, and worsened on 19 routes. Overall, the magnitude of the changes in the HOV travel times from 2009 to 2011 is similar to those observed in the previous year's *Congestion Report*.

The accompanying tables summarize the estimated travel times of a traveler who uses available HOV lane options on each of the general purpose commute trip routes described previously on pp. 30-31. The tables summarize the relative benefit of using HOV lanes rather than the adjacent GP lanes, from a travel time perspective (average peak travel time savings) and a travel reliability perspective (as represented by the 95th percentile travel times).

The tables are followed by a series of graphs that summarize the reliability of travel on HOV routes, versus the equivalent GP routes, for selected commutes. In each graph, the likelihood of having a congested commute on a given trip is shown for the GP and associated HOV routes, as a function of time of day on an average 2011 weekday, using the HOV performance standard of 45 mph as the threshold for congestion. These graphs illustrate the extent to which HOV travel time reliability benefits can vary from corridor to corridor, and at different times of the day.

HOV lanes save time during morning commutes

Morning commutes: HOV lane travel time performance compared to general purpose lanes

Morning (AM) peak is between 5 a.m. and 10 a.m.; Length of route in miles; All travel times and differences in minutes; Peak of commuter rush expressed in hours and minutes for an annual average weekday

Route	Length of route	Peak of commuter AM rush	Travel times on the route at Posted speed	Travel times on the route at Maximum throughput speed	Average travel time at peak of AM rush: HOV lanes 2009	HOV lanes 2011	Δ	GP lanes 2011	2011: Difference HOV vs. GP	95% reliable travel times: HOV lanes 2009	HOV lanes 2011	Δ	GP lanes 2011	2011: Difference HOV vs. GP
To Seattle														
I-5 Everett to Seattle														
Regular HOV lane[1]	22	7:30	22	27	33	33	0	40	-7	51	49	-2	66	-17
Reversible lanes[1]	22	7:30	22	27	29	30	1	40	-10	45	44	-1	66	-22
I-5 Federal Way to Seattle	22	7:35	22	27	27	29	2	42	-13	33	38	5	58	-20
I-90/I-5 Issaquah to Seattle														
HOV & GP lanes[2]	14	7:45	14	17	15	16	1	18	-2	18	19	1	27	-8
HOV & reversible lanes[2]	14	7:45	14	17	15	15	0	18	-3	18	17	-1	27	-10
SR 520/I-5 Redmond to Seattle														
2+ person HOV[1]	13	7:45	13	16	20	19	-1	20	-1	29	25	-4	28	-3
3+ person HOV[1]	13	7:45	13	16	15	15	0	20	-5	17	18	1	28	-10
I-5 SeaTac to Seattle	13	8:30	13	16	17	17	0	26	-9	23	23	0	43	-20
I-405/I-90/I-5 Bellevue to Seattle														
HOV & GP lanes[2]	9	8:35	9	11	10	10	0	10	0	13	13	0	15	-2
HOV & reversible lanes[2]	9	8:35	9	11	9	9	0	10	-1	9	9	0	15	-6
I-405/SR 520/I-5 Bellevue to Seattle														
2+ person HOV	10	7:45	10	12	17	18	1	18	0	26	23	-3	26	-3
3+ person HOV	10	7:45	10	12	12	13	1	18	-5	14	16	2	26	-10
To Bellevue														
I-5/I-405 Everett to Bellevue[1]	24	7:25	24	28	27	27	0	46	-19	33	36	3	70	-34
I-405 Lynnwood to Bellevue[1]	16	7:30	16	19	18	18	0	37	-19	22	22	0	57	-35
I-405 Tukwila to Bellevue[1]	13	7:45	13	16	14	14	0	25	-11	16	17	1	32	-15
I-5/I-90/I-405 Seattle to Bellevue[2]	9	8:45	9	11	11	14	3	15	-1	18	22	4	23	-1
I-90/I-405 Issaquah to Bellevue	10	7:45	10	12	12	11	-1	14	-3	16	13	-3	19	-6
SR 520/I-405 Redmond to Bellevue[1]	6	7:50	6	7	8	8	0	8	0	8	9	1	10	-1

Data source: WSDOT Strategic Assessment Office and the Washington State Transportation Center (TRAC) at the University of Washington.

Notes: Due to changes in the way WSDOT processed 2011 loop data, 2009 travel time data reported in the 2010 *Congestion Report* is not comparable with the current report. HOV trips with the same endpoints as GP lane trips, but differing lengths, do not require any adjustment, since the difference in lengths is the result of HOVs using different roadways than GPs (e.g., an HOV only interchange ramp). Commute lengths have been rounded to integer values for publication purposes only. Trip routes on I-5 and I-90 include reversible lane options for the weekday time periods (AM or PM) and directions of travel when the reversible lanes are in effect. Beginning with this year's report, the HOV trip on SR 520 eastbound from Seattle to Bellevue is no longer reported, because HOV lanes exist along only a very short portion of the route.

1 Some HOV trips have modified trip lengths compared to the corresponding standard GP trips mentioned on pp. 30-31, due to the lack of data at the HOV trip's endpoints. Affected trips are I-5 trips to and from Everett, I-405 trips with a Tukwila endpoint, SR 520 trips to and from Redmond, and northbound I-405 trips heading toward Bellevue, and northbound I-405 trips starting from Bellevue. In each case, to enable a direct comparison, the lengths of the corresponding GP trips have been adjusted to match the HOV trip length as closely as possible; this means travel times and time stamps for the peak of the commuter rush for these modified GP trips will not necessarily match those in the GP trip tables on pp. 30-31, and the 2009 values in this table will not match 2009 values reported in the 2010 *Congestion Report*.

2 For each HOV trip to/from Seattle on I-90, comparisons are made with a modified GP trip that is 1.2 to 1.8 miles shorter (depending on trip type and direction) than the corresponding standard GP trip, to enable a direct apples-to-apples GP vs. HOV comparison. Travel times and time stamp for peak of commuter rush for these shortened GP trips will not match travel times and time stamp for peak of commuter rush in the tables on pp. 30-31.

High Occupancy Vehicle Lanes Performance Analysis

HOV lanes reduce travel times for evening commuters

Evening commutes: HOV lane travel time performance compared to general purpose lanes

Evening (PM) peak is between 2 p.m. and 8 p.m.; Length of route in miles; All travel times and differences in minutes; Peak of commuter rush expressed in hours and minutes for an annual average weekday

			Travel times on the route at		Average travel time at peak of PM rush					95% reliable travel times				
Route	Length of route	Peak of commuter PM rush	Posted speed	Maximum throughput speed	HOV lanes 2009	HOV lanes 2011	Δ	GP lanes 2011	2011: Difference HOV vs. GP	HOV lanes 2009	HOV lanes 2011	Δ	GP lanes 2011	2011: Difference HOV vs. GP
From Seattle														
I-5 Seattle to Everett														
Regular HOV lane[1]	22	16:25	22	26	35	30	-5	33	-3	50	43	-7	45	-2
Reversible lanes[1]	22	16:25	22	26	30	27	-3	33	-6	40	37	-3	45	-8
I-5 Seattle to Federal Way	22	16:40	22	27	29	26	-3	29	-3	38	35	-3	40	-5
I-5 Seattle to SeaTac	13	16:40	13	16	17	16	-1	17	-1	23	22	-1	24	-2
I-5/I-90/I-405 Seattle to Bellevue														
HOV & GP lanes[2]	9	17:25	9	11	13	14	1	15	-1	22	23	1	26	-3
HOV & reversible lanes[2]	10	17:25	10	12	12	10	-2	15	-5	20	11	-9	26	-15
I-5/SR 520 Seattle to Redmond[1]	13	17:35	13	16	23	20	-3	21	-1	33	31	-2	32	-1
I-5/I-90 Seattle to Issaquah														
HOV & GP lanes[2]	14	17:30	14	17	17	19	2	20	-1	27	27	0	29	-2
HOV & reversible lanes[2]	14	17:30	14	17	15	14	-1	20	-6	15	15	0	29	-14
From Bellevue														
I-405 Bellevue to Everett[1]	23	17:20	23	28	29	28	-1	39	-11	36	35	-1	52	-17
I-405 Bellevue to Lynnwood[1]	16	17:25	16	19	20	20	0	30	-10	29	26	-3	43	-17
I-405 Bellevue to Tukwila[1]	12	17:25	12	15	15	17	2	31	-14	20	26	6	40	-14
I-405/I-90/I-5 Bellevue to Seattle[2]	9	17:30	9	11	13	15	2	21	-6	21	25	4	33	-8
I-405/SR 520/I-5 Bellevue to Seattle														
2+ person HOV	10	17:30	10	12	26	27	1	27	0	37	36	-1	38	-2
3+ person HOV	10	17:30	10	12	16	16	0	27	-11	23	20	-3	38	-18
I-405/I-90 Bellevue to Issaquah	9	17:30	9	11	13	13	0	16	-3	16	18	2	20	-2
I-405/SR 520 Bellevue to Redmond[1]	5	17:35	5	7	7	8	1	8	0	10	11	1	13	-2

Data source: WSDOT Strategic Assessment Office and the Washington State Transportation Center (TRAC) at the University of Washington.

Notes: Due to changes in the way WSDOT processed 2011 loop data, 2009 travel time data reported in the 2010 *Congestion Report* is not comparable with the current report. HOV trips with the same endpoints as GP lane trips, but differing lengths, do not require any adjustment, since the difference in lengths is the result of HOVs using different roadways than GPs (e.g., an HOV only interchange ramp). Commute lengths have been rounded to integer values for publication purposes only. Trip routes on I-5 and I-90 include reversible lane options for the weekday time periods (AM or PM) and directions of travel when the reversible lanes are in effect. Beginning with this year's report, the HOV trip on SR 520 eastbound from Seattle to Bellevue is no longer reported, because HOV lanes exist along only a very short portion of the route.

1 Some HOV trips have modified trip lengths compared to the corresponding standard GP trips mentioned on pp. 30-31, due to the lack of data at the HOV trip's endpoints. Affected trips are I-5 trips to and from Everett, I-405 trips with a Tukwila endpoint, SR 520 trips to and from Redmond, and northbound I-405 trips heading toward Bellevue, and northbound I-405 trips starting from Bellevue. In each case, to enable a direct comparison, the lengths of the corresponding GP trips have been adjusted to match the HOV trip length as closely as possible; this means travel times and time stamps for the peak of the commuter rush for these modified GP trips will not necessarily match those in the GP trip tables on pp. 30-31, and the 2009 values in this table will not match 2009 values reported in the 2010 *Congestion Report*.

2 For each HOV trip to/from Seattle on I-90, comparisons are made with a modified GP trip that is 1.2 to 1.8 miles shorter (depending on trip type and direction) than the corresponding standard GP trip, to enable a direct apples-to-apples GP vs. HOV comparison. Travel times and time stamp for peak of commuter rush for these shortened GP trips will not match travel times and time stamp for peak of commuter rush in the tables on pp. 30-31.

HOV lane travelers spend less time on (morning/evening) commutes

Morning/Evening commutes: HOV lane travel time performance compared to general purpose lanes

Morning (AM) peak is between 5 a.m. and 10 a.m.; Evening (PM) peak is between 2 p.m. and 8 p.m.
Peak of commuter rush expressed in hours and minutes for an annual average weekday
Length of route in miles; All travel times and differences in minutes;

			Travel times on the route at		Average travel time at peak of rush					95% reliable travel times				
					HOV lanes			GP lanes	2011: Difference	HOV lanes			GP lanes	2011: Difference
Route	Length of route	Peak of commuter rush	Posted speed	Maximum throughput speed	2009	2011	Δ	2011	HOV vs. GP	2009	2011	Δ	2011	HOV vs. GP
To other locations – Morning (AM)														
I-405 Bellevue to Tukwila[1]	12	7:40	12	15	13	13	0	16	-3	14	13	-1	20	-7
SR 167 Auburn to Renton (HOT)	10	7:35	10	12	10	11	1	17	-6	10	13	3	27	-14
I-5/I-90 Seattle to Issaquah[2]	14	8:45	14	17	15	17	2	18	-1	23	26	3	26	0
I-5/SR 520 Seattle to Redmond	13	8:45	13	16	23	24	1	24	0	32	35	3	36	-1
From other locations – Evening (PM)														
I-5 Everett to Seattle[1]	22	16:20	22	27	32	35	3	38	-3	44	51	7	61	-10
I-90/I-5 Issaquah to Seattle[2]	14	17:20	14	17	17	19	2	24	-5	25	28	3	43	-15
SR 520/I-5 Redmond to Seattle														
2+ person HOV[1]	13	17:35	13	16	31	32	1	33	-1	52	51	-1	55	-4
3+ person HOV[1]	13	17:35	13	16	20	19	-1	33	-14	37	30	-7	55	-25
I-5 SeaTac to Seattle	13	17:20	13	16	18	17	-1	21	-4	26	25	-1	33	-8
SR 167 Renton to Auburn (HOT)	10	16:45	10	12	11	11	0	16	-5	13	14	1	29	-15
I-405 Tukwila to Bellevue[1]	13	17:25	13	16	14	14	0	21	-7	16	15	-1	33	-18

Data source: WSDOT Strategic Assessment Office and the Washington State Transportation Center (TRAC) at the University of Washington.

Notes: Due to changes in the way WSDOT processed 2011 loop data, 2009 travel time data reported in the 2010 *Congestion Report* is not comparable with the current report. HOV trips with the same endpoints as GP lane trips, but differing lengths, do not require any adjustment, since the difference in lengths is the result of HOVs using different roadways than GPs (e.g., an HOV only interchange ramp). Commute lengths have been rounded to integer values for publication purposes only. Trip routes on I-5 and I-90 include reversible lane options for the weekday time periods (AM or PM) and directions of travel when the reversible lanes are in effect. Beginning with this year's report, the HOV trip on SR 520 eastbound from Seattle to Bellevue is no longer reported, because HOV lanes exist along only a very short portion of the route.

1 Some HOV trips have modified trip lengths compared to the corresponding standard GP trips mentioned on pp. 30-31, due to the lack of data at the HOV trip's endpoints. Affected trips are I-5 trips to and from Everett, I-405 trips with a Tukwila endpoint, SR 520 trips to and from Redmond, and northbound I-405 trips heading toward Bellevue, and northbound I-405 trips starting from Bellevue. In each case, to enable a direct comparison, the lengths of the corresponding GP trips have been adjusted to match the HOV trip length as closely as possible; this means travel times and time stamps for the peak of the commuter rush for these modified GP trips will not necessarily match those in the GP trip tables on pp. 30-31, and the 2009 values in this table will not match 2009 values reported in the 2010 *Congestion Report*.

2 For each HOV trip to/from Seattle on I-90, comparisons are made with a modified GP trip that is 1.2 to 1.8 miles shorter (depending on trip type and direction) than the corresponding standard GP trip, to enable a direct apples-to-apples GP vs. HOV comparison. Travel times and time stamp for peak of commuter rush for these shortened GP trips will not match travel times and time stamp for peak of commuter rush in the tables on pp. 30-31.

High Occupancy Vehicle Lanes Performance Analysis

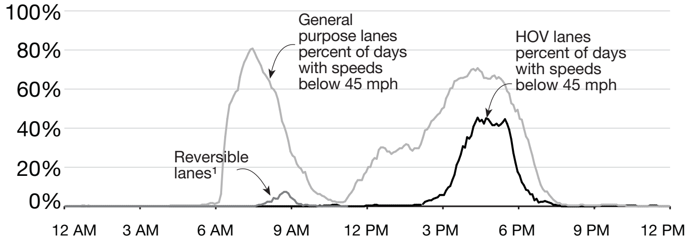
A look at how HOV and GP lane reliability performance compare, *continued*

Comparing HOV and adjacent GP lanes: Percent of days when speeds fell below 45 mph (weekdays only)

2011 weekday data for selected Puget Sound commute routes; 0% on graph indicates that the average trip speed did not fall below 45 mph

I-5 Everett to Seattle

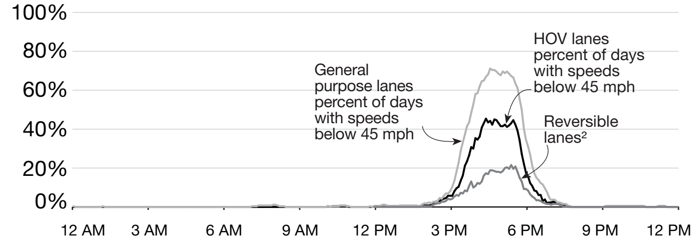
2011 weekday data only



Note: 1 Monday-Friday hours of operation: Southbound - 5 a.m. to 11:15 a.m.; Northbound - noon to 11 p.m.; Closed 11 p.m. to 5 a.m.

I-5 Seattle to Everett

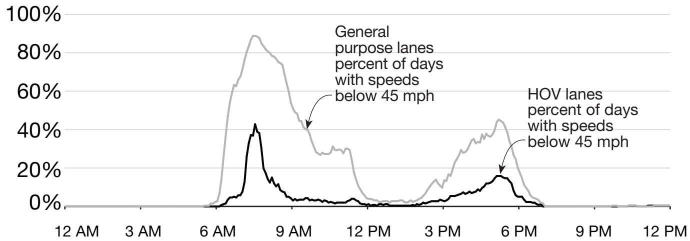
2011 weekday data only



Note: 2 Monday-Friday hours of operation: Southbound - 5 a.m. to 11:15 a.m.; Northbound - noon to 11 p.m.; Closed 11 p.m. to 5 a.m.

