Washington State
Department of Transportation

2001-2011
A decade of transparency

The 2011 Congestion Report

Gray Notebook Special Edition

WSDOT's comprehensive analysis of system performance on state highways

25 August 2011

Paula J. Hammond, P. E.
Secretary of Transportation

10 ANNIVERSARY EDITION

Looking at 2010 Data

In this edition

- Statewide congestion indicators
- Travel delay
- Throughput productivity
- Travel time analyses for Puget Sound and Spokane commute routes
- Truck freight
- HOV lane performance
- Intelligent Transportation Systems/Smarter Highways update
- Incident Response program annual report
- Before and After analysis of Moving Washington congestion relief projects
- Overview of WSDOT's Moving Washington program to fight congestion

Published as part of the June 30, 2011, edition of the *Gray Notebook 42*
www.wsdot.wa.gov/accountability

Foreword

Performance highlights in this edition of WSDOT's Annual Report on Congestion

We are pleased to present you with the Washington State Department of Transportation's 2011 Congestion Report. This report is WSDOT's tenth 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 congestion trend on Washington State's highways appeared to mirror the economic recession and recovery. In 2010, delay on state highways when measured at maximum throughput speed was 13% greater than in 2009 but still 9% lower than in 2008.

Compared to 2008, annual vehicle miles traveled (VMT) increased in 2010 on all roads (by 3.1%) and on state highways (by 3.3%). This means that Washingtonians drove about 65 more miles per person in 2010 (8,505 vehicle miles) compared to 2008 (8,440 vehicle miles), and 57 of those 65 miles were on state highways. Per person VMT increased on all roads by 0.8% and on state highways by 1.2%.

WSDOT continues to fight congestion aggressively through Moving Washington – a three-pronged strategy comprised of operating the transportation system efficiently, managing travel demand, and strategically adding capacity by delivering projects. These three strategies are having an impact, and are improving travel for Washington drivers:

- **Operating the existing system efficiently** Low cost high benefit strategies include dynamic travel time signs with route choices, variable message signs, signal retiming, arterial signal coordination, ramp metering, etc. Advanced ITS techniques such as Smarter Highways (Active Traffic Management), High Occupancy Tolling projects, and the Incident Response program, contribute to the existing transportation infrastructure so it can operate more efficiently.
- **Managing travel demand** Strategies including telecommuting, vanpools, construction traffic mitigation, rideshare online, transit, Commute Trip Reduction, and Growth and Transportation Efficiency Centers (GTECs) all encourage drivers to use less congested routes and reduce trips driving alone.
- **Adding capacity** By June 30, 2011, WSDOT had completed 76 congestion relief projects funded through the 2003 and 2005 gas tax packages valued at $2.586 billion. These projects are reducing the time that Washington drivers spent in traffic. For example, the I-405 – I-5 to SR 169 Stage 2 widening project improved northbound travel times by 10 minutes during the morning peak period between I-5 and Coal Creek Parkway in 2011 compared to 2007.

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 congestion relief projects, including the Alaskan Way Viaduct, SR 520 Floating Bridge, Columbia River Crossing, and projects in the I-405 Corridor Program remain to be delivered. Smarter highways, using technologies such as active traffic management, were implemented on the central Puget Sound region's busiest corridors. Last year, 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 16th, 2010 and I-90 on June 8, 2011. More information on the performance of these systems will be published in the future editions of the Congestion Report.

Table of Contents
Contributors

The 2011 Annual Congestion Report compares data from 2008 and 2010.

The work of many people goes into the writing, editing, and production of WSDOT's annual Congestion Report. This list of contributors reflects the efforts of data analysts, engineers, planners, project leads, and many more individuals behind the scenes. Information is reported on a preliminary basis as appropriate 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.

Contributors to the 2011 Congestion Report

Matt Beaulieu, Mike Bernard, Daniela Bremmer, Brian Mann, Dave Bushnell, Paula Connelley, Keith Cotton, Dan Davis, Vince Fairhurst, Sreenath Gangula, Hien Giang, Manouchehr Goudarzi, Mark Hallenbeck, Robin Hartsell, Monica Harwood, Craig Helmann, Janice Helmann, John Ishimaru, Kumiko Izawa, Rachel Knutson, Brian Lagerberg, Bill Legg, Kathy Leotta, Diane McGuerty, Shamus Misek, Delwar Murshed, Matt Neeley, John Nisbet, Tyler Patterson, Charles Prestrud, Brian Smith, Joe St. Charles, Seth Stark, Jaedi Stevens, Marjorie Vanhoorelbeke, Christie Vintilo, Harold White, Duane Wright, Anna Yamada, Shuming Yan

Performance Analysis Team – Angie Battazzo, Laura Cameron, Sreenath Gangula, Dan Genz, Rachel Knutson, Todd Lamphere

Graphics – Chris Britton, Diana Lessard, Fauziya Mohamedali, Steve Riddle

Publishing and distribution – Linda Pasta, Trudi Philips, Deb Webb

For information, contact:
Daniela Bremmer, Director
WSDOT Strategic Assessment Office
310 Maple Park Avenue SE, PO Box 47374, Olympia, WA 98504-7374
Phone: 360-705-7953 :: E-mail: daniela.bremmer@wsdot.wa.gov

Foreword 2
Contributors 3
Measuring Delay and Congestion Annual Report 4
Congestion Report Dashboard of Indicators 4
2011 Congestion Report Executive Summary: Looking at 2010 data 5
Introduction 8
WSDOT's Congestion Measurement Principles 9
Overview of WSDOT's congestion performance measures 10
Statewide Congestion Indicators and Travel Delay 13
Statewide Travel Delay 13
Delay and Congestion on the State Highway System 14
Statewide Travel Delay and VMT: Distribution by Location 15
Travel Delay and VMT in the Central Puget Sound Region 16
Statewide Vehicle Miles Traveled on the Rise 17
Throughput Productivity 19
Measuring Vehicle Throughput Productivity 19
Measuring Throughput Productivity on Puget Sound Freeways 20
Travel Time Analysis 22
Travel Time Analysis of Major Puget Sound Commute Routes 22
Factors Affecting Travel Times: 2008 – 2010 26
Travel Time Reliability on Major Puget Sound Commute Routes 28
Travel Time Analysis: Other views / Introducing Stamp Graphs 31
Duration and Frequency of Severe Congestion in Peak Travel Periods 32
Travel Time Analysis of 12 Additional Puget Sound Commute Routes 34
Travel Time Analysis: Spokane 35
Truck Freight Bottlenecks 36
High Occupancy Vehicle Lanes Performance Analysis 37
HOV Lane Performance: Speed and Reliability 37
Effectiveness of HOV Lanes 38
HOV Lane Performance: Person Volumes 39
HOV Lanes versus General Purpose Lane Travel Times 40
for Morning Commutes 42
for Evening Commutes 43
for Other Location Commutes 44
Comparing HOV and GP Lane Reliability Performance 45
HOV Lane Travel Times Compared to GP Lanes
for Seattle Work Locations 49
for Bellevue Work Locations 50
for Other Work Locations 51
Moving Washington: Operate Efficiently 52
SR 167 High Occupancy Tolling 52
Intelligent Transportation Systems 53
Incident Response Program Annual Report 54
Moving Washington: Manage Demand 56
WSDOT's Demand Management Tools 56
Moving Washington: Add Capacity Strategically 58
WSDOT Capacity Expansion Projects:
Tacoma/Pierce County HOV Program 58
I-405 Corridor 60
SR 520 Corridor 62
US 2 Corridor 63
SR 519 Corridor 64
Moving Washington: Balanced Strategies 65
Corridor Performance Updates 66
Table of Tables & Graphs 68
Publication Information 70

Measuring Delay and Congestion Annual Report

Congestion Report Dashboard of Indicators

2011 Congestion Report Dashboard of Indicators	2006	2007	2008[7]	2009	2010	Difference 2009 vs. 2010	Difference 2008 vs. 2010
Demographic and economic indicators							
State population (millions)	6.4	6.5	6.6	6.7	6.7	0.8%	1.5%
Average gas price per gallon (July)	$3.08	$3.05	$4.36	$2.81	$3.06	8.2%	-29.8%
Washington unemployment rate (annual)	5.0%	4.6%	5.5%	9.3%	9.6%	0.3%	4.1%
Washington rate of annual economic growth[1]	4.1%	5.2%	1.0%	-2.4%	1.6%	1.6%	-0.8%
Washington real personal income (billions)[2]	$245.3	$258.2	$263.2	$261.5	$263.9	0.9%	0.3%
Systemwide congestion indicators							
Vehicle miles traveled							
All public roads vehicle miles traveled (VMT), in billions	56.5	57.0	55.4	56.5	57.2	1.3%	3.1%
All public roads per capita VMT, in miles	8,867	8,780	8,440	8,467	8,505	0.4%	0.8%
State highways vehicle miles traveled (VMT), in billions	31.8	32.0	30.7	31.5	31.8	1.0%	3.3%
State highways per capita VMT, in miles	4,982	4,928	4,667	4,717	4,724	0.1%	1.2%
System congestion							
Lane miles of state highway system congested[3]	1,030	1,010	930	950	994	4.6%	6.9%
Percent of state highway system congested[3]	5.7%	5.6%	5.2%	5.2%	5.5%	0.3%	0.3%
Delay on state highways							
Total vehicle hours of delay, in millions of hours[4]	39.6	35.1	34.8	28.1	31.7	13%	-9%
Annual hours of per capita delay on state highways[4]	6.2	5.4	4.9	4.2	4.7	12%	-4%
Cost of delay on state highways (2010 dollars in millions)							
Measured at maximum throughput speeds[4,5]	$1,027	$885	$846	$685	$759	11%	-10%
Measured at posted speeds[5]	$1,449	$1,294	$1,215	$1,062	$1,108	4%	-9%
Corridor-specific congestion indicators							
Congestion on 52 commute routes in the central Puget Sound region							
Annual Maximum Throughput Travel Time Index (MT^3I)[6]	1.50	1.45	1.25[7]	1.31	1.37	4.6%	9.6%
Number of commute routes with $MT^3I > 1$[6]	46	46	41[7]	44	45	N/A	N/A
WSDOT congestion relief projects							
Number of completed Nickel and TPA mobility projects as of December 31st of each year (cumulative)	14	33	43	65	73	8	30
Cumulative project value (dollars in millions)	$206	$898	$1,245	$2,128	$2,524	$396	$1,279

Data sources include: WSDOT, 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.

Notes: Analysis in the Congestion Report examines 2008 and 2010 annual data, five years of data is provided here for information only. 1 The rate of annual economic growth is measured through Washington Real Gross Domestic Product as reported in chained 2005 dollars. Values shown in the Difference 2009 vs. 2010 and Difference 2008 vs. 2010 column reflect the difference in Gross Domestic Product instead of the difference in growth rates. 2 Washington real personal income is measured in chained 2005 dollars. 3 Based on below 70% of posted speed. 4 Based on maximum throughput speed thresholds (85% of posted speed). 5 Inflation adjusted using the Consumer Price Index (CPI). 6 MT3I is the ratio of average peak travel time compared to maximum throughput speed travel time. MT^3I greater than one means the commute route experiences congestion. 7 2008 data not available for four of the 52 routes. This lack of data might be a reason for lower average MT^3I and number of commute routes with MT3I >1. For more information see gray box on page 15 of the 2009 Annual Congestion Report.

2011 Congestion Report Executive Summary: Looking at 2010 data

The *2011 Annual Congestion Report* examines 2010 calendar year data focusing on the most traveled commute routes in the central Puget Sound region, and where data are 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 2010 saw a spike in congestion compared to 2009, but still within 2008 levels

The downward congestion trend in Washington seems to have ended in 2009 as 2010 data shows an increase in delay and vehicle miles traveled on state roadways. Statewide congestion data for the past five years shows that 2009 was the least congested year for Washington State. With the rebounding economy and stabilization of gas prices, congestion on the state highway system is on the rise beginning in 2010, however, it is unclear whether the rise in congestion will continue.

In 2010, travel delay on state highways, when measured at maximum throughput speeds, is 13% higher than 2009 and 9% lower than 2008. In the central Puget Sound region, 78% of the monitored commute routes have shown modest changes in average travel times - within two minutes. Less than half of these commutes showed a modest change in 95% reliable travel times, while 39% saw an increase and 14% saw a decrease in 95% reliability, beyond two minute flucutations.

2011 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), decreased by 6% and 9% respectively. The reduction in delay indicates that many highways across the state became less congested between 2008 and 2010. On the other hand, statewide delay, relative to posted speeds and maximum throughput speeds, rose in 2010 compared to 2009 by 8% and 13% respectively.	Total statewide vehicle hours of delay was reduced by 9% between 2008 and 2010 relative to maximum throughput speeds.		13
Per person delay Statewide, delay was reduced from about 4.9 hours per person annually in 2008 to 4.7 hours per person annually in 2010, when measured using maximum throughput speeds. Statewide per capita delay was lowest in 2009 (4.2 hours), and rose again in 2010 (4.7 hours).	Per person delay was reduced by 4% between 2008 and 2010 relative to maximum throughput speed.		14
***NEW* Percent of the system delayed** Roughly 11.6% of state highways (in lane miles) were delayed in 2008, meaning traffic flow dropped below 85% of posted speeds. This metric remained the same at 11.6% in 2010. As expected, most of the traffic delay on state highways is in urban areas.	The percent of state highways with delays is unchanged between 2008 and 2010.		14
Percent of the system congested Roughly 5.2% of state highways (in lane miles) were congested in 2008 and 2009, meaning traffic flow dropped below 70% of posted speeds. This measure rose to 5.5% in 2010. As expected, most of the congested state highways are in urban areas.	0.3% more state highways are congested, up from 2008 (5.2%) to 2010 (5.5%).		14
Vehicle miles traveled (VMT) Between 2008 and 2010, total VMT increased, by 3.1% on all public roads and by 3.3% on state highways. Per person VMT also increased statewide, by 0.8% on all public roads and by 1.2% on state highways.	Total VMT on all public roadways increased by 3.1% between 2008 and 2010.		17
Central Puget Sound corridors: Hours of delay and vehicle miles traveled			
Vehicle hours of delay on major central Puget Sound region corridors Between 2008 and 2010, vehicle hours of delay relative to the posted speeds (60 mph) and maximum throughput speeds decreased by approximately 11% and 14% respectively. All surveyed corridors saw reduced delay. Between 2009 and 2010, some of these corridors saw substantial increases in vehicle hours of delay.	Travel delay in the Central Puget Sound area is down 14% relative to maximum throughput speeds.		16
Vehicle miles traveled (VMT) increased overall in the central Puget Sound in 2010. On selected major Puget Sound region corridors, VMT increased by 1.8% in 2010 compared to 2008. The steepest rise was more than 4% on I-405; VMT on SR 520 saw the smallest increase, 0.7%.	VMT in the Central Puget Sound area increased by 1.8% in 2010 compared to 2008.		16

Executive Summary of Measures & Results – continued

2011 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 2008 and 2010, for 16 selected Puget Sound monitoring locations, 10 showed improvements in vehicle throughput, while three worsened, two did not change, and one did not experience any productivity loss.	Between 2008 and 2010, 13 out of 16 monitored locations either improved or remained the same while three got worse.	19
Travel times analysis: 40 high-demand Puget Sound commute routes		
Average peak travel times Between 2008 and 2010, 28 of 36 surveyed high-demand commute routes saw changes in average peak travel time of less than two minutes. Eight routes changed by more than two minutes: three showed shorter travel times and five routes saw longer travel times. (Note: only 36 of 40 routes had data available for 2008.)	Average peak travel times on 28 of 36 routes changed by less than two minutes between 2008 and 2010, five worsened, three improved.	22
Duration of congested period The duration of congestion—defined as the period of time in which average speeds fall below 45 mph—improved on 18 routes between 2008 and 2010, with improvements ranging from five minutes to 1 hour 45 minutes. The duration of congestion was unchanged on six routes, and average speeds on two routes did not fall under the 45 mph threshold.	Between 2008 and 2010, the duration of congestion improved on 18 routes and was unchanged on six; two routes had no congestion.	22
95% reliable travel times Between 2008 and 2010, 17 of the 36 high-demand commutes saw modest changes (less than or equal to two minutes) in 95% reliable travel time. 14 commutes saw reliable travel times worsen between three and ten minutes, while reliable travel times improved on five commutes ranging from three minutes to 11 minutes.	Reliable travel times improved on four commutes, saw no significant change on 17, and worsened on 14, when comparing 2010 to 2008.	28
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.		28
Percentage of days when speeds were less than 36 mph — Stamp graphs The most visual evidence of how peak periods changed in 2010 can be seen in the graphs on pages 32-33. These "stamp graphs," comparing 2008 and 2010 data, show the percentage of days annually that observed speeds are below 36 mph (threshold for severe congestion).		31
Travel time comparison graphs The bar graphs on pp. 49-51 show four of the travel time performance indicators during the peak five minutes interval for weekday: travel times at posted speeds, travel time at maximum throughput speeds (50mph), average peak five minute travel times, and 95% reliable travel times. For each of the surveyed high-demand commutes, both general purpose (GP) and HOV travel times are shown. The graphs also illustrate the travel time advantages HOV lane users have compared to GP lane users.		49
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 are available. Average travel times for all 12 routes saw a negligible change between 2008 and 2010. In terms of the 95% reliable travel time, eight of the 12 routes saw modest changes (within two minutes), while travel times grew longer (by between two and seven minutes) on the remaining four routes.	95% reliable travel times deteriorated on four of 12 commutes. Average travel time changes between 2008 and 2010 were negligible.	34

Executive Summary of Measures & Results – continued

2011 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
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 (about half a minute). 95th percentile travel times improved eastbound by 32% and deteriorated on westbound by 2%.	95th percentile reliable travel times improved on eastbound by 32%.	35
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 2008, six of 14 HOV commute corridors met the reliability standard; seven of 14 corridors met the standard in 2010. Of the seven that did not, five of the seven evening peak commutes have such high traffic volumes that the corridors are below the HOV performance standard; two of the seven morning peak commutes are also below the performance standard.	In 2010, the HOV lane reliability standard was met on one more location.	37
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 33% of the people on the freeway in the morning and evening peak periods. At seven of the ten monitoring locations, HOV lanes moved more people than adjacent GP lanes.	In 2010, the HOV lanes carried more people than the adjacent GP lanes at one less location.	39
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 2010, average HOV lane travel times performed better than GP lane travel times on 40 out of 48 routes and were unchanged on eight routes. Forty-five HOV routes provide better reliability (95% reliable travel time) than their respective GP counterparts.	In 2010, two more routes showed travel time benefit for HOV compared to adjacent GP lanes.	40
Ongoing tracking of performance for operational strategies		
Operate efficiently: Incident Response (IR) annual report Between 2008 and 2010, statewide average incident clearance time improved by 6.3%. The total number of incindents cleared was down by 2.5%	Average incident clearance time improved by 6.3%.	54
Travel time analysis: January-May 2011 semi-annual report		
The trends described in the article result from a comparison of traffic conditions in the first five months of 2011 to those from the same time periods in 2009 and 2010. Taken as a whole, 2011 travel times in both of the morning and evening commute periods have changed only modestly in comparison to those of both 2009 and 2010.	Travel time changes for 18 commutes monitored have seen little change between 2010 and 2011.	

Introduction

Highlights from the Annual Congestion Report

- Vehicle miles traveled (VMT) has risen for two years in a row. Washingtonians drove 65 miles more in 2010 than in 2008; 57 of those miles were on state highways.
- Delay on state highways in 2010, when measured at maximum throughput speeds, was 13% greater than in 2009 but still 9% lower than in 2008.
- Per person, people in Washington spent 12% more time delayed in traffic in 2010 compared to 2009, but 4% less time than they did in 2008.
- In 2010, the cost of delay to drivers and businesses in Washington was estimated to be $759 million at maximum throughput speeds, and $1,108 million at posted speeds.
- Between 2008 and 2010, changes to travel times and reliability were modest on most of the 40 high-demand Puget Sound region commute routes.
- In 2010, compared to 2008, 45 out of 48 HOV commutes provided more reliable travel times than corresponding general purpose lanes.

Congestion increasing since 2009, nears 2008 levels

The trends of decreasing congestion and lessening delay that prevailed from 2008 through 2009 appear to have slowed, as both delay and vehicle miles traveled on Washington's roadways increased in 2010. Statewide congestion data for the past five years shows that 2009 was the least congested year for Washington. But in 2010, as Washington's economy slowly began to regain ground and gas prices stabilized, congestion on the state highway system rose, however, it is unclear whether the rise in congestion will continue.

Trends in this year's report show that most congestion performance metrics for 2010 are higher than 2009 but below 2008 levels.

In 2010, delay on state highways when measured at maximum throughput speed was 13% greater than in 2009 but still 9% lower than in 2008. Similar trends were seen when the delay metric was calculated at posted speed limits. Per person, people in Washington spent 12% more time in traffic in 2010 compared to 2009, but 4% less time compared to 2008; again, the delay was similar when calculated at posted speeds. WSDOT measures delay against both posted speed and maximum throughput speed, and uses the latter to most efficiently manage the transportation system.

Compared to 2008, annual vehicle miles traveled (VMT) increased in 2010 on all roads (by 3.1%) and on state highways (by 3.3%). This means that Washingtonians drove about 65 more miles in 2010 (8,505 vehicle miles per person) compared to 2008 (8,440 miles), and 57 of those 65 miles were on state highways: per person VMT on all roads increased by 0.8% and on state highways by 1.2%.

Factors influencing congestion

As Washington's economy rebounds, 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 other errands. Congestion metrics demonstrate these signs, as the leading performance indicators showed an increase in 2010 compared to 2009, even though the magnitude of this increase is within 2008 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 is the type of congestion where there are simply more vehicles than 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), work zones (10% of congestion), and weather (15% of congestion).

Although congestion can be used as an indicator of economic growth, it also has negative economic consequences. Delay costs money – for example, as drivers waste fuel in stop-and-go traffic or when businesses suffer lost productivity when shipments are slower to arrive at their destination. When estimated against posted speeds, statewide travel delay cost drivers and businesses in Washington $1.11 billion in 2010; the cost of this delay in 2008 and 2009 was $1.22 billion and $1.06 billion respectively. When measured at maximum throughput speed, delay remains expensive. It cost drivers and businesses $759 million in 2010 – 11% more than the $685 million cost in 2009 – but it is still 10% lower than the $846 million cost in 2008.

WSDOT's Congestion Measurement Principles

Moving Washington: WSDOT's balanced program 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, to manage demand, and to add capacity strategically. By strategically adding capacity, WSDOT targets bottlenecks and chokepoints in the transportation system. However, because of limited resources, WSDOT understands that adding capacity cannot be the only solution to the congestion problem. That is why WSDOT uses operational strategies such as ramp metering, active traffic management, incident response, variable message signs, 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 of specific examples, please see pp. 52-64.

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 are 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 2011 Congestion Report, calendar year 2010 is the current analysis year data, while 2008 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^3I)	The ratio of average peak travel time compared to maximum throughput speed travel time.
Percent of days when speeds are less than 36 mph	Percentage 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

Overview of WSDOT's congestion performance measures

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 are 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 variety of software processes. Using this quality controlled data, WSDOT analyzes 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 page 9.

2011 Semi-annual travel trends report

WSDOT publishes two semi-annual travel times trends each year in addition to the annual congestion report.

The first 2011 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 page 35 for gray box on the semi-annual travel times trends for the first half of 2011.

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

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. Reliability matters to drivers because it is important to be on time all the time.

WSDOT's Congestion Report examines 52 commute routes regularly monitored in the Puget Sound region, reporting in detail on 40 high-demand routes, as well as two Spokane commute routes and travel times for 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 key commutes around Puget Sound, Spokane, and Vancouver are available to the public and updated every five minutes on the WSDOT web site 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, 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, to predict future demands, and to 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.

In 2008, the Legislature established per capita VMT as a measure to support the reduction of greenhouse gas emissions. WSDOT was directed to help the state achieve its goal of reducing VMT as part of the effort to reduce emissions (see pages 17-18 for more information).

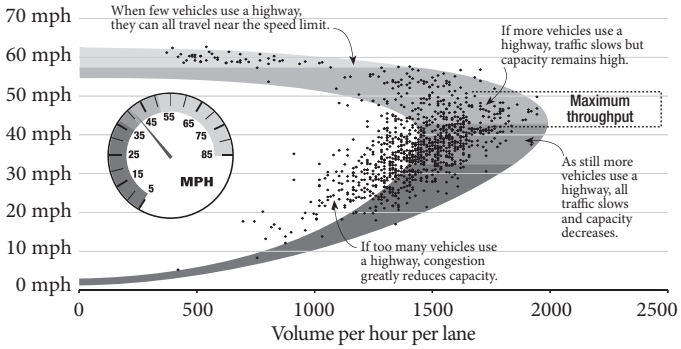
WSDOT uses maximum throughput as the basis for congestion performance measurement

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.

Overview of WSDOT's congestion performance measures, continued

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

I-405 northbound at 24th NE, 6am-10am weekdays 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.

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 at peak efficiency because more vehicles are passing through the segment than could 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 and traffic conditions, such as roadway alignment, lane width, slope, shoulder width, pavement conditions, traffic composition, conflicting traffic movements, heavy truck traffic, presence or absence of median barriers, 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. 13.

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—MT^3I (For a more detailed discussion of this measure, please see p. 25)
- Duration of the congested period

WSDOT state highway congestion measurement speed thresholds

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, so fewer vehicles can pass through the segment in a given amount of time. The segment is not operating at maximum efficiency.
Maximum throughput 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 triggered when 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% percent 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.

Overview of WSDOT's congestion performance measures, 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 the total hours of delay, WSDOT also evaluates annual per person delay and the cost of delay to drivers and businesses.

Measuring the percent of the highway system that is delayed

The 2011 Congestion Report introduces a new metric that examines the percentage of the highway system that is experiencing delay. It 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 percent 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 (vphpl) traveling at speeds between 42 and 51 mph (100% efficiency) to as low as 700 vehicles per hour per lane (35% efficiency) when traveling at speeds less than 30 mph.

Measuring travel time reliability

Travel time reliability is directly proportional to the travel time percentile value: the higher the percentile, the higher the reliability requirement for the commute. WSDOT uses the 95th percentile reliable travel time as its key reliability metric for all the monitored 52 Puget Sound area commute routes. A benefit to using percentile measures is that they are not affected by outlier values, generally the highest values. 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. 28-30 for detailed reliability data and p. 52 for more on operational strategies such as HOT lanes.

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 period, 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.

Before & After analyses of congestion relief strategies and projects

As of June 30, 2011, WSDOT has completed 303 out of 421 projects funded by the 2003 and 2005 gas tax packages, of which 76 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 by using automated license plate recognition cameras or a moving test vehicle. Before and After performance evaluations will be expanded to key congestion relief projects. These studies will evaluate the benefits of *Moving Washington* strategies and projects that operate efficiently, manage demand, and add capacity strategically. For more information on *Moving Washington*, please see pp. 52-64.

Evaluating operational strategies: IR

WSDOT uses several measures to evaluate the performance of its Incident Response (IR) Program. This year's report examines annual performance data beginning in calendar year 2005 while focusing the analysis for calendar years 2008 and 2010. Quarterly updates are published in the *Gray Notebook 42*. For details on this tool for managing non-recurrent congestion, see p. 54.

Statewide Congestion Indicators and Travel Delay

Statewide Travel Delay

Travel delay is estimated both relative to the posted speed limit and relative to maximum throughput speeds (85% of posted speed limit). For both methods, WSDOT estimates the sum of vehicle delay in hours across a typical 24 hour weekday to demonstrate the extent, severity, and duration of congestion. (See pages 10 and 11 for detailed discussion of these measures.)

Statewide travel delay trend appeared to mirror economic recession and recovery

All of WSDOT's performance measures for travel delay display the same pattern over the last three years: a drop between 2008 and 2009 followed by a return to higher values – but not as high as 2008 – in 2010. This was true for the hours of delay statewide, hours of delay per person, and the cost of delay to drivers and businesses: all 2010 metrics, while lower than those of 2008, are higher – albeit by a small percentage – than results in 2009.

Travel delay estimate for 2010 down compared to 2008

Washingtonians spent fewer hours delayed in congestion in 2010 than in 2008, but more time than in 2009. Between 2010 and 2008, average weekday delay compared to posted speed decreased by 6%, while delay relative to the maximum throughput speed decreased by 9%. However, compared to 2009, delay in 2010 grew by 8% at posted speed, while delay at maximum throughput speed grew by 13%.

Most of the delay was concentrated in the state's major urban areas as shown in the graphic and table on page 15.

Congestion cost Washington drivers and businesses $1.1 billion in 2010

When measured against posted speeds, statewide travel delay cost drivers and businesses in Washington $1.108 billion in 2010; the cost of this delay in 2008 and 2009 was $1.215 billion and $1.062 billion respectively. Travel delay when measured at maximum throughput speeds cost drivers and businesses $759 million in 2010; this cost was $846 million in 2008 and $685 million in 2009. In 2010, the cost of delay had dropped by $87 million compared to 2008, but rose by $74 million compared to 2009. The dollar amounts are inflation adjusted using CPI.

Calculating the cost of delay

The cost of delay is estimated by applying a monetary value to the vehicle hours of delay incurred by passenger cars and trucks plus additional operating costs. The value of time for passenger trips was assumed to be half of the average wage rate.

Congestion, or delay, imposes costs for the lost time of travelers, higher vehicle operating costs from things such as wasted fuel, and other effects of stop-and-go driving. Truckers and shippers and their 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 and business travel
- Increased vehicle operating expense
- Direct shipper/recipient productivity loss
- Indirect (downstream) productivity loss
- Local income/economy suffered from lost opportunities to attract new businesses
- Increased vehicle emissions due to stop-and-go conditions.

Estimated travel delay and cost of delay on all state highways

Average weekday delay comparison (daily and annual) and estimated cost of delay on state highways (annual) 2006-2010

	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 2010 dollars)	
Actual travel compared to:	**Maximum throughput speeds**	**Posted speeds**	**Maximum throughput speeds**	**Posted speeds**	**Maximum throughput speeds**	**Posted speeds**
2006	155,040	223,000	38,760	55,750	$930	$1,449
2007	140,370	204,850	35,090	51,210	$885	$1,294
2008	139,098	199,980	34,775	49,950	$846	$1,215
2009	112,340	174,260	28,085	43,565	$685	$1,062
2010	126,580	187,650	31,650	46,910	$759	$1,108
%Δ (2010 vs. 2008)	-9%	-6%	-9%	-6%	-10%	-9%
%Δ (2010 vs. 2009)	13%	8%	13%	8%	11%	4%

Data source: WSDOT Urban Planning Office.

