Washington State
Department of Transportation

The 2009 Congestion Report

Gray Notebook Special Edition

WSDOT's Comprehensive Analysis of System Performance on State Highways, November 2009

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Secretary of Transportation

Moving Washington
A Program to Fight Congestion

Looking at 2008 Data

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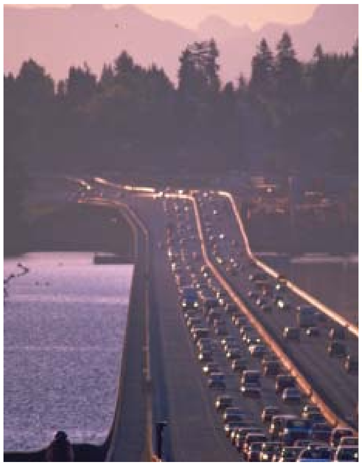
Foreword



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 2009 Congestion Report. This report is WSDOT's annual analysis of travel in the Puget Sound region and assessment of WSDOT's congestion relief projects and strategies.

Congestion on Washington State's highways decreased in 2008 compared to 2006. On average, travelers spent an average of an hour less in congestion. Delay on some of the most heavily traveled Puget Sound corridors travel delay was reduced by 25%. Much of this decline is due to high fuel prices in the first half of 2008 and the effects of the economic recession, which hit Washington hard during the later half of 2008.

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

- Adding Capacity: By the end of 2008, WSDOT had completed 46 congestion relief projects funded through the 2003 and 2005 gas tax packages valued at $1.2 billion. These projects are reducing time spent in traffic for Washington drivers. For example, the I-405 South Bellevue widening project improves travel times by 12 minutes during the morning peak period.
- Operating the system efficiently: Low cost, high benefit strategies including signal coordination, hard shoulder running and ramp metering are making the existing transportation infrastructure operate more efficiently. A $70,000 project to open a shoulder lane to traffic during peak periods in Everett reduced travel times by half—six minutes—exemplifies the strategies we are using to make the system more efficient.
- Managing travel demand: Strategies including vanpools, Commute Trip Reduction, and growth and transportation efficiency centers (GTEC) all encourage drivers to use less congested routes and reduce trips driving alone. A Spokane GTEC that opened in 2007 has reduced the drive alone rate among residents by over 12%.

As the economy improves, it will be accompanied by increased demand. WSDOT stands ready to address these challenges. Looking to the future, WSDOT will continue to aggressively fight congestion using the three strategies of Moving Washington. Major congestion relief projects, including the Alaskan Way Viaduct, SR 520 Floating Bridge, and projects in the I-405 Corridor Program remain to be delivered. Smarter highways, using technologies such as active traffic management, are planned for the central Puget Sound region's busiest corridors, including I-90 and SR 520 between I-405 and I-5. Next year's Annual Congestion Report will report on the benefits of these improvements and how they have impacted system performance.

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Work started in August 2009 on this project to extend the Puget Sound HOV system into Pierce County. Crews will build HOV lanes, or carpool lanes, in the freeway median in both directions of I-5 from Port of Tacoma Road to the King County line.

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The work of many people goes into the writing, editing, and production of the *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. On-line versions of this publication are available at www.wsdot.wa.gov/accountability

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Mobility
(Congestion Relief)

Statewide policy goal:

To improve the predictable movement of goods and people throughout the state.

WSDOT's business goal:

To move people, goods, and services reliably, safely, and efficiently, by adding infrastructure capacity strategically, operating transportation systems efficiently, and managing demand effectively.

Measuring Delay and Congestion Annual Report

Congestion Indicators

Many factors contributed to reduced congestion in 2008

Even in the face of continued population growth, the dynamics of higher fuel prices, the economic recession, and the completion of numerous congestion relief projects helped reduce congestion on state highways in 2008. Drivers drove less and experienced less delay during peak traffic periods on the most congested state highways. The efficiency of the highway system increased, reducing economic costs of delay to businesses and citizens.

2009 Congestion Report Dashboard of Indicators	2006	2007	2008	Difference 2006 vs. 2008*
Demographic and Economic Indicators				
State population (millions)	6.4	6.5	6.6	+3%
Average gas price per gallon (January)	$2.23	$2.65	$3.16	+42%
Average gas price per gallon (July)	$3.02	$2.96	$4.36	+44%
Unemployment rate (annual)	4.9%	4.5%	5.3%	+0.4%
Rate of annual economic growth (Gross Domestic Product—Washington)[1]	2.8%	4.4%	2.0%	-0.8%
Rate of change in real personal income[1]	5.6%	5.3%	0.5%	-5.1%
System-wide Congestion Indicators				
Less Travel				
Statewide vehicle miles traveled (VMT), in billions	56.5	57.0	55.6	-2%
Statewide per capita VMT, in miles	8,867	8,779	8,440	-5%
Less System Congestion				
Lane miles of state highway system congested[2]	1,030	1011	930	-10%
Percent of state highway system congested[2]	6%	6%	5%	-1%
Less Delay				
Total vehicle hours of delay on state highways, in millions of hours[2]	37	32	32	-13%
Per capita delay on state highways, in hours of delay/capita[2]	5.7	4.9	4.8	-16%
Reduced Costs				
Estimated economic costs of delay on state highways in millions[1,2]	$880	$770	$765	-13%
Corridor Specific Congestion Indicators				
Congestion on 38 High-Demand Commute Routes in the central Puget Sound[3]				
Number of routes where the duration of the congested period improved[2]	1	8	31	30
Number of routes where average peak travel time improved	3	9	30	27
Number of routes where 95% reliable travel time improved	2	10	26	24
WSDOT Congestion Relief Projects				
Number of completed Nickel and TPA mobility projects as of September 30th of each year (cumulative)	12	34	46	34
Cumulative Project Value (millions)	$172	$708	$1,154	$982

Data sources include: WSDOT, Office of Financial Management; Economic and Revenue Forecast Council; Bureau of Economic Analysis, U.S. Department of Commerce.