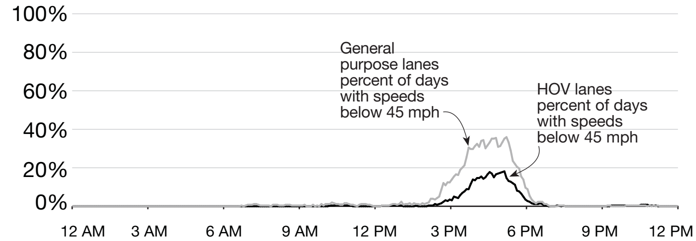
I-5 Federal Way to Seattle

2011 weekday data only



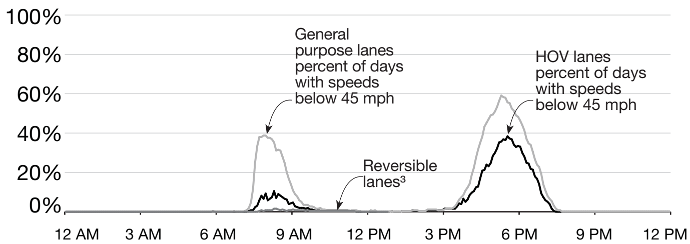
I-5 Seattle to Federal Way

2011 weekday data only



I-90/I-5 Issaquah to Seattle

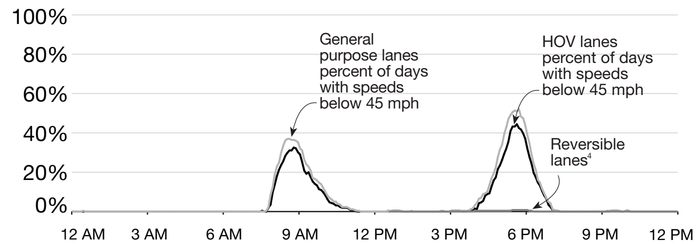
2011 weekday data only



Note: 3 Monday-Friday hours of operation: Westbound - 1 a.m. to 12:30 p.m.; Eastbound - 2 p.m. to midnight. In 2011 the speeds rarely dropped below 45 mph in the AM peak period on the reversible lanes.

I-5/I-90 Seattle to Issaquah

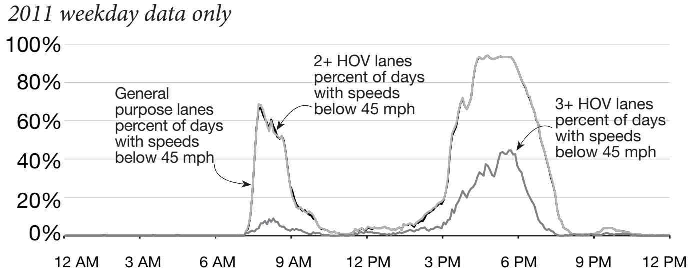
2011 weekday data only



Note: 4 Monday-Friday hours of operation: Westbound - 1 a.m. to 12:30 p.m.; Eastbound - 2 p.m. to midnight. In 2011 the speeds rarely dropped below 45 mph in the PM peak period on the reversible lanes.

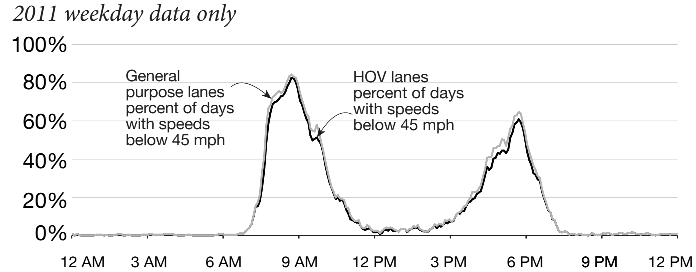
SR 520/I-5 Redmond to Seattle

2011 weekday data only



I-5/SR 520 Seattle to Redmond

2011 weekday data only



Data source: WSDOT Strategic Assessment Office and the Washington State Transportation Center (TRAC) at the University of Washington.

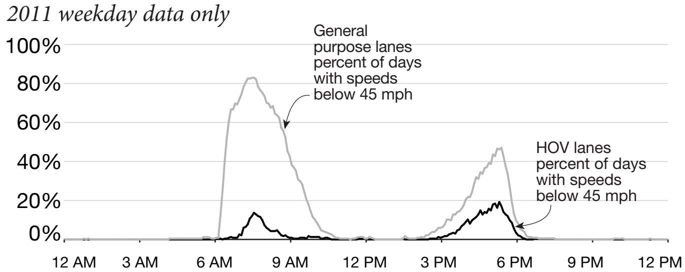
A look at how HOV and GP lane reliability performance compare, *continued*

Comparing HOV and adjacent GP lanes: Percent of days when speeds fell below 45 mph (weekdays only)

2011 weekday data for selected Puget Sound commute routes; 0% on graph indicates that the average trip speed did not fall below 45 mph

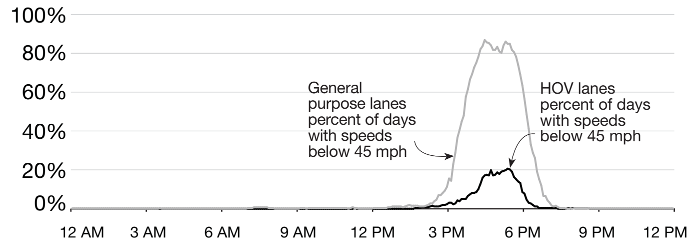
I-5/I-405 Everett to Bellevue

2011 weekday data only



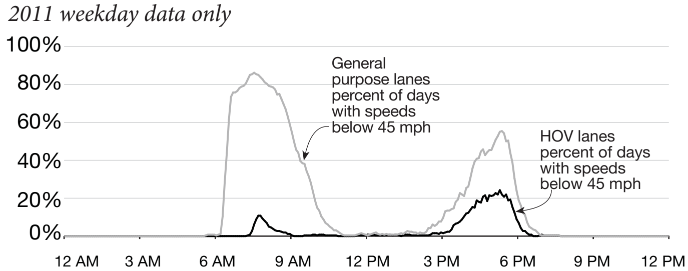
I-405/I-5 Bellevue to Everett

2011 weekday data only



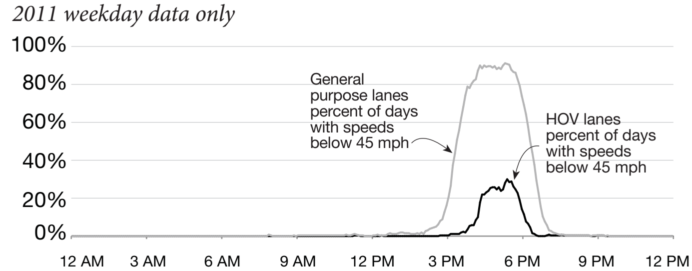
I-405 Lynnwood to Bellevue

2011 weekday data only



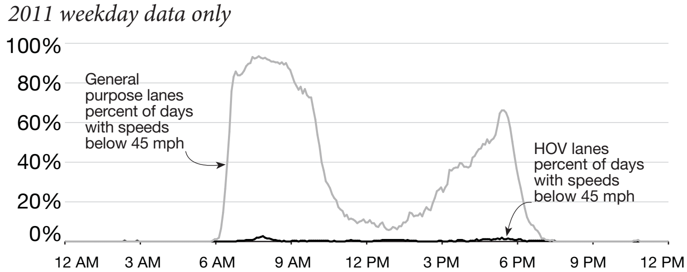
I-405 Bellevue to Lynnwood

2011 weekday data only



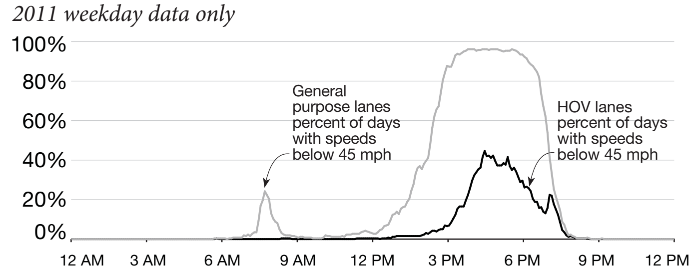
I-405 Tukwila to Bellevue

2011 weekday data only



I-405 Bellevue to Tukwila

2011 weekday data only



Data source: WSDOT Strategic Assessment Office and the Washington State Transportation Center (TRAC) at the University of Washington.

High Occupancy Vehicle Lanes Performance Analysis

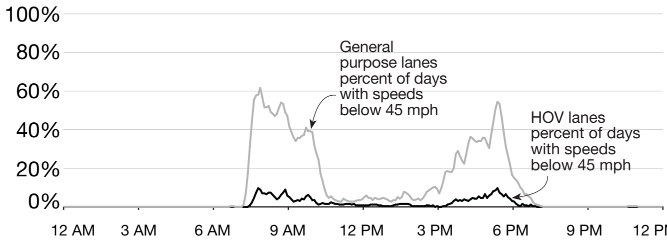
A look at how HOV and GP lane reliability performance compare, *continued*

Comparing HOV and adjacent GP lanes: Percent of days when speeds fell below 45 mph (weekdays only)

2011 weekday data for selected Puget Sound commute routes; 0% on graph indicates that the average trip speed did not fall below 45 mph

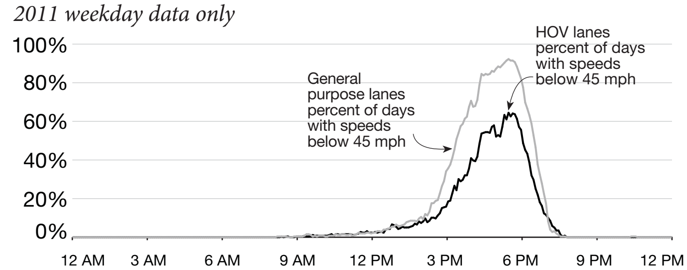
I-90/I-405 Issaquah to Bellevue

2011 weekday data only



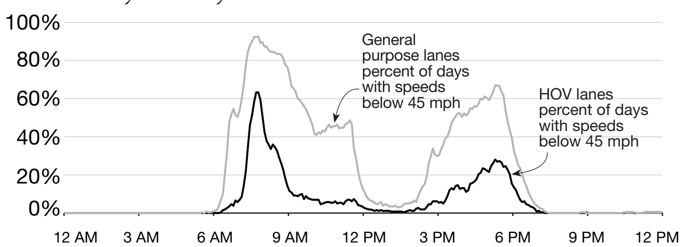
I-405/I-90 Bellevue to Issaquah

2011 weekday data only



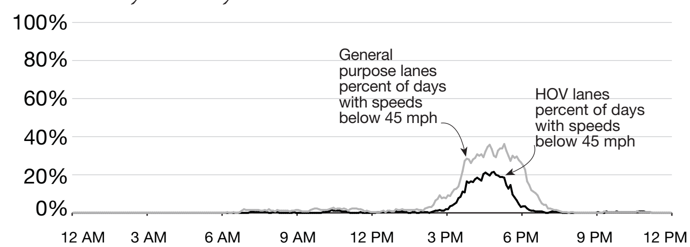
I-5 SeaTac to Seattle

2011 weekday data only



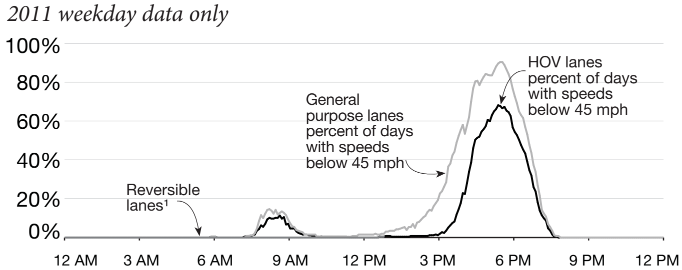
I-5 Seattle to SeaTac

2011 weekday data only



I-405/I-90/I-5 Bellevue to Seattle

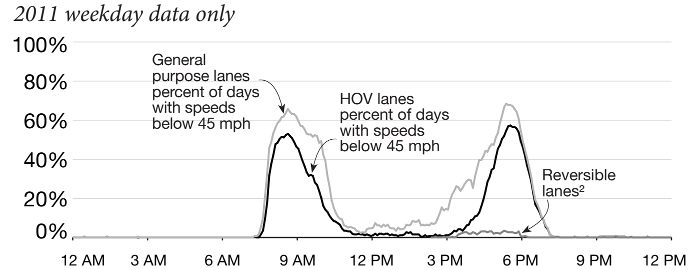
2011 weekday data only



Note: 1 Monday-Friday hours of operation: Westbound - 1 a.m. to 12:30 p.m.; Eastbound - 2 p.m. to midnight. In 2011 the speeds rarely dropped below 45 mph in the AM peak period on the reversible lanes.

I-5/I-90/I-405 Seattle to Bellevue

2011 weekday data only



Note: 2 Monday-Friday hours of operation: Westbound - 1 a.m. to 12:30 p.m.; Eastbound - 2 p.m. to midnight.

Data source: WSDOT Strategic Assessment Office and the Washington State Transportation Center (TRAC) at the University of Washington.

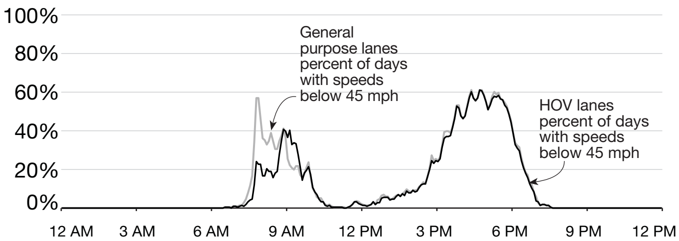
A look at how HOV and GP lane reliability performance compare, *continued*

Comparing HOV and adjacent GP lanes: Percent of days when speeds fell below 45 mph (weekdays only)

2011 weekday data for selected Puget Sound commute routes; 0% on graph indicates that the average trip speed did not fall below 45 mph