Note: Maximum throughput speeds are calculated at 85% of posted speeds. Past editions of the Congestion Report used 80% of posted speed for delay calculations. This report recalculated previously published delay numbers for 2006-2009. Inflation adjusted using the Consumer Price Index (CPI).

Statewide Congestion Indicators and Travel Delay

Delay and Congestion on the State Highway System

Annual statewide per capita delay

Hours of delay annually

		Relative to maximum throughput speed			Relative to posted speed		
Year	Population	Annual delay (in thousands)	Delay per capita	%Δ from 2010	Annual delay (in thousands)	Delay per capita	%Δ from 2010
2006	6,375,600	38,760	6.1	-23%	55,752	8.7	-20%
2007	6,488,000	35,090	5.4	-13%	51,212	7.9	-11%
2008	6,587,600	34,775	4.9	-4%	49,950	7.6	-8%
2009	6,668,200	28,085	4.2	12%	43,565	6.6	6%
2010	6,724,520	31,650	4.7	n/a	46,910	7.0	n/a

Data source: WSDOT Urban Planning Office.

Note: Maximum throughput speeds are calculated at 85% of posted speeds. Past editions of the Congestion Report used 80% of posted speed for delay calcualtions. This report re-calculated previously published delay numbers for 2006-2009.

Statewide per capita delay down 4% in 2010 compared to 2008

On a per person basis, when measured at posted speed, people in Washington experienced around 8% more congestion in 2008 (7.6 hours of delay/person/year) compared to 2010 (7.0 hours of delay/person/year). The 2010 per person delay was higher by 6% compared to 2009 (6.6 hours of delay/person/year). When measured at maximum throughput speeds, time lost due to delay was reduced from about 4.9 hours/person/year (2008) to 4.7 hours/person/year (2010). The per person delay in 2009, when measured at maximum throughput speeds, was 4.2 hours/person/year. Even though per person delay in 2010 is at its second lowest since 2006, the statewide VMT shows a rising trend (see page 17 for VMT and per capita VMT trends).

The percentage of delayed state highway lane miles remained the same between 2008 and 2010

The percentage of state highway lane miles with delay is a new metric for the 2011 Congestion Report. It is based on the highway segment operating at 85% of posted speed (in line with the other delay metrics) on an annual average weekday, and calculated by dividing delayed lane miles by total state highway lane miles.

Traffic congestion on eastbound I-90 Snoqualmie pass

Using 85% of posted speed as the threshold, 11.6% of state highway lane miles were delayed in 2010 and 2008, and 11.5% in 2009. The table below shows the breakdown for urban and rural roads with delay, as well as all state highway lane miles, for the past five years.

The percentage of congested state highway lane miles increased slightly in 2010 compared to 2008 and 2009

Congestion means the roadway's operational speed drops below 70% of its posted speed limit on an annual average weekday. The percentage of state highway lane miles that suffered from congestion was calculated by dividing congested lane miles by total state highway lane miles.

Using this threshold, 5.5% of state highway lane miles were congested in 2010 while 5.2% were congested in 2008 and 2009. The table below shows the breakdown for urban and rural roads with congestion, as well as all state highway lane miles, for the past five years.

Percentage of the state highway system that is delayed or congested

By percentage of total system, 2006–2010

	% of system delayed			% of system congested		
	All	Urban	Rural	All	Urban	Rural
2006	12.2%	10.8%	1.4%	5.7%	5.2%	0.5%
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%

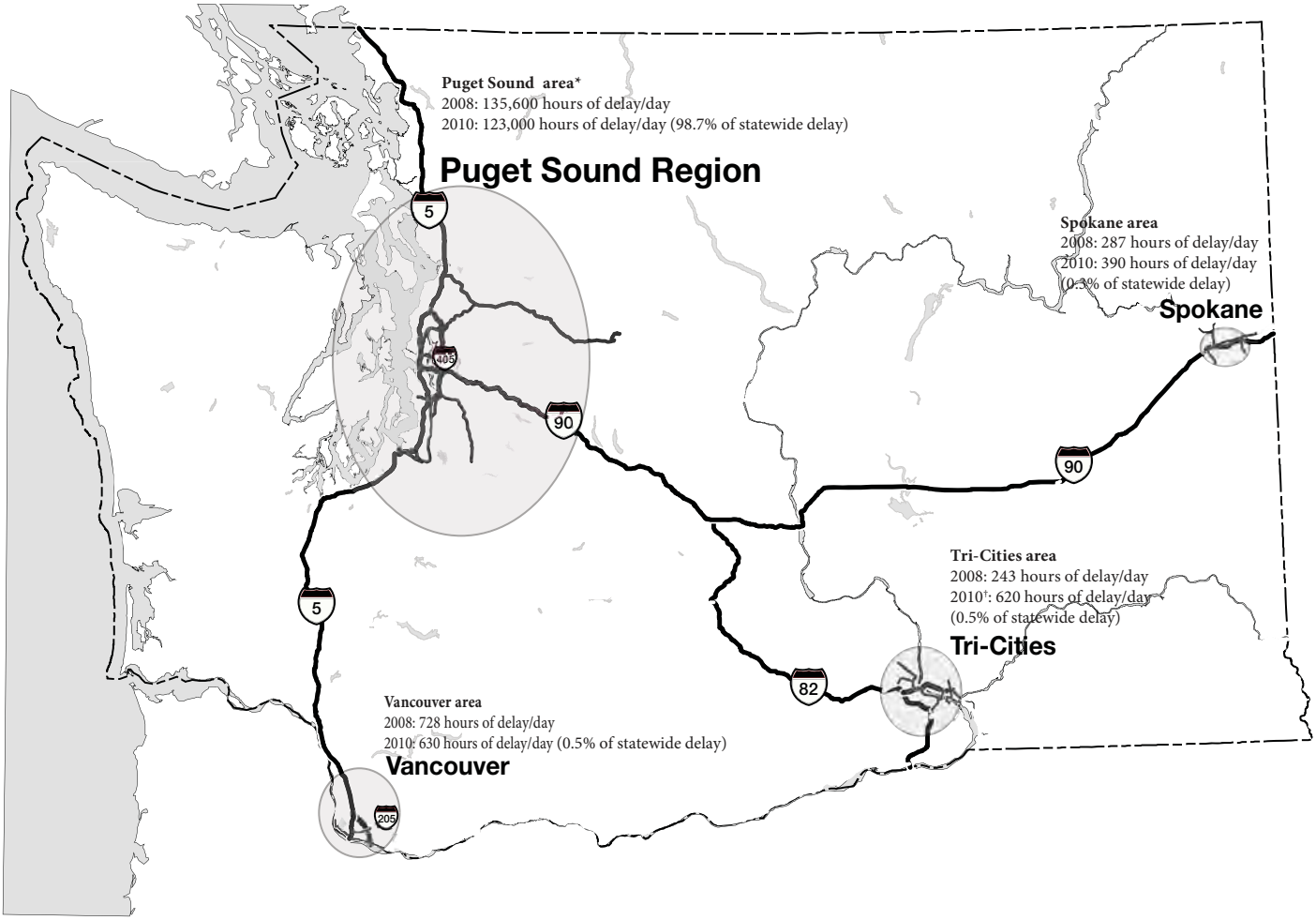
Data source: WSDOT Urban Planning Office.

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

Statewide Travel Delay and VMT: Distribution by Location

Schematic representation of statewide delay distribution on the state highway system

Delay estimates for major urban areas, 2008 compared to 2010



Data source: WSDOT Urban Planning Office.

Note: 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.

† The significant increase is due to the influx of people working on the Hanford Cleanup project.

Delay and vehicle miles traveled (VMT) on state highways by urban area

Delay in hours; 2006–2010

	2006		2007		2008		2009		2010	
	VMT	Delay	VMT	Delay	VMT	Delay	VMT	Delay	VMT	Delay
Central Puget Sound	44,503,864	151,710	44,585,515	137,013	43,163,152	135,600	43,871,168	108,944	44,128,145	123,000
Spokane	4,280,109	215	4,363,190	283	4,186,710	287	4,282,691	156	4,383,801	390
Tri-Cities	3,020,948	313	3,089,714	245	2,979,417	243	3,145,678	347	3,262,005	620*
Vancouver	4,057,532	707	3,989,308	707	3,822,662	728	3,887,984	1090	3,927,146	630
Total	**55,862,453**	**152,945**	**56,027,727**	**138,248**	**54,151,941**	**136,858**	**55,187,520**	**110,537**	**55,701,097**	**124,640**

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

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

Statewide Congestion Indicators and Travel Delay

Travel Delay and VMT in the Central Puget Sound Region

Major central Puget Sound area corridors record less delay in 2010 compared to 2008

Consistent with the pattern of reduced delay statewide, daily vehicle hours of delay on major freeway corridors in the central Puget Sound region also improved. Between 2008 and 2010, delay relative to posted speeds and maximum throughput speeds decreased by about 11% and 14% respectively. Improvements in hours of delay were more mixed from 2009 to 2010: relative to the posted speed, delay decreased by about 1% but when measured at maximum throughput speed, delay increased by 4%.

Between 2008 and 2010, delay on individual corridors improved by 4% to 14% relative to posted speed, and by 2% to 18% relative to maximum throughput speed. I-405 experienced the greatest reduction in delay relative to both posted and maximum throughput speeds. (Note: Because the lengths and widths of these corridors are different, it is not meaningful to compare and rank the corridors.)

Between 2009 and 2010, SR 167 experienced the highest increase in delay (69%) relative maximum throughput speeds. The potential reasons for this increase can be attributed to the construction activity of I-405 – I-5 to SR 169 Stage 2 widening project. Just over 50 % of all the delay change for the entire corridor occured within about 1.5 miles of the I-405 interchange (in either direction). Another 17% of all the delay change occured near the south endpoint of the analysis corridor. Most of that delay change occurs in the southbound direction, just north of SR 18.; the balance was distributed, to varying degrees, along the rest of the corridor.

Overall, VMT increased in the central Puget Sound area corridors

Vehicle miles traveled between 2008 and 2010 grew slightly in the central Puget Sound region, with the largest increase (4%) seen on I-405 due in large part to capital improvements made on I-405 corridor (see the 2010 Congestion Report, pp. 56-59).

Major central Puget Sound freeways: average weekday delay comparison

Vehicle hours of delay per day; 2006-2010

	Relative to posted speed (60 mph)							Relative to maximum flow speed (50 mph)						
State route	2006	2007	2008	2009	2010	%Δ 2010 vs. 2008	%Δ 2010 vs. 2009	2006	2007	2008	2009	2010	%Δ 2010 vs. 2008	%Δ 2010 vs. 2009
I-5	20,094	20,167	15,696	15,329	13,981	-10.9%	-8.8%	10,520	10,568	7,324	6,982	6,395	-12.7%	-8.4%
I-90	2,114	2,141	1,433	1,187	1,240	-13.5%	4.5%	824	659	282	201	255	-9.6%	26.9%
SR 167	3,021	2,734	2,084	1,598	1,982	-4.9%	24.0%	1,257	1,138	618	360	608	-1.6%	68.9%
I-405	13,759	12,966	11,754	9,165	10,094	-14.1%	10.1%	8,334	7,654	6,864	4,546	5,603	-18.4%	23.3%
SR 520	3,670	3,577	2,781	3,017	2,659	-4.4%	-11.9%	2,224	2,180	1,518	1,689	1,417	-6.6%	-16.1%
Total	**42,658**	**41,585**	**33,748**	**30,296**	**29,956**	**-11.2%**	**-1.1%**	**23,159**	**22,199**	**16,606**	**13,778**	**14,278**	**-14.0%**	**3.6%**

Data source: WSDOT Urban Planning Office.

Note: The article on delay examines individual corridors while the travel time analysis (page x-x) examines commutes which can include multiple corridors. 2008 data was re-calculated using the improved data processing and doesnot match with the numbers reported in 2009 Congestion Report.

Major central Puget Sound freeways: Vehicle miles traveled (VMT)

2006-2010; In thousands

State route	2006	2007	2008	2009	2010	%Δ 2010 vs. 2008	%Δ 2010 vs. 2009
I-5	7,687	7,744	7,583	7,698	7,640	0.8%	-0.8%
I-90	1,464	1,580	1,414	1,512	1,433	1.3%	-5.2%
SR 167	977	947	921	963	951	3.2%	-1.2%
I-405	3,593	3,507	3,500	3,554	3,653	4.4%	2.8%
SR 520	1,053	1,019	932	1,022	939	0.7%	-8.1%
Total	**14,774**	**14,797**	**14,350**	**14,749**	**14,616**	**1.8%**	**-0.9%**

Data source: WSDOT Urban Planning Office.

Note: The delay article examines VMT for all weekdays, while travel time analysis looks at VMT for weekdays during AM peak (5 am to 10 am) and PM peak (2 pm to 8 pm) periods. VMT in central Puget Sound region is for General Purposes (GP) lanes only. 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.

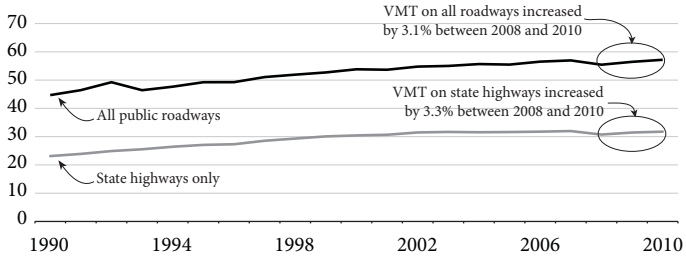
Statewide Vehicle Miles Traveled on the Rise

VMT data presented in the table on the previous page is only for general purpose lanes. It is important to recognize that VMT data collection in the central Puget Sound area is heavily influenced by disruptive factors such as construction staging, data station malfunction, and work zone traffic diversions, which make it difficult to capture consistently accurate VMT counts from traffic induction loops.

Statewide vehicle miles traveled increased between 2008 and 2010

The average annual vehicle miles traveled (VMT) on all public roadways in Washington increased by 3.1% in 2010 (57.191 billion) compared to 2008 (55.447 billion). The VMT on state highways increased by 3.3% in 2010 (31.764 billion) compared to 2008 (30.742 billion). The 2010 annual VMT compared to 2009 also rose by 1.3% for all public roadways (56.461 billion) and by 1% for state highways only (31.456 billion).

Annual vehicle miles traveled statewide
1990–2010; In billions



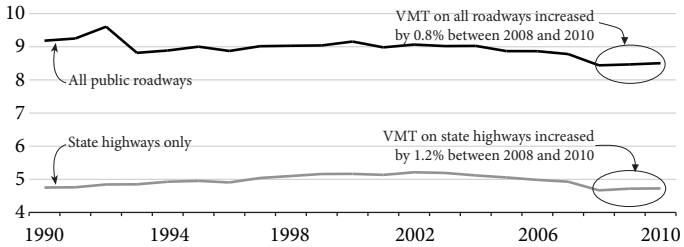
Data source: WSDOT Statewide Travel and Collision Data Office (STCDO).

WSDOT continues its efforts to understand and respond to the factors that influence greenhouse gas emissions and VMT, to help the state achieve its legislative goal of reducing per capita VMT 18% by 2020 as directed by RCW 47.01.440. The agency was directed by Governor Gregoire's Executive Order 09-05 Washington's Leadership on Climate Change to analyze VMT in the state and to develop strategies to reduce GHG emissions from the transportation sector. WSDOT is refining its VMT forecasts while developing strategies to reduce greenhouse gas emissions from the transportation sector. WSDOT reported to the Governor and Legislature on this work in December 2010. (See the gray panel on page 18 for details of the report's content.)

Per person vehicle miles traveled increased slightly in 2010 compared to 2008 and 2009

On average, Washingtonians drove 65 more miles in 2010 than they did in 2008, with 57 of those miles on state highways. On a per-person basis, vehicle miles traveled on all public roadways increased by 0.8% between the 2008 baseline year (8,440 VMT per person) and 2010 (8,505 VMT per person); the per person VMT increase between 2009 (8,467 VMT per person) and 2010 was 0.4%. The per person VMT metric on state highways only also showed an increase of 1.2% in 2010 (4,724 VMT per person) compared to 2008 (4,667 VMT per person). The per person VMT in 2009 was 4,717 vehicle miles traveled.

Annual per capita vehicle miles traveled
1990–2010; In thousands



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

Annual and per capita VMT on state highways and all public roads
2006–2010

		Annual vehicle miles traveled (billions)				Per capita vehicle miles traveled			
Year	Population	State highways	% Δ from 2010	All public roads	% Δ from 2010	State highways	% Δ from 2010	All public roads	% Δ from 2010
2006	6,375,600	31.764	0.0%	56.532	1.2%	4,982	-5.2%	8,867	-4.1%
2007	6,488,000	31.970	-0.6%	56.964	0.4%	4,928	-4.1%	8,780	-3.1%
2008	6,587,600	30.742	3.3%	55.447	3.1%	4,667	1.2%	8,440	0.8%
2009	6,668,200	31.456	1.0%	56.461	1.3%	4,717	0.1%	8,467	0.4%
2010	6,724,520	31.764	n/a	57.191	n/a	4,724	n/a	8,505	n/a

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

Statewide Congestion Indicators and Travel Delay

Statewide Vehicle Miles Traveled on the Rise

Key points in WSDOT's report to the Legislature and Governor, December 2010

- WSDOT is taking steps to conserve fuel and energy, reduce carbon emissions and vehicles miles traveled, and protect our natural environment while keeping people, goods and the economy moving.
- The Highway Performance Monitoring System (HPMS) is an appropriate tool to monitor VMT statewide. It may also be an appropriate tool for monitoring VMT at the local and regional levels.
- The June 2010 VMT forecasting model uses a new methodology that more accurately forecasts VMT. Forecast models are most accurate in predicting VMT in the near-term (two to four years) and less accurate beyond four years.
- Basing reduction percentages on a forecast is problematic because the forecasts are adjusted annually and create unnecessary confusion.
- Regional transportation planning organizations forecast VMT using very different methodologies than the state. Some regional organizations do not use models and do not have the capability to forecast VMT.
- WSDOT recommends that the legislature use historical, measured VMT (e.g 2000, 2005, 2010 levels), rather than forecasted VMT to set the VMT baseline.
- Greenhouse gas reduction strategies from the transportation sector fit into four broad categories:
    - Operating the system more efficiently
    - Advancing vehicle technology
    - Improving fuels
    - Reducing VMT
- WSDOT's analysis suggests that there is no "silver bullet" and major contributions from each of the strategies will be needed to reduce GHG emissions.
- WSDOT's analysis suggests that implementing combinations of aggressive transportation emission reduction strategies can achieve roughly a ten percent reduction in total statewide GHG emissions compared to the 2050 baseline. Implementing many of these strategies would require changes in policy, funding, and authority, and also assumes ambitious improvements in vehicles and fuels. WSDOT did not assess the political or financial feasibility of implementing the strategies.
- WSDOT recommends that the state consider the most viable ways to reduce statewide GHG emissions across all sectors.

Providing charging stations for electric vehicles will be an important component of Green Highways initiatives.

Measuring Vehicle Throughput Productivity

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: it is the difference between the maximum five-minute flow rate observed during the year and the flow rate that occurs when vehicles move below the maximum throughput speed of 50 mph. 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.

Throughput productivity can be measured in duration and in severity, and shown as a percentage of the achievable 100% throughput capacity. The example below shows that morning congestion in 2010 (the black line) began later than in 2008 (the gray line); it was less severe (the highway operated at about 76% of capacity in 2010, compared to 68% in 2008) – for an overall improvement in relative throughput of 8%.

WSDOT uses highest observed optimal flow rate to determine throughput productivity

Not all highway lanes can achieve a maximum throughput of 2,000 vphpl because 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 the highest observed optimal flow rate as the maximum throughput for each monitoring location, throughput analysis can more realistically determine the loss in productivity owed to changes in traffic conditions.

For 2011, the throughput productivity graphs on pages 20-21 show each direction of travel and location. Earlier reports combined both directions, so the number of reported locations has doubled from last year.

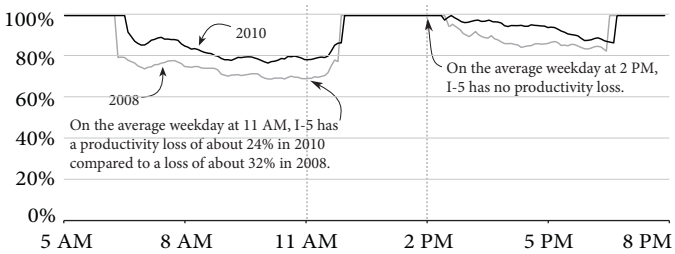
Throughput productivity improved at most monitored locations of major Puget Sound freeways in 2010

Although the Puget Sound monitoring locations continue to show throughput productivity below 100% during peak periods, productivity has nevertheless improved at most locations. Of the 16 locations monitored (eight in each direction), one did not experience any loss in throughput, 10 showed improvements ranging from 1% to 11%, two location were unchanged, and three changed for the worse. This is some loss in productivity compared to the 2010 Congestion Report, when all locations saw improved throughput.

Two segments showed the greatest gains: I-405 northbound at SR 169 in Renton improved by 10% during the morning commute and 11% in the evening, due to the I-405 South Bellevue widening project, which opened a new lane between 112th Ave SE and I-90 in January 2009. I-5 at I-90 in Seattle improved by 8% and 6% in the northbound morning commute and southbound afternoon commute respectively. The greatest loss in vehicle throughput was seen on I-5 southbound at NE 103rd Street, near Northgate, where throughput decreased by 9%.

Vehicle throughput productivity: example

Based on the highest average five minute flow rates observed on I-5 at I-90 MP 164, for northbound commute direction of traffic in 2008 and 2010



Data source: WSDOT Urban Planning Office.

Changes in loss of vehicle throughput at select Puget Sound locations

2008 compared to 2010; Maximum loss of vehicle throughput

	Northbound/Eastbound commute direction			Southbound/Westbound commute direction		
Location description	**2008**	**2010**	**Δ**	**2008**	**2010**	**Δ**
I-5 at S 188th Street, near SeaTac (MP 153.0)	18%	14%	-4%	19%	18%	-1%
I-5 at I-90 (MP 164.0)	32%	24%	-8%	14%	8%	-6%
I-5 at NE 103rd Street, near Northgate (MP 172.0)	16%	16%	0%	15%	24%	9%
I-90 at SR 900, in Issaquah (MP 16.5)	0%	0%	0%	14%	14%	0%
SR 167 at 84th Avenue SE (MP 21.5)	10%	14%	4%	18%	15%	-3%
I-405 at SR 169, in Renton (MP 4.0)	54%	44%	-10%	29%	18%	-11%
I-405 at NE 160th Street, in Kirkland (MP 22.5)	20%	19%	-1%	25%	23%	-2%
SR 520 at Evergreen Point Floating Bridge (MP 1.5)	27%	29%	2%	7%	5%	-2%

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

Note: Negative values in the delta column indicate that the vehicle throughput has increased in 2010 compared to 2008.

Throughput Productivity

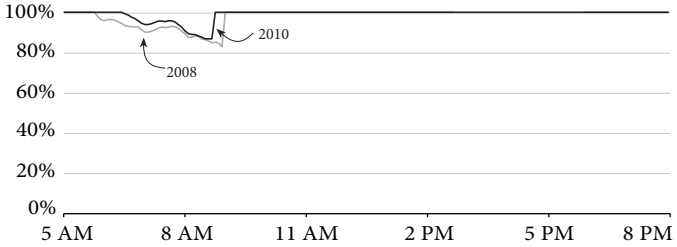
Measuring Throughput Productivity on Puget Sound Freeways

Throughput productivity at selected Puget Sound freeway locations by commute direction

Based on the highest observed five minute flow rates, 2008 and 2010; Vehicles per hour per lane (vphpl)

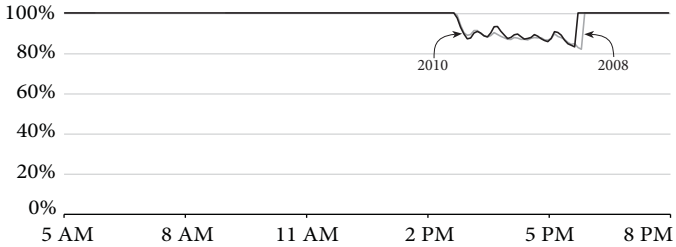
NB I-5 at S 188th Street (MP 153.0)

Based on highest observed 5 min flow rate; northbound = 1,940 vphpl



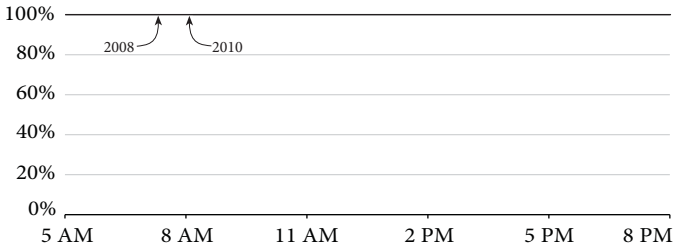
SB I-5 at S 188th Street (MP 153.0)

Based on highest observed 5 min flow rate; southbound = 1,675 vphpl



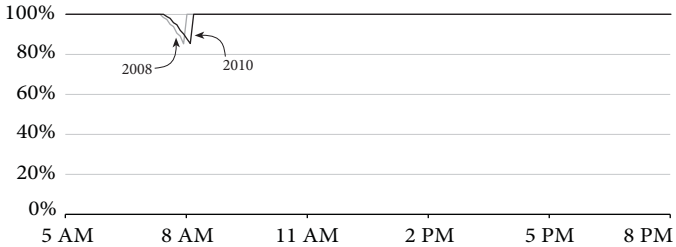
EB I-90 at SR 900 (MP 16.5)

Based on highest observed 5 min flow rate; eastbound = 1,655 vphpl



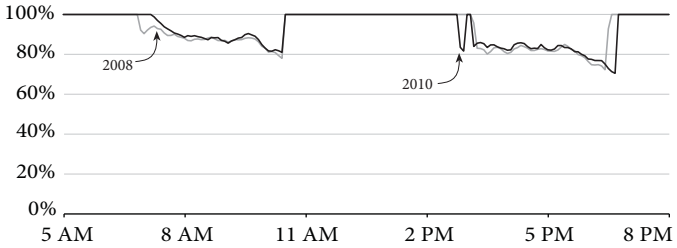
WB I-90 at SR 900 (MP 16.5)

Based on highest observed 5 min flow rate; westbound = 1,610 vphpl



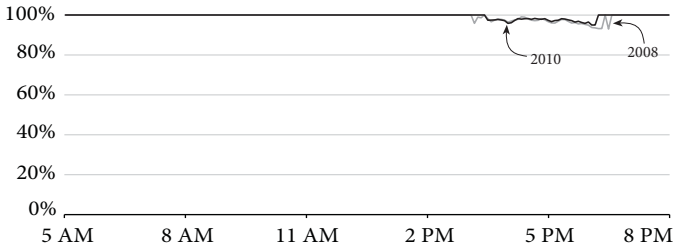
EB SR 520 at Evergreen Point Floating Bridge (MP 1.5)

Based on highest observed 5 min flow rate; eastbound = 1,800 vphpl



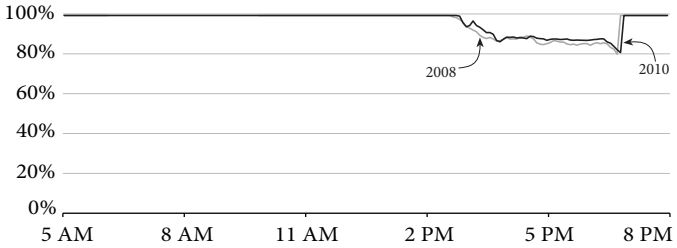
WB SR 520 at Evergreen Point Floating Bridge (MP 1.5)

Based on highest observed 5 min flow rate; westbound = 1,710 vphpl



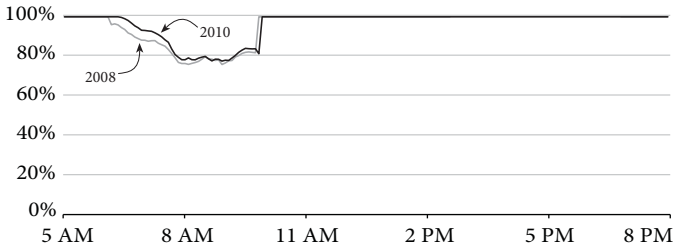
NB I-405 at NE 160th Street (MP 22.5)

Based on highest observed 5 min flow rate; northbound = 1,710 vphpl



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

Based on highest observed 5 min flow rate; southbound = 1,780 vphpl



Data source: WSDOT Urban Planning Office.