***Note:** Analysis in the Congestion Report examines 2006 and 2008 annual data, to more accurately capture congestion trends. 2007 data is provided for information only. **1** Adjusted for inflation. **2** Based on maximum throughput speed thresholds. 'Maximum throughput' is defined as the optimal traveling speed, where the greatest number of vehicles can occupy the highway at the same time; usually measured at between 70% and 85% of posted speeds. For delay 50 mph is used for the threshold, and for duration of the congested period, 45 mph is used. **3** 2008 data not available for four of the 38 routes. For more information please see gray box on p. 15 of the 2009 Annual Congestion Report.

Measuring Delay and Congestion Annual Report

2009 Congestion Report: Executive Summary of Measures and Results

This summary provides a menu of measures to readers of the *Gray Notebook* that are elaborated on in greater detail in the full report. The page numbers shown in this executive summary refer the reader to the full analyses on each measure topic in the *Annual Congestion Report*.

The *2009 Annual Congestion Report* examines 2008 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 Annual Congestion Report's detailed analysis shows where and how much congestion occurs, and whether it has grown on the state highway system.

Gas prices, the economic recession, and WSDOT's *Moving Washington* projects and strategies helped reduce congestion in 2008

The dynamics of higher fuel prices, the economic recession, and the completion of numerous WSDOT *Moving Washington* projects helped reduce congestion on state highways in 2008. Overall, individuals in Washington traveled over 400 miles less in 2008 compared to 2006 with per capita VMT dropping from 8,867 miles to 8,440 miles. Statewide, travel delay on state highways declined by roughly 13% in 2008 compared to 2006. On major Puget Sound corridors travel delay was reduced by 25%. Commute times and reliability also improved on most of the tracked high-demand commute routes in the central Puget Sound.

2009 Congestion Report Executive Summary of Measures and Results – Looking at 2008 data

⇧ Trend is moving in a favorable direction. ⇔ Trend is holding. ⇩ Trend is moving in an unfavorable direction.

Measure	Result	Trend	Page
Statewide Indicators: Percent system congested, Hours of delay, and vehicle miles traveled			
***NEW* Percent System Congested:** Roughly 5.7% of state highways (in lane miles) were congested in 2006, meaning they dropped below the maximum throughput speed defined as being below 70% of posted speeds. This measure dropped to 5.2% in 2008, mirroring the decrease in travel seen throughout the country. As expected, most of the congested state highways are in urban areas (4.7% of all state highways in 2008).	Percent of state highways that are congested dropped by 0.5% from 2006 (5.7%) to 2008 (5.2%).	⇧	p. 11
Total statewide delay: Statewide delays, relative to posted speeds and maximum throughput speeds (roughly 50 mph) decreased by 10% and 13% respectively. The decrease in delays indicates that many highways across the state became less congested between 2006 and 2008.	Total statewide vehicle hours of delay declined by 13% relative to max flow speeds.	⇧	p. 10
***NEW* Per capita delay:** On a statewide per capita basis, between 2006 and 2008, delay declined from about 5.7 hours/capita/year to 4.8 hours/capita/year as measured using maximum throughput speeds (roughly 50 mph).	Per capita delay declined by 16% between 2006 and 2008.	⇧	p. 10
Vehicle miles traveled: Total VMT on state highways declined by 3.8% between 2007 and 2008 and 3.2% between 2006 and 2008. VMT on all public roads dropped by 2.4% between 2007-08 and 1.7% between 2006-08. Associated with this, statewide per capita VMT dropped by 3.9% between 2007-08 and 4.8% between 2006-2008.	Per capita VMT on all public roadways declined by 4.8% between 2006 and 2008.		pp. 11-12
Central Puget Sound corridors: Hours of delay and vehicle miles traveled			
Vehicle hours of delay on major central Puget Sound corridors: Between 2006 and 2008, vehicle hours of delay relative to the posted speeds (60 mph) and maximum throughput speeds decreased by approximately 19% and 25% respectively. All surveyed corridors saw drops in travel delay.	Travel delay dropped by 25% relative to max flow speeds.	⇧	p. 12
Vehicle miles traveled (VMT) dropped overall in the central Puget Sound in 2008. On the selected major Puget Sound corridors, VMT dropped by 2.1% in 2008 compared to 2006. The steepest drop was over 4% seen on SR 167 while VMT on I-5 dropped the least at just above 1%.	VMT dropped by 2.1% in 2008 compared to 2006.		p. 12