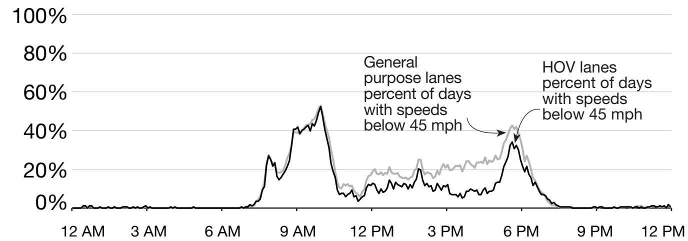
SR 520/I-405 Redmond to Bellevue

2011 weekday data only



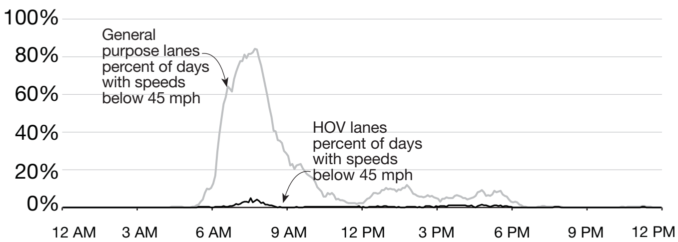
I-405/SR 520 Bellevue to Redmond

2011 weekday data only



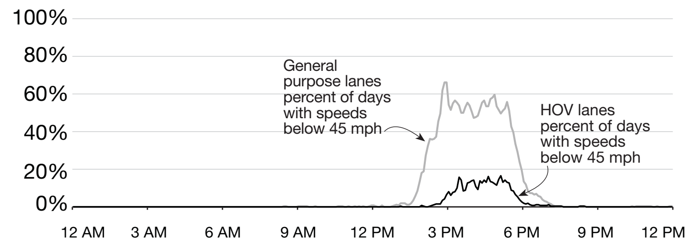
SR 167 Auburn to Renton

2011 weekday data only



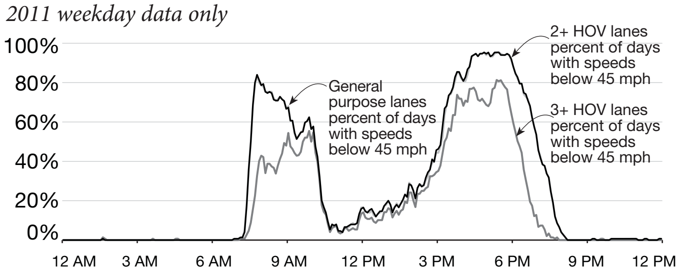
SR 167 Renton to Auburn

2011 weekday data only



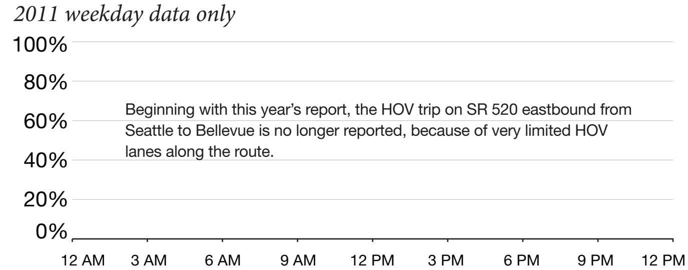
I-405/SR 520/I-5 Bellevue to Seattle

2011 weekday data only



I-5/SR 520/I-405 Seattle to Bellevue

2011 weekday data only

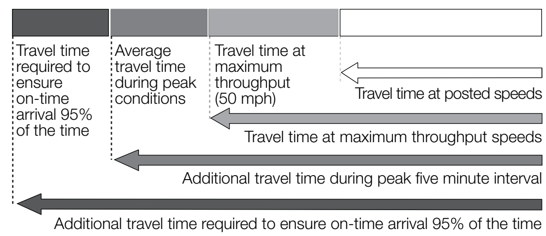


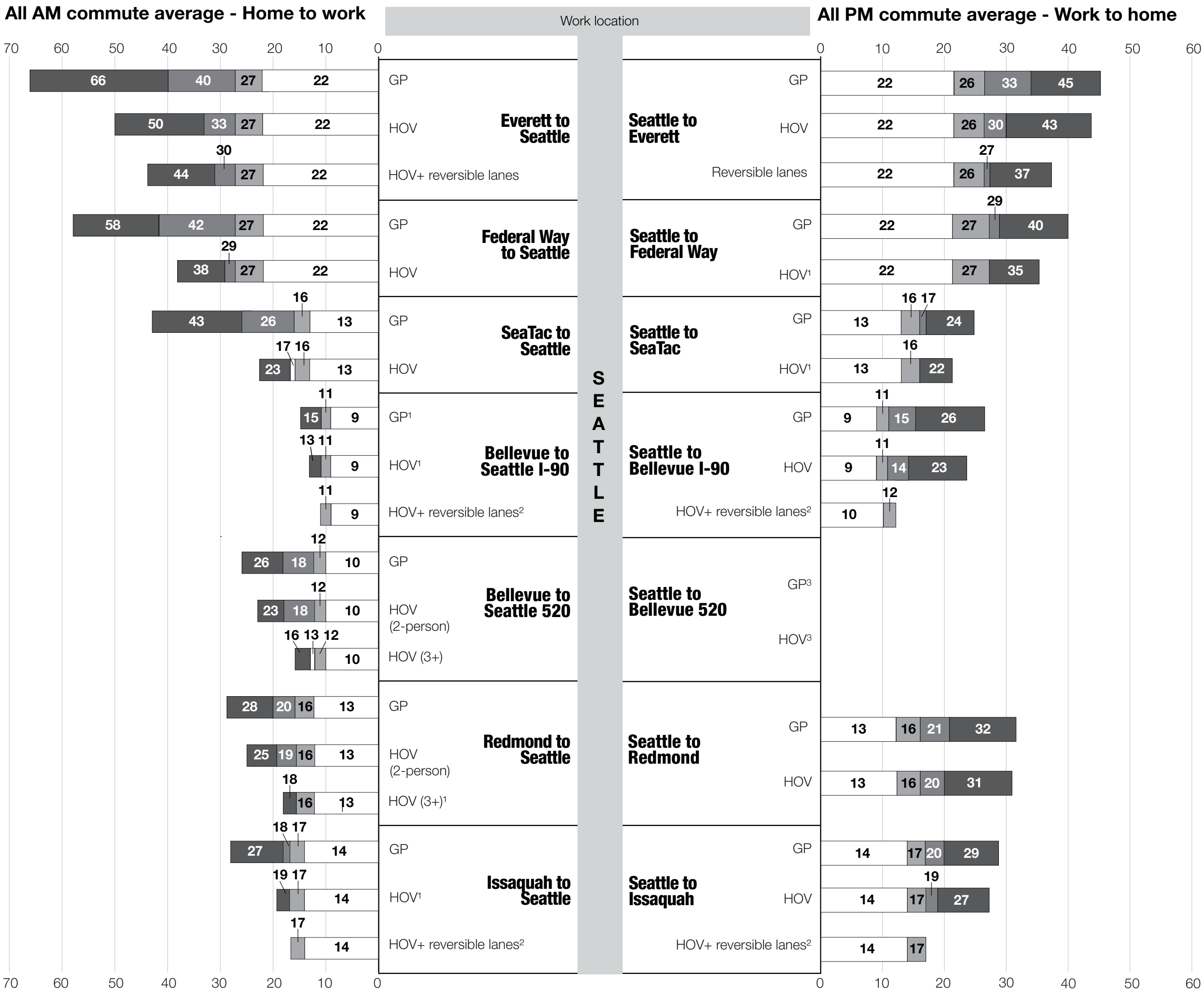
Data source: WSDOT Strategic Assessment Office and the Washington State Transportation Center (TRAC) at the University of Washington.

High Occupancy Vehicle Lanes Performance Analysis

Comparing HOV lane travel times to GP lanes for Seattle work locations

Travel times at posted speed, maximum throughput speeds, peak travel times, and 95% reliable travel times
Morning and afternoon commutes by work location
General purpose (GP) and high occupancy vehicle (HOV) commutes in the central Puget Sound area in 2011
Travel time in minutes



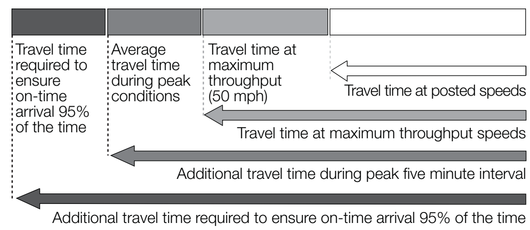


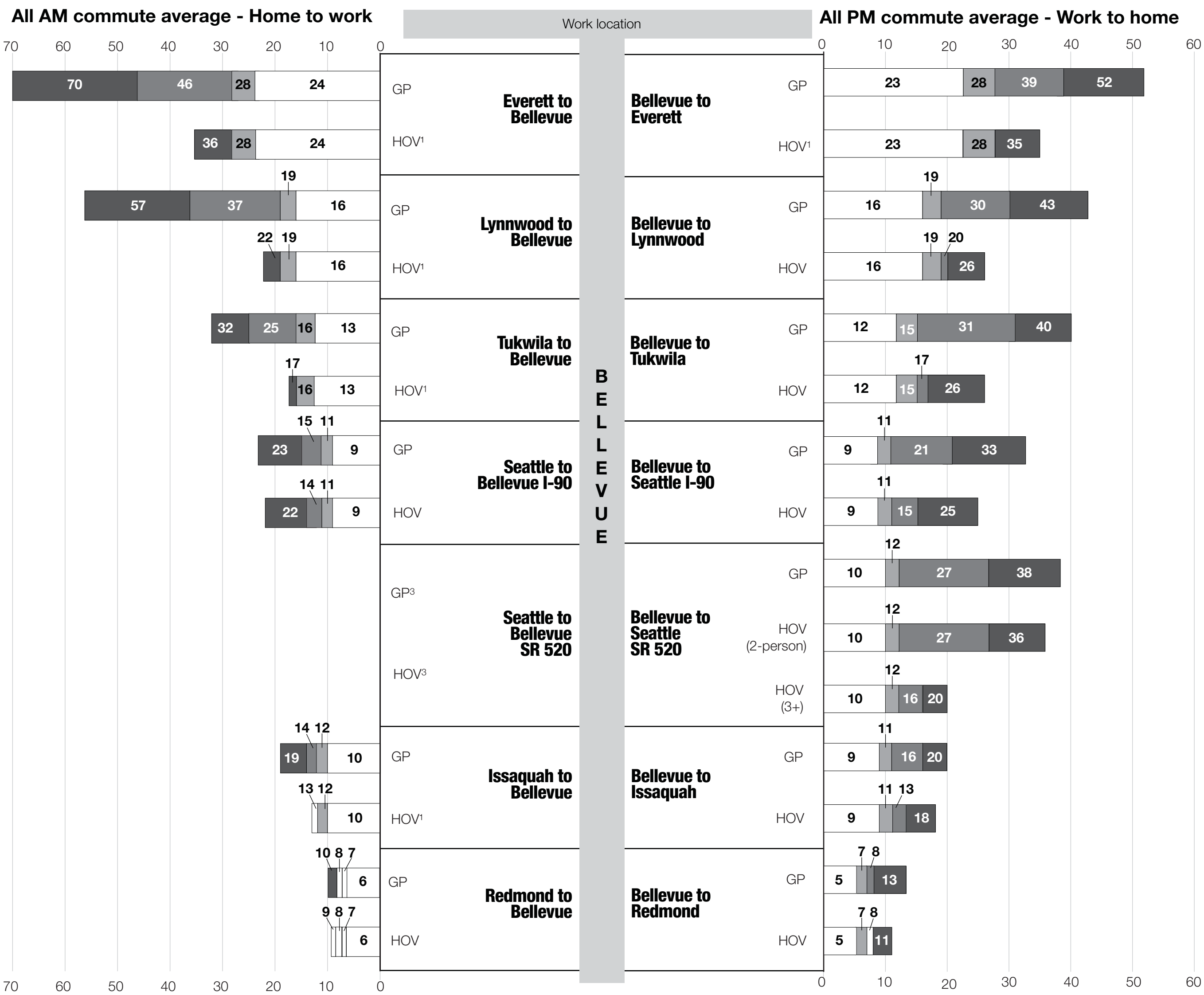
Data source: WSDOT Strategic Assessment Office and the Washington State Transportation Center (TRAC) at the University of Washington.

Notes: 1 Average travel times were equal to or faster than maximum throughput travel times on this route.
2 Average travel times and 95% reliable travel times were equal to or faster than maximum throughput travel times on this route.
3 The eastbound Seattle to Bellevue via SR 520 commute has an HOV lane for a short section compared to the length of the route. Therefore, comparing GP and HOV travel times does not show a significant difference, and will no longer be reported. When the SR 520 corridor program has completed work on the eastbound HOV lanes, this comparision will be included in this report again.

Comparing HOV lane travel times to GP lanes for Bellevue work locations

Travel times at posted speeds, maximum throughput speeds, peak travel times, and 95% reliable travel times
Morning and afternoon commutes by work location
General purpose (GP) and high occupancy vehicle (HOV) commutes in the central Puget Sound area in 2011
Travel time in minutes





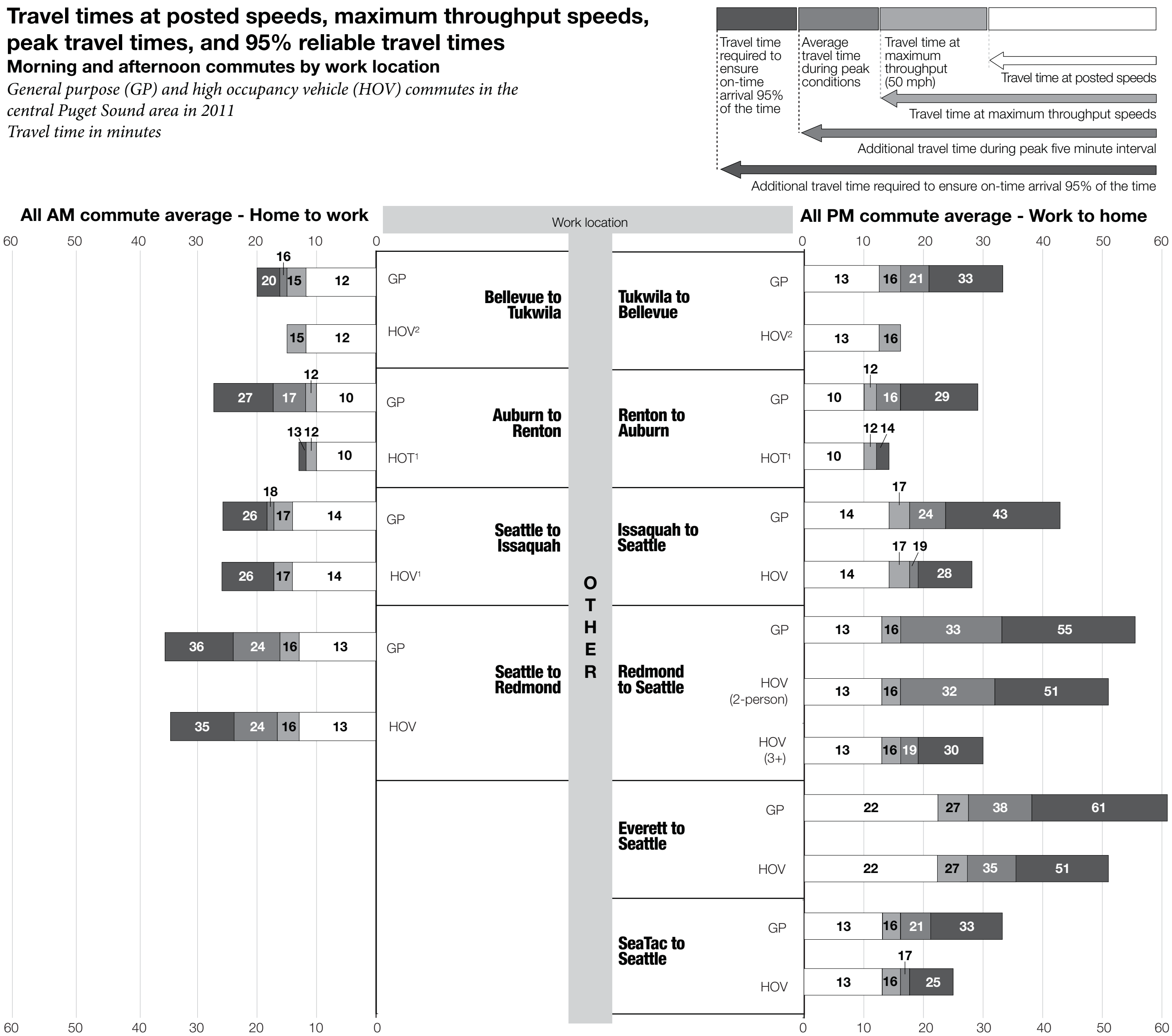
Data source: WSDOT Strategic Assessment Office and the Washington State Transportation Center (TRAC) at the University of Washington.

Notes: 1 Average travel times were equal to or faster than maximum throughput travel times on this route.
2 Average travel times and 95% reliable travel times were equal to or faster than maximum throughput travel times on this route.
3 The westbound Seattle to Bellevue via SR 520 commute has an HOV lane for a short section compared to the length of the route. Therefore, comparing GP and HOV travel times does not show a significant difference, and will no longer be reported. When the SR 520 corridor program has completed work on the westbound HOV lanes, this comparision will be included in this report again.

High Occupancy Vehicle Lanes Performance Analysis

Comparing HOV lane travel times to GP lanes for other work locations

Travel times at posted speeds, maximum throughput speeds, peak travel times, and 95% reliable travel times
Morning and afternoon commutes by work location
General purpose (GP) and high occupancy vehicle (HOV) commutes in the central Puget Sound area in 2011
Travel time in minutes



Work location	Lane	AM: posted speed	AM: max throughput	AM: peak average	AM: 95% reliable
Bellevue to Tukwila	GP	12	15	16	20
Bellevue to Tukwila	HOV²	12	15		
Auburn to Renton	GP	10	12	17	27
Auburn to Renton	HOT¹	10	12	13	
Seattle to Issaquah	GP	14	17	18	26
Seattle to Issaquah	HOV¹	14	17		26
Seattle to Redmond	GP	13	16	24	36
Seattle to Redmond	HOV	13	16	24	35

Work location	Lane	PM: posted speed	PM: max throughput	PM: peak average	PM: 95% reliable
Tukwila to Bellevue	GP	13	16	21	33
Tukwila to Bellevue	HOV²	13	16		
Renton to Auburn	GP	10	12	16	29
Renton to Auburn	HOT¹	10	12	14	
Issaquah to Seattle	GP	14	17	24	43
Issaquah to Seattle	HOV	14	17	19	28
Redmond to Seattle	GP	13	16	33	55
Redmond to Seattle	HOV (2-person)	13	16	32	51
Redmond to Seattle	HOV (3+)	13	16	19	30
Everett to Seattle	GP	22	27	38	61
Everett to Seattle	HOV	22	27	35	51
SeaTac to Seattle	GP	13	16	21	33
SeaTac to Seattle	HOV	13	16	17	25

Data source: WSDOT Strategic Assessment Office and the Washington State Transportation Center (TRAC) at the University of Washington.

Notes: 1 Average travel times were equal to or faster than maximum throughput travel times on this route.
2 Average travel times and 95% reliable travel times were equal to or faster than maximum throughput travel times on this route.

WSDOT Strategies

In WSDOT Strategies:

Moving Washington
A Balanced Approach

WSDOT takes a three-pronged approach to fighting congestion

Washington depends on mobility

Effective transportation is critical to maintaining Washington's economy, quality of life, and environment. *Moving Washington* is WSDOT's foundational strategy and framework for making transparent, cost-effective decisions that keep people and goods moving. WSDOT's highest priority is maintaining and preserving the safe and long-lasting performance of existing infrastructure, facilities, and services. This is the heart of *Moving Washington* and the target of investments. *Moving Washington* integrates new capacity, efficiencies, and commute options to address congestion head-on and improve the performance of our state's transportation system.

The transportation improvements outlined here are necessary for citizens to continue to enjoy all that the state has to offer. From the coastal rain forests of the Olympic Peninsula to the river gorges in the south and east, Washington is rich with landscapes and a diverse economy: its people depend on a reliable trip to work, and want to spend time with their families when the work day is done. Businesses from agriculture and manufacturing to retail and tourism rely on the transportation system. More information on *Moving Washington* can be found at www.wsdot.wa.gov/movingwashington/.

WSDOT implements *Moving Washington* by:

Using Intelligent Transportation Systems to operate the system more efficiently:

- Active Traffic Management, traffic cameras, traffic management centers, variable message signs, integrated traffic signals, ramp meters, traffic data collectors.

Providing commute choices to manage demand:

- Vanpools, park and rides, transit partnerships, telecommuting programs, commute trip reduction, HOV/carpooling.

Building additional highway capacity

- Since 2003, WSDOT planned 126 mobility projects to fight congestion; 82 were completed as of December 31, 2011.

Washington drivers are already seeing benefits

The *Moving Washington* program will improve current traffic conditions and prepare our system for heightened demands in the future. The program includes specific actions that can achieve tangible early results. WSDOT has already started to realize results from the program's strategies with the completion of numerous highway construction projects. Examples of these project benefits can be found on pp. 75-79.

Balanced strategies anchor WSDOT's program

There is no single solution for traffic congestion, which is why WSDOT reduces congestion by focusing on three key balanced strategies – the basis for the *Moving Washington* program.