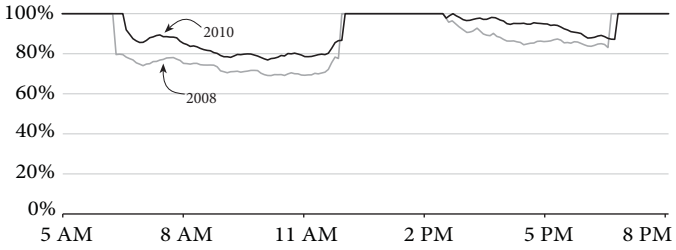
Measuring Throughput Productivity on Puget Sound Freeways

Throughput productivity at selected Puget Sound freeway locations by commute direction

Based on the highest observed five minute flow rates, 2008 and 2010; Vehicles per hour per lane (vphpl)

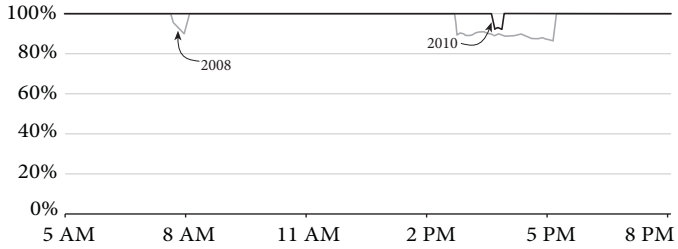
NB I-5 at I-90 (MP 164.0)

Based on highest observed 5 min flow rate; northbound = 1,670 vphpl



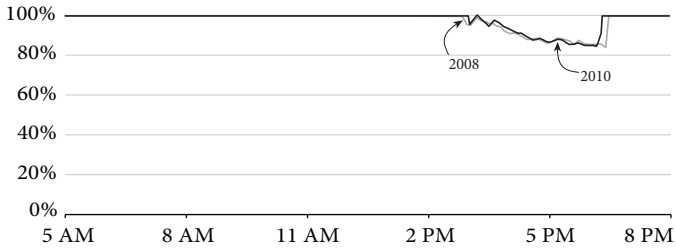
SB I-5 at I-90 (MP 164.0)

Based on highest observed 5 min flow rate; southbound = 1,550 vphpl



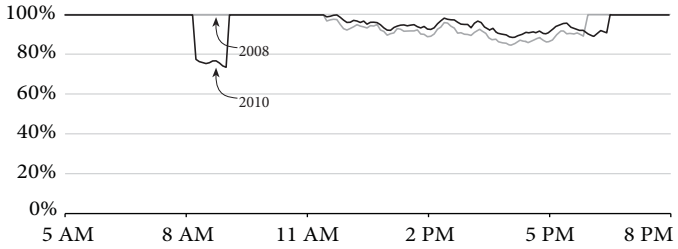
NB I-5 at NE 103rd Street (MP 172.0)

Based on highest observed 5 min flow rate; northbound = 1,565 vphpl



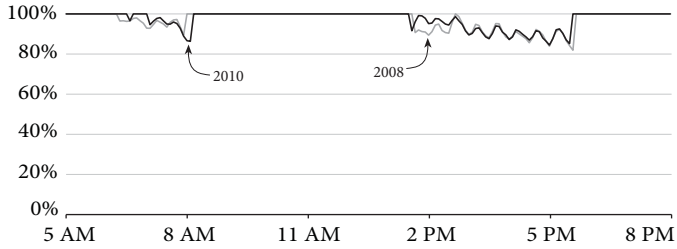
SB I-5 at NE 103rd Street (MP 172.0)

Based on highest observed 5 min flow rate; southbound = 1,525 vphpl



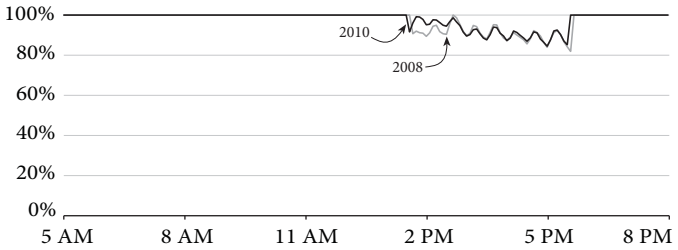
NB SR 167 at 84th Avenue SE (MP 21.50)

Based on highest observed 5 min flow rate; northbound = 1,550 vphpl



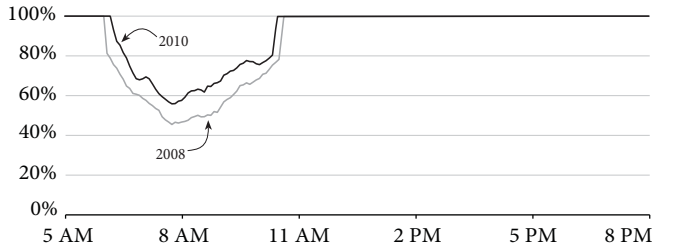
SB SR 167 at 84th Avenue SE (MP 21.50)

Based on highest observed 5 min flow rate; southbound = 1,630 vphpl



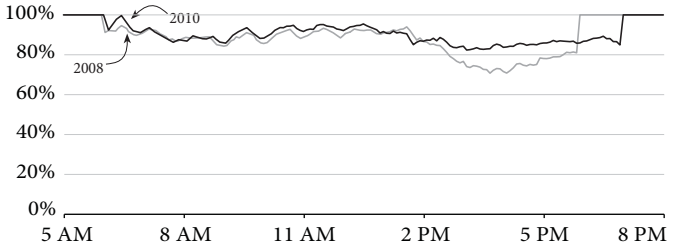
NB I-405 at SR 169 (MP 4.0)

Based on highest observed 5 min flow rate; northbound = 1,630 vphpl



SB I-405 at SR 169 (MP 4.0)

Based on highest observed 5 min flow rate; southbound = 1,440 vphpl



Data source: WSDOT Urban Planning Office.

Travel Time Analysis

Travel Time Analysis of Major Puget Sound Commute Routes

WSDOT uses the following performance measures to develop its travel time analysis for general purpose 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 p. 23-24 and 29-30. In addition to these measures, the travel time analysis also includes the percentage of days when speeds are below 36 mph, which WSDOT defines as severe congestion (see the stamp graphs on p. 32-33). In addition to the discussion of general purpose lane travel times, the annual Congestion Report includes an analysis of HOV lane travel times beginning on p. 37.

Most routes show little change in travel time

The 2011 annual Congestion Report has upgraded the number of high-demand Puget Sound area commute routes from 38 to 40, by including the routes on SR 520 between Redmond and Bellevue which were reported under the list of uncongested routes in previous editions. This lowers the number of uncongested routes reported on from 14 to 12.

Data for four of the 40 commutes routes were unavailable due to construction. Of the remaining 36 commute routes with data, 28 saw changes in average peak travel time of less than two minutes between 2008 and 2010. Eight routes changed by more than two minutes: three routes saw shorter travel times, five routes saw longer travel times.

The greatest decreases in travel time were seen during the morning commute on I-405 northbound from Tukwila to Bellevue and during the evening commute on I-405 southbound from Bellevue to Tukwila. Travel time dropped by 13.4 minutes (33%) and 5.5 minutes (16%), while vehicle miles traveled (VMT) rose by 20% and 5% respectively. The southern half of the I-405 corridor continues to benefit from two projects which both opened new lanes in 2009: the I-405–South Bellevue Widening project and the I-405–I-5 to SR 169 Stage 1 project. The Before and After analysis of these capital improvement projects are discussed in WSDOT's 2010 Congestion Report, p. 56-58.

Duration of congestion shows mixed results

WSDOT defines the duration of the congestion (see page 11) 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 duration of congestion presented in the 2010 Congestion Report – comparing 2007 to 2009 data – either decreased or remained unchanged on all routes. The 2008 to 2010 comparison does not show a consistent trend. Of the 36 routes with travel time data, the duration of congestion increased on 10 and decreased on 18; six were unchanged, and two routes do not regularly drop below an average speed of 45 mph.

The evening commute on SR 167 southbound from Renton to Auburn saw a dramatic change from 2007 to 2009: a drop in congestion duration from 3 hours 30 minutes to just 10 minutes. However, analysis showed that congestion duration in 2010 returned to the 2008 level, with both years having an average of 2 hours 55 minutes a day, down slightly from 2007.

Two routes, the I-5 southbound evening commutes from Seattle to SeaTac and Seattle to Federal Way, had no measurable duration of congestion in 2010. In 2008, both routes exhibited durations of congestion of 1 hour 5 minutes and 1 hour 45 minutes, respectively. Although drivers on these routes do experience regular congestion, the average speed for the full route did not drop below 45 mph on an average weekday. Peak travel time was also reduced on both routes by 9%, accompanied by a slight reduction in VMT. The duration of congestion was also significantly shorter on the morning counterpart routes, I-5 northbound from SeaTac to Seattle and Federal Way to Seattle, by 1 hour 5 minutes and 1 hour 10 minutes, with slight reductions in peak travel time and VMT.

Two evening routes that did not experience any corridor-level congestion below the threshold speed in 2008 did experience congestion in 2010: the I-90 eastbound commutes from Seattle to Bellevue and Seattle to Issaquah. The duration of congestion in 2010 was one hour for Seattle to Bellevue, and 35 minutes for Seattle to Issaquah. The average peak travel time also increased by 25% and 17% respectively. The increase in congestion on I-90 eastbound may be due to the summer 2010 start of construction on the I-90 – Two Way Transit and HOV Operations Project, between 80th Ave SE on Mercer Island and Bellevue Way.

Vehicle miles traveled: Down in the morning, up in the evening

VMT changed by more than 2% on 12 of the 36 routes in 2010. Of the morning routes, VMT was down by more than 2% on three routes, and up on one route by more than 2% (I-405 northbound Tukwila to Bellevue). Of the evening routes, eight increased by more than 2% and none decreased by more than 2%; 13 morning routes and 11 evening routes changed by 2% or less.

Travel Time Analysis of Major Puget Sound Commute Routes, continued

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

Morning (AM) peak is between 5 am and 10 am; 2008 morning (AM) peak vs. 2010 morning (AM) 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

				Travel time on the route at		Average travel time at peak of AM rush			Maximum throughput travel time		VMT during peak period	Duration of congestion (how long is average speed below 45mph)		
									MT³ Index					
Route	Direction of travel	Length of route	Peak time of commuter AM rush	Posted speed	Maximum throughput speed	2008	2010	%Δ	2008	2010	%Δ in VMT	2008	2010	Δ
To Seattle														
I-5 Everett to Seattle	SB	24	7:30	24	28	41	45	8%	1.46	1.58	-2%	2:15	1:50	-0:25
I-5 Federal Way to Seattle	NB	22	7:35	22	27	40	39	-2%	1.48	1.46	-1%	3:25	2:15	-1:10
I-90/I-5 Issaquah to Seattle	WB/NB	15	8:20	15	19	n/a	22	n/a	n/a	1.18	-2%	n/a	0:15	n/a
SR 520/I-5 Redmond to Seattle	WB/SB	13	7:45	13	16	19	20	3%	1.19	1.22	-1%	0:25	0:45	0:20
I-5 SeaTac to Seattle	NB	13	8:35	13	16	25	24	-2%	1.58	1.54	-2%	3:50	2:45	-1:05
I-405/I-90/I-5 Bellevue to Seattle	SB/WB/NB	10	8:35	10	12	n/a	14	n/a	n/a	1.10	0%	n/a	*	n/a
I-405/SR 520/I-5 Bellevue to Seattle	NB/WB/SB	10	7:45	10	12	17	18	7%	1.38	1.48	-2%	1:30	2:20	0:50
To Bellevue														
I-5/I-405 Everett to Bellevue	SB	24	7:25	24	28	43	47	7%	1.53	1.64	-2%	2:15	2:20	0:05
I-405 Lynnwood to Bellevue	SB	16	7:30	16	19	34	37	9%	1.75	1.90	-2%	2:25	2:40	0:15
I-405 Tukwila to Bellevue	NB	13	7:40	13	16	41	27	-33%	2.51	1.68	20%	4:25	3:10	-1:15
I-5/I-90/I-405 Seattle to Bellevue	SB/EB/NB	11	8:45	11	13	17	16	-7%	1.32	1.24	-6%	2:00	0:25	-1:35
I-5/SR 520/ I-405 Seattle to Bellevue	NB/EB/SB	10	8:40	10	12	22	22	0%	1.76	1.76	-2%	2:35	2:35	0:00
I-90/I-405 Issaquah to Bellevue	WB/NB	9	8:40	9	11	15	15	-5%	1.35	1.29	-2%	2:25	1:20	-1:05
SR 520/I-405 Redmond to Bellevue	WB/SB	6	7:50	6	7	7	8	8%	1.00	1.08	2%	*	*	*
To Other Locations														
I-405 Bellevue to Tukwila	SB	13	7:40	13	16	21	20	-4%	1.32	1.27	2%	0:50	0:35	-0:15
I-405/SR 520 Bellevue to Redmond	NB/EB	5	8:55	5	7	8	8	-1%	1.24	1.22	-5%	1:20	1:20	0:00
SR 167 Auburn to Renton	NB	10	7:35	10	12	16	17	4%	1.40	1.45	1%	2:40	2:15	-0:25
I-5/I-90 Seattle to Issaquah	SB/EB	16	8:50	16	19	20	19	-3%	1.05	1.02	-2%	*	*	*
I-5/SR 520 Seattle to Redmond	NB/EB	13	8:40	13	16	25	25	-2%	1.57	1.54	-3%	2:25	2:20	-0:05

Data source: WSDOT Strategic Assessment, WSDOT NWR 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. "n/a" indicates no data available for those routes. Commute trip lengths along SR 520 between Redmond and Seattle, Redmond and Bellevue are 1.4 mile shorter than as published in 2010 Annual Congestion Report. * Indicates that the average speed for the route did not fall below 45 mph (75% of posted speed) on a route.

Travel Time Analysis of Major Puget Sound Commute Routes, continued

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

Evening (PM) peak is between 2 pm and 8 pm; 2008 evening (PM) peak vs. 2010 evening (PM) 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

				Travel time on the route at		Average travel time at peak of PM rush			Maximum throughput travel time		VMT during peak period	Duration of congestion (how long is average speed below 45mph)		
									MT³ Index					
Route	Direction of travel	Length of route	Peak time of commuter PM rush	Posted speed	Maximum throughput speed	2008	2010	%Δ	2008	2010	%Δ in VMT	2008	2010	Δ
From Seattle														
I-5 Seattle to Everett	NB	23	17:00	23	28	38	39	1%	1.38	1.40	0%	2:30	2:30	0:00
I-5 Seattle to Federal Way	SB	22	16:05	22	27	34	30	-9%	1.26	1.14	0%	1:45	*	-1:45
I-5 Seattle to SeaTac	SB	13	16:05	13	16	19	17	-9%	1.23	1.12	-1%	1:05	*	-1:05
I-5/I-90/I-405 Seattle to Bellevue	SB/EB/NB	11	17:30	11	13	14	18	25%	1.12	1.40	0%	*	1:00	1:00
I-5/SR 520/I-405 Seattle to Bellevue	NB/EB/SB	10	17:30	10	12	19	21	11%	1.53	1.70	1%	2:45	2:45	0:00
I-5/SR 520 Seattle to Redmond	NB/EB	13	17:35	13	16	23	25	8%	1.46	1.59	1%	1:30	2:05	0:35
I-5/I-90 Seattle to Issaquah	SB/EB	16	17:35	16	19	20	24	17%	1.08	1.26	2%	*	0:35	0.35
From Bellevue														
I-405/I-5 Bellevue to Everett	NB	23	17:20	23	28	40	39	-3%	1.45	1.41	2%	2:55	2:35	-0:20
I-405 Bellevue to Lynnwood	NB	16	17:20	16	19	32	31	-4%	1.68	1.61	3%	3:15	3:05	-0:10
I-405 Bellevue to Tukwila	SB	13	17:25	13	16	35	30	-16%	2.23	1.88	5%	5:15	5:25	0:10
I-405/I-90/I-5 Bellevue to Seattle	SB/WB/NB	10	17:25	10	12	n/a	24	n/a	n/a	1.99	2%	n/a	2:40	n/a
I-405/SR 520/I-5 Bellevue to Seattle	NB/WB/SB	10	17:25	10	12	28	30	7%	2.28	2.43	1%	5:00	4:50	-0:10
I-405/I-90 Bellevue to Issaquah	SB/EB	9	17:35	9	11	15	16	5%	1.42	1.49	4%	3:25	2:45	-0:40
I-405/SR 520 Bellevue to Redmond	NB/EB	5	17:40	5	7	10	10	3%	1.48	1.52	4%	1:00	1:50	0:50
From Other Locations														
I-5 Everett to Seattle	SB	24	16:05	24	28	39	37	-6%	1.39	1.31	3%	2:50	2:50	0:00
I-90/I-5 Issaquah to Seattle	WB/NB	15	17:25	15	19	n/a	28	n/a	n/a	1.51	3%	n/a	1:30	n/a
SR 520/I-5 Redmond to Seattle	WB/SB	13	17:30	13	16	31	32	4%	1.94	2.02	2%	4:15	3:50	-0:25
SR 520/I-405 Redmond to Bellevue	WB/SB	6	17:25	6	7	13	13	1%	1.74	1.76	7%	3:15	2:05	-1:10
I-5 SeaTac to Seattle	NB	13	17:25	13	16	20	21	6%	1.28	1.36	1%	1:55	2:05	0:10
SR 167 Renton to Auburn	SB	10	16:50	10	12	16	16	0%	1.38	1.38	3%	2:55	2:55	0:00
I-405 Tukwila to Bellevue	NB	13	17:25	13	16	21	23	12%	1.29	1.44	5%	1:40	1:35	-0:05

Data source: WSDOT Strategic Assessment, WSDOT NWR 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. "n/a" indicates no data available for those routes. Commute trip lengths along SR 520 between Redmond and Seattle, Redmond and Bellevue are 1.4 mile shorter than as published in 2010 Annual Congestion Report. * Indicates that the average speed for the route did not fall below 45 mph (75% of posted speed) on a route..

Travel Time Analysis of Major Puget Sound Commute Routes, continued

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

In 2010, the westbound evening commute between Bellevue and Seattle via SR 520 continued to be the route with the worst travel time compared to its length. The length of this commute route is about 10 miles and the average peak travel time was about 30 minutes, or roughly two and a half times the time needed when traveling at maximum throughput speeds. Of the 40 commute routes tracked, this route had the highest ratio of the average travel time to maximum throughput travel time at 2.43. The gray box below explains how WSDOT calculates this ratio and uses it to compare results on different commute routes with varying lengths.

For the five years prior to 2009, the Tukwila to Bellevue morning commute on I-405 northbound was the worst commute route, edging out Bellevue to Seattle westbound evening commute via SR 520. Beginning in 2009, the Bellevue to Seattle via SR 520 westbound evening commute was designated as the new "worst" commute route in the Puget Sound (out of the 40 high demand commutes monitored by WSDOT). Congestion on the Tukwila to Bellevue morning commute was greatly reduced after a series of congestion relief projects along I-405, which dropped the maximum throughput travel time index (MT^3I) well below 2.0. (See the 2010 annual Congestion Report, pages 56-58.)

WSDOT is working towards much needed SR 520 improvements

The SR 520 Bridge Replacement and HOV program will enhance safety and improve mobility by replacing the aging floating bridge and making transit and roadway improvements throughout the corridor. The program is made up of four projects, each with its own timeline, design, and environmental process. The I-5 to Medina project is in the process of environmental review and permitting, with construction expected to start in 2012. The pontoon construction project and the Medina to SR 202 Eastside Transit and HOV projects are currently under construction; the Lake Washington Congestion Management Project will implement variable tolling in 2011.

In preparation for tolling the SR 520 bridge crews installed two toll rate signs (one in each direction) that will display the current toll rate for both Good To Go! customers and Pay By Mail. Tolls on the bridge will vary by time of day.

How WSDOT compares travel times on different routes: Calculating MT^3I

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-5 Seattle to Federal Way and the SR 520 Bellevue to Seattle evening commutes (shown in the travel time table on page 24) both had average travel times of 30 minutes. At a glance, the routes appear roughly equal. However, the first route is 22 miles long and the second is 10 miles; this difference means that using average travel times alone is not a meaningful comparison.

The maximum throughput travel time index (MT^3I) incorporates the expected travel time under maximum throughput conditions, taking into account the length of the route. An MT^3I of 1.0 would indicate a highway operating at maximum efficiency. As the MT^3I value increases, travel time performance deteriorates. In this example, the Seattle to Federal Way evening commute has an MT^3I of 1.14, which means that the commute takes 14% longer than it would at maximum throughput speeds.

The other example, Bellevue to Seattle via SR 520 evening route, has an MT^3I of 2.43, which means that the commute route takes two-and-a-half times as long as the time it would normally take at maximum throughput speeds. The Bellevue to Seattle via SR 520 evening route is the slower commute of the two – and is currently worst of the 52 monitored Puget Sound commute routes.

Factors Affecting Travel Times: 2008 – 2010

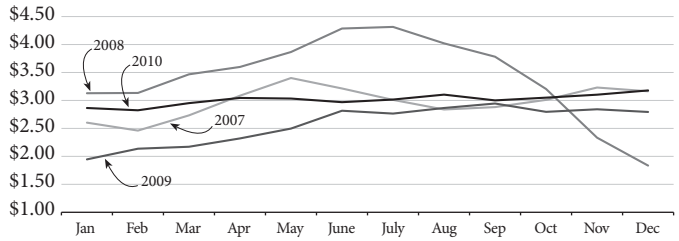
Economic conditions in the central Puget Sound, 2010 compared to 2008

Washington, like most of the rest of the country is still recovering from the recession that began in December 2007 and ended in June of 2009. The recovery has been slow, with many indicators of economic growth and activity lagging statewide. Economic conditions are thought to play a role in commute patterns in the Puget Sound region. The comparison between 2008 and 2010 average travel times shows small changes on most routes, while the duration of congestion showed mixed results with roughly a third of the routes taking longer and the rest shorter or unchanged. The labor market, gasoline prices, and other economic factors can influence commute decisions.

Gasoline prices down 11% between 2008 and 2010

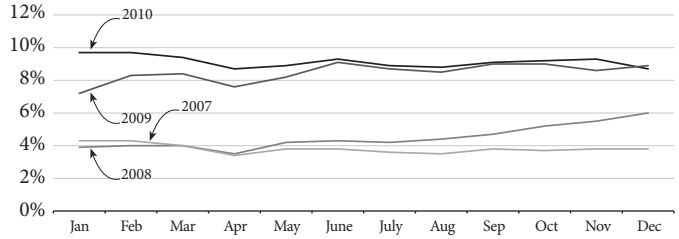
Between 2008 and 2010, fuel prices in Washington dropped by more than 11% after peaking in the summer of 2008 at about $4.30 a gallon. Through the second half of 2008 prices dropped rapidly, settling below $2 a gallon by the end of the year. Average gasoline prices climbed to around $3 a gallon by mid-2009 and remained stable through 2010. High gasoline prices can play a significant role in commute decisions in the Central Puget Sound, as people carefully consider travel options.

Average monthly gasoline prices in Washington
In dollars; 2007 - 2010



Data source: U.S. Dept. of Energy's Energy Information Administration.

Unemployment rate for the Seattle-Bellevue-Everett metropolitan area
2007 - 2010



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

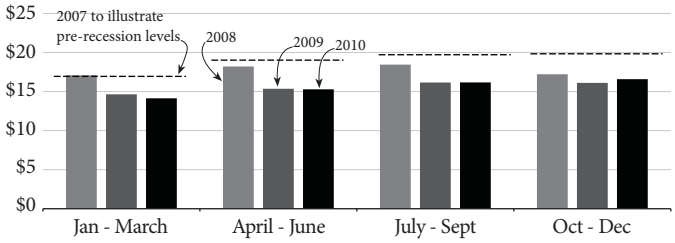
Unemployment rates remain high in the central Puget Sound region

Unemployment rates in the Puget Sound region were low before the recession, hovering at or below 4% for most of 2007 and 2008. Unemployment rose rapidly in the last quarter of 2008 and into 2009, and both private and public sector jobs have been slower-than-average to recover. Job losses can impact the travel patterns of many daily commuters. Since 2008, many people who were previously commuting to jobs during peak times may no longer be making the same trips in 2010. Although the economic climate began to improve in 2010, the average unemployment rate in the Seattle-Bellevue-Everett metropolitan area remained high at 9.1%, more than double the 2008 average rate of 4.5%.

Taxable retail sales in Puget Sound Counties down 11% between 2008 and 2010

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 financial crisis started to take its toll on consumer spending and purchasing behavior in the second half of the year. Taxable retail sales in 2009 remained significantly depressed, at about 11.2% lower than 2008 levels. Growth remained flat between 2009 and 2010, with only a 0.2% increase overall. Between 2008 and 2010, taxable retail sales were down 11% in the Puget Sound region.

Taxable retail sales for selected Puget Sound Counties
In billions of dollars; 2007 - 2010



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

Washington real personal income shows little change between 2008 and 2010

Washington's real personal income is a measure of income received by all state residents from all sources in a given year. Between 2008 and 2010, real personal income increased slightly from $263.3 billion in 2008 to $264.1 billion in 2010, an $800 million increase. Closer examination shows that between 2008 and 2010 salary income decreased while non-wage income increased, indicating

Factors Affecting Travel Times: 2008 – 2010, continued

that on average more people may have looked to alternative means to make ends meet as the labor market remained depressed. On a per capita basis, real wages have fallen slightly from $39,785 per person in 2008 to $39,097 per person in 2010.

Employment and population trends reflect the struggling regional economy

According to the state Office of Financial Management, natural population growth (births minus deaths) in Washington remains steady, while population growth due to migration from other states or countries has slowed somewhat. Individual cities in the central Puget Sound region show relatively small increases: Redmond showed the highest real growth at 5%, adding more than 2,300 people.

Population and employment changes at selected Puget Sound locations
2008 compared to 2010

	Population			Number of Jobs		
	2008	2010	% Δ	2008	2010	% Δ
Seattle	592,800	612,000	3%	497,047	462,180	-7%
Bellevue	119,200	122,900	3%	128,330	119,892	-7%
Southwestern King County cities						
Auburn	67,005	67,755	1%	39,862	37,371	-6%
Des Moines	29,180	29,290	0%	5,479	5,717	4%
Federal Way	88,040	88,760	1%	31,066	28,720	-8%
Kent	86,980	88,760	2%	64,219	60,322	-6%
Renton[1]	78,780	86,230	9%	56,391	53,960	-4%
SeaTac	25,720	25,890	1%	28,080	24,641	-12%
Tukwila	18,080	18,190	1%	47,387	43,126	-9%
Total[2]	**393,785**	**400,595**	**2%**	**272,484**	**253,857**	**-7%**
Eastern King County cities						
Issaquah	26,320	27,160	3%	19,067	19,267	1%
Kirkland	48,410	49,620	2%	32,742	30,942	-5%
Newcastle	9,720	9,955	2%	1,759	1,660	-6%
Redmond	51,320	53,680	5%	89,570	76,876	-14%
Sammamish	40,550	41,070	1%	4,967	4,650	-6%
Total	**176,320**	**181,485**	**3%**	**148,105**	**133,395**	**-10%**
Northern King County and Snohomish County						
Shoreline	53,440	54,580	2%	16,879	16,409	-3%
Snohomish	696,600	711,100	2%	254,185	235,371	-7%

Data source: Puget Sound Regional Council, Seattle, WA - 2010 Covered Employment Estimates by City; Office of Financial Management - Forecasting Division.

1 Renton annexed 4,280 people between April 1 2008 and April 1 2010. Actual population growth between 2008 and 2010 was 3,170 people (4%)

2 Total population numbers for 2010 were adjusted to reflect actual growth, not growth from annexations.

Nearly all cities in the region shed jobs between 2008 and 2010. Both the cities of Seattle and Bellevue lost about 7% of their total jobs, while selected cities in both southwestern and eastern King County lost 7% and 10% of their total jobs respectively. The largest job losses were in the cities of SeaTac (12%) and Redmond (14%).

Fewer collisions help reduce congestion

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 2010, Washington once again saw a reduction in such collisions compared to previous years. In King County, and also statewide, fatal and serious injury collisions were down 5% from 2008. Fewer collisions contribute to the reduction of non-recurrent congestion and to the improvement in reliable travel times on central Puget Sound highways.

Statewide, there were 12% fewer traffic fatalities in 2010 (459) than in 2008 (521), and 29% fewer compared to 2005 (649). In 2010, Washington experienced the lowest fatality rate since 1910, with 0.80 per 100 million VMT.

Fatal and serious injury collisions on all roads

Year	Statewide	Percent change in 2010	King County	Percent change in 2010
2010	2,529	n/a	654	n/a
2009	2,714	-7%	679	-4%
2008	2,643	-4%	692	-5%
2007	2,853	-11%	734	-11%
2006	3,054	-17%	874	-25%

Fatal and serious injury collisions on state highways

Year	Statewide	Percent change in 2010	King County	Percent change in 2010
2010	1,015	n/a	299	n/a
2009	1,066	-5%	212	8%
2008	1,016	0%	207	11%
2007	1,156	-12%	207	11%
2006	1,180	-14%	266	-14%

Data source: WSDOT Statewide Travel and Collision Data Office.

Note: In 2009, WSDOT stopped including citizen-reported collisions in collision data. This data represents officer-reported collisions only.

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 and under the worst conditions – they can make more accurate travel plans. A commuter can plan the daily trip to work at peak hours, a parent can plan the afternoon run to the daycare 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 on any given morning or evening commute route, and the corresponding average annual weekday travel time for the route, over the 260 weekdays in a calendar year. Averaging all weekday travel times at the peak interval includes the fastest days (usually holidays) and slowest days (perhaps recorded during a blizzard), and so it is only a broad indicator of how many minutes are needed to complete the route. A traveler who must be sure of reaching a destination on time needs to know how long the route will take under nearly the worst conditions.

The 95th percentile reliability score includes near worst case travel times: it is the duration that gets drivers to the destination on time 95% of the time. WSDOT uses 80th and 90th percentiles primarily as a tool to track changes in travel times at a finer level. These travel times would allow for routine delays due to a collision or roadwork. The 50th percentile, or median, means that half of all travel times were faster, half slower, than this duration.

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 in 2010

Travel times for 17 out of the 36 routes with available data changed by two minutes or less between 2008 and 2010. Of the remaining 19 routes, travel times were longer on 14 and shorter on five routes. These routes are likely affected by the economic factors discussed on pages 26-27.

The I-405 northbound Tukwila to Bellevue morning commute showed the greatest improvement in 95th percentile reliable travel time: it was shorter by 24 minutes in 2010 (36 minutes) compared to 2008 (60 minutes); see page 41 for more details. Other commutes that had significant improvements are the evening commutes on I-5 southbound Seattle to Federal Way – eight minutes shorter – and I-405 southbound Bellevue to Tukwila – 11 minutes shorter.

Fourteen out of 19 Puget Sound region commute routes saw worsened 95th percentile reliable travel times between 2008 and 2010. Some of the commute routes that suffered significantly are:

Morning commutes	Minutes added
I-5 Everett to Seattle	6 minutes
I-405 Lynwood to Bellevue	6 minutes
Evening commutes	**Minutes added**
I-90 Seattle to Bellevue	10 minutes
I-90 Seattle to Issaquah	7 minutes
SR 520 Redmond to Seattle	7 minutes
I-5 SeaTac to Seattle	7 minutes
SR 167 Auburn to Renton	6 minutes

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 1 of 20 days).