Executive Summary of Measures and Results

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

	Trend	
Central Puget Sound corridors: Throughput Productivity		
Throughput productivity compares the observed average vehicle flow (vehicles per lane per hour – vplph) for a selected location to the observed highest average five minute vehicle flow at that location. Six of the eight selected Puget Sound monitoring locations, show improvements in vehicle throughput from 2006 to 2008. Two locations saw worse throughput productivity (I-5 at I-90 and I-405 at SR 169). I-405 at SR 169 in Renton continues to experience the greatest loss in throughput productivity, whereby congested conditions result in an approximate 45% reduction in vehicle throughput during the morning peak period.	Six of eight locations saw improvements in throughput productivity between 2006 and 2008.	pp. 13-14
Travel Times Analysis: High Demand Puget Sound Commute Routes		
Average peak travel times improved on 30 of the surveyed high demand commute routes between 2006 and 2008, with improvements ranging from 1 to 9 minutes. Average travel times became worst by between one and two minutes on two commutes (Bellevue to Tukwila evening commute and Bellevue to Lynnwood evening commute) during the same period and remained unchanged on two.	Average peak travel times improved on 30 commutes, remained the same on 2, and became worse on 2 between 2006-2008.*	pp. 15-22
95% reliable travel times: Between 2006 and 2008, 26 of the 38 high demand commutes saw improvements in 95% reliable travel time, with improvements ranging from one to 16 minutes. Five commutes saw reliable travel times worsen between one and seven minutes, while reliable travel times remained unchanged on three commutes.	Reliable travel times improved on 26 commutes, remained the same on 3, and became worse on 5 between 2006-2008.*	pp. 15-22
Duration of congested period: The duration of congestion—defined as the period of time in which average speeds fall below 45 mph—improved on 31 routes between 2006 and 2008 with improvements ranging from 5 minutes to 1 hour 35 minutes. One route did not show a change in the duration of congestion, and two routes do not typically fall under the 45 mph threshold.	Duration of congestion improved on 31 commutes, remained the same on 1, and 2 without congested periods.*	pp. 15-22
Additional Performance Analyses for the High Demand Puget Sound Commute Routes		
***NEW* Range of percentiles reliability analysis:** This year, WSDOT is introducing a new analysis of reliability to complement the existing average travel time and 95% reliable travel time discussion. This new analysis includes looking at travel times at the 50th percentile (median), 80th percentile, and 90th percentile values for the 38 high demand routes, in addition to the standard 95th percentile. 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.		pp. 23-25
Percent of days when speeds were less than 35 mph – Stamp graphs: The most visual evidence of peak periods improving in 2008 can be seen in the graphs on pages 25-27 of the 2009 Annual Congestion Report. These "stamp graphs", comparing 2006 and 2008 data, show the percentage of days annually that observed speeds fell below 35 mph (severe congestion).		pp. 25-27
Travel time comparison graphs: These bar graphs on pp. 28-30 show four of the travel time performance indicators: travel times at posted speeds, travel time at maximum throughput speeds (50 MPH), average peak travel times, and 95% reliable travel times. For each of the surveyed high-demand commutes 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.		pp. 28-30

* 2008 data not available for four of the 38 routes. For more information please see gray box on p. 15 of the 2009 Annual Congestion Report.

Measuring Delay and Congestion Annual 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	
Travel Time Analysis: 14 Additional Puget Sound Commutes			
In addition to the high demand commute routes, WSDOT tracks 14 other commutes in the central Puget Sound where data are available. Average travel times for eight of these 14 routes improved by 1 to 2 minutes between 2006 and 2008. One route showed an increase in average travel times with five unchanged in 2008 compared to 2006. In terms of the 95% reliable travel time, nine of the routes saw improvements in travel times ranging from 1 and 7 minutes between 2006 and 2008, with the rest showing no change.	Average peak travel times improved on 8 of 14 commutes, remained the same on 5, and became worse on 1 between 2006-2008.	↑	pp. 31-32
Travel Time Analysis: Spokane Commutes			
For 2008, incidents remained the major cause of delay and congestion on the two tracked Spokane commute corridors as reflected in the increase in the 95% reliable travel time and measured hours of congestion during the evening peak. Reliable travel times for Spokane remain good being no more than 2 minutes than travel times at posted speeds. Spokane traffic volumes on I-90 decreased this past year with a peak flow near Altamont Street of 110,000 vehicles per day. This is a decrease of 2.6% since 2006. An overall decrease was measured not only in volume but also vehicle miles traveled which decreased by 3% during the peak periods in 2008 as compared to 2006.	Average peak travel time increased on one route and stayed the same on the other. Reliable travel times increased on both tracked Spokane commutes.	↔	p. 32
HOV Lane Performance			
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 35% of the people on the freeway in the morning and evening peak periods. At eight of the ten monitoring locations HOV lanes move more people than adjacent GP lanes.	HOV lanes carry more people than average GP lanes at 8 of 10 monitoring locations.	↑	pp. 33-34
HOV Lane Reliability Standard: The reliability standard requires the HOV lane to maintain a speed of 45 mph for 90% of the peak hour. Five of the seven HOV corridors in the peak direction during the evening peak hour have high enough traffic volumes that the corridors are below the HOV performance standard, and three of the seven corridors in the peak direction during the morning peak period are below the performance standard. The graphs on pages 38-39 compare general purpose lane performance and HOV lane performance at the HOV lane reliability speed of 45 mph.	8 of 14 HOV commute corridors did not meet the reliability standard, as compared to 2007 when 9 corridors failed.	↑	p. 35
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 2008 Average HOV travel times beat GP lane travel times on 38 out of 44 instances. Forty-one HOV lanes provide better reliability (95% reliable travel time) than their general-purpose lane counterparts.	In terms of average travel time HOV lanes are faster than GP lanes in 38 of 44 instances.	↑	pp. 35-39
On-going tracking of performance for operational strategies			
Operate Efficiently–Incident Response Quarterly Update: In Quarter 3 of 2009, the statewide average clearance time was 12.9 minutes, up 2.4% from the same quarter last year. The average duration of the 70 over-90-minute lane-blocking incidents on the nine key corridors was 156 minutes during Quarter 3, 2009, and the annualized average for the three quarters of 2008 to date is 156 minutes, just above the target of 155 minutes.	The average clearance time for 90+ minute incidents on the key congested corridors was 156 minutes this quarter, 1 min above the GMAP target.	↔	pp. 49-50