Operate efficiently

Efficiency means taking steps to smooth traffic flow and avoid or reduce situations that constrict road capacity. Collisions account for roughly 25% of traffic backups, so making roads safer will go a long way toward easing congestion. Technology, such as driver information signs, enables WSDOT and the traveling public to react quickly to unforeseen traffic fluctuations. Among the tools WSDOT employs to provide this efficiency are Active Traffic Management (including variable speed-limit systems), Smarter Highways, metered freeway on-ramps, Incident Response teams, variable tolling, and integrated traffic signals.

Manage demand

WSDOT seeks to make the best use of highway capacity by better distributing the demand placed on the most congested bridges and highways. That means offering commuters more choices, such as convenient bus service, incentives to carpool or vanpool, and promoting workplace environments more conducive to telecommuting. WSDOT continues to expand its programs to encourage drivers to use less congested routes and times to travel by displaying real-time traffic information through various means including the Internet and variable message signs.

Add capacity strategically

As Washington continues to grow, it is necessary to develop additional traffic capacity. However, budgetary constraints and other factors mean that the state cannot simply build its way out of congestion. WSDOT plans projects wisely by targeting the worst traffic-flow bottlenecks and chokepoints in the transportation system. The 2003 and 2005 transportation funding packages include mobility projects that add capacity where it makes the most sense statewide. As of December 31, 2011, 82 mobility projects have been completed. Washington continues to invest in improvements to I-5, I-405, and SR 520 in the central Puget Sound and U.S. 395 through Spokane, among others around the state.

Moving Washington
I-5 JBLM: A Case Study

WSDOT takes aim at traffic jams on I-5 at Joint Base Lewis-McChord

Moving Washington: A look at I-5 corridor performance near JBLM before and after Labor Day

The *Moving Washington* program targets congestion on Washington State's busiest corridors. The congestion relief efforts along the I-5 corridor near Joint Base Lewis-McChord (JBLM) is an example of how WSDOT and its partners employed the *Moving Washington* three-pronged strategy (operate efficiently, manage demand, and add capacity strategically) to address congestion problems that occurred following the Labor Day weekend in 2010.

Northbound I-5 traffic grinds to a halt after Labor Day 2010 in Thurston and Pierce counties

Washingtonians who regularly commute between the South Puget Sound communities of Lacey and Lakewood on I-5 got some bad new the morning after Labor Day in 2010. The busiest highway in the state had all but ground to a halt as northbound drivers crested the hill overlooking the picturesque Nisqually basin. The view of brake lights stretching as far the eye could see was just plain ugly September 7 – and it was just getting started.

For the next two days following Labor Day, the northbound backups stretched 11 miles, and made the typical 15 to 30 minute straight-shot commute a tangled mess that took 45 to 90 minutes to navigate. Drivers heading north during the peak commute from 6 to 8:30 a.m. inched along at an average speed of 15 mph – marking a 75% reduction from typical speeds for this weekday time frame.

The traffic wasn't just bad, it was expensive. WSDOT analysis indicated the average cost of delay for these backups was approximately $36,000 for every hour of congestion.

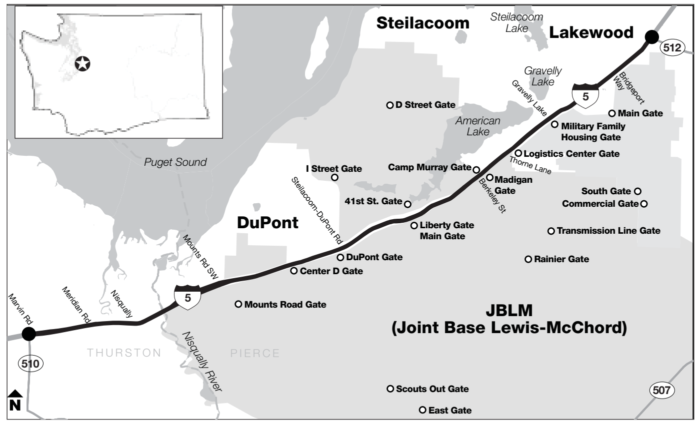
Growing pains: Defining the I-5 JBLM problem

Residential and commercial growth and the consolidation of military bases at JBLM pushed the I-5 corridor's capacity to the brink for the last part of the decade. The northbound average traffic capacity was 59,000 vehicles per day, but over the past several years as many as 66,000 vehicles were using the northbound highway daily.

The graph (at right) shows that the days right after Labor Day in 2010 can be marked as a tangible tipping point for northbound drivers as morning commute times tripled. With no reasonable alternative routes to the I-5 corridor in this vicinity, these motorists were essentially trapped in the backups.

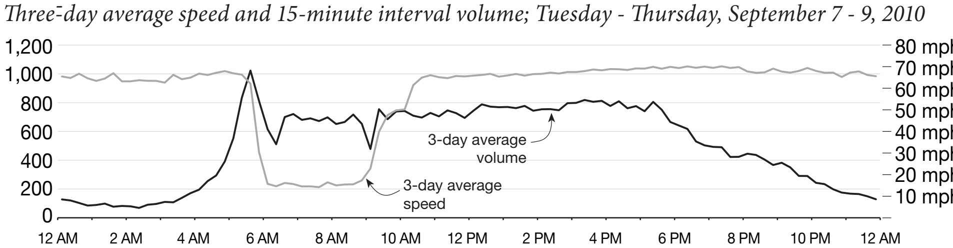
Although the problem seemingly occurred overnight, it was actually the annual advent of the new school year and different travel patterns at summer's end, combined with continued growth at JBLM. The consolidation of Fort Lewis and McChord Air Force Base, which runs adjacent to I-5 for nearly 14 miles, increased its population over time as it added nearly 40,000 people since 2003,

I-5 Joint Base Lewis-McChord corridor between SR 510 and SR 512



Before: I-5 northbound traffic data at milepost 114.31

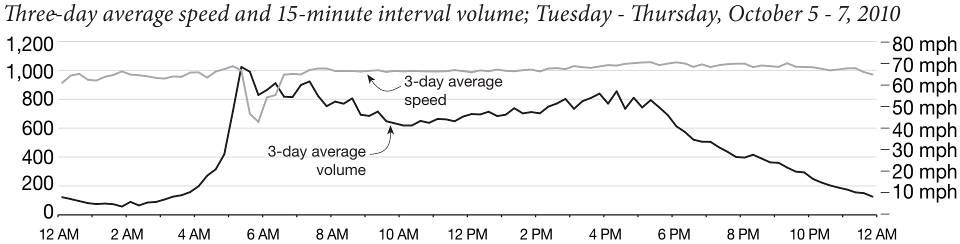
Three-day average speed and 15-minute interval volume; Tuesday - Thursday, September 7 - 9, 2010



Data source: WSDOT Olympic Region Traffic Operations Office.

After: I-5 northbound traffic data at milepost 114.31

Three-day average speed and 15-minute interval volume; Tuesday - Thursday, October 5 - 7, 2010



Data source: WSDOT Olympic Region Traffic Operations Office.

Moving Washington
I-5 JBLM: A Case Study

Improved JBLM vanpool ridership contributes to congestion reduction

bringing the 2010 total at the base to more than 131,000 people. Approximately 18,000 of these troops returned from deployment overseas between February and September 2010.

Putting *Moving Washington* into motion

Leaders from WSDOT, JBLM administrators, Washington State Patrol (WSP), and local municipalities formed the Traffic Circulation Committee to identify and resolve traffic operations issues. The agencies collaborated and used WSDOT's *Moving Washington* strategies to address the traffic issues on I-5. The plan aims to reduce highway congestion and improve mobility with the three principles: operate the existing system efficiently, manage the demand for the system, and add highway capacity strategically.

Results from the early *Moving Washington* strategies

The *Moving Washington* strategy is proving successful in resolving I-5 JBLM traffic. Opening the Mounts Road gate to northbound ingress traffic was the most significant move in terms of relieving the morning congestion. It required obtaining approvals and permits from the city and county public works departments, roadway improvements inside the gate, additional gate personnel, and new signing. All of this was accomplished in five days.

- More than 1,000 vehicles use the Mounts Road gate during the morning rush hours between 5 a.m. and 8 a.m., removing them from I-5 and the DuPont gate.
- Additional personnel assigned to other JBLM gates decreased ingress wait times by more than five minutes.
- Opening the 32nd Street gate for morning ingress decreased wait times by about one minute.

Within one month of implementing congestion relief strategies, northbound morning speeds improved from 15 mph to 60 mph. The duration of congestion also declined dramatically due to these measures. In early September, congestion lasted three hours and 30 minutes; by October 5, 2010, the congestion duration (the amount of time that average travel speeds are less than 45 mph) only lasted about 15 minutes.

Moving Washington strategies that contributed to the I-5 Corridor congestion relief near JBLM

Actions	Timeline	Results
Operate roadways efficiently		
Opened new gates at Mounts Road and 32nd Street for morning ingress	Fall 2010	Decreased vehicles at the DuPont gate and I-5 by 1,000 and wait times by more than ten minutes
Adjusted traffic signal light timing	Fall 2010	Improved traffic flow at DuPont and Berkeley interchanges resulting in reduced queue spillback onto I-5.
Realigned Incident Response team priorities in the JBLM corridor to meet demands	Fall 2010	Reduced incident detection times, cleared collisions quickly, and provided updated information
Adjusted weigh station operations	Fall 2010	Reduced impact of truck ingress and egress on I-5 during peak AM commute
Improved signing and pavement marking	Fall 2010	Improved ingress traffic flow at DuPont gate.
Expanded I-5 ITS system (adding new traffic cameras and data collectors)	Within two years (by September 2012)	Provided drivers and WSDOT additional information on I-5 traffic conditions around JBLM
Installed new traffic signal at East Gate Road and SR 507	Within two years (by September 2012)	Improved access to and from JBLM and redistributed demand away from I-5
Installed northbound I-5 ramp meters	Within two years (by September 2012)	Helped manage traffic at three northbound on-ramps
Managing demand		
Deployed rideshare/vanpool marketing strategy	September 2010	Gave drivers additional information on existing travel resources
Modified access procedures	Fall 2010	Increased throughput into JBLM
Increased communications with traveling public	September 2010	Provided drivers with traffic conditions and changes on I-5
Add capacity strategically		
Realign Center Drive ramp	Planned as part of JBLM 2015-2017 biennium budget	Will improve safety and egress from the Center Drive gate

Data source: WSDOT Olympic Region Traffic Operations Office.

Vanpool ridership increases to JBLM and helps manage demand on I-5

Vanpool program gaining popularity through JBLM corridor; fights congestion

One of the efforts to manage demand along the I-5 corridor targets those who commute to JBLM and encourages them to join or form vanpools. Vanpools reduce the number of vehicles on the roadway and the number of vehicle miles driven, thereby reducing congestion.

Prior to the severe congestion seen in the morning commutes of September 2010, there were already about 17 Intercity Transit vanpools serving the JBLM population. While this number held steady for the remainder of 2010, an upward trend began in 2011. With slight variations along the way, the number of vanpools increased throughout 2011, concluding the year with ten new vanpools (an increase of 59%).

The average number of total trips taken by Intercity Transit-vanpools in 2010 was 4,555 per month, with a maximum value of 5,250 in March and a minimum of 3,936 in December. The number of trips per month increased throughout 2011. The average number of trips per month in 2011 was 6,488, with a maximum of 8,248 in August (81% higher than the average for 2010) and a minimum in February of 4,270, which is just 6% below the average for 2010.

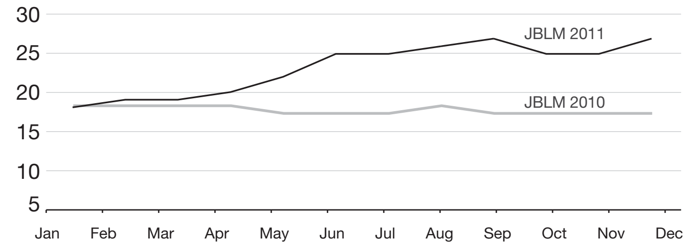
Intercity Transit's vanpool ridership for vanpools serving JBLM increased 42% in 2011 (77,856) compared to 2010 (54,658). Similarly, the passenger miles traveled increased 51% from 2010 to 2011.

This analysis represents Intercity Transit vanpool numbers only. This helps to understand the impact of vanpools on congestion reduction through the JBLM area. Other transit agencies in western Washington also provide vanpool opportunities that help with travel demand management in this corridor.

Intercity Transit in Thurston County purchased vans to assist with growing demand for vanpools through the I-5 JBLM corridor.

Number of vanpools operating by month

2010 - 2011; Vanpools serving Joint Base Lewis-McChord



Data source: Intercity Transit.

Vanpool performance metrics

2010-2011; Unlinked trip; Vanpools serving Joint Base Lewis-McChord

Metric	2010	2011	Percent change
Vanpool fleet	17	27	59%
Ridership	54,658	77,856	42%
Passenger miles traveled	1,180,089	1,777,229	51%

Data source: Intercity Transit.

Future steps to address congestion along the I-5 corridor near Joint Base Lewis-McChord

Moving Washington steps taken to address the congestion on the JBLM corridor so far have produced results. These strategies have given congestion relief in the interim. However, there is more work to do to avoid a reoccurrence of the Labor Day 2010 scenario. More projects are planned to address JBLM congestion relief on a long term basis, such as:

- Installing additional data stations, cameras, and ramp meters for both southbound and northbound: project advertisement is scheduled for June 2013.
- Completing interchange justification reports for the I-5 corridor between SR 510 and SR 512 to determine future needs.
- Realigning the Center Drive ramp is planned as part of the JBLM 2015 - 2017 biennium budget plan. This will improve safety and egress from the Center Drive gate.

Moving Washington
Operate Efficiently

Use of SR 167 high occupancy toll (HOT) lanes continues to increase

Operating efficiently means taking steps to smooth out traffic flow and avoid or reduce situations that constrict road capacity. Collisions account for at least 25% of traffic backups, so making roads safer will help ease congestion. Technology, such as driver information signs, enables WSDOT to react quickly to unforeseen traffic fluctuations. Among the tools that provide this efficiency are metered on-ramps, Incident Response teams, variable speed-limit systems, variable tolling, integrated traffic signals, and Active Traffic Management (ATM).

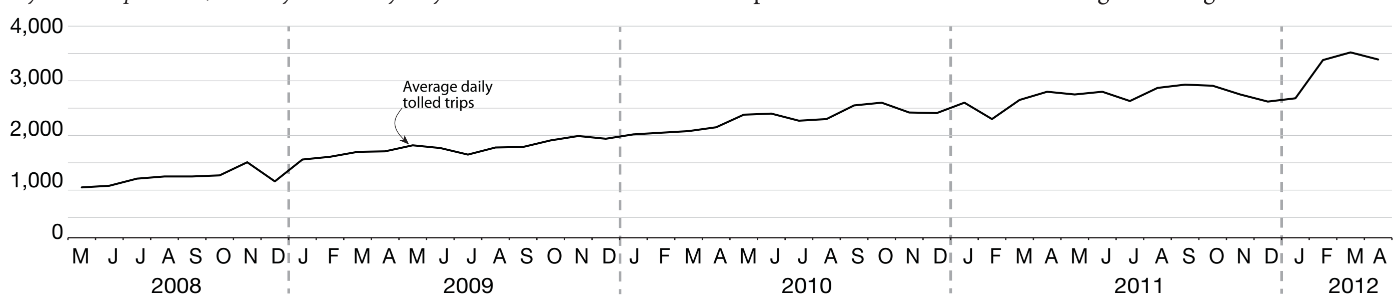
SR 167 high occupancy tolling (HOT) program

The first four years of the State Route 167 high occupancy toll (HOT) lanes have yielded significant results, both for the drivers who access the HOT lanes and for general purpose (GP) lane users. Drivers who opt to use the HOT lanes save time and reduce the stress associated with their daily commute, while also reducing the volume of traffic in the GP lanes. The result is traffic that moves more often at free-flow speeds and benefits all SR 167 users. HOT lanes are another example of how high occupancy vehicle (HOV) lanes can operate efficiently to relieve congestion in vital corridors.

HOT lanes result in faster travel times

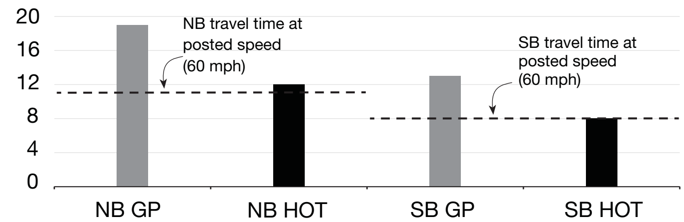
Between May 2011 and April 2012, the northbound HOT lane saved weekday drivers an average of seven minutes of travel time in the peak hour (7-8 a.m.). Average travel time in the HOT lane was 12 minutes compared to 19 minutes in the GP lanes. The average toll for single occupant vehicles to use the HOT lane was $2. The weekday southbound HOT lane saved drivers five minutes during the peak afternoon hour (4 p.m. - 5 p.m.), with average travel times of eight minutes in the HOT lane and 13 minutes in the GP lane.

SR 167 HOT lanes average number of daily tolled trips
May 2008 - April 2012; Tuesday - Thursday only



Data source: WSDOT Northwest Region Traffic Office.