Travel Time Reliability on Major Puget Sound Commute Routes, continued

Morning commutes: changes in reliable travel time percentiles for 19 high demand AM commute routes, 2008-2010

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

			Travel times on the route at		2008 percentiles				2010 percentiles				Difference 2008 vs. 2010			
Route	Length of route	Peak of commuter AM rush	Posted speed	Maximum throughput speed	Median 50th	80th	90th	95th	Median 50th	80th	90th	95th	Median 50th	80th	90th	95th
To Seattle																
I-5 Everett to Seattle	24	7:30	24	28	38	51	58	**68**	42	56	67	**74**	3	5	9	**6**
I-5 Federal Way to Seattle	22	7:35	22	27	38	48	52	**59**	36	46	52	**56**	-2	-2	0	**-3**
I-90/I-5 Issaquah to Seattle	15	8:20	15	19	n/a	n/a	n/a	**n/a**	20	26	31	**34**	n/a	n/a	n/a	**n/a**
SR 520/I-5 Redmond to Seattle	13	7:45	13	16	19	22	24	**27**	19	23	25	**28**	0	1	1	**1**
I-5 SeaTac to Seattle	13	8:35	13	16	24	30	33	**41**	22	28	34	**40**	-2	-2	0	**-1**
I-405/I-90/I-5 Bellevue to Seattle	10	8:35	10	12	n/a	n/a	n/a	**n/a**	13	15	18	**21**	n/a	n/a	n/a	**n/a**
I-405/SR 520/I-5 Bellevue to Seattle	10	7:45	10	12	16	20	23	**25**	17	22	26	**29**	1	2	3	**4**
To Bellevue																
I-5/I-405 Everett to Bellevue	24	7:25	24	28	41	52	60	**70**	44	57	67	**74**	3	5	7	**4**
I-405 Lynnwood to Bellevue	16	7:30	16	19	32	44	50	**53**	35	47	54	**59**	3	3	5	**6**
I-405 Tukwilla to Bellevue	13	7:40	13	16	42	51	56	**60**	27	32	34	**36**	-14	-19	-21	**-24**
I-5/I-90/I-405 Seattle to Bellevue	11	8:45	11	13	15	19	24	**26**	14	19	23	**26**	-1	0	-1	**-1**
I-5/SR 520/I-405 Seattle to Bellevue	10	8:40	10	12	21	27	29	**32**	21	27	30	**32**	0	0	0	**0**
I-90/I-405 Issaquah to Bellevue	9	8:40	9	11	15	18	20	**22**	14	18	20	**21**	-1	0	0	**-1**
SR 520/I-405 Redmond to Bellevue	6	7:50	6	7	7	7	8	**8**	8	8	9	**9**	0	1	1	**1**
To Other Locations																
I-405 Bellevue to Tukwilla	13	7:40	13	16	20	24	27	**29**	20	23	25	**27**	-1	-1	-2	**-2**
I-405/SR 520/I-5 Bellevue to Redmond	5	8:55	5	7	8	9	10	**11**	8	9	10	**10**	0	0	0	**-1**
SR 167 Auburn to Renton	10	7:35	10	12	16	18	20	**24**	16	19	23	**27**	0	2	3	**3**
I-5/I-90 Seattle to Issaquah	16	8:50	16	19	19	23	25	**28**	17	22	26	**28**	-1	0	1	**0**
I-5/SR 520 Seattle to Redmond	13	8:40	13	16	25	30	33	**35**	24	30	33	**36**	-1	0	0	**0**

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

Notes: 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. Δ values cannot be reproduced as published using the integer values in the table. "n/a" implies lack of data for those particular commute routes. Commutes trip lengths along SR 520 between Redmond and Seattle, Redmond and Bellevue are 1.4 mile shorter than usual, as published in 2010 Annual Congestion Report.

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, 2008-2010

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

			Travel times on the route at		2008 percentiles				2010 percentiles				Difference 2008 vs. 2010			
Route	Length of route	Peak of commuter PM rush	Posted speed	Maximum throughput speed	Median 50th	80th	90th	95th	Median 50th	80th	90th	95th	Median 50th	80th	90th	95th
From Seattle																
I-5 Seattle to Everett	23	17:00	23	28	37	45	50	**56**	38	46	52	**56**	1	2	2	**0**
I-5 Seattle to Federal Way	22	16:05	22	27	31	39	43	**49**	28	35	38	**41**	-3	-4	-5	**-8**
I-5 Seattle to SeaTac	13	16:05	13	16	18	22	25	**29**	16	19	22	**25**	-1	-3	-3	**-3**
I-5/I-90/I-405 Seattle to Bellevue	11	17:30	11	13	13	16	19	**21**	16	23	27	**31**	3	7	9	**10**
I-5/SR 520/I-405 Seattle to Bellevue	10	17:30	10	12	18	23	27	**30**	19	27	31	**34**	2	4	4	**4**
I-5/SR 520 Seattle to Redmond	13	17:35	13	16	22	28	31	**35**	25	31	35	**38**	2	3	3	**3**
I-5/I-90 Seattle to Issaquah	16	17:35	16	19	18	24	27	**32**	22	29	34	**38**	4	5	6	**7**
From Bellevue																
I-405/I-5 Bellevue to Everett	23	17:20	23	28	40	46	50	**53**	38	44	48	**52**	-2	-2	-2	**-1**
I-405 Bellevue to Lynnwood	16	17:20	16	19	32	38	42	**45**	30	36	40	**43**	-2	-2	-2	**-2**
I-405 Bellevue to Tukwilla	13	17:25	13	16	35	41	45	**49**	30	33	37	**38**	-5	-8	-9	**-11**
I-405/I-90/I-5 Bellevue to Seattle	10	17:25	10	12	n/a	n/a	n/a	**n/a**	23	33	38	**41**	n/a	n/a	n/a	**n/a**
I-405/SR 520/I-5 Bellevue to Seattle	10	17:25	10	12	29	33	35	**38**	31	35	38	**41**	1	3	3	**4**
I-405/I-90 Bellevue to Issaquah	9	17:35	9	11	15	18	19	**21**	16	18	19	**21**	1	0	0	**-1**
I-405/SR 520 Bellevue to Redmond	5	17:40	5	7	9	11	15	**17**	9	12	16	**17**	0	1	2	**0**
From other locations																
I-5 Everett to Seattle	24	16:05	24	28	37	46	54	**59**	36	45	52	**58**	-2	-1	-3	**-1**
I-90/I-5 Issaquah to Seattle	15	17:25	15	19	n/a	n/a	n/a	**n/a**	25	38	45	**48**	n/a	n/a	n/a	**n/a**
SR 520/I-5 Redmond to Seattle	13	17:30	13	16	28	39	47	**52**	30	41	48	**59**	1	1	2	**7**
SR 520/I-405 Redmond to Bellvue	6	17:25	6	7	8	17	26	**31**	9	18	23	**33**	1	1	-3	**2**
I-5 SeaTac to Seattle	13	17:25	13	16	18	24	27	**30**	19	26	33	**36**	1	2	5	**7**
SR 167 Renton to Auburn	10	16:50	10	12	15	19	22	**26**	13	21	25	**31**	-1	1	3	**6**
I-405 Tukwilla to Bellevue	13	17:25	13	16	20	23	25	**31**	23	27	31	**35**	3	4	6	**4**

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

Notes: 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. Δ values cannot be reproduced as published using the integer values in the table. "n/a" implies lack of data for those particular commute routes. Commutes trip lengths along SR 520 between Redmond and Seattle, Redmond and Bellevue are 1.4 mile shorter than usual, as published in 2010 Annual Congestion Report.

Travel Time Analysis: Other views / Introducing Stamp Graphs

What others said about congestion in 2010

The 2010 Urban Mobility Report

Texas Transportation Institute published its 2010 annual Urban Mobility Report in January 2011, which was based on 2009 data. The report says congestion is still a problem in America's 493 urban areas. In 2009, congestion caused urban Americans to travel 4.8 billion hours more and to purchase an extra 3.9 billion gallons of fuel for a congestion cost of $115 billion. The report also states that 2008 appears to have been the best year for congestion in recent times; congestion worsened in 2009. The authors caution the reader by pointing out that prior to the economy slowing, just three years ago, congestion levels were much higher than a decade ago; these conditions will return with a strengthening economy.

Seattle area performance metrics:

- Seattle's ranks 11th in 2009 with a Travel Time Index (TTI) of 1.24. It ranked 8th in 2008 with a TTI value of 1.26.
- Seattle ranks 10th for congestion cost per peak auto commuter and 13th for total cost of congestion.
- Benefits from implementation of operational treatments represents a total congestion cost savings of $179 million annually.
- Benefits from implementation of public transportation services represents a total congestion cost savings of $347 million annually.

Inrix 2010 Annual Scorecard

Published by Inrix, a private sector traffic data collection company, the 2010 Annual Scorecard documents that after three years of relatively modest traffic congestion, America is now back on the road to gridlock with a vengeance.

Seattle area performance metrics:

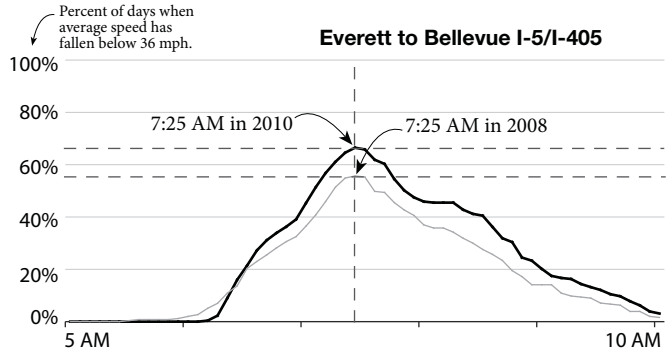
- Seattle metropolitan area ranked as the nation's 10th-most congested area with a Travel Time Tax of 19.8%. In 2008, Seattle was ranked as the 9th most congested metro area in the nation.
- Congested corridor: I-405 SB between SR 520 and SE Coal Creek Parkway is identified as the most congested corridor in the Seattle metro area.
- Bottlenecks: I-5 SB at 45th street/Exit 169, a 1.22-mile section of I-5 in King County, is identified as the worst bottleneck in Seattle metro area with 52 hours of congested traffic flow at an average congested speed of 20.9 mph.

Stamp graphs show the duration and frequency of severe congestion

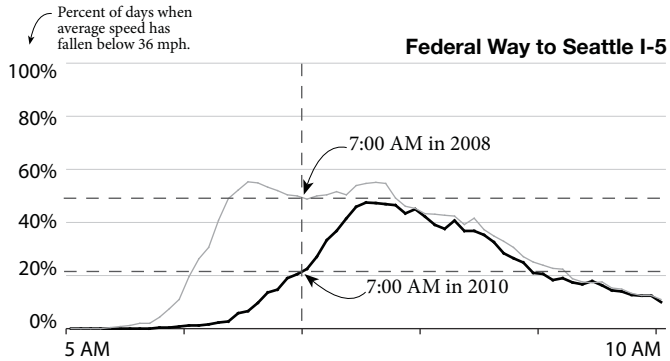
The best visual evidence to show whether the peak period is spreading or contracting can be seen in the "stamp graphs" on the following two pages. The stamp graphs show the frequency of severe congestion on the 40 high demand central Puget Sound commute routes. These graphs, comparing 2008 and 2010 data, show the percentage of days annually that observed average speeds were below 36 mph on the key highway segments. For information on how to read stamp graphs, see the illustrations below.

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

How frequently (and when) did the average trip speed drop under 36 mph? How have those conditions changed from 2008 to 2010?



At 7:25 am in 2008, you had about a 56% chance that traffic would be moving less than 36 mph. In 2010, the situation became worse (black line above the gray line); your chance that traffic would be moving slower than 36 mph was about 67% in 2010.



At 7:00 am in 2008, you had about a 48% chance that traffic would be moving less than 36 mph. In 2010, the situation was better (black line below the gray line); your chance that traffic would be moving slower than 36 mph was about 22%.

Data source: WSDOT Strategic Assessment Office.

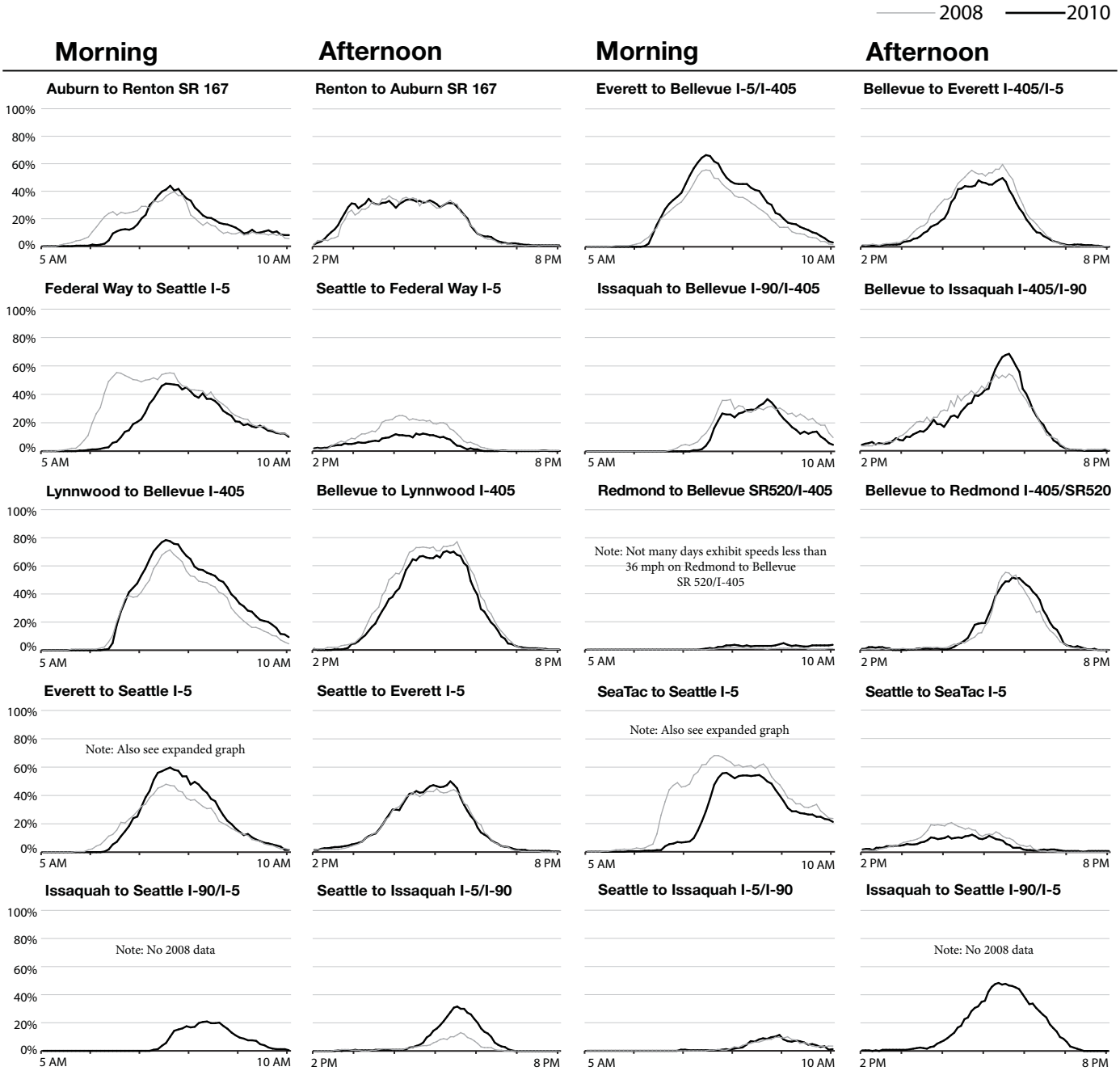
Duration and Frequency of Severe Congestion in Peak Travel Periods

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 percentage of days annually when average speeds were below 36 mph. For more information on how to read them, see page 31.

Comparing 2008 and 2010 GP lanes: Percent of time in an average weekday when speeds fell below 36 mph

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

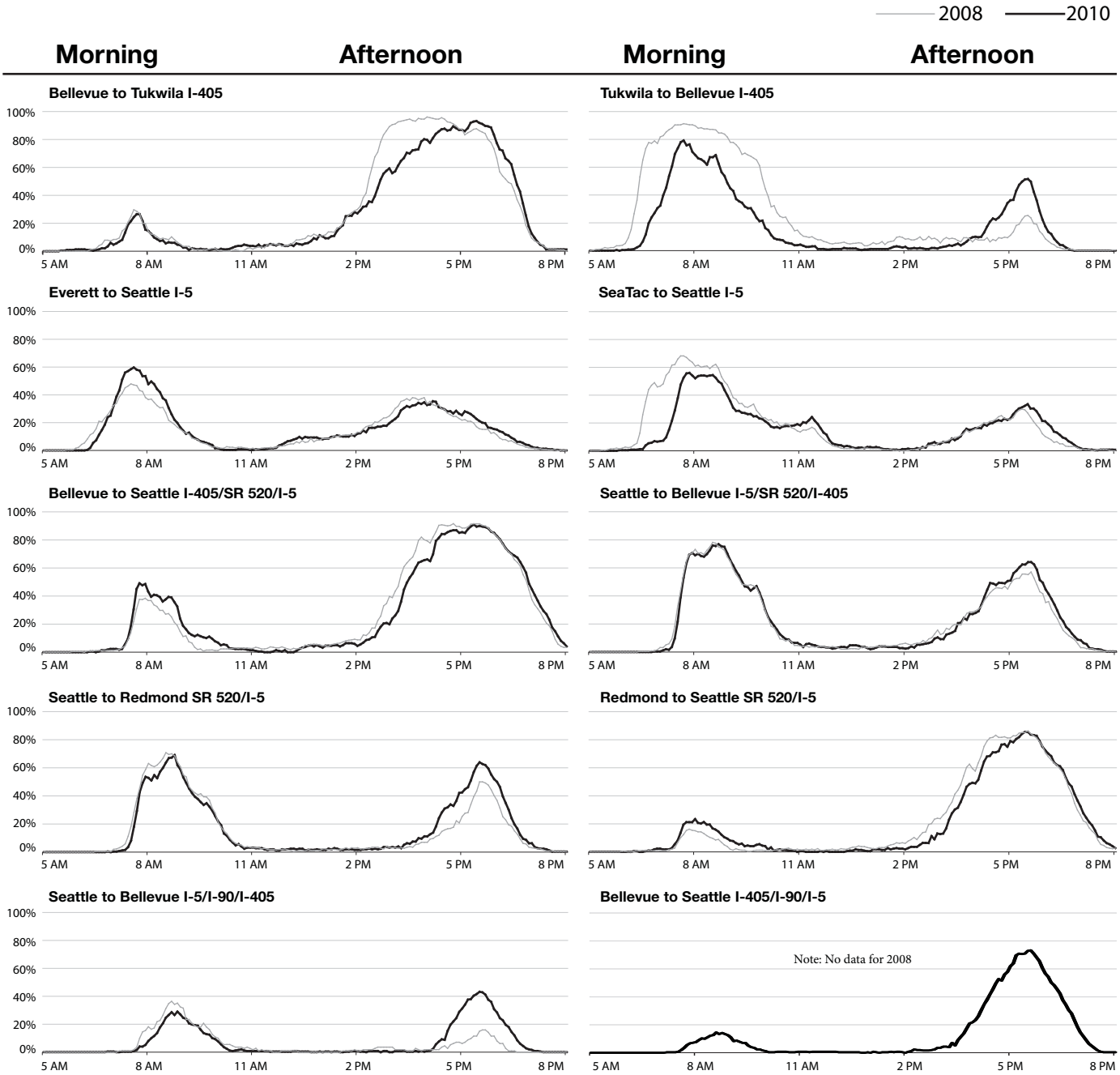


Data source: WSDOT Strategic Assessment Office.

Duration and Frequency of Severe Congestion in Peak Travel Periods, continued

Comparing 2008 and 2010 GP lanes: Percent of time in an average weekday when speeds fell below 36 mph

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



Data source: WSDOT Strategic Assessment Office.

Travel Time Analysis of 12 Additional Puget Sound Commute Routes

WSDOT tracks 12 additional uncongested routes

WSDOT tracks a total of 52 commute routes annually representing morning and evening commutes between major population and work centers. Forty of those routes regularly experience congestion (p.23-24). The additional 12 routes, listed on this page, represent the relatively uncongested routes for which WSDOT tracks travel time and volume data.

Average travel times for all 12 routes saw a negligible change between 2008 and 2010. In terms of the 95% reliable travel time, eight routes saw modest changes (within two minutes) while the remaining four routes worsened, with gains in travel times ranging from two and seven minutes between 2008 and 2010.

In terms of volume (VMT), 10 routes (morning and evening) were up between 1% and 7%, while there was no change on one route (I-5 Seattle to SeaTac) between 2008 and 2010. The standard commute routes have seen an overall decrease in morning VMT and overall increase in afternoon VMT. Please see page 23-24 for more details.

WSDOT monitors these routes to see if they are developing congested characteristics and should be moved to the list of congested routes. For this Congestion Report, SR 520 Bellevue to Redmond morning commute and SR 520 Redmond to Bellevue evening commute have been moved to the congested routes list, bringing that number to 40 (see pages 23-24).

Morning/Evening commutes: changes in travel time performance on 12 additional commute routes

2008 morning (5am-10am) and evening (2pm-8pm) peak vs. 2010 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

			Travel time on the route at		Average travel time at peak of rush			95th percentile			Maximum throughput travel time		VMT during peak period	Duration of congestion (how long the average speed is below 45mph)		
											MT³ Index					
Route	Length of route	Peak time of commuter rush	Posted speed	Maximum throughput speed	2008	2010	Δ	2008	2010	Δ	2008	2010	%Δ in VMT	2008	2010	Δ
Morning (AM)																
I-5 Seattle to Everett	23	8:50	23	28	26	26	0.34	32	31	-0.10	0.93	0.94	1%	*	*	*
I-5 Seattle to SeaTac	13	7:45	13	16	14	14	0.23	16	17	0.82	0.91	0.92	0%	*	*	*
I-405 Bellevue to Lynnwood	16	9:00	16	19	17	17	0.35	18	19	0.57	0.89	0.91	4%	*	*	*
SR 167 Renton to Auburn	10	9:40	10	12	11	10	-0.67	12	11	-1.09	0.94	0.88	3%	*	*	*
I-90 Bellevue to Issaquah	9	8:10	9	11	10	9	-0.51	12	11	-1.27	0.92	0.87	4%	*	*	*
I-5 Seattle to Federal Way	22	7:45	22	27	23	24	0.43	25	26	0.94	0.88	0.89	2%	*	*	*
I-405 Bellevue to Everett	23	9:00	23	28	25	25	0.20	26	26	0.34	0.89	0.90	3%	*	*	*
Evening (PM)																
I-405 Lynnwood to Bellevue	16	17:20	16	19	21	22	0.73	30	33	3.36	1.11	1.14	7%	*	*	*
SR 167 Auburn to Renton	10	16:15	10	12	12	12	0.70	15	17	1.93	1.01	1.07	4%	*	*	*
I-90 Issaquah to Bellevue	9	17:20	9	11	12	12	0.68	16	17	1.45	1.03	1.09	6%	*	*	*
I-5 Federal Way to Seattle	22	17:15	22	27	29	31	1.29	39	46	6.66	1.10	1.15	3%	*	*	*
I-5/I-405 Everett to Bellevue	24	17:20	24	28	30	31	1.37	39	44	4.77	1.05	1.10	6%	*	*	*

Data source: WSDOT Strategic Assessment, WSDOT NWR 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. "n/a" indicates no data was available for those routes. Commute trip lengths along SR 520 between Redmond and Seattle, Redmond and Bellevue are 1.4 mile shorter than as published in 2010 Congestion Report.

* Indicates that speed did not fall below 45 mph (75% of posted speed) on a route.

Travel Time Analysis: Spokane

Spokane travel time analysis

Spokane traffic volumes increased slightly between 2008 and 2010, with a peak flow near Altamont Street of 111,000 vehicles a day. This is an increase of 1% since 2008. On average, VMT remained the same with some variations occurring directionally within the corridor.

Incidents remain the major cause of delay in the corridor. The significant reduction in 95% reliable travel time on I-90 eastbound can be attributed to higher than normal travel times documented in 2008 due to major I-90 construction project and a record-breaking snowfall year January through March of 2008.

Morning/Evening commutes: changes in travel time performance on Spokane commute routes

2008 morning 6am-8am and evening 4pm-6pm peak vs. 2010 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 AM rush			95th percentile			Commute vehicle miles traveled
Route	Direction of travel	Length of route	Peak of commuter rush	Posted speed	Maximum throughput speed	2008	2010	%Δ	2008	2010	%Δ	%Δ
I-90: Argonne Rd. to Division St.	WB	7.5	7:50 AM	7.5	9.0	7.98	8.38	5%	24.67	16.77	-32%	-5%
I-90: Division St. to Argonne Rd.	EB	7.5	5:20 PM	7.5	9.0	8.17	8.73	7%	17.07	17.37	2%	4%

Data source: WSDOT Eastern Region Traffic Office.

Travel Time Trends update for the first half of 2011

Semi-annual travel time analysis provides up-to-date information about central Puget Sound region travel trends due to changes in the economy, as well as 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, listed on page 25 of the *Gray Notebook 42*. 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.

The trends described in this article compare traffic conditions in the first five months of 2011 to those from the same time periods in 2009 and 2010. This report also looks at a five-year trend for some routes.

Travel time changes in first five months of 2011 were modest

The trends shown on page 24 summarize the travel time and volume changes that occurred in the central Puget Sound region in the first five months of 2011 (January-May) in comparison to the same periods in 2009 and 2010. Taken as a whole, travel times in both the morning and evening commute periods have changed only modestly in comparison to those in both 2009 and 2010.

The morning commute shows very little change from 2010, with the largest change measured to be a one minute change on the Bellevue to Seattle via SR 520. Traffic volumes along the key routes have also stayed mostly flat, with only the SR 520 corridor showing a peak period volume reduced by almost 3% from 2010.

In the afternoon commute, travel times changed slightly, with two routes – Bellevue to Everett via I-405 and I-5, and Bellevue to Seattle via SR 520 – showing improvements of more than two minutes. Only three other routes changed by more than a minute. Peak period traffic volumes on those routes have not changed significantly, but they have dropped more than 3% on the commute back to the Eastside from downtown Seattle across the two floating bridges.

For detailed analysis of the first five months of travel time trends in the Puget Sound area, please see the Semi-annual Travel Time Trends article in *Gray Notebook 42* (pages 24-26).

Truck Freight Bottlenecks

Truck Freight Performance Measurement Pilot Program: analysis helps WSDOT identify truck bottlenecks throughout the state

WSDOT, Transportation Northwest at the University of Washington (TransNow), and the Washington Trucking Associations (WTA) have partnered in an effort to collect and analyze Global Positioning Systems (GPS) truck data from commercial, in-vehicle, truck fleet management systems. Data from this project will support a statewide Truck Freight Performance Monitoring (TFPM) program.

In 2010, the state Legislature gave the program additional funding and directed that the study area be expanded statewide from the initial Puget Sound program. Funds were used to increase the number of trucks monitored to 6,000 and widen the study area to include all state highways with freight significance – even tracking trucks in Idaho, Oregon, and British Columbia that are within 100 miles of Washington's borders. An important part of the project's second phase is the use of GPS data to identify and rank truck bottlenecks on Washington's road network.

Bottleneck identification project

The bottleneck identification process developed for the program is designed to find sections of Washington's roadways that perform poorly for trucks, then to develop quantitative measures that allow these bottlenecks to be ranked and compared. Results will be replicable and statistically valid, producing useful data that are straight-forward to use by transportation professionals and decision makers. The measures used will align with measures that WSDOT has already developed for evaluating congestion and roadway performance for all types of vehicles.

Communicating results of the truck bottleneck identification project

Information reported in the table below has been used to classify truck bottlenecks both inside the Central Puget Sound. Truck speeds at these locations are performing poorly, below threshold speeds, which is defined as the percentage of time that truck speeds are less than 60% of the posted speed or 35 mph or lower on a road with a 60 mph posted speed. The average truck speeds are derived from GPS probe data and are an average over time at all times of day. The average daily truck volume is supplied by the Freight Goods Transportation System (FGTS), estimating how many trucks pass through a given segment on an average day. Reliability (or speed distribution) is also determined and categorized as reliably fast, reliably slow, or unreliable. The data in the table below reflects the reliability numbers include impacts of roadway geometric, weather, collision and interrupted traffic flow. For more information, including more details about the bottleneck identification process, see the *Truck, Goods, and Freight Annual Report* in *Gray Notebook* 41, page 42-44.

Selected truck bottlenecks: Inside the Central Puget Sound region

Degree of reliability, September 2009 - February 2011

Road	City	Approximate location	Below threshold speeds[1]	Average speed	Average daily trucks	Reliability[2]			
Example T-1 roadway truck bottlenecks						6am-9am	9am-3pm	3pm-7pm	7pm-6am
I-90	Snoqualmie Pass	Tinkham Rd to Denny Creek	61%	37 mph	6,000	U	U	U	U
SR 99	Fife	54th Ave to Fife Heights Dr	42%	29 mph	3,600	U	U	U	S
SR 18	Issaquah	Tiger Mtn Summit	42%	40 mph	3,600	U	U	S	U
I-90	North Bend	436th St SE to MP 39	38%	45 mph	6,000	U	U	U	U
SR 99	Tukwila	SR 516 to International Blvd	32%	30 mph	1,800	S	S	S	S
Example T-2 roadway truck bottlenecks									
SR 509	Tacoma	Taylor Way to McMurray Rd	61%	22 mph	1,600	U	U	U	U
SR 161	Puyallup/S. Hill	132nd St E to 43rd Ave SE	41%	22 mph	1,600	S/U	S/U	S/U	S/U
SR 516	Kent	Meeker St to I-5	34%	38 mph	1,600	U	U	U	U
SR 3	Kitsap County	SR 104 to Lofall Rd NE	19%	43 mph	1,400	U	U	U	U
SR 99	Lynnwood	228th St SE to 204th St SW	57%	26 mph	3,300	U	U	U	F

Data source: WSDOT Freight Office.

1 The percentage of time truck speeds are less than 60% of posted speeds (35 mph where posted speeds are 60 mph).

2 Reliability abbreviations: F = Reliably Fast, S = Reliably Slow, U = Unreliable.

Note: T-1 roadways carry an average gross truck tonnage of more than 10 million tons a year, T-2 roadways carry an average gross truck tonnage of 4 to 10 million tons a year.

High Occupancy Vehicle Lanes Performance Analysis

HOV Lane Performance: Speed and Reliability

The freeway network in the central Puget Sound region 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 contribute to a more efficient overall freeway system by moving more people in fewer vehicles, compared to adjacent general purpose (GP) lanes. As of December 31, 2010, WSDOT has completed about 309 lane miles of the 320 lane-mile HOV system that is funded. About 84% (or 248 of 297 lane-miles) of the originally planned Puget Sound area freeway HOV system has been built. More about the HOV system can be found online at www.wsdot.wa.gov/hov/.

WSDOT monitors three aspects of Puget Sound area's 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.