Measuring Delay and Congestion Annual Report

Executive Summary of Measures and Results

Before and after analyses for selected Moving Washington projects

WSDOT's program for addressing congestion is Moving Washington—a three part strategy comprised of adding highway capacity strategically, operating the system more efficiently, and managing demand. WSDOT performs before and after studies to assess the effectiveness of Moving Washington projects and strategies in reducing congestion and to report their impacts to the public. Governor Gregoire challenged WSDOT to broaden its reporting of Nickel and TPA project outcomes important to Washington citizens, specifically, measuring the results from the driver's perspective for each completed project. This includes measuring congestion benefits. An overview of WSDOT's Moving Washington Program to fight congestion can be found on pp. 53-55 of the Annual Congestion Report. Page numbers on this page refer to the relevant section of the 2009 Annual Congestion Report.

Moving Washington: Add Capacity Strategically

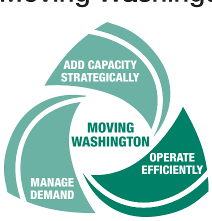
As our state continues to grow, it is necessary to develop additional traffic capacity. To get the most from limited resources, WSDOT plans projects wisely by targeting the worst traffic-flow chokepoints and bottlenecks in the highway system. The following project examples show that this strategy is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

Add Capacity Strategically – Nickel and TPA Mobility Projects, p. 40
A study of 15 completed Nickel and TPA projects statewide resulted in a 15% improvement in combined peak period travel times through these segments after construction was completed. These projects showed a 7 MPH average improvement in travel speeds during peak periods with travel times through the project segments improving by up to 2.5 minutes. The improvements occurred despite the fact that volumes increased by 14% on these segments.

Add Capacity Strategically – I-5/SR 502 interchange project in Clark Co., pp. 41-43
This project helps improve commute times on I-5 during peak periods by seven minutes during the morning peak and two minutes during the evening peak.

Add Capacity Strategically – I-405 South Bellevue widening project, p. 43
The peak morning commute in 2008 was 45 minutes from 7:30 am-8:30 am before construction. After the new lane was opened to traffic, that peak morning commute was reduced to less than 30 minutes.

Moving Washington: Operate Efficiently



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 our roads safer will go a long way toward easing 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 and integrated traffic signals.

Operate Efficiently–I-5 to US 2 Hard Shoulder Running, pp. 44-45
WSDOT added signs and restriped the US 2 trestle to allow shoulder use during the evening peak and installed nine ramp meters. During the evening peak hour, these projects have reduced travel times by six minutes, or more than 50%.

Operate Efficiently–SR 167 HOT Lanes, pp. 45-46
Drivers paid an average of $1 to save eight minutes on average during the morning peak hour and four minutes during the evening peak hour. Travel times for carpools and transit have been maintained.

Operate Efficiently – Signal Coordination Before and After Analysis, p. 46
Analysis of two representative signal coordination projects on SR 525 and SR 104 have reduced vehicle hours of delay by 130 hours a day and 121 hours a day respectively.

Operate Efficiently–Intelligent Transportation Systems Annual Update, pp. 47-48
Active Traffic Management expands the use of ITS technology to dynamically manage traffic based on the prevailing conditions to help improve safety and traffic flow.

Moving Washington: Manage Demand

WSDOT can make the best use of the highways' capacity if it can better distribute the demand travelers place 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. Managing demand strategies encourage drivers to use less congested routes and times to travel by displaying real-time traffic information on the internet and intelligent transportation systems.

Manage Demand–I-90 Homer Hadley Bridge Construction Mitigation, pp. 51-52.
Construction mitigation efforts during the I-90 Homer Hadley Bridge Repair Project helped divert 40% to 60% of traffic every weekday during the construction.

Manage Demand– Spokane Growth and Transportation Efficiency Center (GTEC), p. 52
The Spokane GTEC's goal is to achieve a 10% cut in the drive-alone rate along with an 11% cut in VMT per employee in the GTEC. Since the program began in 2007, the Spokane GTEC has recorded a 12.2% reduction in its drive-alone rate, and a 10.6% reduction in VMT.

Measuring Delay and Congestion Annual Report

Introduction

Highlights from the Annual Congestion Report

- Due in large part to high fuel prices and the economic recession, individuals drove 400 miles less during 2008 in Washington with per capita VMT declining by 5% compared to 2006.
- Statewide vehicle hours of delay declined by 13% between 2006 and 2008, saving Washington drivers and businesses an estimated $115 million in lost productivity due to delay.
- In 2008, less of the highway system was congested than in 2006 (5.7% in 2006 vs 5.2% in 2008). In terms of real numbers, 930 of 18,070 lane miles were congested in 2008.
- In the central Puget Sound vehicle hours of delay on major Puget Sound corridors declined by 25% between 2006 and 2008.
- Travel times and reliability improved on most of the 38 tracked high demand commute routes in the Puget Sound: average travel times improved on 30 commute routes and reliable travel times improved on 26 routes. The duration of the congested period decreased on 31 of the commute routes.
- *Moving Washington* projects are being implemented at strategic locations on the state highway system to help fight congestion. Drivers are seeing the benefits of these projects through improved travel times and reliability. To see the benefits of specific *Moving Washington* strategies and projects please see pp. 40-52.