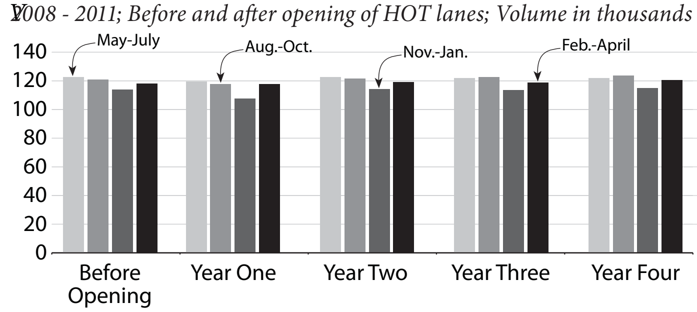
Comparing SR 167 HOT-and GP lane peak travel times
May 2011 - April 2012; Tuesday - Thursday only; Travel time in minutes



Data source: WSDOT Northwest Region Traffic Office.

Note: Dashed lines are travel times during non-peak periods when average speeds are 60 mph.

SR 167 average daily traffic volumes
2008 - 2011; Before and after opening of HOT lanes; Volume in thousands



Data source: WSDOT Northwest Region Traffic Office.

Note: Average daily volume is Tuesday through Thursdays; Mondays and Fridays are excluded due to inconsistent traffic volumes.

Daily volumes consistent with regional trends

During the fourth year of operations, the average combined daily traffic volumes of SR 167 increased 1% compared to the pre-opening volumes recorded in 2007.

HOT lane usage increases

The fourth year data continues to indicate the public understands the benefits of HOT lanes: the average daily number of tolled trips continues to rise. For example, in April 2012 the average tolled trips were 3,400 compared to 2,150 in 2010. Both gross and net revenues continue to climb. The annual net revenue during the fourth operating year was more than $100,000. The fourth annual report will be published soon at www.wsdot.wa.gov/Tolling/SR167HotLanes/.

SR 16 Tacoma Narrows Bridge, SR 520 Floating Bridge tolling see success

SR 16 Tacoma Narrows Bridge

The new Tacoma Narrows Bridge (TNB) opened to traffic on July 16, 2007, four weeks early and under budget. The new TNB is parallel to and south of the Narrows Bridge built in 1950. It carries four 11-foot-wide lanes of eastbound traffic toward Tacoma. The left lane is an HOV lane, the two center lanes are general purpose lanes open to all traffic, and the right lane is an "add/drop" lane that extends across the bridge to the Jackson Avenue exit.

The toll rates on the TNB vary by payment method and axle count; they do not vary by time of day and are not linked to congestion levels. The purpose of the toll on this facility is to repay the capital cost associated with the construction of the new bridge.

On the Tacoma Narrows Bridge, drivers have two options for paying their tolls: stop at the manual toll booths and pay with cash or credit card, or establish a Good To Go! electronic toll account and use the Good To Go! electronic toll lanes.

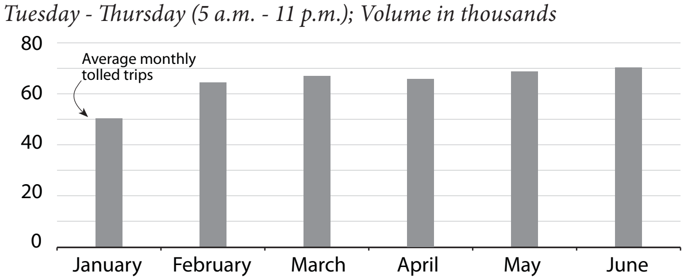
SR 520 Floating Bridge

The existing SR 520 floating bridge was opened to traffic in 1963, and since has become the most congested route in the Puget Sound area. The travel time analysis section of this report on p. 31 shows that the Maximum Throughput Travel Time Index (MT^3I) for the Bellevue to Seattle evening commute via SR 520 was the highest at 2.24 in 2011. The SR 520 Bridge Replacement program will improve safety and mobility by replacing the existing four-lane bridge with a six-lane structure including continuous HOV lanes in both directions.

Funding for the new bridge will come partly from collection of tolls on the existing SR 520 bridge that began on December 29, 2011, using an open road tolling system. This system eliminates congestion typically related to toll booths by collecting all tolls electronically. This allows drivers to maintain regular speeds while tolls are charged electronically using the *Good To Go!* pass. In the absence of a *Good To Go!* pass, tolls are mailed out based on the vehicle license plate.

Through the Urban Partnership Agreement, WSDOT has partnered with the Puget Sound Regional Council and King County to demonstrate strategies with proven effectiveness in reducing traffic congestion. The Urban Partnership Agreement calls for toll prices to vary by time of day, charging the highest rate at peak congestion times; allowing off-peak travelers to pay a lower rate which helps manage congestion by providing an incentive to drive during off-peak periods. There are also programs in place to expand bus services and commuter incentives (carpools and vanpools), as well as with local employers to encourage telecommuting and flexible schedules for employees. The replacement bridge will also ease congestion by providing an HOV lane in both directions.

SR 520 average number of monthly tolled trips in 2012
Tuesday - Thursday (5 a.m. - 11 p.m.); Volume in thousands



Data source: WSDOT Northwest Region Tolling Office.

Traffic continued to change during the first six months of tolling, but overall has stabilized (see the semi-annual travel time update in *Gray Notebook* 46 pp. 21-23). Tolled traffic is on target with forecasted volumes, and collected tolls are meeting the revenue expectations. Volumes on SR 520 have decreased by 38% since tolling began, whereas volumes on I-90 have increased by 10%.

The impacts of tolling SR 520 are felt on several nearby corridors as well. While congestion has not been eliminated from SR 520, reliability has increased along with higher average speed trips. There has also been a significant negative impact on I-90, with longer average commute trips and decreased reliability. This has led to an increased number of congested travel days. In contrast, the impact on SR 522 is minor, with travel time changes of less than two minutes during the peak travel periods.

Moving Washington
Operate Efficiently

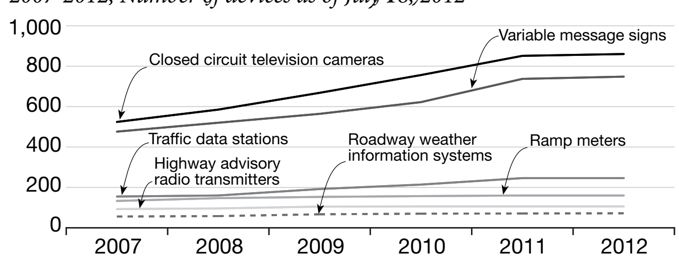
Intelligent Transportation Systems keep traffic flowing smoothly

WSDOT's Intelligent Transportation Systems

Intelligent Transportation Systems (ITS) are technological interventions WSDOT uses to increase safety and help traffic flow move smoothly on the highway. These systems can be as simple as a ramp meter, or as complex as Active Traffic Management (ATM) systems, which includes WSDOT's new Smarter Highways system. During the past five years, WSDOT has increased the number of ITS devices significantly. The graph below describes the agency's key elements in its ITS inventory between 2007 and 2012.

- ***Closed circuit television (CCTV)*** cameras increased 64% between 2007 (524) and 2012 (860). These provide live images that can be viewed by the traveling public either on the road or from one of WSDOT's Traveler Information web pages (www.wsdot.com/traffic/Cameras/default.aspx).
- ***Variable message signs (VMS)*** increased 59% between 2007 (155) and 2012 (246). These VMS boards are used to display short, dynamically created messages or speed limits that help provide information to the traveling public regarding traffic and roadway conditions.
- ***Traffic data stations*** increased 57% between 2007 (476) and 2012 (748). Data stations are embedded in travel lanes to collect various traffic related data that helps in generating a continuous data feed for all other intelligent devices.
- ***Ramp meters*** grew in number by 20% between 2007 (133) and 2012 (160). Ramp meters control the flow of traffic on congested highways, based on information provided by the data stations to monitor and control the traffic flow.
- ***Highway advisory radio transmitter (HART)*** have increased 29% between 2007 (56) and 2012 (72). This system utilizes specific radio frequencies to announce traffic information directly to the traveling public over vehicle radios.

WSDOT's Intelligent Transportation System inventory trends on major devices
2007-2012; Number of devices as of July 18, 2012



Data source: WSDOT Headquarters Traffic Office.

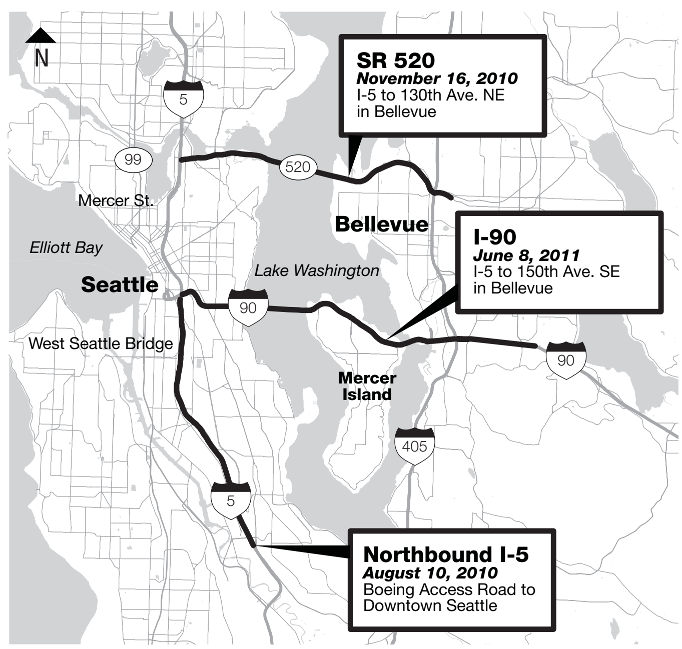
- ***Roadway weather information system (RWIS)*** devices have increased 14%, from 93 in 2007 to 106 in 2012. These are located across the state, some in areas that have been deemed to have microclimates such as the rain forest of the Olympic Mountains or the dry prairies of the Eastern region. The weather reports generated can be found on the Traveler Information weather page at www.wsdot.com/traffic/weather/default.aspx for each site as well as a report generated for the area. Plans are in the works to systematically upgrade RWIS weather stations.

Activating Smarter Highways in Washington

WSDOT activated the state's first Smarter Highways corridor on August 10, 2010. Two other corridors have been added in the last year. SR 520 was activated on November 16, 2010, and I-90 on June 8, 2011.

Although the available collision data is not statistically significant, preliminary data points to safety benefits in the I-5 corridor. The I-90 and SR 520 corridors have been impacted by travel changes due to tolling and construction, making it difficult to isolate the benefits of Active Traffic Management in those corridors.

Active Traffic Management projects near Seattle
Where are drivers seeing Smarter Highways?



Data source: WSDOT Tolling Division.

Incident Response provides $72 million in annual economic benefits

WSDOT's Incident Response (IR) program responded to 44,492 incidents in 2011, saving the citizens and businesses of Washington more than $72 million dollars they would have wasted in time and fuel lost caused by travel delay due to congestion (see table p. 71). The dedicated IR program budget for the 2011-2013 biennium is $9 million. The estimated annual benefit to cost ratio of the IR program is 16:1. The IR program teams operate during peak traffic and commute periods, and are also available 24/7 for call out.

The mission of the IR program is to safely and quickly clear traffic incidents to minimize congestion, restore traffic flow, and reduce the risk of secondary collisions. IR teams provide emergency response and assistance to motorists and the Washington State Patrol (WSP) at collisions and other traffic emergencies. In addition to providing emergency response for blocking and life safety incidents, IR teams report on abandoned vehicles and offer motorist assistance services including changing flat tires and providing a jump start. These services keep roadways clear, traffic moving, and reduce collisions caused by distracted driving.

How WSDOT's IR program works

The IR program is active in all six WSDOT regions and teams rove in urban areas where there is congestion. Statewide, WSDOT has about 47 full-time equivalent (FTE) jobs and operates 62 dedicated IR related vehicles. The FTE decimal number in the table below indicates that an IR responder works part time in a different role at WSDOT. IR trucks rove 493 centerline miles statewide during peak commute hours.

WSDOT Incident Response teams respond to 44,492 incidents in 2011

WSDOT IR teams responded to 44,492 incidents statewide during 2011. The annual number of incidents statewide increased by 1.6% in 2011 (44,492) compared to 2009 (43,786), but decreased 4% compared to the number of incidents in 2010 (46,370).

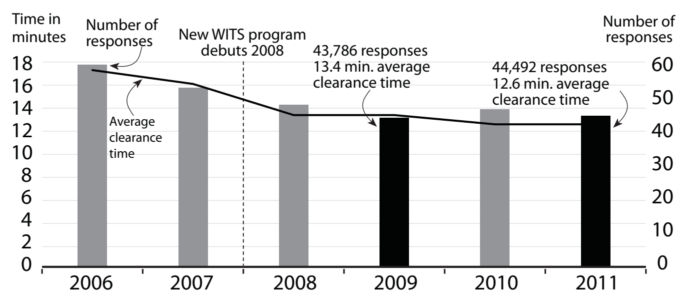
The statewide average annual clearance time for incidents in 2011 (12.6 minutes) improved by 6.0% compared to 2009 (13.4 minutes) and remained the same compared to 2010 (12.6 minutes).

Facts and figures: WSDOT IR program
As of December 31, 2011

WSDOT region	# of IR trucks	# of FTEs
Eastern Region	3	2.0
North Central Region	1	0.8
Northwest Region	43	31.0
Olympic Region	9	7.2
South Central Region	1	0.5
Southwest Region	4	4.4
Headquarters	1	1.0
Statewide	**62**	**46.9**

Data source: WSDOT Traffic Office.

Number of responses and overall clearance time
2006 – 2011; Clearance time in minutes; Responses in thousands



Data source: Washington Incident Tracking System (WITS), WSDOT Traffic Office.

Note: In Q1 2008, WSDOT's IR program moved to a new database system and began calculating average clearance time in a different way. This accounts for the apparent decrease in the average clearance time value.

Incident Response performance measures
As defined by the FHWA Incident Management Handbook

Performance measures	Definition	Measuring unit
Roadway clearance time	The time between the first recordable awareness of an incident (detection, notification, or verification) by a responding agency and first confirmation that all lanes are available for traffic flow.	Time in minutes
Incident clearance time	The time between the first recordable awareness of the incident and the time at which the last responder has left the scene.	Time in minutes
Secondary incidents	These incidents are identified as the number of unplanned incidents beginning with the time of detection of the primary incident where a collision occurs either a) within the incident scene or b) within the queue, including the opposite direction, resulting from the original incident.	Number of incidents

Data source: FHWA Traffic Incident Management Handbook

Note: The number of secondary incidents avoided as a result of the IR team's presence is a nationally recommended performance measure. Neither WSDOT nor the State Patrol currently collect this data. With *Gray Notebook* 46 (p. 26) and the 2012 *Congestion Report* (p. 72), WSDOT is estimating secondary incidents and associated benefits.

Getting a clear picture of incident clearance times by WSDOT region

Incident clearance times by WSDOT region and notification type
January 1 – December 31, 2011; Number of incidents; Clearance time in minutes

	Roved upon		Dispatched		Called out		Total by region		
WSDOT Region	Incidents	Clearance time	Incidents	Clearance time	Incidents	Clearance time	Incidents	Clearance time	Percent of total statewide incident
Eastern Region	2,333	6.2	1,236	25.9	5	117.8	3,574	13.2	8.0%
North Central Region	103	22.6	41	71.0	–	–	144	36.4	0.3%
Northwest Region	20,814	6.8	8,381	22.7	90	200.1	29,285	12.0	65.8%
Olympic Region	5,279	9.5	1,052	37.4	42	223.5	6,373	15.5	14.3%
South Central Region	922	10.2	210	41.3	–	–	1,132	15.9	2.6%
Southwest Region	3,057	4.6	813	21.8	114	87.9	3,984	10.5	9.0%
Statewide	**32,508**	**7.2**	**11,733**	**24.8**	**251**	**151.4**	**44,492**	**12.6**	**100.0%**

Data source: WSDOT Traffic Office, WITS.

Incident response by WSDOT region

The Puget Sound region is Washington's most populous area, with more traffic activity than other parts of the state. Of the 44,492 incidents responded to in 2011, the Northwest Region (the program's largest region, covering the northern and central Puget Sound area) responded to 29,285 incidents (66%). Olympic Region (Tumwater – Joint Base Lewis-McChord area) responded to 6,373 incidents (14%). Southwest Region (Vancouver) and Eastern Region (Spokane) responded to 3,984 (9%) incidents and 3,574 (8%) incidents respectively. South Central Region (Yakima) attended 1,132 incidents (3%), and North Central Region (Wenatchee) responded to 144 incidents (less than 1%).

Incident clearance times by notification strategy

During 2011, 73% of the total incidents were "roved upon," 26% were "dispatched," and less than 1% were "called out." The table above presents the incidents that were responded to by IR personnel by region and by notification type. Roving during the busy commute hours helps to address non-recurring congestion by clearing incidents as they happen, hence the comparatively lower average clearance times. Deploying IR crews on the most congested roads help reduce overall delays, thereby reducing distracted driving and the likelihood of secondary collisions.

How are IR teams notified of an incident?

IR teams are notified of an incident in three ways: "roving," "dispatch," and "call out." The IR program has teams that are scheduled to work roving the urban commute corridors during the morning and afternoon peak travel periods. The teams are dispatched by either Washington State Patrol (WSP) 911 communication centers, the WSDOT Traffic Management Centers (TMC), who use CCTV and other tools to locate incidents, or from other WSDOT work crews. IR teams are available 24/7 for after hours call out if needed.

Traffic incidents are major contributors to non-recurring congestion

Blocking incidents hinder the flow of traffic, reducing roadway capacity and vehicle throughput. As long as travel lanes are open, the risk of non-recurring congestion and secondary collisions is greatly reduced. Even incidents that are not in travel lanes but on the shoulder can contribute to congestion, as drivers slow down out of caution or curiosity. It is important to make the distinction between blocking and non-blocking incidents, which are tracked by the IR program regionally and statewide so that resources are made available to strategically handle incident response.