HOV lane performance: 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 met performance reliability standards in 2010

Between 2008 and 2010, a pattern of improved peak-period HOV performance emerged on a growing number of freeway corridors in the area. This was a noticeable change from earlier years, when performance and reliability were generally lower on most HOV corridors in the region during peak hours of travel.

Overall, ten of the 14 HOV peak-direction corridors met or bettered the standard in 2010 compared to 2009, while the performance of four corridors worsened. Of the eight HOV corridors that met or bettered the standard in 2009, all but one continued to meet the standard in 2010. Of the six corridors that did not meet the standard in 2009, four improved in 2010. The improved performance patterns that were seen in the previous two years were largely sustained in 2010. Nevertheless, a number of HOV corridors continue to experience reduced performance and reliability during the peak periods.

The table to the right shows percentage of time during which each HOV corridor meets the performance standard during the AM and PM peak periods, in the peak direction of travel, when HOV lane performance is most likely to be affected by congestion and other factors. Five of the seven corridors have not met the performance standard in the PM peak direction of travel for the last six years, although three of them have shown consistent improvement every year. During AM peak travel, five of the seven routes continued the performance of 2009 and exceeded the goal; one route missed but is just under the standard and one route has missed the goal although its performance is slightly better than the 2008 baseline.

The primary reason HOV lanes do not meet performance and reliability standards in peak hours is because demand for HOV lanes exceeds the available HOV capacity. During off-peak hours, HOV corridors generally exceed the standard throughout

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

2006-2010; Goal is to maintain 45 mph for 90% of peak hour

= Goal not met

Commute routes	2006	2007	2008	2009	2010
Morning peak direction commutes					
I-5, Everett to Seattle SB	35%	35%	**60%**	69%	**61%**
I-5, Federal Way to Seattle NB	47%	33%	**67%**	92%	**86%**
I-405, Lynnwood to Bellevue SB	70%	76%	**92%**	94%	**92%**
I-405, Tukwila to Bellevue NB	49%	31%	**49%**	99%	**99%**
I-90, Issaquah to Seattle WB	100%	99%	**100%**	96%	**100%**
SR 520, Redmond to Bellevue WB	97%	97%	**99%**	94%	**94%**
SR 167, Auburn to Renton NB[1]	99%	96%	**99%**	99%	**100%**
Evening peak direction commutes					
I-5, Seattle to Everett NB	54%	51%	**64%**	49%	**55%**
I-5, Seattle to Federal Way SB	46%	47%	**57%**	67%	**77%**
I-405, Bellevue to Lynnwood NB	69%	53%	**58%**	71%	**77%**
I-405, Bellevue to Tukwila SB	44%	30%	**35%**	70%	**74%**
I-90, Seattle to Issaquah EB	100%	100%	**100%**	95%	**99%**
SR 520, Redmond to Bellevue WB	61%	59%	**68%**	71%	**61%**
SR 167, Renton to Auburn SB[1]	93%	91%	**98%**	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 is not 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 on May 3, 2008.

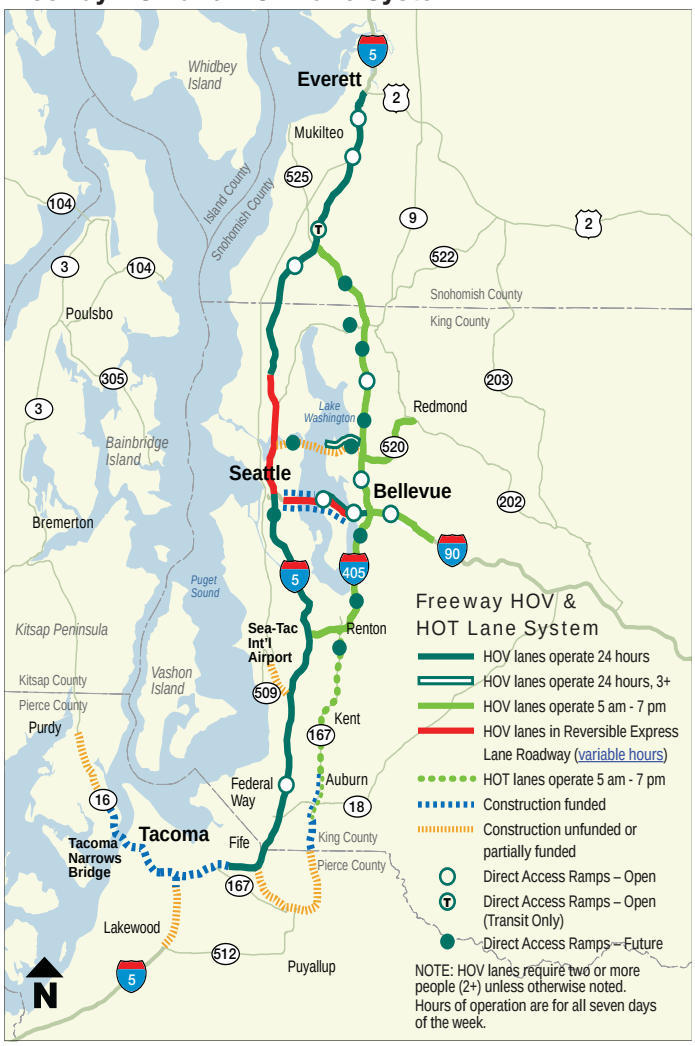
High Occupancy Vehicle Lanes Performance Analysis

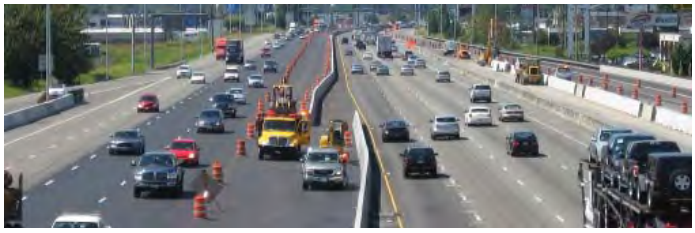
Effectiveness of HOV Lanes

the Puget Sound freeway network. And even when HOV performance is reduced during the peak hours, HOV lanes generally continue to provide a travel time and reliability benefit.

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

Freeway HOV and HOT Lane System





Paving new HOV lanes on I-5 temporarily narrows the roadway.

HOV lane performance: User volumes and compliance with passenger requirements

The WSDOT HOV lane monitoring program tracks vehicle volume patterns at 10 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 generally lower in 2010

Vehicle volumes at the ten monitored locations have varied considerably between 2008 and 2010. While HOV lane volumes were generally down in the morning peak period (seven of ten locations) as well as in the evening (five of ten locations), GP lane volumes were more mixed.

General purpose lane volumes were down at three of ten morning monitoring locations and up at the remaining seven; four evening locations saw lower volumes, but five recorded higher volumes (one remained unchanged).

The most significant change in vehicle volume was observed on I-405 northbound, near Newcastle, where GP vehicle volumes were up 34% in the two-year period. A WSDOT capacity expansion project on the I-405 corridor in that vicinity added a new auxiliary lane as traffic approaches the I-90 interchange. The lane was opened in January 2009, and data shows that traffic performance improved significantly in the months that followed, and has continued to sustain a higher level of performance. Other analyses have documented not only the additional vehicle flow, but significantly improved travel times and reduced duration of congestion along that corridor. Refer to page 57 of the 2010 Congestion Report for more details.

Across all monitoring locations, peak-period vehicle volumes across all lanes (HOV and GP combined) were virtually unchanged over the two-year period. Looking at the HOV and GP lanes separately, HOV volumes were down by almost 5% during past two years, while GP volumes were up by just over 1%.

Note that the vehicle volumes analyzed for HOV-to-GP volume comparison are based on selected spot locations, unlike the travel time analysis for general purpose lanes (page 23-24) which analyzes the aggregate changes in vehicle-miles traveled (VMT) based on a series of locations along each commute route.

HOV Lane Performance: Person Volumes

Vehicle occupancy: Numbers and compliance

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-occupany 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,
- the strictness of the occupancy requirement (2+ vs. 3+).

Even taking these factors into account, the average observed violation rate across all sampling locations during the AM and PM peak periods was about 4%. This high level of compliance has been fairly consistent in recent years.

HOV lane performance: Person volumes

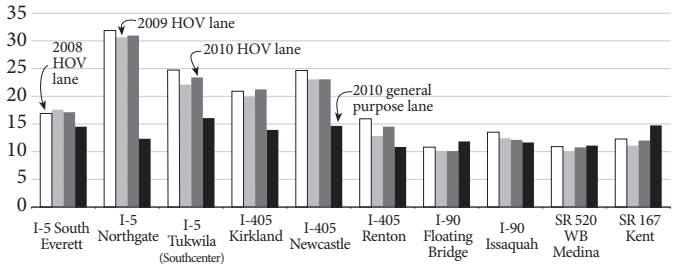
The WSDOT HOV lane monitoring program also estimates the number of people traveling at the same spot locations where vehicle volumes are monitored, to determine how the HOV network is facilitating the efficient movement of more people in fewer vehicles. This is the key metric for HOV performance.

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 2010, during the average AM peak period, the southbound HOV lane carried an average of over 13,900 persons, which is 44% 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 32% of the people on the freeway use the HOV lanes during the peak periods.

The graph below shows peak period HOV lane usage in recent years, on a person volume basis, at spot locations on the major corridors. Previous annual congestion reports noted that a general pattern of growth in HOV person volumes had been observed from 2004 to 2007. However, subsequent years have seen fluctuations in HOV lane vehicle volumes and transit ridership, both of which are significant factors in overall person volume. In 2008, HOV person volume patterns were mixed, but trending downward somewhat. The pattern became more pronounced in 2009, when nearly every monitoring location showed lower HOV lane person volumes than in the previous year. That pattern was reversed in 2010, however, with six of ten locations showing some growth in HOV lane person volumes compared to the previous year.

Comparison of HOV lane and general purpose lane person throughput

Total of AM and PM peak period volumes; number of people in thousands



Data source: Washington State Transportation Center (TRAC).

Notes: 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.

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 2010, the per-lane HOV person throughput was higher than adjacent GP lanes at seven out of ten locations. Of the remaining three locations, the 3+ SR 520 westbound location showed some growth in HOV person volumes during the past year, as did SR 167 in Kent (which was converted to a HOT lane in mid-2008). The third location, I-90 midspan, is technically a general-purpose express roadway and not an HOV facility, as it allows SOV traffic between Seattle and Mercer Island. However, the continuation of the I-90 center lanes farther east toward Bellevue becomes an HOV-only facility.

High Occupancy Vehicle Lanes Performance Analysis

HOV Lanes versus General Purpose Lane Travel Times

HOV lane performance: Transit ridership considerations

Bus transit ridership contributes signicantly to estimated HOV lane person volume at the monitoring locations. While the freeway monitoring locations showed some HOV person-volume growth in the past year, major bus transit agencies in the region saw lower ridership overall in 2010 compared to 2009, with contributing factors including local economic conditions (which affect employment levels and commuting) and fare increases. King County Metro, Pierce Transit, and Community Transit are all contemplating or preparing to implement further reductions in service hours in 2011-2012 in response to lower sales tax-based revenues.

However, Metro reported that in the first five months of 2011, year-over-year bus ridership was up by 2.4%. In May 2011 alone, year-over-year bus ridership was up 5%, which Metro atrributes to improving local economic conditions and higher gas prices seen in the first half of 2011. WSDOT will continue to monitor changes in transit service levels and ridership, and their effects on HOV lane performance, during 2011.

45 of 48 HOV lanes provide better reliability compared to 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, 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 monitors 48 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. Because several routes on I-90 and I-5 have reversible express lanes, and the four westbound routes on SR 520 have both 2+ and 3+ HOV lanes, there are eight more HOV routes available and monitored than GP lanes.

Of the 48 HOV trips analyzed, 40 are faster at times of peak congestion than the associated GP trip, while the other eight trips show no significant 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 travel times are lower on 45 of the 48 HOV trips relative to their GP counterparts, often by a significant degree, indicating that not only average travel times, but also reliability of travel are generally enhanced when using the HOV route option.

Of the 42 HOV trips for which data exist for both 2008 and 2010, travel times for 16 routes improved, 14 routes remained unchanged, and 12 routes worsened. Of the 48 HOV trips analyzed for the 2010 Congestion Report (2009 vs. 2007 data), 37 routes improved, eight routes remained unchanged, and three routes worsened. Overall, the magnitude of the changes in HOV travel times from 2008 to 2010 was smaller than those observed in the 2010 Congestion Report.

The accompanying tables on pages 42-44 summarize the estimated travel times of a traveler who uses available HOV lane options on each of the general-purpose commute trip routes described on pages 23-24. They show 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 on pages 45-48 by a series of graphs that summarize the reliability of travel on HOV routes versus the equivalent GP routes, for all 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 2010 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 versus General Purpose Lane Travel Times, continued

Tukwila to Bellevue morning and evening HOV travel times double in reliability in 2010 despite higher VMT

In 2008, Tukwila to Bellevue HOV lane speeds during the morning peak were above 45 mph for 49% of the time. By 2009 and 2010, this result had improved two-fold, with speeds better than 45 mph 99% of the time, indicating substantial HOV lane reliability improvements. The table on page 42 shows that HOV lane reliability on this route, measured by the percentage of time that peak hour speeds are above 45 mph, showed significant improvement overall.

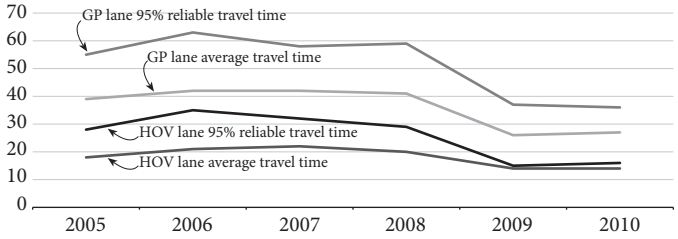
Between 2008 and 2010, average HOV travel times on the I-405 Tukwila to Bellevue morning commute were six minutes faster. The 95th percentile reliable travel times improved even more: 13 minutes faster – while VMT increased about 20%. The evening commute on this route also showed improvement, with average HOV travel times four minutes faster, 95% reliable travel times seven minutes faster, and 5% higher VMT.

This significant improvement can be attributed to the I-405 South Bellevue widening project which has helped to relieve congestion for drivers traveling to and from Bellevue on I-405. Construction on this project began in July 2007 and was completed in 2009. (For more information on this project, see the 2010 Congestion Report, p. 57.) The graph below displays travel time data for this route beginning in 2005. It demonstrates that travel time reliability improved significantly immediately following construction.

The project has also made travel times on this route more reliable: 2009 and 2010 average HOV travel times compared to 95th percentile reliable HOV travel times differ by only one or two minutes.

Tukwila to Bellevue morning commute: HOV and GP travel times

In minutes; 2005-2010



Data source: WSDOT Strategic Assessment Office.

January 2009 – Downtown Bellevue looms in the background, above construction on a new retaining wall along southbound I-405. The wall will allow additional freeway widening near SE 8th Street.

Looking at HOV lane performance in detail

The tables on the following three pages address HOV lane travel time performance compared to general purpose lanes. The 2011 Congestion Report has adopted improved data processing techniques for 2010 loop data. In order to make apples-to-apples comparisons, 2008 data has been recalculated to reflect this updated methodology, which means that 2008 travel time data reported in 2009 Congestion Report is not comparable with the current report.

HOV trips with the same endpoints as GP lane trips, but differing lengths, did 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 and travel time values in the following tables are rounded to integer values for publication purposes only.

High Occupancy Vehicle Lanes Performance Analysis

HOV Lane Travel Times for Morning Commutes

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

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 2008	HOV lanes 2010	HOV lanes Δ	GP lanes 2010	2010: Difference HOV vs. GP	95% Reliable travel times: HOV lanes 2008	HOV lanes 2010	HOV lanes Δ	GP lanes 2010	2010: Difference HOV vs. GP
To Seattle														
I-5 Everett to Seattle														
Regular HOV lane[1]	21	7:35	21	26	33	35	2	42	-7	50	58	8	71	-13
Reversible lanes[1]	21	7:35	21	26	30	32	2	42	-10	44	51	7	71	-20
I-5 Federal Way to Seattle	22	7:35	22	27	30	27	-3	39	-12	41	36	-5	56	-20
I-90/I-5 Issaquah to Seattle														
HOV & GP lanes[2]	14	7:55	14	17	n/a	16	n/a	19	-3	n/a	21	n/a	28	-7
HOV & reversible lanes[2]	14	7:55	14	17	n/a	15	n/a	19	-4	n/a	17	n/a	28	-11
SR 520/I-5 Redmond to Seattle														
2 person	13	7:45	13	16	19	19	0	20	-1	27	26	-1	28	-2
3+ HOV	13	7:45	13	16	16	16	0	20	-4	20	19	-1	28	-9
I-5 SeaTac to Seattle	13	8:35	13	16	18	16	-2	24	-8	24	22	-2	40	-18
I-405/I-90/I-5 Bellevue to Seattle														
HOV & GP lanes[2]	8	8:10	8	10	n/a	10	n/a	10	0	n/a	14	n/a	15	-1
HOV & reversible lanes[2]	9	8:10	9	10	n/a	9	n/a	10	-1	n/a	9	n/a	15	-6
I-405/SR 520/I-5 Bellevue to Seattle														
2 person	10	7:45	10	12	17	18	1	18	0	27	26	-1	29	-3
3+ HOV	10	7:45	10	12	13	14	1	18	-4	16	16	0	29	-13
To Bellevue														
I-5/I-405 Everett to Bellevue	23	7:25	23	27	27	26	-1	46	-20	35	34	-1	74	-40
I-405 Lynnwood to Bellevue	16	7:30	16	19	19	18	-1	37	-19	24	21	-3	59	-38
I-405 Tukwila to Bellevue	13	7:40	13	16	20	14	-6	27	-13	29	16	-13	36	-20
I-5/I-90/I-405 Seattle to Bellevue														
HOV & GP lanes[2]	9	8:50	9	11	13	12	-1	14	-2	20	21	1	23	-2
I-5/SR 520/I-405 Seattle to Bellevue	10	8:40	10	12	21	22	1	22	0	31	33	2	32	1
I-90/I-405 Issaquah to Bellevue	9	8:40	9	11	12	11	-1	15	-4	14	14	0	21	-7
SR 520/I-405 Redmond to Bellevue	6	7:50	6	7	8	8	0	8	0	10	8	-2	9	-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 2010 loop data, 2008 travel time data reported in 2009 Congestion Report is not comparable with the current report. N/A indicates that data was not available.

1 The I-5 HOV trips between Everett and Seattle that use the express lanes are 2.3 miles shorter, while trips between Everett and Bellevue are 0.6 to 1.5 miles shorter, than the standard GP trips mentioned on page 23-24 due to the lack of data at the commute end points. To enable a direct comparison, the corresponding GP trips have been shortened by the same amount; this means travel times and time stamps for peak of commuter rush for these shortened GP trips will not match the tables on pages 23-24, and the 2008 values in this table will not match 2008 values reported in the 2009 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 pages 23-24.

HOV Lane Travel Times for Evening Commutes

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

			Travel times on the route at		Average travel time at peak of PM rush					95% Reliable travel times				
					HOV lanes			GP lanes	2010: Difference	HOV lanes			GP lanes	2010: Difference
Route	Length of route	Peak of commuter PM rush	Posted speed	Maximum throughput speed	2008	2010	Δ	2010	HOV vs. GP	2008	2010	Δ	2010	HOV vs. GP
From Seattle														
I-5 Seattle to Everett														
Regular HOV lane[1]	21	16:50	21	25	32	32	0	35	-3	45	46	1	51	-5
Reversible lanes[1]	21	16:50	21	25	28	27	-1	35	-8	37	37	0	51	-14
I-5 Seattle to Federal Way	22	16:05	22	27	30	27	-3	30	-3	46	36	-10	41	-5
I-5 Seattle to SeaTac	13	16:05	13	16	18	16	-2	17	-1	27	21	-6	25	-4
I-5/I-90/I-405 Seattle to Bellevue														
HOV & GP lanes[2]	9	17:30	9	11	12	14	2	15	-1	20	22	2	24	-2
HOV & reversible lanes[2]	9	17:30	9	11	10	9	-1	15	-6	11	10	-1	24	-14
I-5/SR 520/I-405 Seattle to Bellevue	10	17:30	10	12	19	21	2	21	0	30	36	6	34	2
I-5/SR 520 Seattle to Redmond	13	17:35	13	16	21	23	2	25	-2	31	37	6	38	-1
I-5/I-90 Seattle to Issaquah														
HOV & GP lanes[2]	14	17:35	14	17	17	19	2	21	-2	25	26	1	30	-4
HOV & reversable lanes[2]	14	17:35	14	17	14	15	1	21	-6	15	15	0	30	-15
From Bellevue														
I-405 Bellevue to Everett[1]	22	17:20	22	26	29	27	-2	38	-11	39	35	-4	50	-15
I-405 Bellevue to Lynnwood	16	17:20	16	19	22	20	-2	31	-11	31	29	-2	43	-14
I-405 Bellevue to Tukwila	13	17:25	13	16	20	16	-4	30	-14	29	22	-7	38	-16
I-405/I-90/I-5 Bellevue to Seattle														
HOV & GP lanes[2]	8	17:30	8	10	n/a	16	n/a	19	-3	n/a	29	n/a	32	-3
I-405/SR 520/I-5 Bellevue to Seattle														
2 person	10	17:25	10	12	29	30	1	30	0	39	39	0	41	-2
3+ HOV	10	17:25	10	12	17	17	0	30	-13	24	25	1	41	-16
I-405/I-90 Bellevue to Issaquah	9	17:35	9	11	11	13	2	16	-3	12	16	4	21	-5
I-405/SR 520 Bellevue to Redmond	5	17:40	5	7	7	8	1	10	-2	11	11	0	17	-6

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 2010 loop data, 2008 travel time data reported in 2009 Congestion Report is not comparable with the current report. N/A indicates that data was not available.

1 The I-5 HOV trips between Everett and Seattle that use the express lanes are 2.3 miles shorter, while between Everett and Bellevue are 0.6 to 1.5 miles shorter, than the standard GP trips mentioned on page 23-24 due to the lack of data at the commute end points. To enable a direct comparison, the corresponding GP trips have been shortened by the same amount; this means travel times and time stamps for peak of commuter rush for these shortened GP trips will not match the tables on pages 23-24, and the 2008 values in this table will not match 2008 values reported in the 2009 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 pages 23-24.

High Occupancy Vehicle Lanes Performance Analysis

HOV Lane Travel Times for Other Location Commutes

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

			Travel times on the route at		Average travel time at peak of rush					95% Reliable travel times				
					HOV lanes			GP lanes	2010: Difference	HOV lanes			GP lanes	2010: Difference
Route	Length of route	Peak of commuter rush	Posted speed	Maximum throughput speed	2008	2010	Δ	2010	HOV vs. GP	2008	2010	Δ	2010	HOV vs. GP
To other locations – Morning (AM)														
I-405 Bellevue to Tukwila	13	7:40	13	16	14	13	-1	20	-7	14	14	0	27	-13
SR 167 Auburn to Renton														
HOT lanes	10	7:35	10	12	10	10	0	17	-7	12	12	0	27	-15
I-5/I-90 Seattle to Issaquah														
HOV & GP lanes[2]	14	8:50	14	17	17	17	0	17	0	25	26	1	25	1
I-5/SR 520 Seattle to Redmond	13	8:40	13	16	25	25	0	25	0	35	36	1	36	0
From other locations – Evening (PM)														
I-5 Everett to Seattle														
Regular HOV lane[1]	21	16:05	21	26	34	31	-3	33	-2	50	45	-5	51	-6
I-90/I-5 Issaquah to Seattle														
HOV & GP lanes[2]	14	17:25	14	17	n/a	20	n/a	23	-3	n/a	28	n/a	43	-15
SR 520/I-5 Redmond to Seattle														
2 person	13	17:30	13	16	31	31	0	32	-1	49	54	5	59	-5
3+ HOV	13	17:30	13	16	21	22	1	32	-10	35	39	4	59	-20
I-5 SeaTac to Seattle	13	17:25	13	16	17	17	0	21	-4	21	25	4	36	-11
SR 167 Renton to Auburn	10	16:50	10	12	11	11	0	16	-5	15	16	1	31	-15
I-405 Tukwila to Bellevue	13	17:25	13	16	15	15	0	23	-8	16	17	1	35	-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 2010 loop data, 2008 travel time data reported in 2009 Congestion Report is not comparable with the current report. N/A indicates that data was not available.

1 The I-5 HOV trips between Everett and Seattle that use the express lanes are 2.3 miles shorter, while between Everett and Bellevue are 0.6 to 1.5 miles shorter, than the standard GP trips mentioned on page 23-24 due to the lack of data at the commute end points. To enable a direct comparison, the corresponding GP trips have been shortened by the same amount; this means travel times and time stamps for peak of commuter rush for these shortened GP trips will not match the tables on pages 23-24, and the 2008 values in this table will not match 2008 values reported in the 2009 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. Therefore, 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 pages 23-24.

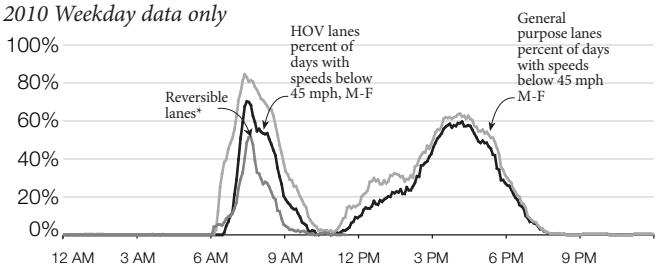
Comparing HOV and GP Lane Reliability Performance

Comparing HOV and adjacent GP lanes: Percent of time in an average weekday when speeds fell below 45mph

2010 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

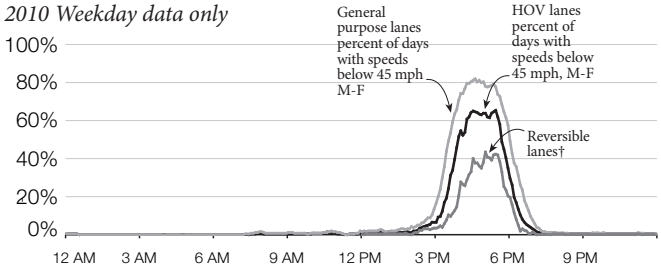
2010 Weekday data only



* Monday-Friday hours of operation: Southbound - 5 am to 11:15 am; Closed 11 pm to 5 am.

I-5 Seattle to Everett

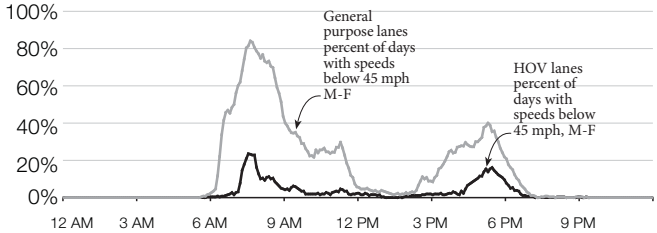
2010 Weekday data only



† Monday-Friday hours of operation: Northbound - noon to 11 pm; Closed 11 pm to 5 am.

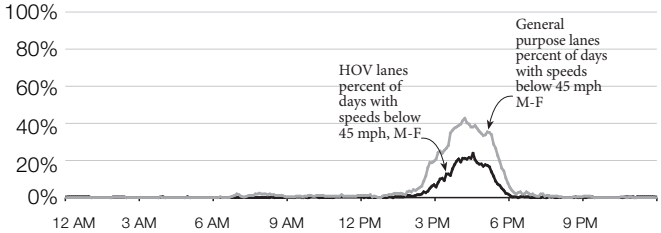
I-5 Federal Way to Seattle

2010 Weekday data only



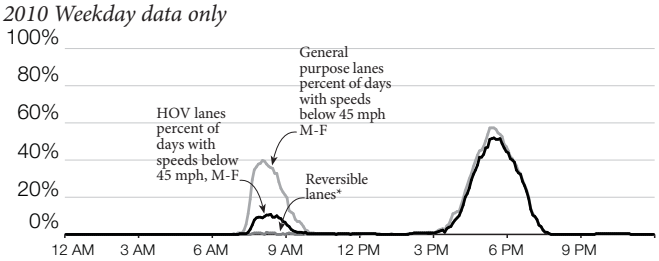
I-5 Seattle to Federal Way

2010 Weekday data only



I-90/I-5 Issaquah to Seattle

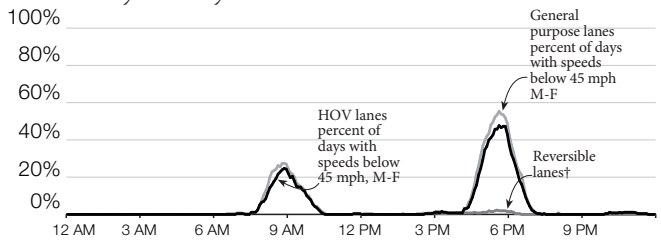
2010 Weekday data only



* Monday-Friday hours of operation: Westbound - 1 am to 12:30 pm.

I-90/I-5 Seattle to Issaquah

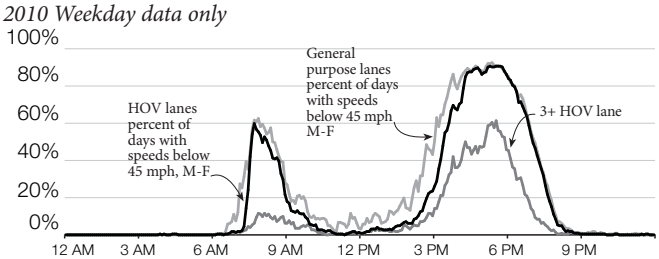
2010 Weekday data only



† Monday-Friday hours of operation: Eastbound - 2 pm to midnight.