Washington drivers spent less time stuck in traffic in 2008

The dynamics of higher fuel prices, the economic recession, and the completion of numerous WSDOT congestion relief projects helped reduce congestion on state highways in 2008. On a per capita basis, people in Washington spent nearly one hour less in congestion in 2008 (4.8 hrs of delay per capita) compared to 2006 (5.7 hrs of delay per capita). Overall, travel delay on state highways declined by roughly 13% in 2008 compared to 2006. On some of the most heavily traveled Puget Sound corridors travel delay was reduced by 25%. Commute times also improved on most of the major high-demand commute routes in the central Puget Sound.

The decline in congestion is primarily a result of decreased travel demand during 2008. High fuel prices seen during the first half of 2008 helped spur a decline in travel demand on the highway system, as people made efforts to save money by making fewer trips or by taking alternative modes of transportation such as vanpools or transit. Despite the sharp decline in gas prices during the second half of 2008, the decline in travel was further exacerbated by the economic recession which hit Washington hard during the later half of 2008. Overall, individuals in Washington drove over 400 miles less in 2008 as compared to 2006.

Congestion and the economy

When Washington's economy recovers, economic growth will likely result in more drivers spending more time on the road. It is not surprising that congestion is often used as an indicator of economic health: a strong economy drives growth in travel demand which results in increasing congestion. More specifically, the growth in travel demand, particularly during peak periods, consumes the limited capacity of the highway system, leading to increased congestion. This *recurring congestion* occurs during peak travel periods for a simple reason—the number of vehicles trying to use the highway system exceeds the available capacity. *Non-recurring congestion*—congestion resulting from weather, roadway construction, collisions, vehicle breakdowns, and other incidents—further reduces the operating efficiency of the highway system.

Although congestion is used as an indicator of economic growth, it also has negative economic consequences. Even with decreased congestion during 2008, Washington's drivers and businesses lost $765 million due to the losses in time and productivity while in congestion.

Moving Washington: WSDOT's balanced program to fight congestion

Faced with these realities, WSDOT utilizes three balanced strategies to fight congestion—add capacity strategically, operate efficiently, and manage demand. 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 for solving the congestion problem. That is why WSDOT uses operational strategies to maximize the efficiency of the existing transportation system (operate efficiently). Added to this, WSDOT manages demand by encouraging and providing alternatives to the traveling public between and within modes of travel. 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. 40-52.

Introduction: Overview of WSDOT's congestion performance measures

This year's Annual Congestion Report examines 2008 calender year data

The annual congestion report examines 2008 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 whether it has grown on state highways. The report compares system data over a two year period (2006 vs. 2008) to more accurately identify changes and trends seen on the state highway system often missed looking at a one-year comparison.

WSDOT's congestion measurement principles

WSDOT collects real-time data for 52 commute routes in the Puget Sound region, two commutes in Spokane, and at various locations statewide. In the central Puget Sound, alone, data are collected from over 5,000 loop detectors embedded in the pavement of the 709 centerline miles. Using this quality controlled data, WSDOT analyzes system performance by using a variety of performance measures. In tracking and communicating performance results, WSDOT adheres to the congestion measurement principles the agency established (see gray box to the right). These principles call for the use of accurate, real-time data rather than modeled data in order to better communicate with the public, and using language and terminology that is meaningful to the public ("Plain English").

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 State. 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. Likewise, reliability matters to drivers because it is important to be on time all the time. In addition to reporting on the 38 high demand Puget Sound commute routes and the two Spokane commutes, the Congestion Report's travel time analysis looks at travel times for the other 14 commutes (of the 52 tracked Puget Sound commutes) and for HOV lanes. The metrics used in the travel time analysis include the average peak travel time, 95% reliable travel time, the duration of the congested period, and the percent of weekdays when average travel speeds fell below 35 mph. The performance of an individual route is compared to data from previous years.

New to this year's Congestion Report is an expanded reliability analysis looking at a range of travel time percentiles. This analysis provides a way to track travel time changes at a finer level in order to evaluate operational strategies.

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.
- Measure congestion due to incidents (non-recurrent) as distinct from 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 about 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 travel period.
95% Reliable Travel Time	Travel time with 95% certainty (i.e. on-time 19 out of 20 work days).
Maximum Throughput Travel Time Index (MT³I)	The ratio of peak commute period travel time compared to maximum throughput speed travel time.
Percent of Days When Speeds Fall Below 35 mph	Percentage of days annually that observed speeds fall below 35 mph (severe congestion) on key highway segments.
Vehicle Throughput	Measures how many vehicles move through a highway segment in an hour.
Lost Throughput Productivity	Percentage of a highway's lost vehicle throughput due to congestion.
Delay	The average total daily hours of delay per mile based on the maximum throughput speed of 50 mph measured annually as cumulative (total) delay.
Percent System Congested	Percent of total state highway lane miles that drop below 70% of the posted speed limit.
Duration of the Congested Period	The time period in minutes when speeds fall below 45 mph.
HOV Lane Reliability	An HOV lane is deemed "reliable" so 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 clearance time of incidents (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.