Of all incidents statewide in 2011, 22% (9,668 incidents) blocked traffic, while 78% (34,824 incidents) did not block traffic. The table below shows the percent of blocking and non-blocking incidents by region.

WSDOT classifies incidents based on the duration for clearance times: less than 15 minutes, 15-90 minutes, and longer than 90 minutes. The table on p. 71 shows how many blocking and non-blocking incidents occurred within each of the three categories and the associated societal costs.

Blocking/non-blocking incidents by WSDOT region
January 1 – December 31, 2011

Region Name	Blocking (%)	Non-blocking (%)
Eastern Region	832 (23%)	2,742 (77%)
North Central Region	96 (67%)	48 (33%)
Northwest Region	7,050 (24%)	22,235 (76%)
Olympic Region	645 (10%)	5,728 (90%)
South Central Region	408 (36%)	724 (64%)
Southwest Region	637 (16%)	3,347 (84%)
Statewide	**9,668 (22%)**	**34,824 (78%)**

Data source: WSDOT Traffic Office, WITS.

Incident response reduces societal costs

Blocking and non-blocking average clearance times by incident duration

2011; Time in minutes; Cost and economic benefits in dollars

Incident type	Number of incidents	Average IR response time	Average *roadway* clearance time	Average *incident* clearance time	Incident-induced delay costs[1]	Economic benefits from the IR program
Incident duration less than 15 minutes						
Blocking	5,104	2.7	5.3	7.2	$12,601,125	$3,150,281
Non-blocking	28,952	0.5	–	5.2	$36,564,620	$9,141,155
<15 Total	34,056	0.8	5.3	5.5	$49,165,745	$12,291,436
Incident duration ranging between 15 and 90 minutes						
Blocking	4,204	9.1	25.3	32.3	$46,824,090	$11,706,023
Non-blocking	5,770	7.1	–	26.9	$37,824,880	$9,456,220
>=15-<90 Total	9,974	8.0	25.3	29.1	$84,648,970	$21,162,243
Incident duration greater than 90 minutes						
Blocking	360	24.2	183.9	193.5	$24,034,770	$6,008,693
Non-blocking	102	29.8	–	148.8	$3,704,164	$926,041
>=90 Total	462	25.4	183.9	183.7	$27,738,934	$6,934,734
Grand Total	**44,492**	**2.7**	**20.7**	**12.6**	**$161,553,649**	**$40,338,412**

Data source: Washington Incident Tracking System (WITS), Washington State Patrol, WSDOT Traffic Office, and University of Washington.

Notes: The total number of incidents statewide is 44,492. Of these, 1,904 incidents are "unable to locate" (UTL) incidents: IR personnel were en route to respond, but the incident cleared before the team reached it. The average times in the table above do not include UTL incidents. 1 The incident induced costs can not be reproduced using the average clearance times as actual incident clearance times were used for the computation.

The cost of incident induced delay can be significant

During peak commute periods, roving IR teams are able to clear blocking incidents soon after they occur. This keeps people and business moving by operating the state highway system efficiently, and in turn provides considerable economic benefits. Statistics show that the WSDOT Incident Response program cost is about $50 per hour of operation which includes the cost of labor and equipment.

On average, an incident that does not involve a lane closure results in about 576 vehicle-minutes of delay per minute that the incident is present. If the same incident closes a lane, the effect of that lane closure results in 814 vehicle-minutes of delay per minute of closure. When converted to dollars, an average incident with no lane closure costs $244 per minute of incident; an incident with lane closure costs $345 per minute of lane closure. These are averaged numbers that can significantly underestimate delay in heavier volume conditions and significantly overestimate delay in lower volume conditions. These numbers are based on the Incident Response Phase 3 research conducted by the Washington State Transportation Center (TRAC) at the University of Washington. The complete research report can be found on the WSDOT website at www.wsdot.wa.gov/Research/Reports/700/761.1.htm.

During 2011, WSDOT responded to 44,492 incidents, of which 9,668 incidents were blocking and 34,824 incidents were non-blocking. The cost of delay for the 9,668 blocking incidents at $345 per minute of lane closure is about $83.5 million. The cost of delay for 34,824 non-blocking incidents at $244 per minute of incident is $78 million. The cost of delay incurred in the three duration categories was about $49.2 million for incidents lasting less than 15 minutes; $84.6 million for incidents lasting 15-90 minutes; and $27.7 million for over-90-minute incidents. The total incident-induced delay cost is $161.6 million.

Percentage of capacity reduction by lane closure

Location of closure; Number of lanes in each direction

Incident location	Two-lane road	Three-lane road	Four-lane road
Shoulder	25%	16%	11%
Blocking one lane	68%	47%	44%
Blocking two lanes	100%	78%	66%

Data source: WSDOT Research Report WA-RD 761.1.

Moving Washington
Operate Efficiently

Estimating the societal costs associated with secondary crashes; Fatality incidents and over-90-minute incidents

Estimated annual IR benefits from avoiding “secondary crashes”

Secondary crashes are identified as the number of incidents that occur after a primary incident either a) within the primary incident scene or b) within the queue, including the opposite direction of travel, and resulting from the primary incident.

Based on national case studies produced by FHWA, WSDOT estimates that in 2011 the IR program provided $32 million in economic benefits by preventing the prime conditions in which secondary incidents occur.

Methodology

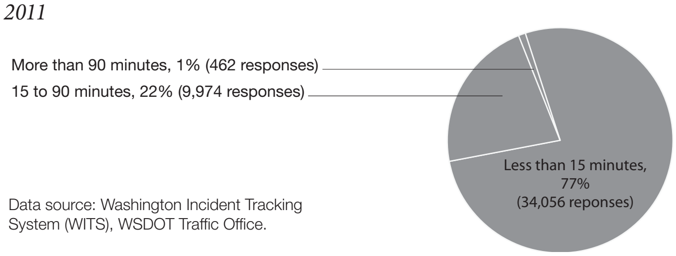
FHWA states that on average there are 20% or more secondary crashes occurring on the system due to primary incidents. WSDOT Incident Response phase 3 research conducted by the Washington State Transportation Center (TRAC) at the University of Washington found on average it costs $286 per minute of crash scene duration. The complete research report can be found on the WSDOT website at www.wsdot.wa.gov/Research/Reports/700/761.1.htm.

Based on these findings, the annual estimate of economic benefits from avoiding secondary crashes due to the proactive work of Incident Response teams is calculated as = (estimated secondary crashes)*(average incident duration in minutes)*(cost per minute of crash scene duration) = (44,492 *0.2)*12.6*$286 = $32 million

Incident Response teams clear 77% of all incidents in less than 15 minutes

In 2011, the WSDOT IR teams responded to 44,492 incidents statewide. The incident data are grouped into three categories based on the duration of incident, as shown below. The over-90-minute incidents category made up 1% of all incidents in 2011.

Number and percentage by incident duration
2011

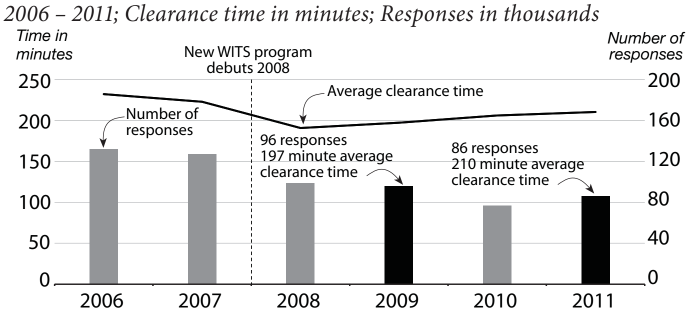


Data source: Washington Incident Tracking System (WITS), WSDOT Traffic Office.

Incident Response crews assisted with 86 fatality incidents

In 2011, IR teams responded to 86 incidents in which a fatality was one of several factors contributing to a longer clearance time. Eighty-one of these were over-90-minute incidents. Seventy-nine of these 86 incidents were blocking incidents while the remaining seven were non-blocking incidents. The average clearance time for the 86 fatality incidents was recorded at 210 minutes. Clearance times depend on the complexity of the incidents and the number and types of emergency responders required at the scene.

Number of responses and average clearance time for fatality collisions
2006 – 2011; Clearance time in minutes; Responses in thousands



Data source: Washington Incident Tracking System (WITS), WSDOT Traffic Office.

Note: In Q1 2008, WSDOT’s Incident Response program moved to a new database system and began calculating average clearance time in a different way. This accounts for the apparent decrease in the average clearance time value.

WSP and WSDOT target reductions in duration of over-90-minute incidents

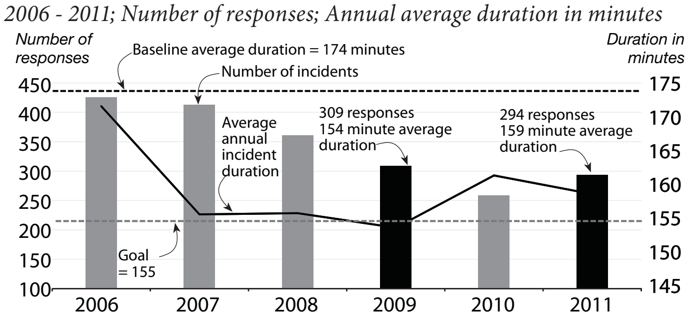
WSDOT and WSP have a formal agreement in the Joint Operations Policy Statement (JOPS) to clear incidents in 90 minutes or less, if possible, although incidents with complicating factors may require more time to clear. Through her Government Management, Accountability, and Performance (GMAP) program, Governor Gregoire has charged the two agencies with lowering the average duration of over-90-minute incidents to a 155-minute goal on nine key GMAP highway corridors in the state.

In GMAP corridors, there were 294 over-90-minute incidents in 2011, with an annualized average clearance time of 159 minutes. This is four minutes slower than the Governor’s 155-minute goal established and five minutes slower than 2009, when IR crews responded to 309 over-90-minute incidents with an annualized average clearance time of 154 minutes.

The Major Incident Tow program pulls heavy loads off highways

Progress toward the goal for reducing average clearance times for over-90-minute incidents on the nine key western Washington highway segments

2006 - 2011; Number of responses; Annual average duration in minutes



Data source: Washington State Patrol and WSDOT Traffic Office.

Note: Baseline average duration is 174 minutes based on four quarters of data: Q3 and Q4 of 2005, Q1 and Q2 of 2006. GMAP over-90-minute incident clearance goal is 155 minutes.

What is the Major Incident Tow (MIT) program?

Heavy trucks are involved in about 5% of all collisions, yet they comprise a disproportionate 25% to 30% of collisions that take longer than 90 minutes to clear – generally due to their physical size and their capacity to carry heavy and diverse loads. Trucks carry every type of cargo imaginable, from groceries to toxic chemicals – the latter especially can create environmental and public safety risks if the containers are breached or the load is spilled in a collision or rollover. These incidents can cause prolonged highway closures that lead to congestion, secondary incidents, and economic loss. Clearing them often requires specialized recovery equipment that is not always readily available.

To reduce the cost and damages to the highway system from these major incidents, immediate and significant response is required to restore the highway system's capacity, operation and function. Non-recurring congestion and secondary incidents constitute a major loss to the highway system and the traveling public. Within this context, it is the policy of WSDOT, WSP, and heavy-tow-truck contractors to respond to these incidents and return the highway system to its original operating condition as quickly as possible.

Major Incident Tow (MIT) is a legislatively mandated program, instituted to improve the incident clearance times when a heavy vehicle is involved in a blocking incident. This program provides incentive pay for authorized tow companies to clear the incident within 90-minutes upon receiving a notice-to-proceed instruction from the scene commander. Since the beginning of the MIT program in June 2007, the total amount of money spent for 84 MIT activations is approximately $197,500.

Customer service is an integral part of IR

IR teams provide important motorist assistance services to the traveling public, but also offer reassurance to motorists who may be alarmed or upset by their situation. Conditions on routes where there are narrow or no shoulders make even changing a flat tire hazardous. The IR team's primary concern is the safety of all parties involved. Upon arrival, the IR technicians will ask about the problem and, if needed, offer assistance to ensure their safety.

“

Incident Response: What customers said in 2011...

- *Just don't cut this service from the state's budget. It was so wonderful to get this assistance in putting on our spare tire on I-5 among high traffic. Craig was a great help.*
- *Perfect service today - made our trip safe - prevented accident.*
- *Change your name to Highway Angels!*
- *Very helpful. Very safe. Very professional. A true God sent to this stranded motorist.*
- *Kathy was a life saver. Thanks Kathy and the Incident Response Team.*
- *The service was excellent. So very helpful!! Kim was defi - nitely my hero that day!*
- *Thank God. I finally got something for my tax dollar! Great service.*
- *Thank you Mike! Very friendly & made me and my 3 year old daughter feel safe!!!*
- *The service was wonderful and entirely unexpected. I would love to donate to the program.*
- *Sincere thanks to Pat who helped the eldest daughter of a dying dad get to the airport on time to say good-bye before it was too late.*

WSDOT welcomes feedback from travelers who have been helped by its Incident Response teams. Customers can use the pre-addressed business reply post cards provided by IR teams, email HQCustomerService@wsdot.wa.gov, or WSDOT's on-line survey at wsdot.wa.gov/Operations/Incident Response/surveylink.htm. The comments above were selected from all customer comments received between January 1 and December 31, 2011.

”

Moving Washington
Manage Demand

Manage demand: WSDOT's tools make best use of highway capacity

WSDOT uses several strategies to manage the demand for capacity on state highways, such as encouraging travelers to use higher occupancy modes of transportation and to shift some travel to non-peak hours. These strategies also support other important WSDOT goals, including reducing greenhouse gas emissions and energy consumption. WSDOT builds on a foundation of strong partnerships throughout the region to successfully reduce the demand for vehicle travel throughout the state.

Alaskan Way Viaduct construction traffic mitigation keeps traffic moving

WSDOT is investing more than $125 million to help keep people and goods moving during construction of the Holgate to King Street portion of the Alaskan Way Viaduct (AWV) and Seawall Replacement Project. WSDOT traffic analysis indicated that to keep traffic moving 11,130 daily peak period round trips would need to be reduced from the SR 99 corridor, which is up to 35% of the traffic carried on SR 99 during the combined AM and PM peak commute periods. The needed reduction includes diversions to other routes, shifts to higher efficiency modes, and elimination of trips.

Known as the "Moving Forward Initial Transit Enhancements and Other Improvements" project, this suite of projects includes:

- Supporting the operations of alternate routes with the South Spokane Street widening, SR 519 improvements, I-5 Active Traffic Management, and electronic travel times signs.
- Supporting shifts to higher efficiency modes or elimination of trips with enhanced bus and water taxi transit services and transportation demand management (TDM) projects.

These strategies build upon foundational transportation systems and services, including I-5, local roadways, local transit service, Intelligent Transportation System (ITS) infrastructure, vanpools, commute trip reduction, etc.

By the end of 2011, WSDOT and its partners had completed the improvements to SR 519 and the ITS (including the new electronic travel time signs and Active Traffic Management on I-5), and travel demand management efforts were under way.

Managing demand through the Alaskan Way corridor

Throughout 2011 King County Metro and WSDOT worked aggressively to encourage drivers to find other ways to travel rather than driving alone during construction of the Alaskan Way Viaduct. Construction impacts included a reduction from three to two lanes in each direction of the viaduct south of South King Street starting in May 2011. In fall 2011, an advisory speed limit of 25 mph was instated and will remain throughout the construction period.

In fall 2011, bus ridership was up approximately 17% in areas where WSDOT funded bus service, compared to a 3% increase in system wide ridership through other routes not funded by WSDOT. In total by the end of 2011, the transit and TDM strategies reduced approximately 5,500 daily round trips in the SR 99 corridor. The overall number of reduced trips on the corridor exceeds 5,500 trips due to diversion to other routes, commuters working compressed workweeks, etc. State-supported transit service and TDM projects are slated to continue through 2014.

All construction activities are also supported by ongoing WSDOT and local jurisdiction programs including transit services, vanpooling, park and rides, commute trip reduction, growth and transportation efficiency centers, tolling, and communications. Over the course of the AWV project, WSDOT will continue to monitor and report on the results of these investments. Other projects currently under way, include:

- Funding King County Metro transit services to maintain transit service reliability during construction.
- Funding 30 peak period weekday bus trips in the construction corridor and water taxi service from West Seattle to downtown Seattle past the AWV construction zone.
- Targeting outreach to employment centers and residential areas affected by the construction.
- Offering carpool and vanpool incentives and promotions, and incentives to employers to provide employee transit passes.

Employer access to labor by transit

Adie Tomer at the Metropolitan Policy Program at Brookings

The suburbanization of jobs obstructs transit's ability to connect workers to opportunity and jobs to local labor pools. As metro leaders continue to grapple with limited financial resources, it is critical for transit investment decisions to simultaneously address suburban coverage gaps as well as disconnected neighborhoods. Those decisions should be made in concert with actors from other public agencies and the private sector.

Over three-quarters of all jobs in the 100 largest metropolitan areas are in neighborhoods with transit service. Western metro areas like Los Angeles and Seattle exhibit the highest coverage rates ... city jobs across every metro area and industry category have better access to transit than their suburban counterparts.

Moving Washington
Add Capacity Strategically

Capacity expansion: I-5 Blakeslee Junction to Grand Mound and Grand Mound to Maytown reduce Thurston, Lewis County congestion

As the state continues to grow, developing additional traffic capacity becomes necessary. To get the most from limited resources, WSDOT plans projects wisely by targeting the worst traffic-flow chokepoints and bottlenecks in the highway system. The following project examples show that this strategy is working to ease congestion.