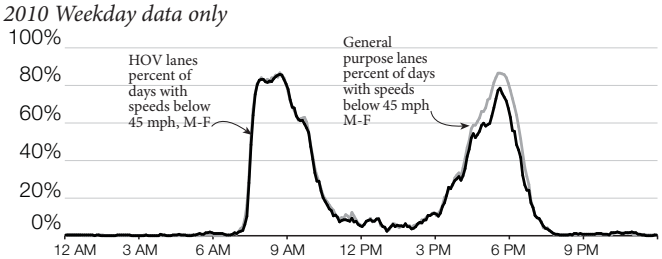
SR 520/I-5 Redmond to Seattle

2010 Weekday data only



I-5/SR 520 Seattle to Redmond

2010 Weekday data only



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

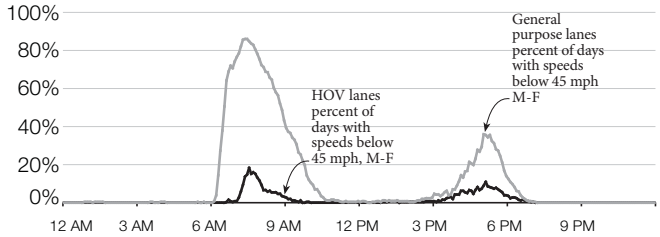
Comparing HOV and GP Lane Reliability Performance, continued

Comparing HOV and adjacent GP lanes: Percent of time in an average weekday when speeds fell below 45mph

2010 data for selected Puget Sound commute routes. 0% on graph indicates that the average trip speed did not fall below 45 mph.

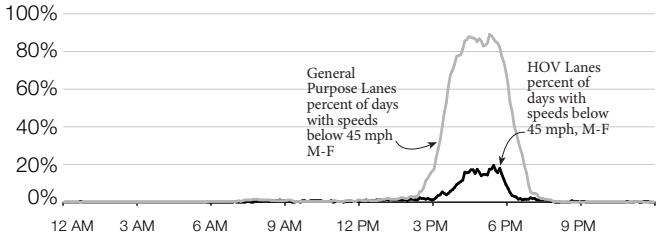
I-5/405 Everett to Bellevue

2010 Weekday data only



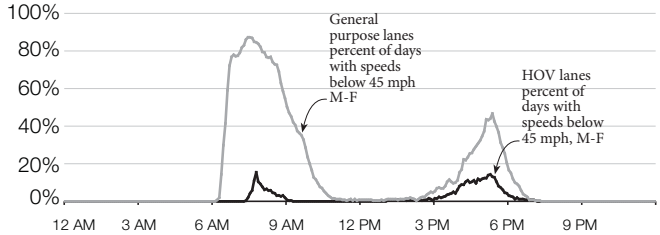
I-405/I-5 Bellevue to Everett

2010 Weekday data only



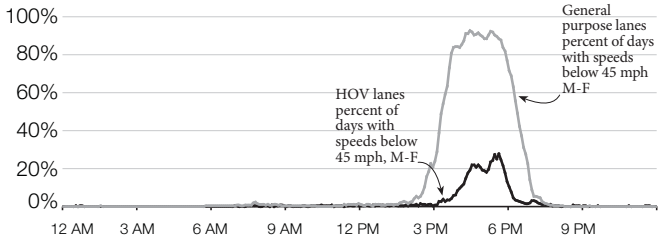
I-405 Lynnwood to Bellevue

2010 Weekday data only



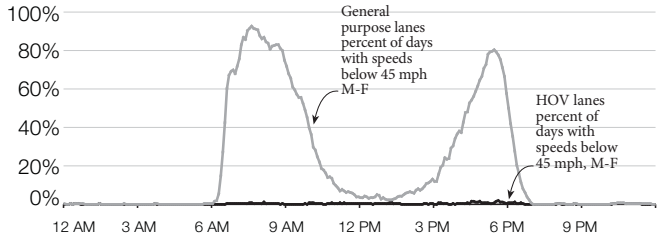
I-405 Bellevue to Lynnwood

2010 Weekday data only



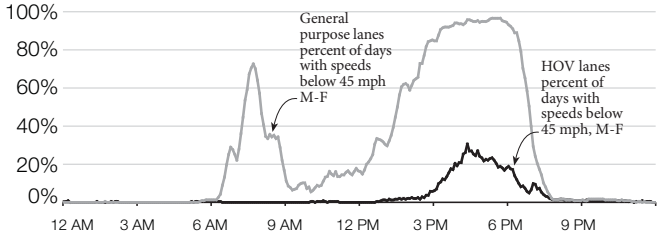
I-5 Tukwila to Bellevue

2010 Weekday data only



I-5 Bellevue to Tukwila

2010 Weekday data only



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

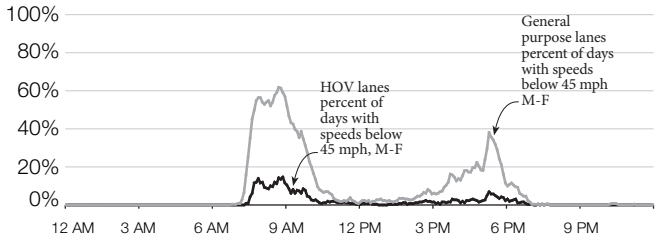
Comparing HOV and GP Lane Reliability Performance, continued

Comparing HOV and adjacent GP lanes: Percent of time in an average weekday when speeds fell below 45mph

2010 data for selected Puget Sound commute routes. 0% on graph indicates that the average trip speed did not fall below 45 mph.

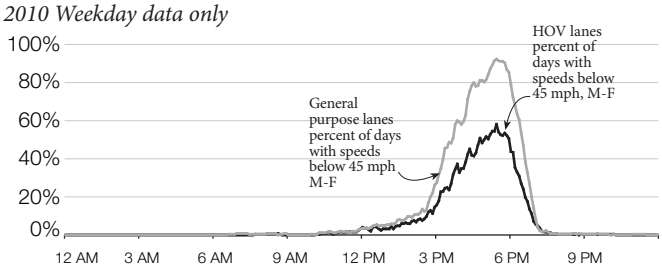
I-90/I-405 Issaquah to Bellevue

2010 Weekday data only



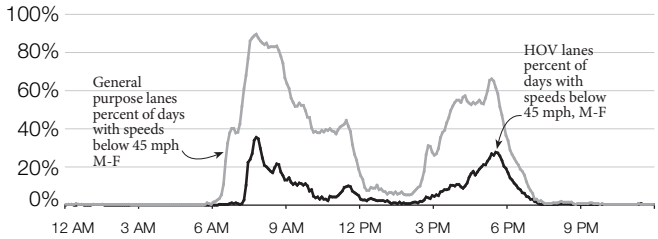
I-405/I-90 Bellevue to Issaquah

2010 Weekday data only



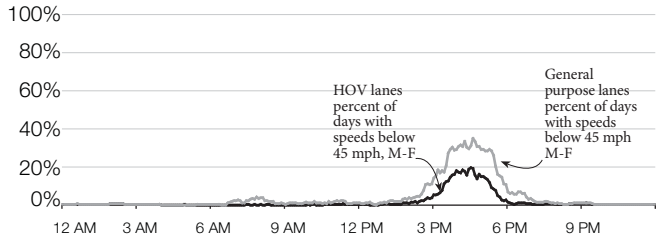
I-5 SeaTac to Seattle

2010 Weekday data only



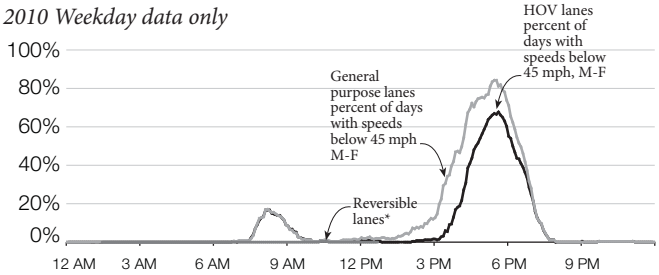
I-5 Seattle to SeaTac

2010 Weekday data only



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

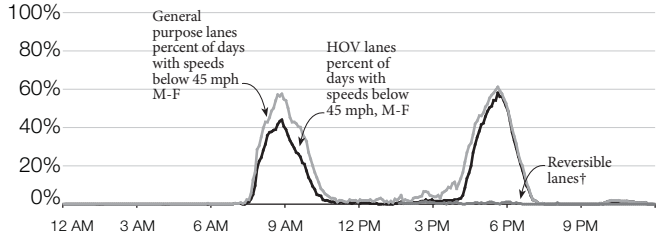
2010 Weekday data only



* Monday-Friday hours of operation: Westbound - 1 am to 12:30 pm.

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

2010 Weekday data only



† Monday-Friday hours of operation: Eastbound - 2 pm to midnight.

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

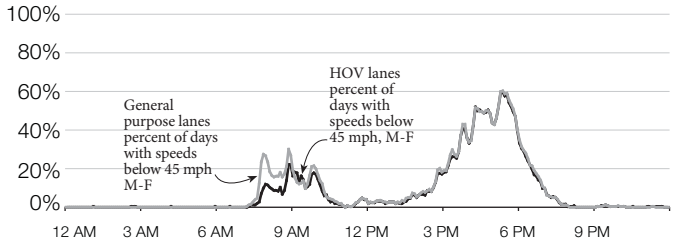
Comparing HOV and GP Lane Reliability Performance, continued

Comparing HOV and adjacent GP lanes: Percent of time in an average weekday when speeds fell below 45mph

2010 data for selected Puget Sound commute routes. 0% on graph indicates that the average trip speed did not fall below 45 mph.

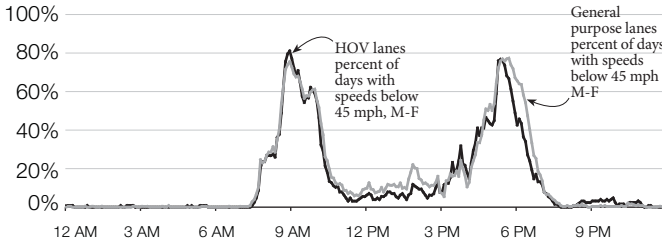
SR 520/I-405 Redmond to Bellevue

2010 Weekday data only



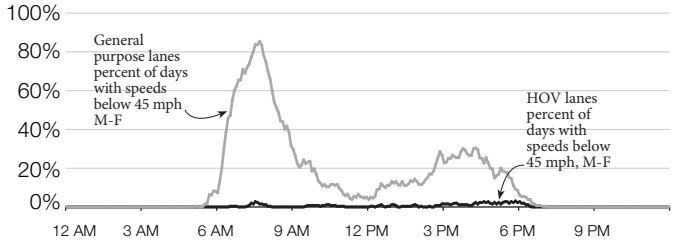
I-405/SR 520 Bellevue to Redmond

2010 Weekday data only



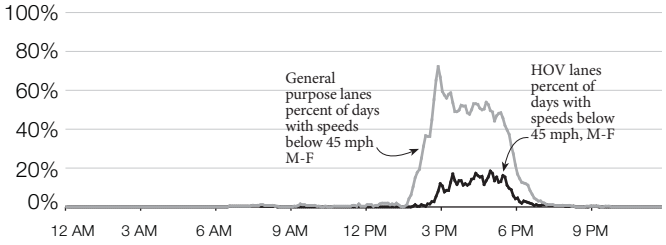
SR 167 Auburn to Renton

2010 Weekday data only



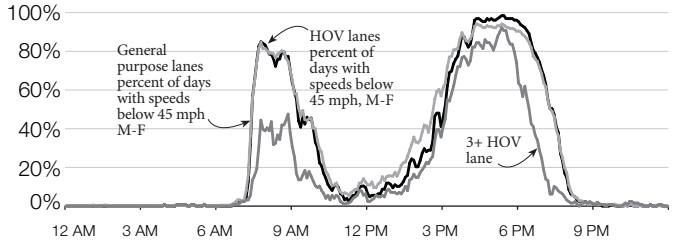
SR 167 Renton to Auburn

2010 Weekday data only



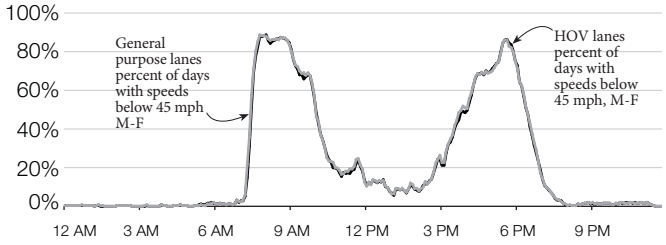
I-405/SR 520/I-5 Bellevue to Seattle

2010 Weekday data only



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

2010 Weekday data only



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

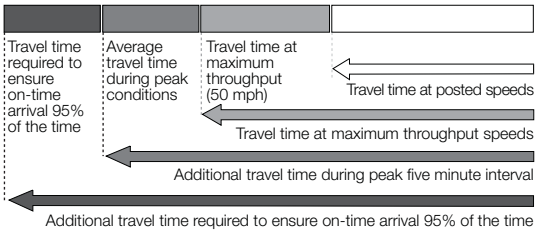
HOV Lane Travel Times Compared to GP Lanes for Seattle Work Locations

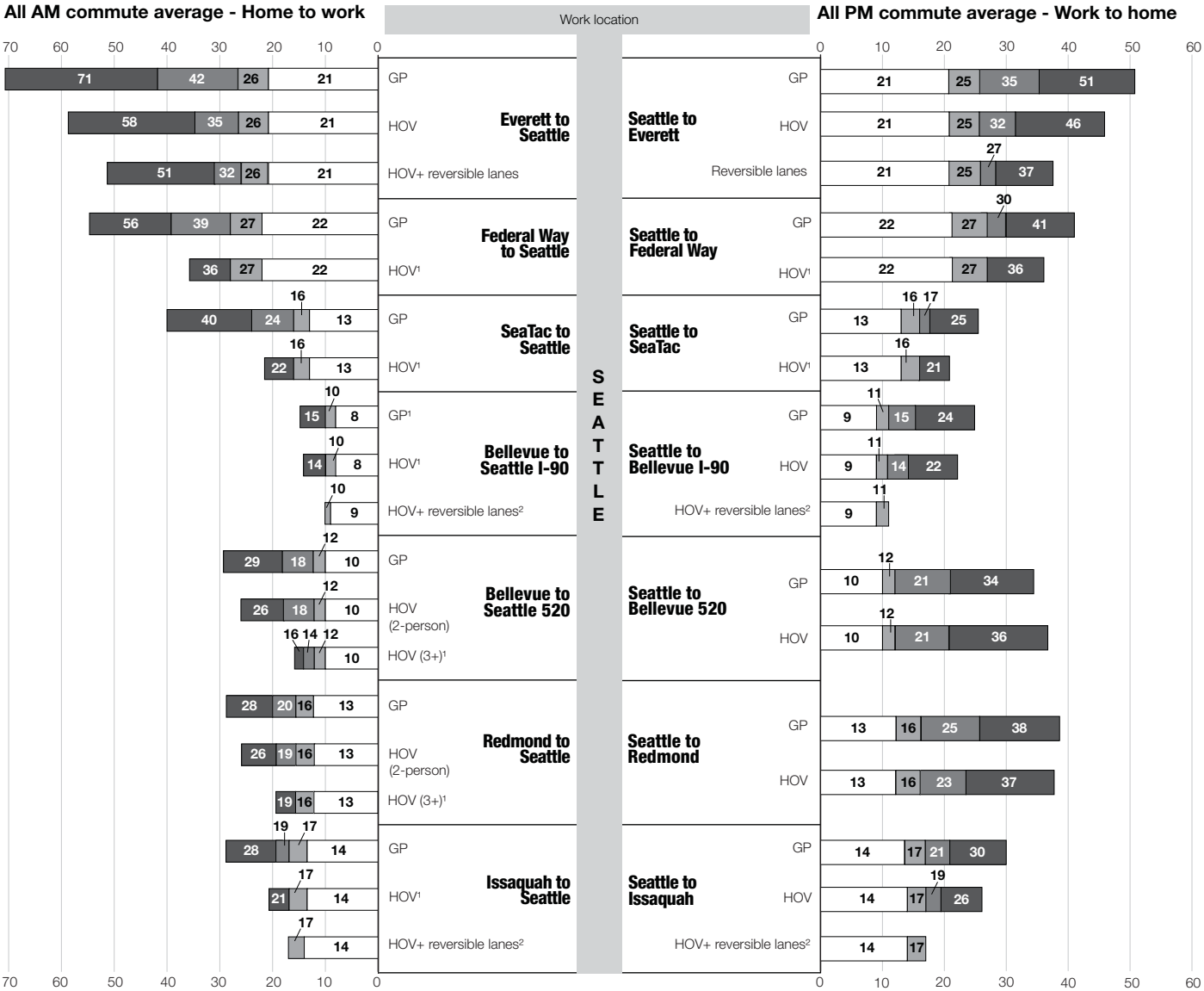
Travel times at posted speeds, maximum throughput speeds, peak travel times, and 95% reliable travel times

Morning and afternoon commutes by work location

General purpose (GP) and High Occupancy Vehicle (HOV) commutes in the central Puget Sound area in 2010

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.

High Occupancy Vehicle Lanes Performance Analysis

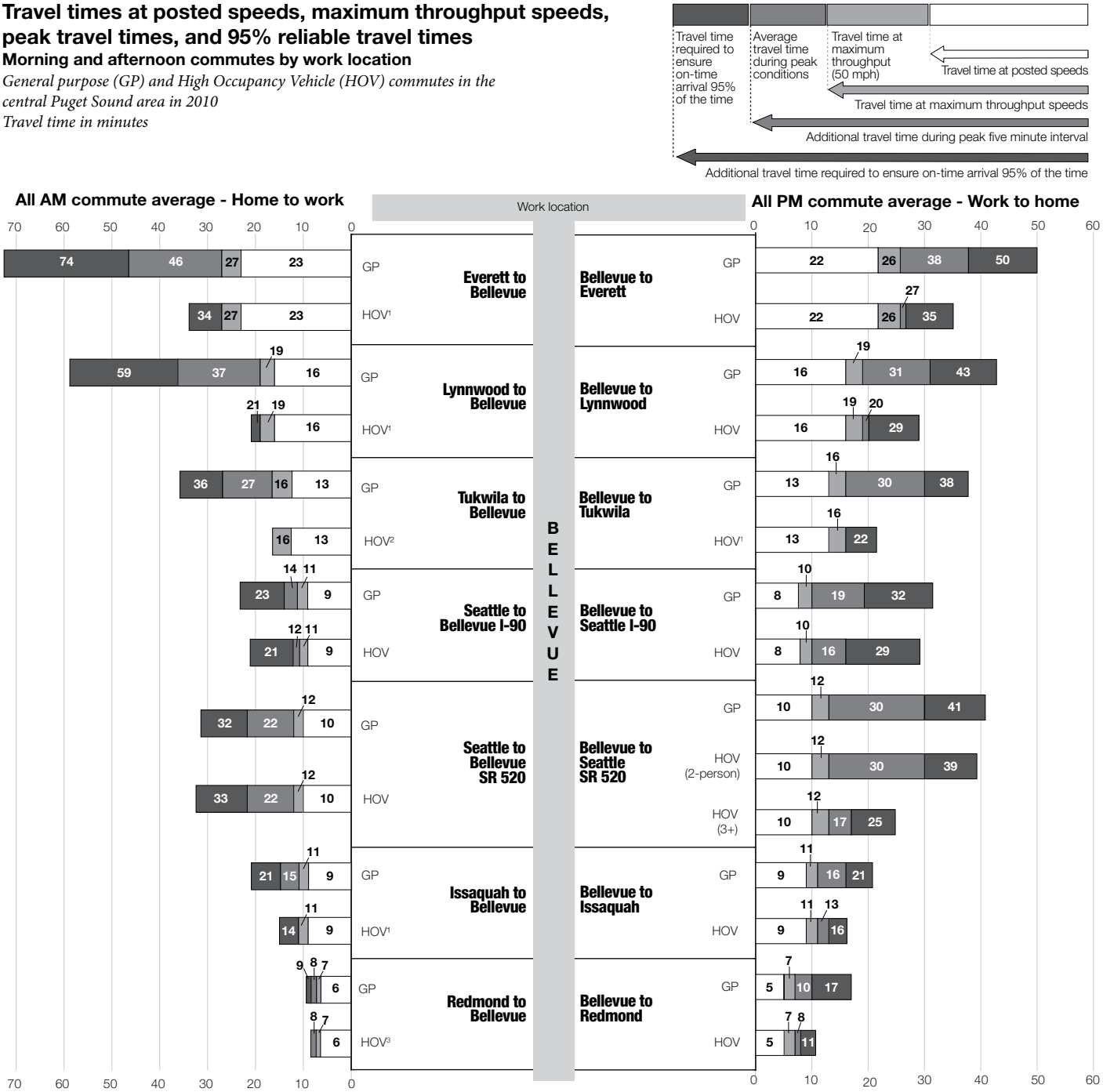
HOV Lane Travel Times Compared to GP Lanes for Bellevue Work Locations

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 2010

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 Average travel times were equal to 95% reliable travel times on this route.

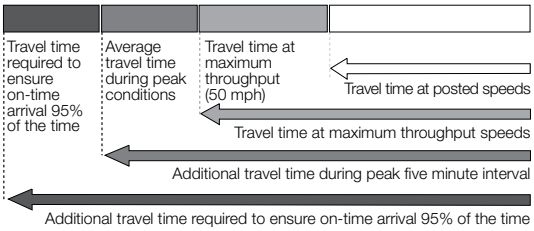
HOV Lane Travel Times Compared to GP Lanes for Other Work Locations

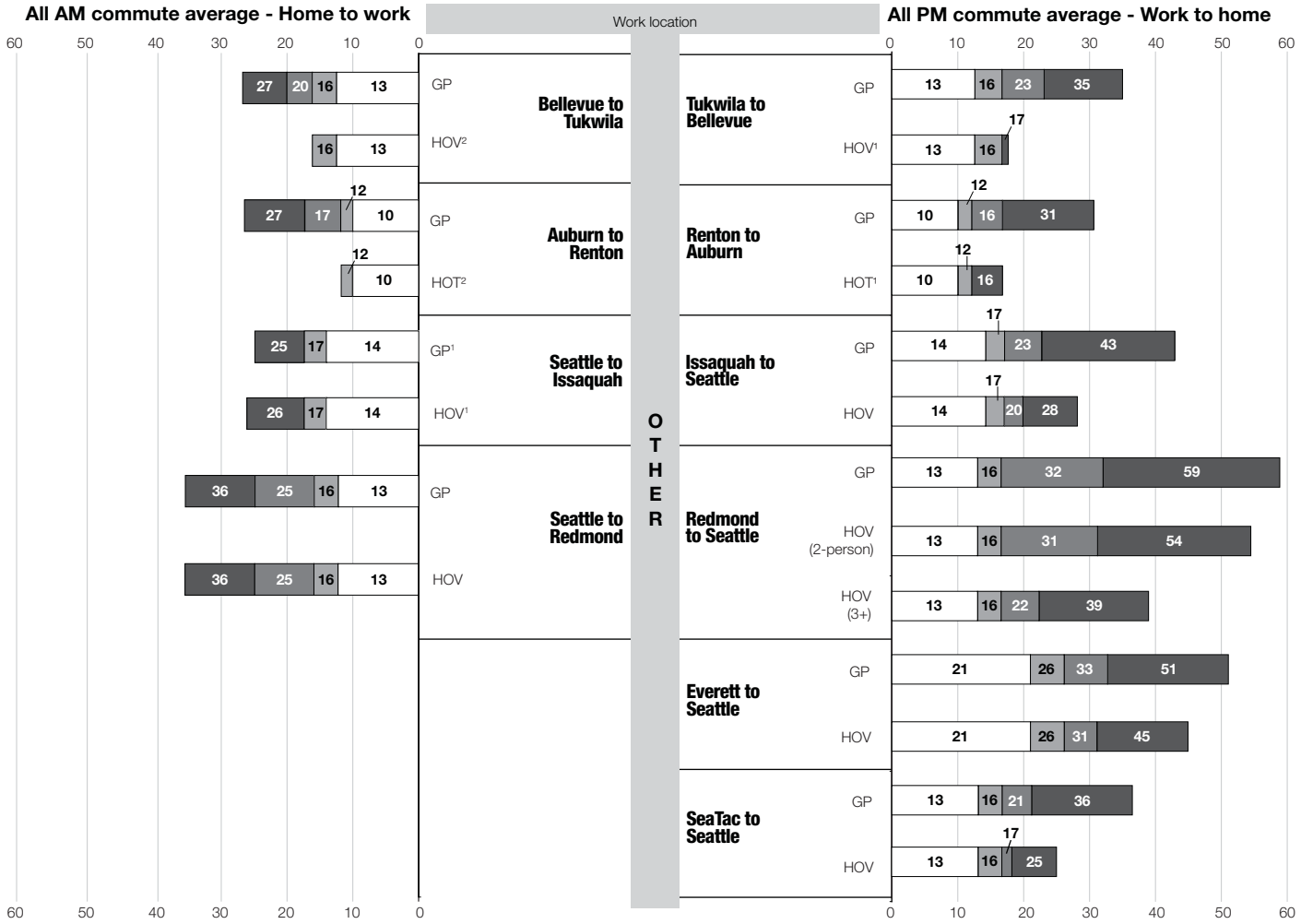
Travel times at posted speeds, maximum throughput speeds, peak travel times, and 95% reliable travel times

Morning and afternoon commutes by work location

General purpose (GP) and High Occupancy Vehicle (HOV) commutes in the central Puget Sound area in 2010

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.

Moving Washington
Operate Efficiently

Operate Efficiently: SR 167 High Occupancy Tolling

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 freeway on-ramps, incident response teams, variable speed-limit systems, variable tolling, integrated traffic signals, and Active Traffic Management.

SR 167 High Occupancy Tolling program

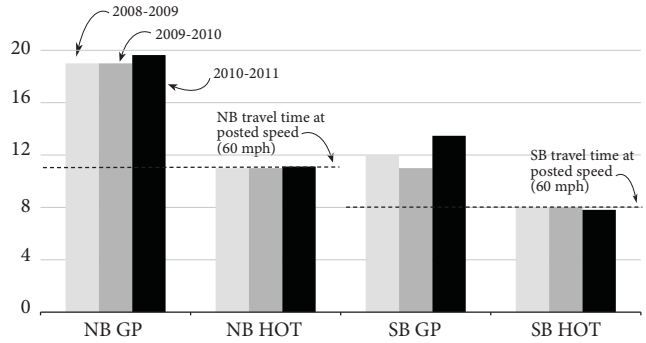
The first three years of the SR 167 High Occupancy Toll (HOT) Lane project have yielded significant results, both for the drivers who access the HOT lanes and for general purpose (GP) lane users. Drivers who opt to use the HOT lanes save time and reduce the stress associated with their daily commute,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

HOT lanes result in faster travel times

In 2010, the northbound HOT lane provided weekday (Tuesday through Thursday) drivers with an average travel time savings of nine minutes in the peak hour (7-8 am), with an average travel time of 11 minutes and an average toll of $1.50. The average peak travel time for the GP lanes was 20 minutes. The weekday southbound HOT lane provided drivers with an average savings of six minutes during the peak hour (4-5 pm), with an average travel time of eight minutes and an average toll of $1.25. Once again, the GP peak travel time average was longer at 14 minutes.

SR 167 travel times: Comparing HOT and GP lanes for peak northbound and southbound commutes

Travel time in minutes; May-April 2008-2011; Tuesday-Thursday

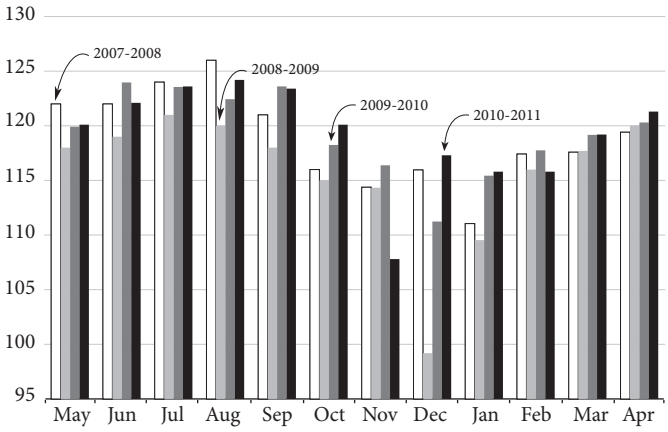


Data source: WSDOT Nortwest Region Traffic Office.

Note: Travel time is an average of morning (7-8 am) and evening (4-5 pm) peak periods.

SR 167 Average daily traffic volumes

Before and After opening of HOT lanes, 2007-2011; Volume in thousands



Data source: WSDOT Nortwest Region Traffic Office.

Daily volumes consistent with regional trends

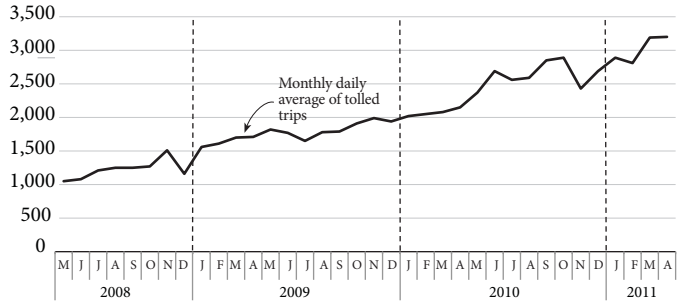
During the third year of operations, the average combined daily traffic volumes of SR 167 fell 3% compared to the pre-opening volumes recorded in 2007. During the peak hours in 2010, peak direction GP lane volumes were down 5%, while HOT lane volumes are up 15% when compared to 2007.

Increased usage of HOT lanes

The third year data indicates that the public understands the benefits of HOT lanes: the average daily number of tolled trips rose to 3,200 in April 2011 compared to 2,150 in 2010. Monthly revenue continues to climb, and annual figures show a 44% increase to $604,700 in gross revenue by April 30, 2011.

SR 167 HOT lanes average number of daily tolled trips

May 2008-April 2011, Tuesday-Thursday only



Data source: WSDOT Northwest Region Traffic Office.

Intelligent Transportation Systems

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 small as a ramp meter, and as complex as active traffic management systems, which includes WSDOT's new Smarter Highways system. The table below shows the agency's ITS inventory as of June 30, 2011. The ITS category for Smarter Highway gantries captures the devices supporting automated traffic management operations on I-5, I-90, and SR 520.