Measuring Delay and Congestion Annual Report

Introduction: Overview of WSDOT's congestion performance measures

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 http://www.wsdot.wa.gov/traffic/seattle/traveltimes/.

Measuring traffic volumes and vehicle miles traveled

WSDOT examines two volume metrics for each commute route: volumes during peak hours and the total daily volumes. WSDOT continues to analyze factors such as the use of public transportation, population change, job growth, and fuel prices as they relate to volume and travel time changes.

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 approximately half-mile intervals throughout the central Puget Sound freeway network, and at various locations on the highway system statewide.

Vehicle miles traveled (VMT) is a metric WSDOT uses to quantify travel along a route. It is simply the vehicle count multiplied by a length of roadway. 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 VMT. WSDOT uses this measure to better understand the number of trips taken for certain commute routes, as well as total miles traveled on state highways to predict future demands and establish needs.

In 2008, the Legislature established per capita VMT as the primary measure connecting congestion and greenhouse gas emissions.

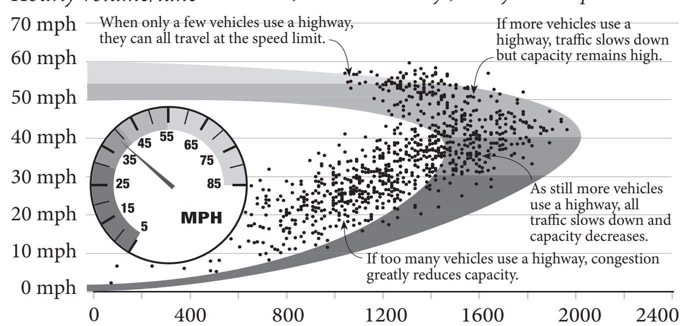
WSDOT uses maximum throughput as the basis for congestion performance measurement

From the perspective of operating the highway system as efficiently as possible, speeds at which the most vehicles can move through a highway segment (maximum throughput) is the most meaningful basis of measurement for WSDOT's management needs. It is logical for WSDOT to aim towards providing and maintaining a system that yields the most productivity (or efficiency) versus providing a free flowing system where not as many vehicles are passing through a segment during peak travel periods.

Maximum throughput is achieved when vehicles travel at speeds between roughly 70% and 85% of posted speeds (approximately 42-50 mph). At maximum throughput speeds, highways are operating at peak efficiency because more vehicles are passing through the segment than there would be at posted speeds. This happens because drivers at maximum throughput speeds can safely travel with a shorter following distance between vehicles than they can at posted speeds.

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

I-405 Northbound at 24th Northeast, 6-11 AM weekdays, hourly volume per lane



Maximum throughput speeds vary from one highway segment to the next depending on prevailing roadway design and traffic conditions, such as lane width, slope, shoulder width, pavement conditions, traffic compositions, conflicting traffic movements, heavy truck traffic, presence or lack of median barriers, etc. It should also be noted that 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 based on field surveys. For surface arterials, maximum throughput speeds are difficult to predict due to the fact that they are heavily influenced by conflicting traffic movements at intersections.

Evaluating vehicle throughput productivity

As stated earlier, WSDOT's goal is to achieve maximum throughput whenever possible. Highways are engineered to move specific volumes of vehicles based on the number of lanes and other design aspects. Many people are surprised to learn that highways are not operating at their maximum efficiency when vehicles are moving at 60 mph (the typical urban highway posted speed limit in Washington State). Maximum throughput, where the greatest number of cars pass through an individual lane every hour, actually occurs at between 70% and 85% of posted speeds (roughly 42-50 mph). As congestion increases, speeds decrease, and fewer vehicles pass through a corridor. Throughput productivity may decline from a maximum of about 2,000 vehicles per lane per hour traveling at speeds between 42-50 mph (100% efficiency) to as low as 700 vehicles/lane/hr (35% efficiency) when traveling at speeds less than 30 mph.

In the 2009 Congestion Report, WSDOT uses maximum throughput as a basis for evaluating the system through the following measures:

- Total Delay and Per Capita Delay.
- Percent System Congested;

Introduction: Overview of WSDOT's congestion performance measures

WSDOT congestion measurement speed thresholds

Posted speed	i.e. 60 mph	Vehicles are moving through a highway segment at approximately the posted speed. However since there are fewer vehicles on the highway, the highway segment is not reaching its maximum productivity under these conditions.
Maximum throughput speeds	70%-85% of posted speed (Approx. 42-50 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	Mid-point of 70% and 85% of posted speeds (Under 45 mph)	The AM and PM time period (in minutes) when average vehicle speeds drop below 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.
Severe congestion	Less than 60% of posted speeds (35 mph or below)	Speeds and spacing between vehicles continue to decline on a highway segment and highway efficiency operates well below maximum productivity.

- Lost throughput productivity;
- Maximum Throughput Travel Time Index—MT^{3}I (For a more detailed discussion of this measure, please see p. 16);
- Duration of the congested period.

Measuring total delay and per capita delay

Typically, delay is calculated as the difference between actual travel times and travel times at posted speeds. WSDOT uses maximum throughput speeds, rather than posted speeds, to measure delay relative to the highway's most efficient condition. WSDOT measures travel delay statewide and on five major commute corridors in the central Puget Sound. In addition to measuring the total hours of delay, WSDOT also evaluates the cost of delay to drivers and businesses. New this year, the Annual Congestion Report has tried to better capture what delay means for individual users of the system by measuring annual per capita delay.