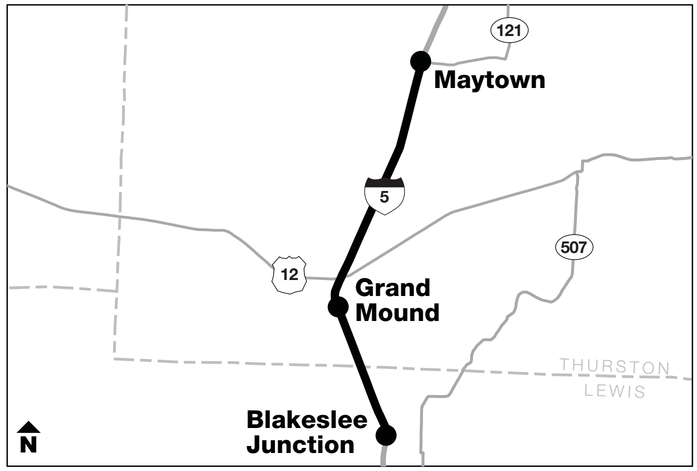
I-5 Blakeslee to Maytown capacity improvements

I-5 is the most significant freight freeway on the West Coast. It is critical to the regional, state, and national economy by linking markets in Canada, the United States, and Mexico. Throughout most of Washington state, I-5 is three to four lanes in each direction. However, a 40-mile section from the Toutle River Safety Rest Area in Cowlitz County to the Maytown interchange in Thurston County was only two lanes in each direction, and frequently experienced weekend and incident related congestion.

During 2008 and 2011, WSDOT widened the two-lane cross-section northbound and southbound to a three-lane cross-section with a median barrier. The two construction projects totaled 16 miles of improvements. One project was between Blakeslee Junction and Grand Mound (MP 83.5 - 88) and the other was between Grand Mound and Maytown (MP 88 - 95). This study summarizes the combined mobility benefit gained from these two I-5 projects.

Construction on I-5 Blakeslee Junction to Grand Mound and Grand Mound to Maytown widening projects.

I-5 Blakeslee Junction to Grand Mound map



Performance criteria defined

Besides daily freight and commute traffic, this segment of I-5 carries a moderate volume of recreational users (tourists, campers, RVers, etc). The study looked to identify the mobility benefits for commute traffic as well as recreational users. Therefore, average speed and volumes were analyzed during the Memorial Day holiday weekend and during non-holiday average weekdays.

Travel times and average speeds are influenced by the volume of traffic. For this study, a permanent traffic recorder located at I-5 MP 85.58 collected volume data.

Lane-specific speed and volume data were collected from the permanent traffic recorder for the study period of January 2008 (before) and March 2012 (after).

Mobility benefits

Higher and lower weekday average speeds observed

In order to assess mobility improvements, WSDOT compared the weekday average speeds by lane before and after the addition of the third lane. The posted speed limit is 70 mph. Before the addition of the third lane, the speed in the left-hand "passing lane" averaged approximately 70 mph. The right-hand lane showed a slower average speed of 64 mph, which is expected due to the merging traffic typical of the right-hand lane.

After construction of the third lane, the average weekday speed in the left-hand passing lane increased by about two miles per hour (to 72 mph), the middle lane had an average speed of 67 mph (this lane carried the greatest percentage of traffic volume), and the right-hand lane operated at an average speed of about 63 mph, one mph slower than in the before conditions. Northbound and southbound average speeds were the same for equivalent lanes.

Moving Washington
Add Capacity Strategically

Projects provide reprieve from weekend traffic jams

Because the traffic congestion on this route was more typically concentrated on weekends, the minimal changes in weekday average speeds were to be expected. Further analysis of the weekend traffic patterns uncovered additional mobility benefits of the project.

Project eliminates congestion on holiday weekends

Traffic is generally heavier on weekends than on typical weekdays on this stretch of I-5. Consequently, the area experienced heavy congestion during major holiday weekends, such as Memorial Day, when the traffic volume further increased. For example, on Friday and Saturday before Memorial Day, southbound traffic was normally heavy. On Memorial Day (Monday), traffic was heavy again from the return trips northbound. In order to assess the changes to holiday traffic, WSDOT collected hourly volume and speed data during the Memorial Day weekend before (2008) and after (2012) construction. Two charts at right show average hourly speed by direction for each day of the Memorial Day weekend, before and after construction of the third lane.

There was no traffic congestion for the southbound direction for the Memorial Day weekend either before or after construction. Following construction of the third lane, average speed increased from 63 mph to 70 mph.

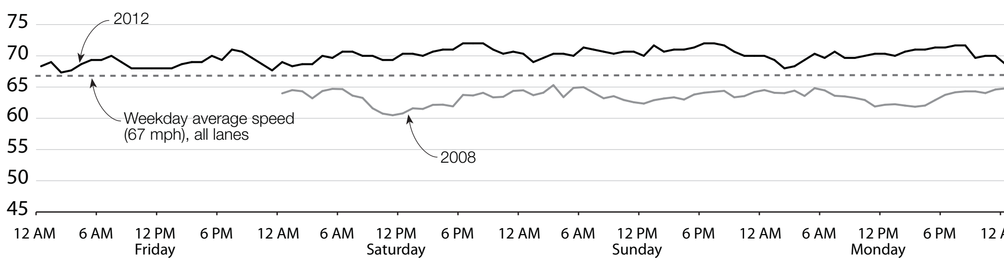
The afternoon traffic (return trips) northbound on Memorial Day showed a significant slowdown before construction, and the average speed was slower than the weekday average speed due to the larger volumes of traffic (64 mph compared to 67 mph on an average weekday).

After construction, there was no congestion and average speed increased to 69 mph, exceeding the average weekday speed. The total holiday weekend volume for northbound and southbound did not change significantly from before to after construction.

New lane added on the I-5 Blakeslee Junction to Grand Mound and Grand Mound to Maytown widening projects.

Memorial Day weekend: Southbound hourly average speed near Grand Mound

Before (May 23-26, 2008) and after (May 25-28, 2012) construction

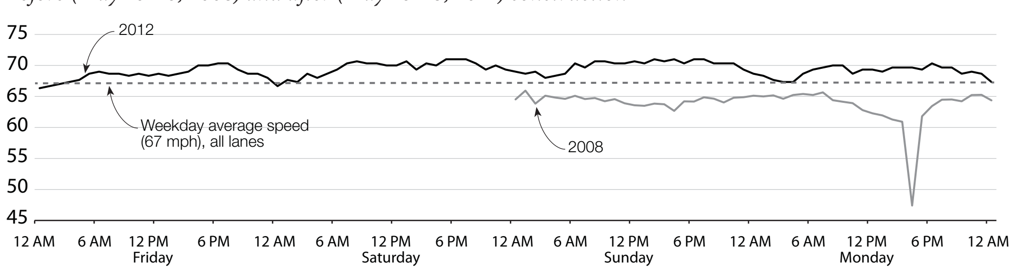


Data source: WSDOT Statewide Travel and Collision Data Office (STCDO).

Notes: 2008 data represents the speed averaged in Lane 1 and Lane 2; the 2012 data represents the speed average in Lane 1, Lane 2, and the new Lane 3. Data was not available for Friday, May 23, 2008.

Memorial Day weekend: Northbound hourly average speed near Grand Mound

Before (May 23-26, 2008) and after (May 25-28, 2012) construction



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

Notes: 2008 data represents the speed average of Lane 1 and Lane 2; the 2012 data represents the speed average of Lane 1, Lane 2, and the new Lane 3. Data was not available for Friday or Saturday, May 23-24, 2008.

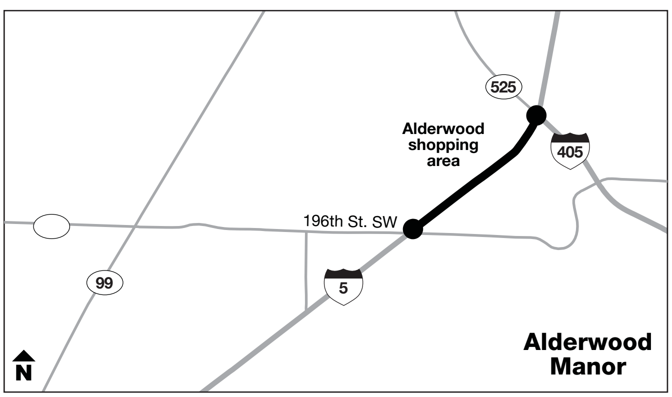
Overall the project resulted in increased capacity and average speeds for commuters and recreational users alike. These improvements also present benefits for freight mobility.

I-5 – 196th Street southbound braided ramps (Lynnwood) reduce backups

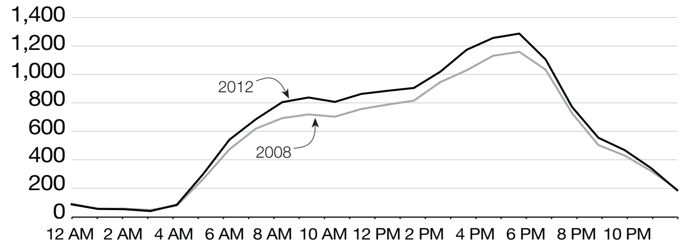
This project constructed new on- and off-ramps on southbound I-5 in Lynnwood. The new on-ramps from SR 525 and I-405 are elevated over a new off-ramp to 196th Street SW. From above, this ramp configuration resembles a braid. The new ramps separate traffic merging from I-405 and SR 525 to southbound I-5 from traffic exiting southbound I-5 to 196th Street SW. These improvements help reduce congestion by eliminating lane-weaving and reduce the risk of rear-end and sideswipe collisions.

The braided ramps opened to traffic in September 2011. However, dry weather is needed for repaving the stretch of I-5 near the I-405 interchange. WSDOT expects to complete this work in the summer of 2012. The map below shows the project location.

I-5 southbound at 196th Street braided ramp location



Average daily ramp volume on I-405 to southbound I-5
Weekday data for January - December 2008 and January - June 2012
Volume in vehicles per hour



Data source: WSDOT Northwest Region Traffic Office.

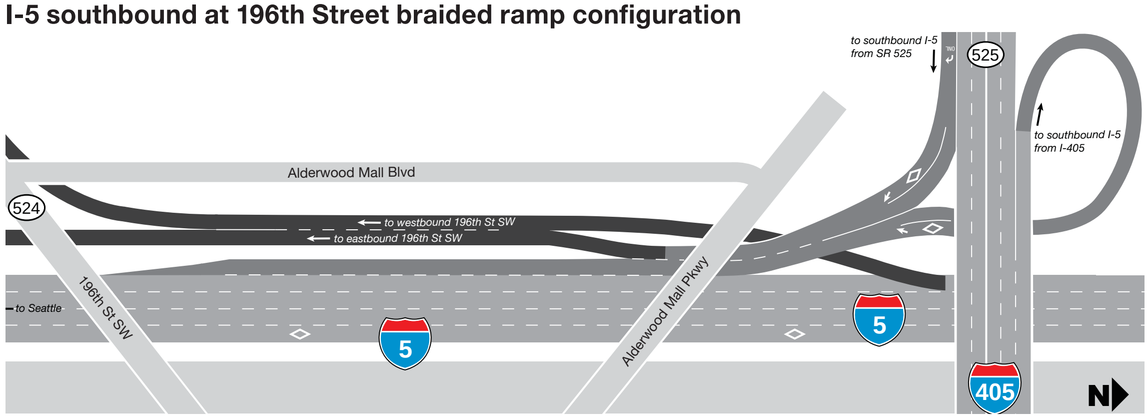
Southbound I-5 traffic will travel through the tunnel to exit to 196th Street SW. Traffic from I-405 and SR 525 will travel over the tunnel to enter southbound I-5 or exit to 196th Street SW.

Braided ramp to SB I-5 improves daily volume by 11%

Before the project, busy residential and retail traffic exiting at 196th Street SW caused severe backups onto southbound I-5 as fast mainline traffic mixed with slow moving traffic exiting to the 196th Street interchange. These traffic flow problems led to rear-end and sideswipe collisions. With the braided ramp configuration, southbound I-5 drivers exiting to 196th Street SW are separated from traffic entering southbound I-5 from SR 525 and I-405, therefore eliminating lane-weaving. The regular backups onto southbound I-5 are also eliminated.

The average daily volume for the I-405 ramp to southbound I-5 has increased from 13,550 before the project in 2008 to 15,100 vehicles after the project in 2012. During the evening peak hour, volume increased by 120 to 150 vehicles per hour and the average speed for the ramp increased from 33 mph to 39 mph.

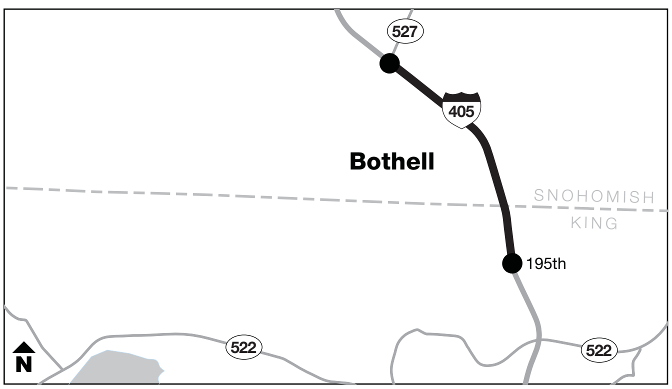
I-5 southbound at 196th Street braided ramp configuration



I-405 – NE 195th Street to SR 527 consistent auxiliary lane keeps traffic moving

Through funding made possible by the 2009 American Recovery and Reinvestment Act (ARRA), WSDOT opened a new, 1.8-mile auxiliary lane on northbound I-405 in Bothell between NE 195th Street and SR 527 on June 17, 2010. The new lane opened two full years ahead of schedule – alleviating a major bottleneck on this heavily traveled corridor. The map below shows the project area.

I-405 from NE 195th Street to SR 527



I-405 NB auxiliary lane helps relieve congestion

Traffic backups resulting from the bottleneck at NE 195th Street on-ramp contributed to an average of three hours of congestion in the northbound direction of I-405 between NE 195th Street and SR 527. Comparing the speed data from average weekdays in July and August in 2009 to 2010, the newly constructed auxiliary lane has greatly improved the northbound congestion situation between NE 195th Street and SR 527. The graphs on this page show volume and travel time data for the average weekdays in July and August in 2009 (pre-construction) and 2010 (after the northbound auxiliary lane was completed). The July 4th holiday was removed from the data set for both 2009 and 2010.

Average daily volume on I-405 northbound, south of SR 527

Weekday average for July - August 2009 and 2010; Volume in thousands of vehicles per hour

Data source: WSDOT Northwest Region Traffic Office.

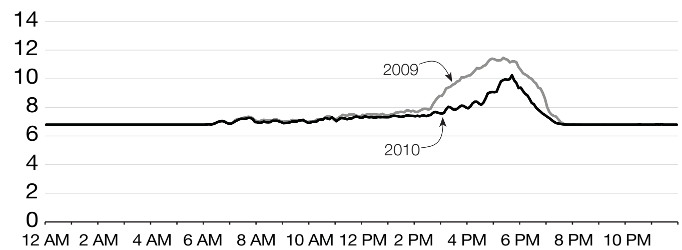
Auxiliary lane contributes to improved travel time and throughput while reducing the congestion duration

Before the project was under construction, total volume on I-405 northbound just south of SR 527 reached 5,000 vehicles per hour (vph) during the afternoon peak. After the new auxiliary lane was opened, total volume reached an hourly average of 5,500 vph, an increase of 10%.

In 2009, the two general purpose (GP) lanes reached a peak of 4,000 vph before breaking down and averaging about 3,800 vph for the rest of the peak period. In 2010, the three GP lanes reached a peak of more than 4,500 vph. The graph below shows the average travel time between NE 160th Street in Bothell and I-5 in Lynnwood during the same time periods in 2009 and 2010.

Average daily travel time on I-405 northbound, NE 160th Street to I-5 (6.8 miles)

Weekday average for 2009 and 2010; Travel time in minutes



Data source: WSDOT Northwest Region Traffic Office.

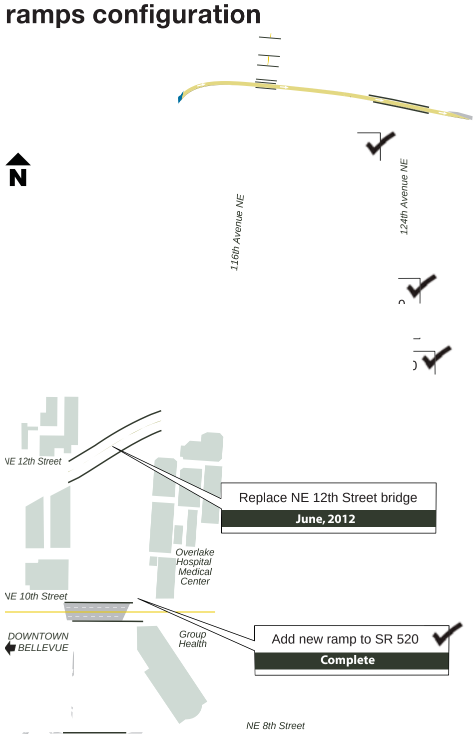
The peak hour travel time through this 6.8-mile stretch was 11.3 minutes in 2009 and 9.7 minutes in 2010. This is an improvement of about 14%. An even more significant improvement can be seen in the afternoon peak period with regard to the time frame during which there were long travel times. The duration of congestion declined from three hours 40 minutes in 2009 to one hour in 2010, an improvement of about 73%.

The northbound auxiliary lane on I-405 between NE 195th Street and SR 527 has reduced congestion in this section of I-405 and helped to improve travel time and throughput during the afternoon peak.