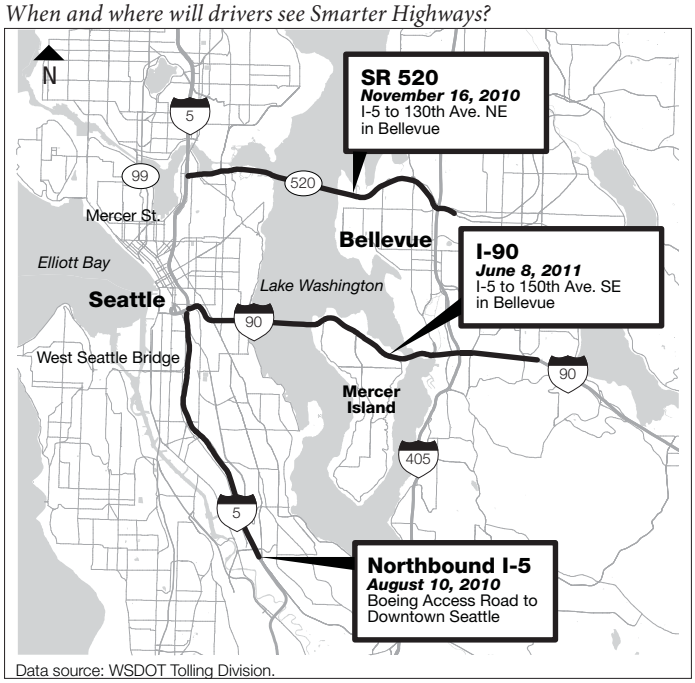
Smarter Highways in Washington

Last year, 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 16th, 2010 and I-90 on June 8, 2011.

WSDOT continues to make small adjustments to the Variable Speed Limit component of the Smarter Highways System, and is collecting data and monitoring the performance and safety benefits of the system.

Active traffic management projects near Seattle

When and where will drivers see Smarter Highways?



Data source: WSDOT Tolling Division.

WSDOT's Intelligent Transportation System inventory

Statewide inventory as of June 30, 2011

	Number of devices or sites each year					
Device type	**2007**	**2008**	**2009**	**2010**	**2011**	**Approximate cost per device**
Closed circuit television camera[1]	521	542	555	699	746	$15,000 - $30,000
Variable message signs[1]	179	181	188	201	258	$100,000 - $250,000
Highway advisory radio transmitters[2]	64	68	70	82	88	$50,000
Road/weather information system	94	97	100	105	106	$25,000 - $50,000
Metered ramps	137	137	143	154	155	$10,000 - $20,000[3]
Traffic data stations[4]	530	554	565	639	660	$10,000 - $20,000
Smarter highway gantries[5]	0	0	25	53	56	$650,000 - $900,000

Data source: WSDOT SIMMS database.

Notes: 1 Some local cities and counties pay WSDOT to operate and/or maintain their closed circuit televisions (CCTV) and variable message signs (VMS); for 2007, figures include both WSDOT owned and maintained devices, 2008 - 2011 include only WSDOT owned devices.

2 Highway Advisory Transmitter (HART) count also includes nine portable devices.

3 This represents the cost of one ramp meter device; there may be multiple ramp meters on one ramp.

4 The number of data stations includes those operated by the Traffic Data Office.

5 The increase in some of the numbers of CCTV, VMS, Traffic Data Stations are as a direct result of the installation of the highway gantries. While each gantry is separate the data collection as well as the data informational signing cannot be attributed to a specific 'gantry' unless actually installed upon it. The individual devices installed upon each gantry are not delineated at this time. All of the gantries may now be installed but are not yet operational.

Moving Washington: Operate Efficiently

Incident Response Program Annual Report

The mission of WSDOT's Incident Response (IR) program is the safe, quick clearance of traffic incidents on state highways. IR minimizes traffic congestion and restores traffic flow by removing dangerous traffic blockages that can lead to secondary collisions. IR trucks travel state highways during peak traffic periods, offering a variety of motorist assistance services such as providing fuel and jump starts, changing flat tires, and moving disabled vehicles safely off the roadway reducing motorists' exposure to danger.

IR responders are trained and equipped to assist Washington State Patrol (WSP) troopers at collisions and other traffic emergencies. Available for call out 24/7, IR units assist WSP with traffic control, mobile communications, clean-up, and other response functions as needed during major incidents. More information on the IR program can be found at www.wsdot.wa.gov/Operations/IncidentResponse/.

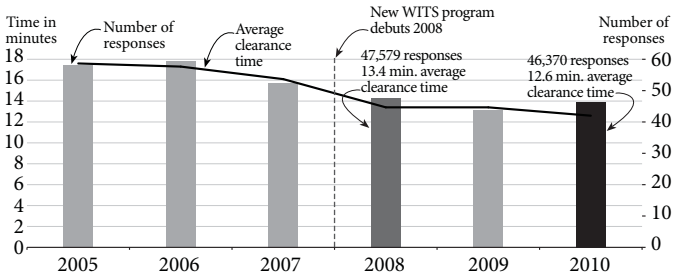
WSDOT Incident Response teams cleared 46,370 incidents in 2010

The annual number of incidents statewide decreased by 2.5% in 2010 (46,370) compared to 2008 (47,579), but increased 5.9% compared to the number of 2009 (43,786) incidents.

The statewide average annual clearance time for incidents in 2010 (12.6 minutes) improved by 6.3% compared to 2008 and 2009 (13.4 minutes for both years).

Number of responses and overall clearance time

Clearance time in minutes, number of responses in thousands
2005-2010



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

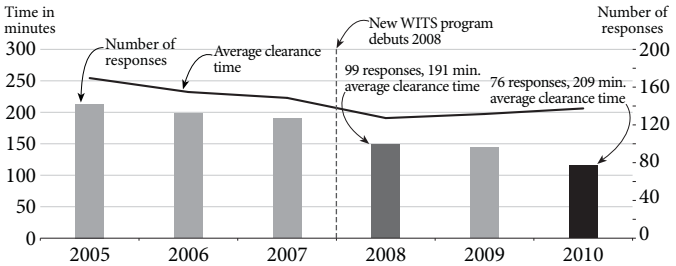
Note: In Q1 2008, WSDOT's Incident Response Program moved to a new database system and began calculating average clearance time in a different way. This accounts for the apparent decrease in the average clearance time value.

Fewer fatality collisions, but longer clearance times needed for incidents in 2010

The annual number of fatality incidents statewide decreased by 23% in 2010 (76) compared to 2008 (99). The average clearance times for fatality incidents in 2010 and 2008 were 209 minutes and 191 minutes respectively.

Fatality collisions: Number of responses and average clearance time

Clearance time in minutes, number of responses in thousands
2005 – 2010



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.

Lowest number of traffic fatalities since 1954

The downward trend in traffic fatalities continues on Washington's highways, city streets, county roads, and other public roadways. The years 2006-2010 represent the first time in the state's motoring history that Washington experienced a consecutive annual downward trend in the number of fatalities over a five year time span, and 2010 reflects the lowest number of traffic fatalities recorded (459) since 1954 (413).

Washington annual traffic fatalities

2005-2010

Year	2005	2006	2007	2008	2009	2010
All roads	649	633	571	521	492	459
State highways	316	308	280	234	241	232

Data source: Fatal Accident Reporting System (FARS).

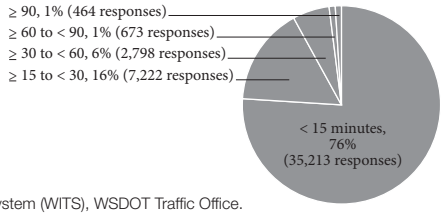
Note: The 2010 Congestion Report published the number of traffic fatalities for 2008, 2009 as 522, 491 respectively. These numbers has been updated to 521 and 492 due to updates made to FARS. The 2010 numbers are considered to be preliminary until December 31, 2011.

Incident Response Program Annual Report, continued

Incident Response teams clear 76% of all incidents in less than 15 minutes

In 2010, the WSDOT IR teams responded to 46,370 incidents statewide. The incident data is grouped into five categories, based on the duration of the incident. The over-90 minute incidents category made up 1% of all incidents in 2010.

Number and percentage by incident duration
2010



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

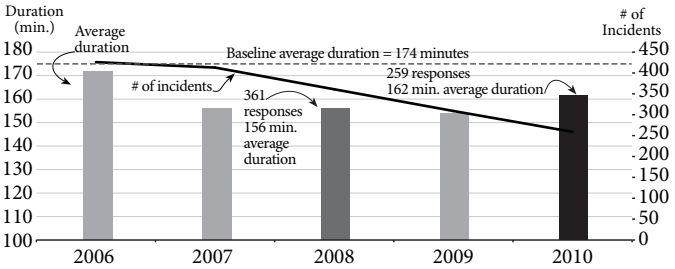
WSDOT Incident Response teams work with the Washington State Patrol and other local emergency responders to assist motorists and keep traffic moving safely.

WSDOT and WSP continue to work towards annual GMAP target

WSDOT and WSP continue to work together on Governor Gregoire's initiative to reduce the duration of serious blocking incidents on nine key congested corridors. For 2010, the two agencies were 7 minutes short of the GMAP (Government Management Accountability and Performance) goal of 155 minutes, with the average annual duration for serious blocking incidents coming in at 162 minutes. The annual average clearance time in 2009 and 2008 were 154 and 156 minutes respectively.

Over 90-minute incidents on GMAP corridors have been reduced 28% between 2008 (361) and 2010 (259).

Progress toward the goal for reducing average clearance times for over-90-minute incidents on the nine key western Washington highway segments
2006-2010
Average duration in minutes vs number of incidents annually



Data source: Washington State Patrol and WSDOT Traffic Office.
Note: Baseline average duration is 174 minutes based on four quarters of data that includes: Q3 and Q4 of 2005 and Q1 and Q2 of 2006.

Moving Washington
Manage Demand

Manage Demand: WSDOT's Demand Management Tools

Reducing trips on our highway system by encouraging the use of higher occupancy modes of transportation, and by shifting some travel to non-peak hours are some of the strategies WSDOT uses to manage the demand for capacity on Washington's highways. 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.

Vanpool

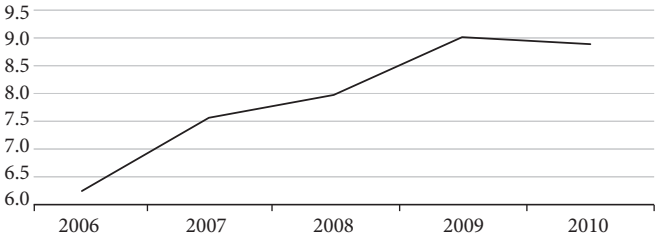
The 2010 economic climate within Washington continuesd to have an impact on transit agency operated vanpool programs. Budgetary constraints coupled with increased operating costs and equipment unavailability, and in some cases an unsuccessful attempt to pass a transit tax increase ballot measure, resulted in some transit agency's inability to meet and address vanpool demand. Additionally, some transit agencies during WSDOT's last vanpool grant funding cycle did not apply for grant funds due to the economic unknowns and demand unknowns and/or inability to support additional vanpools in operation.

Economic conditions have improved some in 2011, contributing to statewide transit operated vanpool programs adding 160 vanpools through June 2011. New participant survey data obtained from King County Metro vanpool staff indicated that the primary contributing factor that prompted new riders to start vanpooling was that they were returning back to work. The survey also showed that 34% of new vanpool participants joined or started a vanpool as a result of increased fuel costs. Before joining a vanpool, 48% of the survey respondents indicated that they drove alone to work.

Joint Base Lewis-McChord

During the 2011 legislative session, the legislature made an effort to address continued congestion and traffic delays along I-5 by funding 50 new vans that would serve Joint Base Lewis-McChord (JBLM). Pierce Transit, which serves the base, experienced severe budget problems in 2010 and a failed transit tax increase ballot measure in 2011. Due to proposed staff cuts in 2011, transit agencies that border Pierce's Pubic Transportation Benefit Area (PTBA) may be called upon to assist with the operation of vanpools to JBLM.

Statewide annualized vanpool trips
2006-2010



Data source: WSDOT Public Transportation Division.

Construction Traffic Management

WSDOT works with dozens of project teams from counties, cities, transit agencies and ports to assess construction traffic impacts before construction activities begin. This assessment considers the impacts of all construction projects as well as events that affect traffic. Highway construction projects are complex, and delivering projects on time, within budget, and safely, all while keeping people and goods moving is a difficult balancing act. Identifying areas of concern early provides opportunity to consider strategies to help mitigate the impacts. Often the most cost effective solutions are changes to schedules or construction methods, and by providing public information. When additional mitgation is required, WSDOT can also implement demand management programs to reduce demand on corridors under construction.

To develop demand management plans, construction impacts on roadway capacity are analyzed, and an overall trip reduction target is developed. The goal is to keep traffic moving as well as it did prior to construction. WSDOT works with local jurisdiction partners including cities, counties and transit agencies to develop trip reduction programs with the target in mind.

Targeted demand management programs reduced traffic during I-405 construction

In 2007 and 2008, the South Bellevue Widening (112th Ave SE to SE 8th St) and Renton Stage 1 (I-5 to SR 169) projects narrowed lanes and reduced shoulders during construction. Analysis of this reduced capacity showed that 1,150 daily round trips needed to be removed from the I-405 corridor to keep traffic moving at the same speed as before construction. Demand management programs designed to help achieve this reduction included targeted outreach along the I-405 corridor to promote carpooling, vanpooling and transit. Special programs to support I-405 construction combined with ongoing statewide commute trip reduction and vanpool programs resulted in a total of 2,700 trips removed.

Manage Demand: WSDOT's Demand Management Tools

AWV implements strategies before construction begins

The downtown Seattle area has been a busy site of major construction projects from multiple agencies including the state, county, city, port and utilities, requiring considerable coordination. One of the largest construction programs, the Alaskan Way Viaduct and Seawall Replacement Program (AWV), is using construction traffic management techniques even before construction begins to keep people and goods moving. In May 2011, traffic capacity along a portion of the viaduct was reduced from three to two lanes in each direction, and more intense impacts are expected in fall 2011. WSDOT began investing $31.9 million in transit and demand management strategies through King County Metro (KCM) prior to construction to help minimize construction effects. These strategies include:

- Funding KCM transit services to maintain transit service reliability during construction. As construction delays affect transit services more buses are needed to maintain the scheduled frequency riders expect.
- Strategically increasing transit capacity on well used routes close to the construction to offer travelers additional options for getting around, funding 31 peak period weekday bus trips from West Seattle and SODO to downtown Seattle past the AWV construction zone.
- Targeting outreach to employment centers and residential areas where travelers are likely to be affected by the construction. Outreach includes promoting transit, teleworking, carpooling, and vanpooling. As of February 2011, more than 1,580 new transit passes were issued reducing about 130 new round trips per day. Eight major employers with about 8,500 employees were recruited to implement telework programs. Teleworking is expected to reduce 700 round trips daily.

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 project, WSDOT will continue to monitor and report on the results of these investments.

New and improved RideshareOnline.com

RideshareOnline.com (RSO) is an online service that helps commuters make more efficient transportation choices that save them time and money. RSO provides tools that make transit, vanpooling, carpooling, teleworking, walking, and bicycling easier and more rewarding. By helping commuters find alternatives to driving alone, RSO provides congestion relief, helps the environment, and reduces energy consumption.

A cyclist makes good use of the bike-carrying capabilities of this vanpool vehicle, connected through RideshareOnline.com.

More than 200 employee transportation coordinators and trip reduction program managers are promoting RideshareOnline website and its features. Some are encouraging people to track trips and earn subsidies and incentives while others are encouraging people to use the system to join a carpool or vanpool. RSO is also used by agencies and community organizations throughout Washington, Oregon, and Idaho, and is not just for employees commuting to work: it's used for sharing a ride to events such as concerts and ballgames as well.

Additional features are in development, including features that support ridematching for families with children in schools (SchoolPool), and ridematching for community groups that want to expand travel options for people with special transportation needs.

Since March 2010 when the new system launched:

- More than 30,000 people have registered on RideshareOnline.com – more than doubling membership over the original RideshareOnline.com system.
- Members have logged more than 400,000 bus, train, carpool, vanpool, bicycle, and pedestrian trips, totaling nearly 8 million miles of travel in vehicles carrying more than one passenger.
- Compared to driving alone, members saved more than 300,000 gallons of fuel and more than $4,000,000.
- About 35% of active members used the ridematch service and 65% used the trip calendar and other features.

Moving Washington
Add Capacity Strategically

WSDOT Capacity Expansion Projects: Tacoma/Pierce County HOV Program

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.

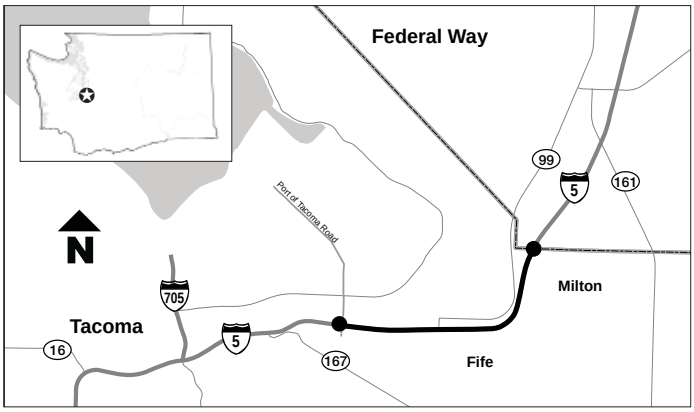
Tacoma/Pierce County HOV Program

The Tacoma/Pierce County HOV Program is a series of projects that build 70 high occupancy vehicle (HOV) lane miles on I-5, SR 16, and SR 167 in Pierce County. HOV lanes are reserved for those who travel by motorcycle, carpool, vanpool, or bus. They increase the person-throughput of the highway system, by allowing multi-person vehicles to move more efficiently when traffic is congested in the general purpose (GP) lanes. HOV reliability tends to increase ridership for carpools and transit, easing demand in the GP lanes and contributing to the overall highway system efficiency.

Project update: I-5 Port of Tacoma Road to King county line – Add HOV lanes

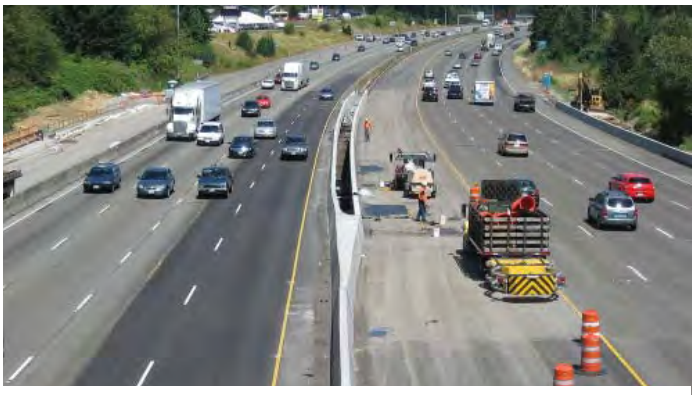
The I-5 Port of Tacoma Road to King county line – Add HOV lanes project has provided congestion relief for the northbound morning commute by boosting HOV capacity. Nearly two hours of congestion were eliminated and median travel time was reduced to about eight minutes between 6 and 10 AM. As part of the Tacoma/Pierce County HOV Program, the project widened roughly three miles of northbound and southbound I-5 between Port of Tacoma Road and the Pierce/King county line, adding almost six new HOV lane miles. Construction began in August 2009 and HOV lanes were open to traffic in late 2010.

I-5 Port of Tacoma Road to King county line project map



In the future, two other HOV projects will be located adjacent to this three mile project segment: the I-5: Portland Avenue to Port of Tacoma Road – Northbound HOV project, and the I-5: Portland Avenue to Port of Tacoma Road – Southbound HOV project. Before and After data collected for the corridor includes all three projects as one eight-mile study area, with the south boundary located at the South "G" Street/Tacoma Avenue South overpass (milepost 133), and the north boundary at the SR 161 overpass in King County at the end of the existing HOV lane (milepost 141), just north of where new HOV lane was constructed. Travel time data were collected for three of the far left lanes for each direction of travel; only the through traffic between the two data collection points were included.

February 2010 – Progress at West Hylebos Creek. Crews are preparing to pour the bridge deck that will carry northbound I-5 traffic.



August 2010 – WSDOT began paving the new carpool lanes on I-5 in Pierce County.

WSDOT Capacity Expansion Projects: Tacoma/Pierce County HOV Program

Before and After results of I-5 Port of Tacoma Road to King County Line show travel time improvements

Data were collected in April 2009 before project construction, and again exactly two years later in April 2011. Data collection includes the morning commute between 6 AM and 10 AM, and the evening commute between 2:30 PM and 6 PM. Both directions of I-5 within the study area were heavily traveled during the morning and the afternoon peaks.

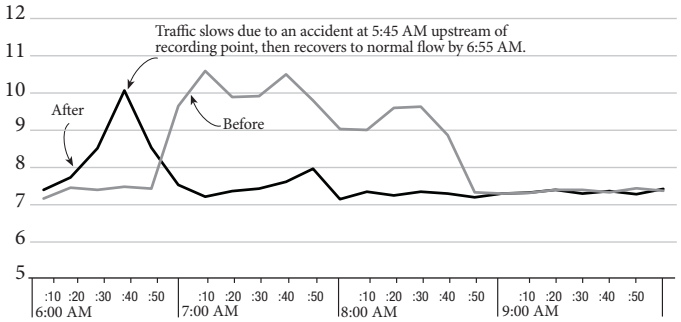
Northbound morning commute (peak direction)

The northbound morning commute has slightly higher volumes compared to the afternoon commute and is the peak direction during the morning commute. Before construction, travel times along northbound I-5 in the study area began to increase sharply around 6:50 AM, lasting until just before 9 AM, and varied between nine and 11 minutes. After construction, travel times were about seven to eight minutes throughout the morning commute period, and speeds averaged 64 mph.

While the After construction data show a sharp increase in GP travel time before 7 AM, this increase was due to a crash (at 5:44 AM) that had occurred near the north end of the study area. The rightmost GP lane was closed for about one hour to clean up debris and a downed light pole. The accident occurred and was cleared before the peak morning commute began, and after the impact to traffic had dissipated, travel times returned to typical peak hour durations.

Before and After travel times from HOV lane additions on I-5 northbound (peak direction) between Port of Tacoma Road and King County line

April 2009 & 2011; Travel time in minutes



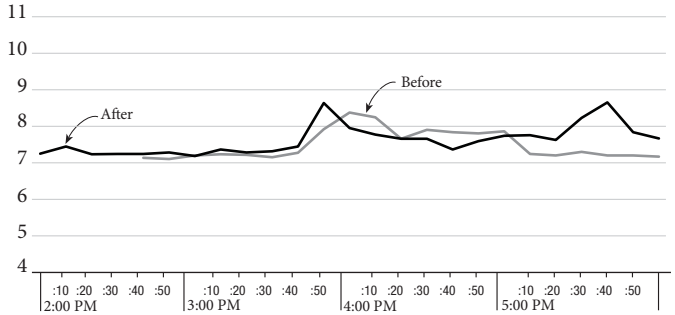
Data source: WSDOT Statewide Traffic and Collision Data Office.
Note: Median travel time for each ten minute interval.

Northbound afternoon commute (non-peak direction)

In the afternoon, northbound travel times changed only slightly after construction resulting in slightly lower travel times and shorter peak duration.

Before and After travel times from HOV lane additions on I-5 northbound (non-peak direction) between Port of Tacoma Road and King County line

April 2009 & 2011; Travel time in minutes



Data source: WSDOT Statewide Traffic and Collision Data Office.
Note: Median travel time for each ten minute interval.

Southbound I-5 travel times

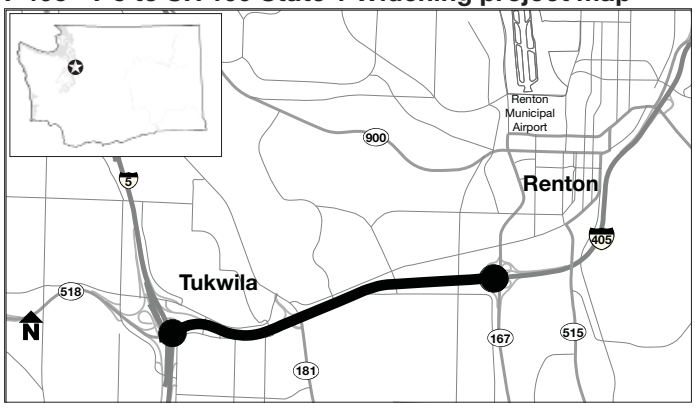
Construction from the nearby I-5/SR 16 Westbound Nalley Valley project influenced southbound travel time data for the I-5 Port of Tacoma Road to King County Line HOV Lanes project, and construction related backups have obscured HOV lane benefits. Since the I-5/SR 16 Westbound Nalley Valley project opened to traffic on June 26, 2011, congestion patterns continue to respond to project improvements. Analysis of southbound travel times will be provided in future congestion reports alongside results from the two adjacent HOV projects, upon completion.

WSDOT Capacity Expansion Projects: I-405 Corridor

I-405 – I-5 to SR 169 Stage 2 Widening

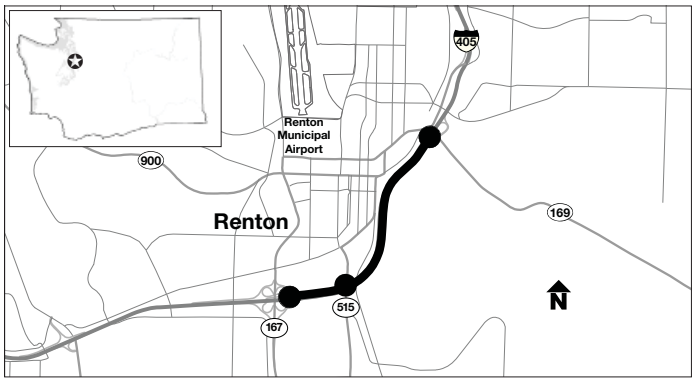
The I-405–I-5 to SR 169 widening project included two stages. Stage 1 of the project widened I-405 between I-5 and SR 167 and opened a new lane in each direction in December 2009. The project details for Stage 1 are published on page 56 of the 2010 Congestion Report.

I-405 - I-5 to SR 169 State 1 Widening project map



In Stage 2 of the I-405–I-5 to SR 169 Widening project, WSDOT built a new half-diamond interchange on I-405 at SR 515 (Talbot Rd) to improve access to downtown Renton and to relieve traffic demand on the I-405 interchanges at SR 167 and SR 169. In the future, if additional funding is authorized, a second half-diamond interchange could be constructed on I-405 west of the I-405/SR 167 interchange at Lind Avenue. Access to Renton and I-405 will be greatly improved with the completion of a frontage road system to connect the two half-diamond interchanges.

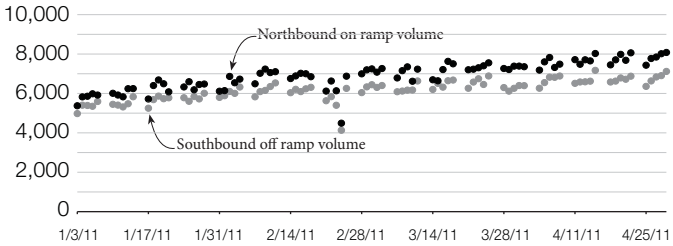
I-405 - I-5 to SR 169 State 2 Widening project map



In addition to the new interchange ramps, the Stage 2 project constructed one additional lane in each direction on I-405 between SR 167 and SR 169. The new ramps and I-405 lanes were opened to traffic on December 21, 2010. The weekday daily volume on the ramps has been steadily increasing during the first four months since opening. The northbound exit carries over 7,000 vehicles each day while the southbound on ramp carries over 8,000.

I-405 at SR 515 (Talbot Road) new interchange ramp volume

Weekday data from January - April 2011
Volume in vehicles per day



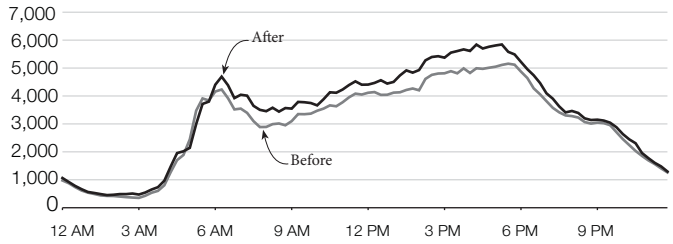
Data source: WSDOT Northwest Region Traffic Office.

New northbound and southbound lanes allow increased traffic volumes on I-405

The additional lane in each direction allows more vehicles to get through on I-405. Northbound volume increased by more than 7,500 vehicles daily; southbound volume by more than 6,500. During peak periods, northbound volume increased by up to 800 vehicles an hour and southbound by up to 900 vehicles an hour. I-405 still experiences some congestion in this area, but traffic volume has increased since the new lanes opened.

Before and After volume throughput profile on I-405 Northbound between SR 515 and SR 169

Weekday data for March - April 2007 & 2011
Volume in vehicles per hour

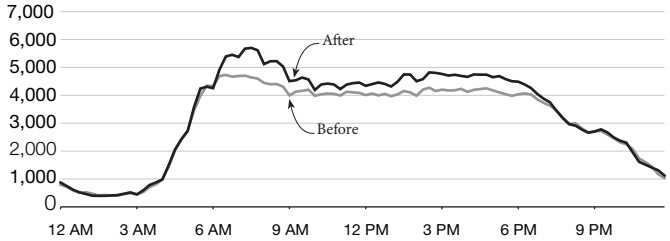


Data source: WSDOT Northwest Region Traffic Office.

WSDOT Capacity Expansion Projects: I-405 Corridor, continued

Before and After volume throughput profile on I-405 Southbound between SR 181 and SR 167

Weekday data for March - April 2007 & 2011
Volume in vehicles per hour



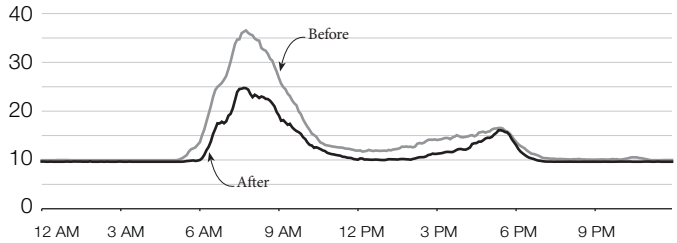
Data source: WSDOT Northwest Region Traffic Office.

Travel time and congestion improvements on I-405 corridor

Northbound travel time between Tukwila and Bellevue was greatly reduced in January 2009 when the I-405 – South Bellevue Widening project opened an auxiliary lane between 112th Ave SE and I-90 (see pp. 57-58 in the 2010 Annual congestion Report). After the completion of both stages of the I-405–I-5 to SR 169 Widening project, congestion has improved between I-5 and SR 169. However, the northbound bottleneck shifted downstream to SR 169 where the number of lanes is reduced from four to three. Although some congestion remains, the morning peak travel time between I-5 and Coal Creek Parkway was reduced from more than 35 minutes to less than 25 minutes.