Measuring the percent of the highway system that is congested

New to this year's Annual Congestion Report, the percent system congested measure allows WSDOT to evaluate what percentage of the system that the agency manages is indeed congested. This measure is calculated by dividing the number of lane miles where speeds drop below 70% of posted speeds by total lane miles. This measure also differentiates what proportion of the congested lane miles are in urban areas versus rural areas of the state.

Identifying mobility needs on state highways

WSDOT applies a consistent methodology to identify the current and future mobility needs on the state highway network. This evaluation identifies locations that operate below 70% of the posted speed limit. These locations are analyzed in detail to first assess strategies to enhance the operational efficiency of the existing system before recommending system expansion. For more information on identifying system needs and the Highway System Plan please see p. 32.

Measuring HOV lane performance

WSDOT utilizes multiple measures to evaluate HOV lane performance. WSDOT and the Puget Sound Regional Council 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 lanes. WSDOT also reports on HOV lane travel times as compared to GP lane travel times.

Before and after analyses of congestion relief strategies and projects

As of September 30, 2009, WSDOT has completed 215 projects funded by the 2003 and 2005 gas tax packages, of which 46 were congestion relief projects. To measure the extent to which 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 through the use of automated license plate recognition cameras or through the use of floating cars. Where real-time data is unavailable, modelling is used. Before and after performance evaluations will be expanded to all congestion relief projects in the coming years. These studies will evaluate the benefits of *Moving Washington* strategies and projects that add capacity strategically, operate efficiently, and manage demand. For more information on *Moving Washington* please see pp. 53-55.

Evaluating operational strategies: Incident Response

WSDOT conducts on-going performance evaluation of its Incident Response (IR) program which is published quarterly in the *Gray Notebook*. Reducing the average clearance time for all incidents statewide and over-90-minute incidents on key congested corridors are specific performance targets related to IR. WSDOT also measures the number and clearance times of incidents involving fatalities, blockages, disabled vehicles, injury collisions and non-injury collisions, among other measures.

Measuring Delay and Congestion Annual Report

Statewide Travel Delay

Drivers experience delay when congestion occurs. Simply put, delay is the extra period of time it takes a driver to get to her or his destination of choice. Delay is typically calculated as the difference between actual travel times and posted speed travel times. WSDOT uses maximum throughput as a basis for measurement to assess delay relative to a highway's most efficient condition at optimal flow speeds. For the purpose of this analysis, delay is estimated both ways: relative to the posted speed limit and relative to maximum throughput speeds. For both methods, WSDOT measures the sum of vehicle delay (in hours) across an average twenty-four hour day to demonstrate the extent, severity, and duration of congestion.

Statewide delay decreases by 13% between 2006-2008

Overall, there has been a noticeable decrease in the amount of delay on state highways between 2006 and 2008. Statewide delay, relative to posted speeds and maximum throughput speeds, decreased by 10% and 13% respectively. The decrease in delay indicates that many highways across the state became less congested between 2006 to 2008. Most of the delay was concentrated in the major urban areas as shown in the graphic on the next page.

On a statewide per capita basis, delay declined from about 5.7 hour/capita/year to 4.8 hours/capita/year as measured using maximum throughput speeds.

Cost of delay to Washington drivers and businesses declines by $115 million

Relative to optimal flow speeds, statewide delay cost drivers and businesses $880 million in 2006. In 2008, delay, relative to maximum throughput speeds, cost Washington businesses and drivers roughly $765 million—$115 million less than in 2006. Relative to posted speeds, delay cost drivers and businesses $1,200 million in 2008, a decrease of $140 million compared to 2006 ($1,340 million).

Statewide per capita delay drops in 2008
Hours of delay per year

	2006	2008	%Δ
Statewide population	6,375,600	6,488,000	+1.8%
Delay per capita (Relative to max flow speed of 50 mph)	5.7	4.8	-16%
Delay per capita (Relative to posted speed of 60 mph)	8.7	7.6	-13%

Source: WSDOT Urban Planning Office.

The cost of delay is calculated by applying monetary values to the estimated hours of delay incurred by passenger and truck travel plus additional vehicle operating costs. The value of time for passenger trips 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 such things 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 travel;
- Increased travel time for business travel;
- Increased vehicle operating expense;
- Direct shipper/recipient productivity lost;
- Indirect (downstream) productivity lost;
- Local income/economy suffered from lost opportunities to attract new businesses;
- Increased vehicle emissions due to stop and go conditions.

Only the first three items were included in this year's delay estimates.