I-405 – NE 8th Street to SR 520 braided ramps – Interchange improvements

This project improved efficiency and safety by adding ramps to SR 520 and I-405 and constructing grade separated ramps on I-405. These ramps, referred to as braids, separate northbound I-405 traffic exiting to SR 520 from traffic entering I-405 northbound at NE 8th Street. On SR 520, the project includes a new on-ramp east of 124th Avenue NE, providing a bypass for drivers merging onto eastbound SR 520 from northbound I-405. This eliminates the previously existing weave on eastbound SR 520 between I-405 and 124th Avenue NE. The project also added a northbound on-ramp from NE 10th Street to SR 520.

I-405 NE 8th Street to SR 520 braided ramps configuration



By eliminating the northbound I-405 mainline weave and providing an additional on-ramp for northbound I-405/NE 10th Street to SR 520, congestion is alleviated and safety is improved. This project began in winter 2009 and was completed in May 2012.

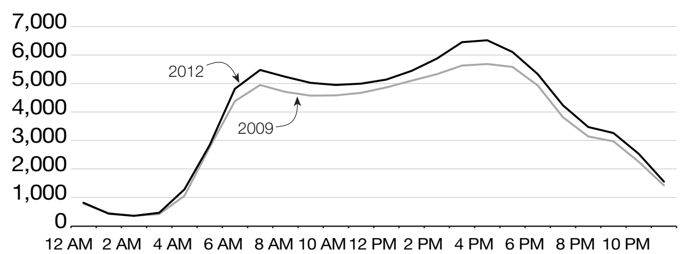
I-405 to SR 520 braided ramps reduce congestion

This area experiences severe traffic congestion up to eight hours a day. The new ramps reduce congestion on I-405 by eliminating northbound weaving between traffic exiting to SR 520 and entering from NE 8th Street. The project also eliminates weave related congestion on eastbound SR 520 at 124th Avenue NE.

An average of 13,000 vehicles per day currently enter northbound I-405 from NE 8th Street and 30,500 vehicles exit to SR 520 from I-405 (highest volume ramps on I-405 corridor). Weaving between these traffic streams is eliminated due to this project. Drivers to and from I-405 and to eastbound SR 520 are experiencing increased throughput, less delay, and reduced risk of rear-end and sideswipe collisions.

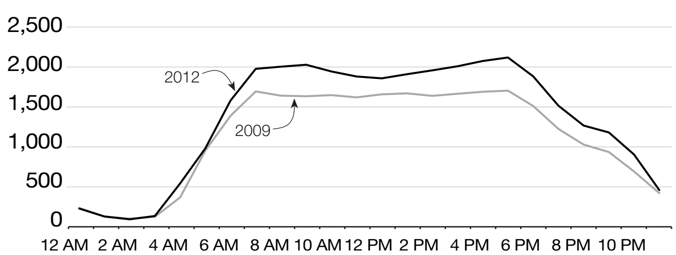
With limited traffic data (due to the recent project opening), there is about a 10% traffic throughput increase on northbound I-405 and an improvement in average speed by ten to 22 mph during peak hours.

Average daily volume on I-405 northbound before and after project (south of SR 520 braided ramps)
Weekday data for May - July 2009 and 2012; Volume in vehicles per hour



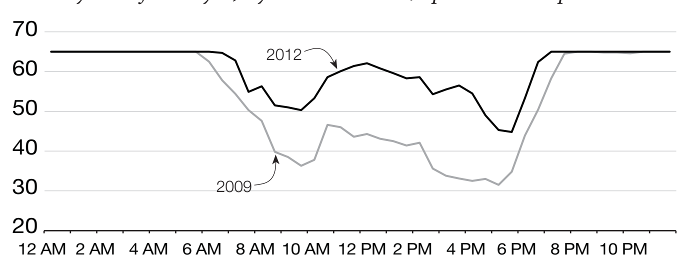
Data source: WSDOT Northwest Region Traffic Office.

Average daily braided ramp volume before and after project on I-405 northbound to eastbound SR 520
Weekday data for May - July 2009 and 2012; Volume in vehicles per hour



Data source: WSDOT Northwest Region Traffic Office.

Average daily speed on I-405 northbound before and after project (south of braided ramps)
Weekday data for May - July 2009 and 2012; Speed in miles per hour



Data source: WSDOT Northwest Region Traffic Office.

Moving Washington Balanced Strategies

Corridor performance updates

Moving Washington: Corridor performance

The *Moving Washington* program targets congestion on Washington state's busiest corridors. For each corridor, WSDOT utilizes the three strategies to fight congestion: operate efficiently, manage demand, and add capacity strategically. Projects listed are not comprehensive, but are only selected projects for the corridors. For more information on the *Moving Washington* program and the strategic corridors, please see: www.wsdot.wa.gov/movingwashington/.

Westside corridor: I-5 between Arlington and Tumwater, SR 99, U.S. 2

Selected congestion relief projects programmed to improve corridor performance:

Corridor performance highlights

Average travel times in minutes	2009	2011	%Δ
I-5 Everett-Seattle (AM)	42	42	2%
I-5 Seattle-Everett (PM)	41	36	-12%
I-5 Federal Way-Seattle (AM)	35	42	18%
I-5 Seattle-Federal Way (PM)	32	29	-8%
Delay[1] on I-5	6,684	6,849	2.5%

Notes: 1 Daily hours of delay relative to maximum throughput speeds. *Before and After case study:* I-5 to U.S. 2 hard shoulder running project helped reduce travel times by six minutes during evening peak (2011 *Congestion Report*, p. 63).

Operate efficiently

- I-5 Active Traffic Management.
- Install additional ramp meters.
- Automate operation of reversible lanes.
- Integrate ramp arterial signals.

Manage demand

- WSDOT provides right of way and works with transit agencies to improve access and performance.
- Transit uses shoulder during peak periods from Olive Way to SR 520.
- Construct an Industrial Way HOV direct access ramp.
- Further expand the vanpool program in the central Puget Sound region.
- Expand park and ride lot capacity.
- Support established growth and transportation efficiency centers (GTECs).

Add capacity strategically

- SR 99 Alaskan Way Viaduct Replacement.
- SR 512 westbound to southbound flyover ramp.
- I-5 HOV lanes Lakewood to Fife.
- I-5/SR 18 westbound to southbound flyover ramp.
- SR 509 connection to SeaTac airport.
- Complete business access and transit lanes on SR 99 in Shoreline.
- SR 518 third lane from I-5 to SeaTac airport.
- New HOV lanes on SR 99.
- Interchange reconstruction at SR 531.

Cross-Lake corridor: I-90 and SR 520 between Seattle and Bellevue

Selected congestion relief projects programmed to improve corridor performance:

Corridor performance highlights

Average travel times in minutes	2009	2011	%Δ
I-90 Issaquah-Bellevue (AM)	15	14	-7%
I-90 Seattle-Bellevue (PM)	16	18	10%
SR 520 Bellevue-Seattle (AM)	17	17	2%
SR 520 Seattle-Bellevue (PM)	20	20	-2%
Delay[1] on SR 520	1,334	1,058	-21%
Delay[1] on I-90	212	388	84%

Note: 1 Daily hours of delay relative to maximum throughput speeds. *Before and After case study:* Construction mitigation efforts during the I-90 Homer Hadley Bridge Repair project in July 2009 helped divert 40% to 60% of traffic every weekday during the construction (2009 *Congestion Report*, pp. 51-52).

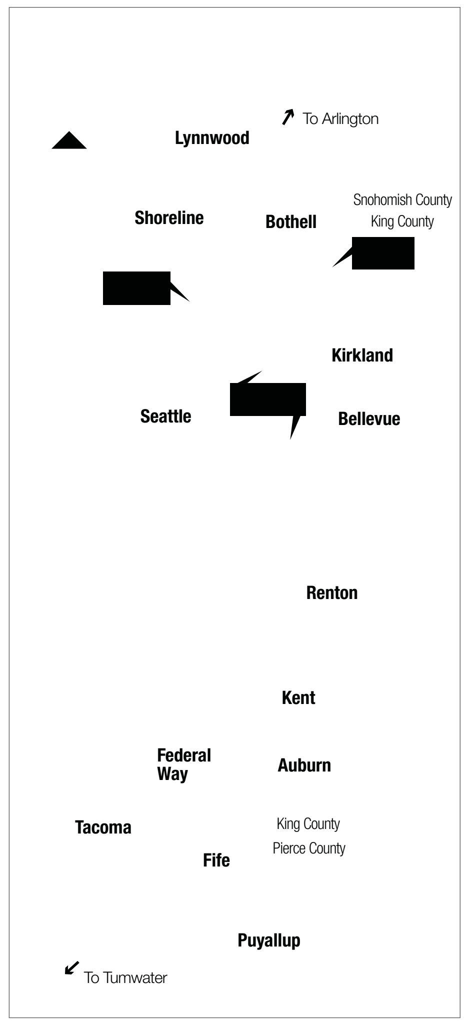
Operate efficiently

- I-90 and SR 520 Active Traffic Management.
- Automate operation of the I-90 reversible lanes.
- Direct ramp connection between the new SR 520 HOV lane and I-5 reversible lanes.
- Move HOV lanes to the inside on SR 520 east of Lake Washington.

Manage demand

- Begin variable time-of-day tolling on SR 520.
- Support the implementation of Bus Rapid Transit service on SR 520.
- Increase capacity of park and ride lots.

Moving Washington: Puget Sound corridors



Add capacity strategically

- SR 520 HOV and bridge replacement.
- Extend the I-90 HOV lane in Issaquah
- Widen SR 900 in Issaquah by one lane in each direction with HOV lanes.
- Phase 2 of the SR 519 south Seattle intermodal access to Port of Seattle.
- New SR 520 / SR 202 interchange.

Corridor performance updates

Puget Sound Eastside corridor: I-405, SR 167, and SR 512

Selected congestion relief projects programmed to improve corridor performance *(See map on p. 80)*

Corridor performance highlights

Average travel times in minutes	2009	2011	%Δ
I-405 Tukwila-Bellevue (AM)	25	25	0%
I-405 Bellevue-Tukwila (PM)	31	33	7%
SR 167 Auburn-Renton (AM)	15	17	11%
SR 167 Renton-Auburn (PM)	14	16	10%
Delay[1] on I-405	4,478	5,413	21%
Delay[1] on SR 167	350	536	53%

Note: 1 Daily hours of delay relative to maximum throughput speeds. *Before and After case study:* Following completion of the I-405 South Bellevue widening project the peak morning commute was reduced to 22 minutes in 2009 as compared to 43 minutes before construction (2010 *Congestion Report* p. 57).

Operate efficiently

- Use SR 512 shoulders during peak commuting periods as additional lanes.
- I-405/SR 167 HOT lanes/express toll lanes.
- Construct an HOV bypass and signal improvements on SR 169 at I-405.

Manage demand

- Support the implementation of bus rapid transit service on the I-405 corridor.
- Help identify new GTECs along the SR 167 and I-405 corridors.
- Expand park and ride lot capacity, and better manage existing lot space.

Add capacity strategically

- Improve ramp connections on SR 512 at SR 7 and at Canyon Road.
- Extend the SR 167 HOV/HOT lanes.
- I-405 corridor express lanes.
- Additional lanes on I-405 in Renton and Bellevue vicinities.
- Build a new freeway connection from the Port of Tacoma to Puyallup.
- New bridge over NE 10th Street in downtown Bellevue.

Spokane: I-90 and North Spokane corridors

Selected congestion relief projects programmed to improve corridor performance:

Corridor performance highlights

Average travel times in minutes	2009	2011	%Δ
I-90 Argonne-Division (AM)	8.98	8.03	-11%
I-90 Division-Argonne (PM)	8.97	8.93	-0.4%

Note: *Before and After case study:* Spokane's Growth and Transportation Efficiency Center (GTEC) has helped reduce drive alone rates by 12.2% and VMT by 10.6% (2009 *Congestion Report*, p. 52).

Operate efficiently

- Intelligent Transportation Systems upgrades.
- I-90 Sullivan interchange to Idaho state line-enhanced incident response.
- TMC expansion and security enhancements.
- I-90 / Spokane port of entry weigh station relocation.

Manage demand

- U.S. 195 Hatch Road to I-90 – park and ride facilities.
- North Spokane Corridor–new park and ride and pedestrian/bike paths.

Add capacity strategically

- U.S. 395 North-South freeway.
- I-90/U.S. 2 interchange eastbound off-ramp and terminal improvements.

Moving Washington: Spokane corridors

Other *Moving Washington* corridors: selected congestion relief projects to improve performance

Vancouver corridors: I-5/I-205 north-south, SR 500, and SR 14

Operate efficiently

- Clark County and Vancouver signal optimization.

Manage demand

- Advanced traffic information system infill.

Add capacity strategically

- Columbia River Crossing.
- SR 500/St. Johns Boulevard – Interchange.

Cross-State corridors: I-90, U.S. 2, and SR 97

Operate efficiently

- TMC improvements for Yakima and Wenatchee.
- I-90 IRT from North Bend to Spokane.
- U.S. 2 Stevens Pass VSL System.

Manage demand

- Traveler information including flow maps, VMS, and web messaging on I-90 and U.S. 2.
- I-90/SR 17 park and ride.

Add capacity strategically

- I-90 Snoqualmie Pass East project.
- U.S. 2/U.S. 97 Peshastin East interchange.
- U.S. 97 Blewett Pass add passing lanes.

Connecting Communities Program

Operate efficiently

- SR 17 signal retiming.
- I-5 Lewis County ITS infill.
- Add Tri-Cities Incident Response teams.
- SR 21 ferry boat replacement.

Manage demand

- Chuckanut park and ride.
- Tri-Cities traveler information enhancements.
- New park and ride lots for U.S. 97/SR 970, Alger, Conway.

Add capacity strategically

- I-82/Valley Mall Boulevard - Interchange.
- SR 240 Columbia Court Boulevard to U.S. 395 – Construct interchange.
- Additional lanes on SR 28 at Sunset Highway.

Table of Tables and Graphs

Table of Tables and Graphs

Table or graph title	page

High occupancy vehicle (HOV) lanes like those pictured above are one of the strategies for Moving Washington.

Acronyms used in the *Congestion Report*

A partial list of acronyms and abbreviations appearing in this issue

ADA	Americans with Disabilities Act
ALRP	Automated license plate reader
ARRA	American Recovery and Reinvestment Act
ATM	Active Traffic Management
AWV	Alaskan Way Viaduct
CCTV	Closed circuit television
CPI	Consumer Price Index
EB	Eastbound
FHWA	Federal Highway Administration
FY	Fiscal year
FTE	Full-time equivalent
GDP	Gross Domestic Product
GMAP	Government Management, Accountability and Performance
GP	General purpose
GTEC	Growth and Transportation Efficiency Center
HART	Highway advisory radio transmitter
HOT	High occupancy toll
HOV	High occupancy vehicle
IR	Incident Response
ITS	Intelligent Transportation Systems
JBLM	Joint Base Lewis-McChord
JOPS	Joint Operation Policy Statement
MIT	Major Incident Tow
MP	Mile post
mph	Miles per hour
MT^3I	Maximum Throughput Travel Time Index
NB	Northbound
OEO	Office of Equal Opportunity
PSRC	Puget Sound Regional Council
RWIS	Roadway weather information system
SB	Southbound
SOV	Single occupant vehicle
SR	State route
TDM	Transportation demand management
TMC	Traffic Management Center
TPA	Transportation Partnership Account
TRAC	Washington State Transportation Center
TTI	Travel Time Index
VMS	Variable message signs
VMT	Vehicle miles traveled
vph	Vehicles per hour
vphpl	Vehicles per hour per lane
VSL	Variable speed limit
WB	Westbound
WITS	Washington Incident Tracking System
WSDOT	Washington State Department of Transportation
WSP	Washington State Patrol

Publication Information

Americans with Disabilities Act (ADA) Information

Americans with Disabilities Act (ADA) information

Persons with disabilities may request this information be prepared and supplied in alternative formats (large print, Braille, cassette tape, or on computer disk) by emailing the Washington State Department of Transportation Diversity/ADA Compliance Team at wsdotada@wsdot.wa.gov or by calling toll free (855) 362-4ADA (4232). Persons who are deaf or hard of hearing may make a request by calling through Washington Relay at 7-1-1.

Civil Rights Act of 1964, Title VI Statement to Public

The Washington State Department of Transportation (WSDOT) assures that no person shall, on the grounds of race, color, national origin, sex, age, disability, or income status, as prescribed by Title VI of the Civil Rights Act of 1964, the Civil Rights Restoration Act of 1987, and related statutes, be excluded from participation in, be denied the benefits of, or be otherwise subjected to discrimination under any program or activity. WSDOT further assures every effort will be made to ensure nondiscrimination in all of its programs and activities, whether or not those programs and activities are federally funded. For questions regarding WSDOT's Title VI Program, please call (509) 324-6018 (Eastern Washington Title VI Coordinator), or (360) 705-7082 (Western Washington Title VI Coordinator).

Other WSDOT information available

The Washington State Department of Transportation has a vast amount of traveler information available. Current traffic and weather information is available by dialing 5-1-1 from most phones. This automated telephone system provides information on:

- Puget Sound traffic conditions and travel times
- Statewide construction impacts
- Statewide incident information
- Mountain pass conditions
- Weather information
- State ferry system information, and
- Phone numbers for transit, passenger rail, airlines and travel information systems in adjacent states and for British Columbia.

For additional information about highway traffic flow and cameras, ferry routes and schedules, Amtrak Cascades rail, and other transportation operations, as well as WSDOT programs and projects, visit www.wsdot.wa.gov.

For more information about performance measurement and reporting, visit www.wsdot.wa.gove/accountability/.

Prepared by the Strategic Assessment Office of the Washington State Department of Transportation.
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