Before and After travel time profile on I-405 Northbound between I-5 and Coal Creek Parkway (10 miles)

Weekday data for March - April 2007 & 2011
Travel time in minutes

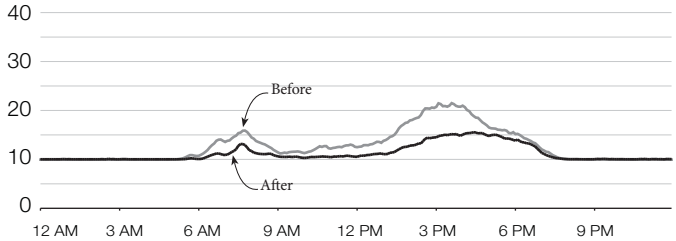


Data source: WSDOT Northwest Region Traffic Office.

In 2007, southbound I-405 was heavily congested throughout weekday afternoons between SR 169 and SR 167 as well as approaching I-5. In 2009, Stage 1 helped to relieve congestion between SR 167 and I-5. After opening Stage 2, congestion no longer occurs between NE Park Drive and I-5, and the evening peak travel time has been reduced from more than 20 minutes to about 15 minutes from Coal Creek Parkway to I-5.

Before and After travel time profile on I-405 Southbound between Coal Creek Parkway and I-5 (10 miles)

Weekday data for March - April 2007 & 2011
Travel time in minutes



Data source: WSDOT Northwest Region Traffic Office.

October 2009 – Crews have started to pave a section of a new northbound on-ramp from Talbot Road (SR 515) to northbound I-405.

Moving Washington
Add Capacity Strategically

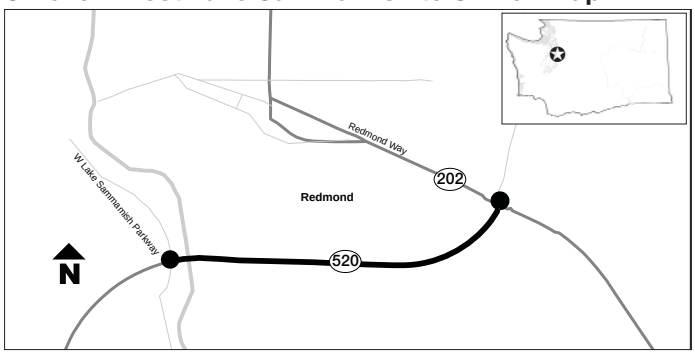
WSDOT Capacity Expansion Projects: SR 520 Corridor

SR 520 – West Lake Sammamish Parkway to SR 202

The SR 520–West Lake Sammamish to SR 202 widening project has reduced traffic congestion and increased vehicle throughput for SR 520 commuters.

WSDOT completed the project in February 2011. Stage 1 included a new flyover ramp from westbound SR 202 to westbound SR 520 and was completed in February 2008. Stage two widened SR 520 from two lanes to four lanes (in each direction) between West Lake Sammamish Parkway and SR 202. Two additional lanes were added eastbound for another half mile up to the Avondale Rd/NE Union Hill Rd intersection.

SR 520 – West Lake Sammamish to SR 202 map



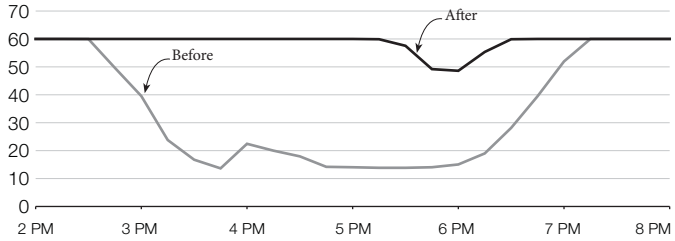
Congestion improvements

The new lanes, a half mile in each direction with a posted speed limit of 50 mph, have greatly improved eastbound congestion during the afternoon commute. At West Lake Sammamish Parkway, congestion (average speed less than 45 mph) in 2007 occurred on SR 520 in both lanes and lasted an average of four hours on weekday afternoons. In 2011, the average duration of congestion in the right (HOV) lane approaching the SR 202 exit was reduced to roughly one hour on the average weekday, with no congestion in the left lanes. Some congestion remains due to capacity constraints on SR 202.

June 2010 – WSDOT opened a new westbound SR 520 lane between SR 202 and West Lake Sammamish Parkway.

Before and After speed profile on SR 520 eastbound at West Lake Sammamish Parkway

Weekday data for March - April 2007 & April 2011
Speed in miles per hour



Data source: WSDOT Northwest Region Traffic Office.
Note: Speeds are averaged across all the general purpose lanes.

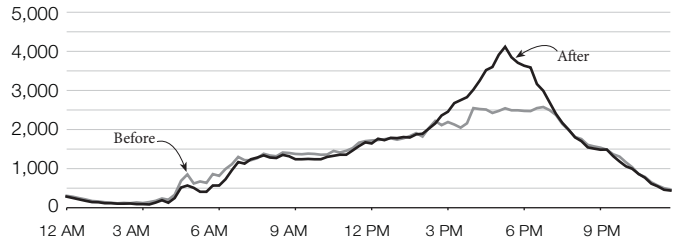
Volume and throughput improvements

The new lanes have increased throughput on eastbound SR 520. Vehicle throughput has increased by up to 1,500 vehicles per hour, allowing a 3,600 vehicle increase in volume between 3 pm and 7 pm.

Westbound SR 520 also saw an increase in vehicle throughput during the morning peak and continues to have free flow conditions.

Before and After volume throughput profile on SR 520 eastbound at West Lake Sammamish Parkway

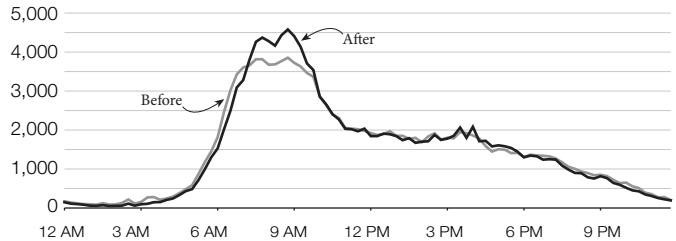
Weekday data for March - April 2007 & April 2011
Volume in vehicles per hour



Data source: WSDOT Northwest Region Traffic Office.

Before and After volume throughput profile on SR 520 westbound at West Lake Sammamish Parkway

Weekday data for March - April 2007 & April 2011
Volume in vehicles per hour



Data source: WSDOT Northwest Region Traffic Office.

WSDOT Capacity Expansion Projects: US 2 Corridor

US 2 Peak Period Shoulder Lane

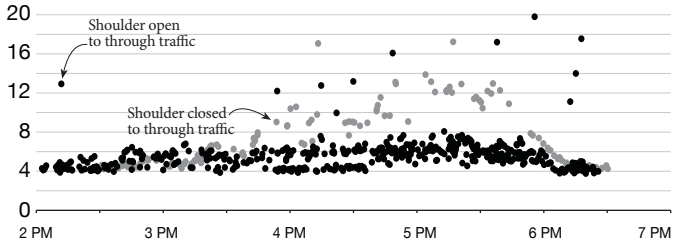
The US 2 Peak Period Shoulder Lane restripe project has increased vehicle throughput and reduced travel time for afternoon drivers: it continues to provide significant benefit in both travel time and throughput. As reported in the 2009 Congestion Report (page 44), WSDOT restriped US 2 eastbound for 1.5 miles between I-5 and SR 204 to provide two lanes of traffic and a wider, 14 foot shoulder that can be managed as a shoulder or as a travel lane during designated time periods. In April 2009, the managed shoulder was opened up as a lane for drivers to use between 3 pm and 7 pm on weekdays. The extra capacity continues to relieve congestion on US 2 eastbound as well as on the exit from I-5 northbound.

Travel times have improved since opening of managed shoulder lane

When the managed shoulder lane opened in 2009, travel time from I-5 at 41st Street to US 2 at SR 204 (55 mph, two-mile section) dropped from 14 minutes to less than seven minutes during the afternoon peak. Travel time data was collected again for four days in 2011. On three days, the shoulder lane was open and travel times reached a maximum of eight minutes. On one day, the shoulder lane was closed to allow crews to clean up debris under the trestle. On that day, travel time averaged up to 14 minutes, the same as before the original opening in 2009.

Before and After travel times on US 2 between I-5 NB at 41st Street and US 2/SR 204 Interchange with and without shoulder running

Before Data (shoulder closed) - March 31, 2011;
After Data (shoulder open) - April 5,12,13 2011
Travel Time in minutes



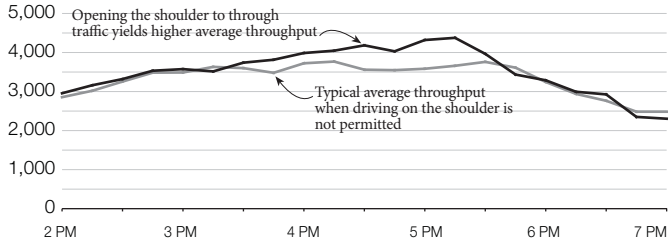
Data source: WSDOT Northwest Region Traffic Office.

Shoulder lane significantly improves capacity and throughput

While the shoulder lane was closed for work crews, the capacity of US 2 eastbound at Homeacres Road was reduced by 200-500 vehicles an hour. During the entire peak period from 3 pm to 7 pm, throughput was 500-1200 vehicles less than on the days when the shoulder lane was open.

Before and After volume throughput on US 2 eastbound with and without shoulder running at Homeacres Road

Before Data (shoulder closed) - March 31, 2011;
After Data (shoulder open) - 3 day average (April 5,12,13, 2011)
Volume in vehicles per hour



Data source: WSDOT Northwest Region Traffic Office.

This photo, taken from a WSDOT traffic camera, shows cars traveling in the peak period shoulder running lane (the far right lane) on US 2 at Homeacres Road.

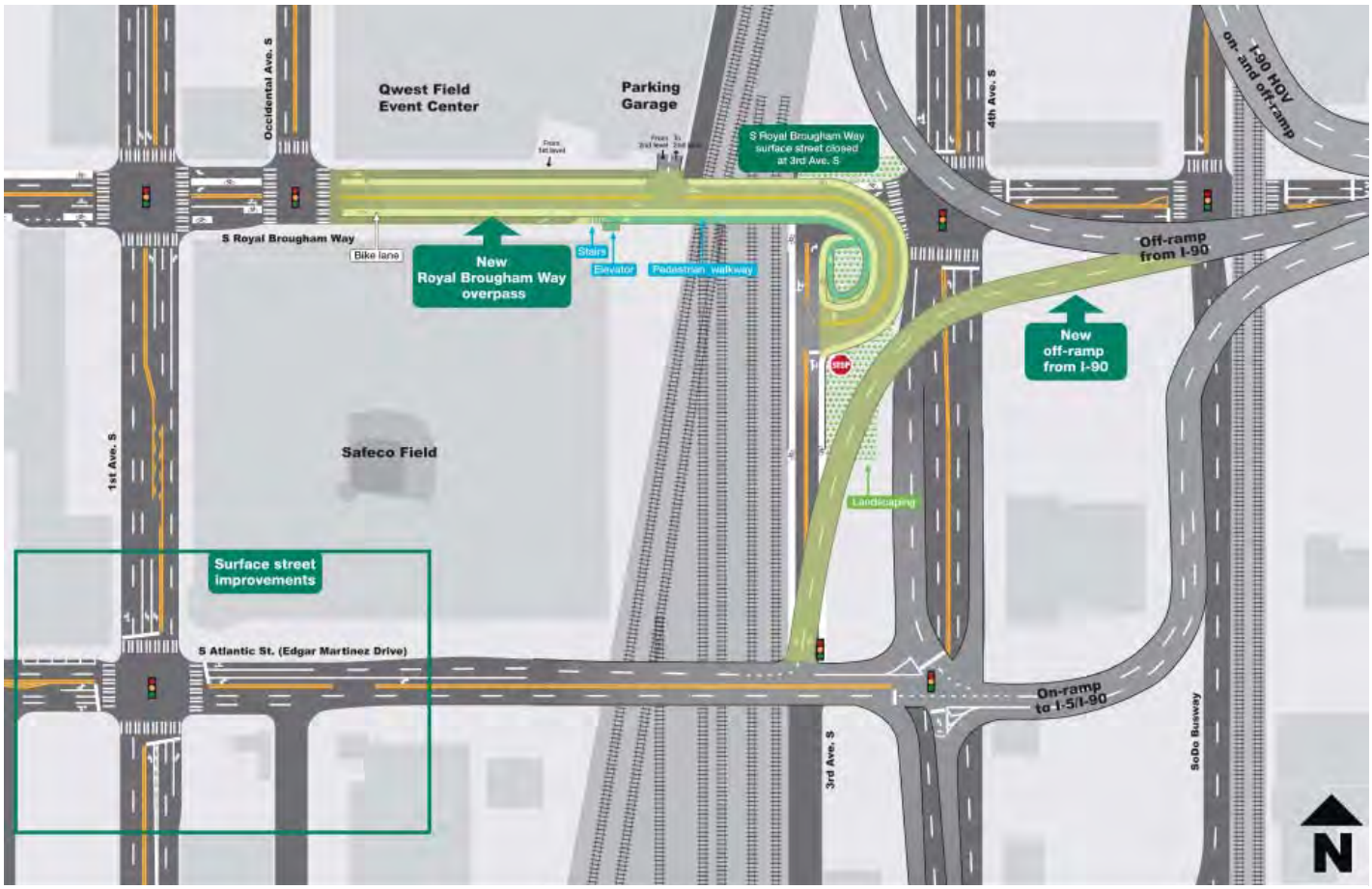
WSDOT Capacity Expansion Projects: SR 519 Corridor

SR 519 – South Seattle Intermodal Access – Royal Brougham Phase 2

The SR 519 South Seattle Intermodal Access project has improved mobility and safety for drivers, pedestrians, and rail within the busy area of south Seattle. SR 519 is a truck route, Qwest and Safeco Fields are located north and south of S Royal Brougham Way, and the Burlington Northern Santa Fe (BNSF) Railroad runs east of the stadiums limiting access to and from the east. The SR 519 South Seattle Intermodal Access project improved connections between I-5 and I-90, and between the Port of Seattle terminals and the central waterfront area. This area sees heavy freight, vehicle, and pedestrian traffic.

Phase 1 of the project was completed in fall of 2003. It constructed an overpass along South Atlantic Street above the BNSF Railroad and built an eastbound connection from South Atlantic Street to I-90 and I-5. Phase 2 construction was complete in June 2010. Phase 2 constructed an overpass above the BNSF Railroad along South Royal Brougham Way, built a westbound connection from I-90 and I-5 to South Atlantic Street, and made improvements to the intersection of South Atlantic Street and 1st Ave S. The SR 519 improvements better separate car, freight, pedestrian, and rail traffic to improve traffic flow and reduce the risk of collisions.

The off ramp to 4th Ave S from I-90 and I-5 had an average weekday volume of over 11,000 vehicles in 2008. In 2010, the two ramps served 14,000 vehicles on an average weekday. The 4th Ave S off ramp carried about 7,000 vehicles, while the new off ramp to S Atlantic St carried about 7,000 vehicles. The new off ramp to South Atlantic Street saves drivers an average of one minute compared to the 4th Ave South ramp, and allows trips destined for the waterfront to avoid additional delays of up to several minutes at the railroad crossing.



SR 519 – South Seattle Intermodal Access – Royal Brougham Phase 2 project map

Moving Washington Balanced Strategies

How WSDOT Fights Congestion

Washington depends on mobility

Effective transportation is critical to maintaining our economy, environment, and quality of life. Moving Washington is WSDOT's vision of investments and priorities for the next 10 years. It integrates new capacity, efficiencies, and commute options to address congestion head-on and improve the performance of our state's transportation system. The program's primary objective is mobility, one of the state Legislature's six transportation goals, along with preserving our transportation infrastructure, making the system safe for all, protecting the environment, striving for economic vitality, and practicing sound stewardship.

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/.

Washington drivers are already seeing benefits

The Moving Washington 10-year transportation 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 pages 66-67.

The 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.

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 June 30, 2011, 76 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 US 395 through Spokane, among others around the state.

How WSDOT is fighting congestion

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 & rides
- Transit partnerships
- Telecommuting programs
- Commute trip reduction
- HOV/carpooling

Building additional highway capacity

- The 421 construction projects of the 2003 and 2005 transportation funding packages include more than 126 mobility projects to fight congestion, of which 76 have been completed as of June 30, 2011.

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 and 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 via the Internet and variable message signs.

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: add capacity strategically, operate efficiently, and manage demand. 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, US 2

Selected congestion relief projects programmed to improve corridor performance:

Corridor performance highlights

Average travel times in minutes	2008	2010	%Δ
I-5 Everett-Seattle (AM)	41	45	8%
I-5 Seattle-Everett (PM)	38	39	1%
I-5 Federal Way-Seattle (AM)	40	39	-2%
I-5 Seattle-Federal Way (PM)	34	30	-9%
Delay on* I-5	15,696	13,981	-11%

Before & After case study: I-5 to US 2 hard shoulder running project helped reduce travel times by 6 minutes during evening peak (*2011 Congestion Report*, p. 63).

*Daily hours of delay relative to maximum throughput speeds.

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 Sea-Tac Airport.
- Complete business access and transit lanes on SR 99 in Shoreline.
- SR 518 third lane from I-5 to Sea-Tac Airport.
- New HOV lanes on SR 99.
- Interchange reconstruction at SR 531.

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 & Ride lot capacity.
- Support established growth and transportation efficiency centers (GTECs).

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	2008	2010	%Δ
I-90 Issaquah-Bellevue (AM)	15	15	-5%
I-90 Seattle-Bellevue (PM)	14	18	25%
SR-520 Bellevue-Seattle (AM)	17	18	7%
SR-520 Seattle-Bellevue (PM)	19	21	11%
Delay on* SR 520	2,781	2,659	-4%

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*, p. 51-52).

*Daily hours of delay relative to maximum throughput speeds.

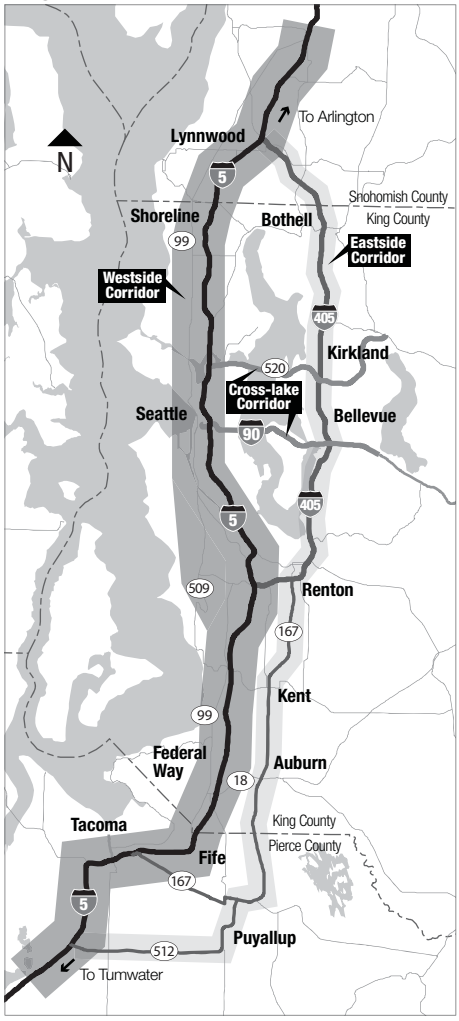
Add capacity strategically

- SR 520 HOV and Bridge Reconstruction.
- 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 interchange between SR 520 and SR 202.

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 the I-5 reversible lanes.
- Move HOV lanes to the inside on SR 520 east of Lake Washington.

Moving Washington: Puget Sound corridors



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 & Ride lots.

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 page 66)

Corridor performance highlights

Average travel times in minutes	2008	2010	%Δ
I-405 Tukwila-Bellevue (AM)	41	27	-33%
I-405 Bellevue-Tukwila (PM)	35	30	-16%
SR 167 Auburn-Renton (AM)	16	17	4%
SR 167 Renton-Auburn (PM)	16	16	0%
Delay on* I-405	11,754	10,094	-14%
Delay on* SR 167	2,084	1,982	-5%

Before & After case study: Following completion of the I-405 South Bellevue widening project the peak morning commute was reduced to 22 min. in 2009 as compared to 43 min. before construction (*2010 Congestion Report* p. 57).

*Daily hours of delay relative to maximum throughput speeds.

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.

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.
- Better manage existing Park and Ride lot space.

Spokane: I-90 and North Spokane Corridors

Selected congestion relief projects programmed to improve corridor performance:

Corridor performance highlights

Average travel times in minutes	2008	2010	%Δ
I-90 Argonne-Division (AM)	7.98	8.38	5%
I-90 Division-Argonne (PM)	8.17	8.73	7%

Before & 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).

Add capacity strategically

- US 395 North-South Freeway
- I-90/US 2 interchange eastbound off-ramp and terminal improvements

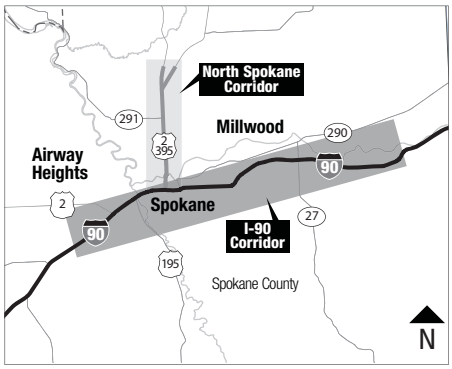
Operate efficiently

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

Manage demand

- US 195 Hatch Road to I-90 – park and ride facilities.
- North Spokane Corridor–new Park & Ride and pedestrian/bike paths.

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

Add Capacity Strategically
- Columbia River Crossing.
- SR 500/St. Johns Blvd. – Interchange.

Operate Efficiently
- Clark Co. and Vancouver signal optimization.

Manage demand
- Advanced Traffic Information System infill.

Cross-State Corridors: I-90, US 2, and SR 97

Add Capacity Strategically
- I-90 Snoqualmie Pass East Project.
- US 2/US 97 Peshastin East Interchange.
- US 97 Blewett Pass add passing lanes.

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

Manage demand
- Traveler information including flow maps, VMS, and web messaging on I-90 and US 2.
- I-90/SR 17 Park & Ride.

Connecting Communities Program

Add Capacity Strategically
- I-82/Valley Mall Blvd - interchange.
- SR 240 Columbia Ctr Blvd to US 395 – Construct interchange.
- Additional lanes on SR 28 at Sunset Highway.

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 & Ride.
- Tri-Cities traveller information enhancements.
- New Park & Ride lots for US 97/SR 970, Alger, Conway.

Table of Tables & Graphs

Table or graph title	page
2011 Congestion Report Dashboard of Indicators	4
Demographic and economic indicators	4
Systemwide congestion indicators	4
Corridor-specific congestion indicators	4
WSDOT congestion relief projects	4
Statewide indicators: Percent system congested, hours of delay, and vehicle miles traveled	5
Central Puget Sound corridors: Hours of delay and vehicle miles traveled	5
Central Puget Sound corridors: Throughput productivity	6
Travel times analysis: 40 high-demand Puget Sound commute routes	6
Additional performance analyses for the 40 high-demand Puget Sound commute routes	6
Travel time analysis: 12 additional Puget Sound commutes	6
Travel time analysis: Spokane commutes	7
HOV Lane performance	7
Ongoing tracking of performance for operational strategies	7
Travel time analysis: January-May 2011 semi-annual report	7
Key congestion performance measures	9
Understanding maximum throughput: An adaptation of the speed/volume curve	11
WSDOT state highway congestion measurement speed thresholds	11
Estimated travel delay and cost of delay on all state highways	13
Annual statewide per capita delay	14
Percentage of the state highway system that is delayed or congested	14
Schematic representation of statewide delay distribution on the state highway system	15
Delay and vehicle miles traveled (VMT) on state highways by urban area	15
Major central Puget Sound freeways: average weekday delay comparison	16
Major central Puget Sound freeways: Vehicle miles traveled (VMT)	16
Annual vehicle miles traveled statewide	17
Annual and per capita VMT on state highways and all public roads	17
Annual per capita vehicle miles traveled	17
Changes in loss of vehicle throughput at select Puget Sound locations	19
Vehicle throughput productivity: example	19
Throughput productivity at selected Puget Sound freeway locations by commute direction	20
NB I-5 at S 188th Street (MP 153.0)	20
EB I-90 at SR 900 (MP 16.5)	20
EB SR 520 at Evergreen Point Floating Bridge (MP 1.5)	20
NB I-405 at NE 160th Street (MP 22.5)	20
SB I-5 at S 188th Street (MP 153.0)	20
WB I-90 at SR 900 (MP 16.5)	20
WB SR 520 at Evergreen Point Floating Bridge (MP 1.5)	20
SB I-405 at NE 160th Street (MP 22.5)	20
Throughput productivity at selected Puget Sound freeway locations by commute direction	21
NB I-5 at I-90 (MP 164.0)	21
NB I-5 at NE 103rd Street (MP 172.0)	21
NB SR 167 at 84th Avenue SE (MP 21.50)	21
NB I-405 at SR 169 (MP 4.0)	21
SB I-5 at I-90 (MP 164.0)	21
SB I-5 at NE 103rd Street (MP 172.0)	21
SB SR 167 at 84th Avenue SE (MP 21.50)	21
SB I-405 at SR 169 (MP 4.0)	21
Morning commutes: changes in travel time performance on 19 AM high demand commute routes	23
Evening commutes: changes in travel time performance on 21 PM high demand commute routes	24
Average monthly gasoline prices in Washington	26
Unemployment rate for the Seattle-Bellevue-Everett metropolitan area	26
Taxable retail sales for selected Puget Sound Counties	26
Population and employment changes at selected Puget Sound locations	27
Fatal and serious injury collisions on all roads	27
Fatal and serious injury collisions on state highways	27
Reliability percentiles in Plain English	28
Morning commutes: changes in reliable travel time percentiles for 19 high demand AM commute routes, 2008-2010	29
Evening commutes: change in reliable travel time percentiles for 21 high demand PM commute routes, 2008-2010	30
How to read a stamp graph: Percent of days when speeds were below 36 mph	31

Table of Tables & Graphs

Table or graph title	page
Comparing 2008 and 2010 GP lanes: Percent of time in an average weekday when speeds fell below 36 mph	32
Comparing 2008 and 2010 GP lanes: Percent of time in an average weekday when speeds fell below 36 mph	33
Morning/Evening commutes: changes in travel time performance on 12 additional commute routes	34
Morning/Evening commutes: changes in travel time performance on Spokane commute routes	35
Selected truck bottlenecks: Inside the Central Puget Sound region	36
HOV lane speed and reliability performance on major central Puget Sound corridors	37
Freeway HOV and HOT Lane System	38
Comparison of HOV lane and general purpose lane person throughput	39
Tukwila to Bellevue morning commute: HOV and GP travel times	41
Morning commutes: HOV lane travel time performance compared to general purpose lanes	42
Evening commutes: HOV lane travel time performance compared to general purpose lanes	43
Morning / Evening commutes: HOV lane travel time performance compared to general purpose lanes	44
Comparing HOV and adjacent GP lanes: Percent of time in an average weekday when speeds fell below 45mph	45
Comparing HOV and adjacent GP lanes: Percent of time in an average weekday when speeds fell below 45mph	46
Comparing HOV and adjacent GP lanes: Percent of time in an average weekday when speeds fell below 45mph	47
Comparing HOV and adjacent GP lanes: Percent of time in an average weekday when speeds fell below 45mph	48
SR 167 travel times: Comparing HOT and GP lanes for peak northbound and southbound commutes	52
SR 167 Average daily traffic volumes	52
SR 167 HOT lanes average number of daily tolled trips	52
WSDOT's Intelligent Transportation System inventory	53
Active traffic management projects near Seattle	53
Number of responses and overall clearance time	54
Fatality collisions: Number of responses and average clearance time	54
Washington annual traffic fatalities	54

Table or graph title	page
Number and percentage by incident duration	55
Progress toward the goal for reducing average clearance times for over-90-minute incidents on the nine key western Washington highway segments	55
Statewide annualized vanpool trips	56
I-5 Port of Tacoma Road to King county line project map	58
Before and After travel times from HOV lane additions on I-5 northbound (peak direction) between Port of Tacoma Road and King County line	59
Before and After travel times from HOV lane additions on I-5 northbound (non-peak direction) between Port of Tacoma Road and King County line	59
I-405 - I-5 to SR 169 State 1 Widening project map	60
I-405 - I-5 to SR 169 State 2 Widening project map	60
I-405 at SR 515 (Talbot Road) new interchange ramp volume	60
Before and After volume throughput profile on I-405 Northbound between SR 515 and SR 169	60
Before and After volume throughput profile on I-405 Southbound between SR 181 and SR 167	61
Before and After travel time profile on I-405 Northbound between I-5 and Coal Creek Parkway (10 miles)	61
Before and After travel time profile on I-405 Southbound between Coal Creek Parkway and I-5 (10 miles)	61
SR 520 – West Lake Sammamish to SR 202 map	62
Before and After speed profile on SR 520 eastbound at West Lake Sammamish Parkway	62
Before and After volume throughput profile on SR 520 eastbound at West Lake Sammamish Parkway	62
Before and After volume throughput profile on SR 520 westbound at West Lake Sammamish Parkway	62
Before and After travel times on US 2 between I-5 NB at 41st Street and US 2/SR 204 Interchange with and without shoulder running	63
Before and After volume throughput on US 2 eastbound with and without shoulder running at Homeacres Road	63
Moving Washington: Puget Sound corridors	66
Moving Washington: Spokane corridors	67

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 calling the Washington State Department of Transportation Office of Equal Opportunity (OEO) at (360) 705-7097. Persons who are deaf or hard of hearing may may contact OEO through the Washington Relay Service at 7-1-1.

Civil Rights Act of 1964, Title VI Statement to Public

WSDOT ensures full compliance with Title VI of the Civil Rights Act of 1964 by prohibiting discrimination against any person on the basis of race, color, national origin or sex in the provision of benefits and services resulting from its federally assisted programs and activities. For questions regarding WSDOT's Title VI Program, you may contact the Department's Title VI Coordinator at (360) 705-7098 or (509) 324-6018.

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.gov/accountability/.

Prepared by the Strategic Assessment Office of the Washington State Department of Transportation.
310 Maple Park Ave SE, Olympia, WA 98504.
© 2011 WSDOT. All rights reserved. Printed in Washington on recycled paper and distributed electronically.