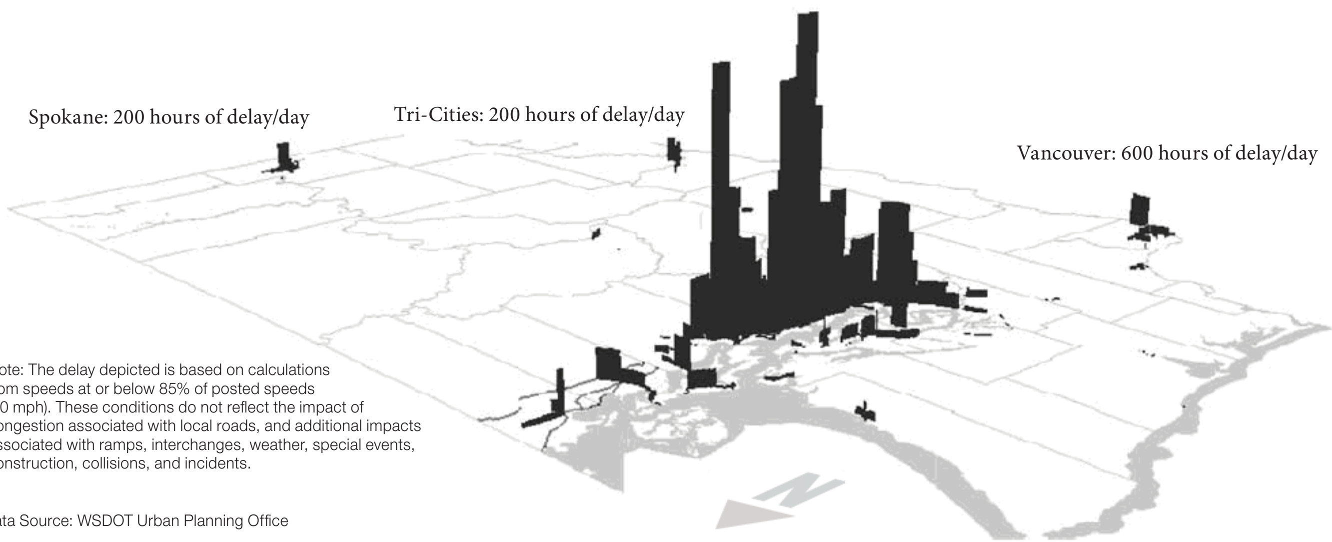
Travel delay on state highways declines in 2008
All state highways: average weekday delay comparison (daily and annual) and estimated cost of delay on state highways (annual); Comparing 2006 and 2008

	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 2008 dollars)		
Actual travel compared to:	2006	2008	%Δ	2006	2008	%Δ	2006	2008	%Δ
Maximum throughput speeds (Approx. 50 mph)	146,140	127,560	-13%	36,530	31,890	-13%	$880	$765	-13%
Posted speeds (60 mph)	223,000	199,980	-10%	55,750	50,000	-10%	$1,340	$1,200	-10%

Source: WSDOT Urban Planning Office.

Statewide Travel Delay and Other Statewide Congestion Indicators

Statewide distribution pattern of delay on the state highway system and 2008 delay estimates for major urban areas



Note: The delay depicted is based on calculations from speeds at or below 85% of posted speeds (50 mph). 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.

Data Source: WSDOT Urban Planning Office

Percentage of the state highway system that is congested drops in 2008

This is a measure introduced in this edition of the Annual Congestion Report. It is calculated by dividing congested lane miles by total state highway lane miles. Congestion means the roadway's operational speed drops below 70% of its posted speed limit. Using this threshold, 5.2% of state highway lane miles were congested in 2008. In other words, 930 of 18,070 highway lanes miles were congested in 2008. From 2004 to 2008, the highest percentage of system congestion was observed in 2005 (6%), it has since dropped to 5.2% in 2008, mirroring the decrease in travel seen in Washington State and throughout the country.

Percent of the state highway system that is congested drops in 2008

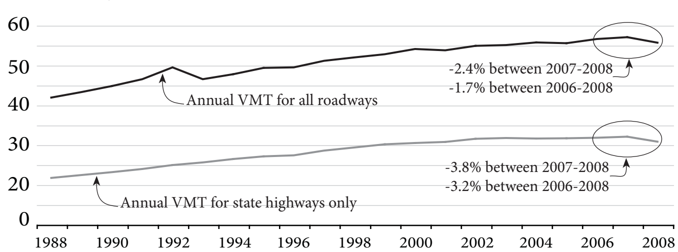
For all lane miles	**2006**	**2008**
All state highways	5.7%	5.2%
Urban state highways	5.2%	4.7%
Rural state highways	0.5%	0.5%

Source: WSDOT Urban Planning Office
* Percent of lane miles that have speeds that drop below 70% of posted speed.

Vehicle miles travel declined statewide

Between 2006 and 2008, annual total vehicle miles traveled (VMT) on state highways declined by 3.2% from roughly 31.8 billion to 30.7 billion VMT. From 2007 to 2008, VMT on state highways declined by 3.8%. Total annual VMT for all public roads dropped by 1.7% between 2006 (56.5 billion) and 2008 (55.6 billion). Between 2007 and 2008, VMT on all public roads dropped by 2.4%. It follows that annual per capita VMT in Washington State dropped 4.8% between 2006 (8,867 VMT/capita) and 2008 (8,440 VMT/capita), and 3.9% between 2007 and 2008, after being flat for several years.

Annual vehicle miles traveled statewide
1988-2008; In billions

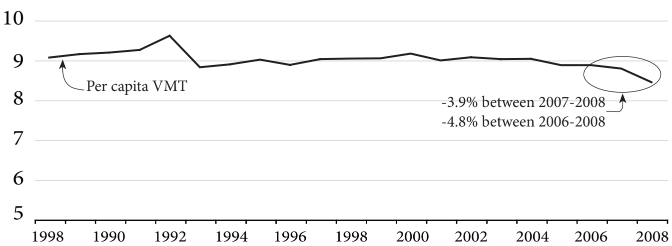


Data Source: WSDOT Transportation Data Office.

WSDOT is working to better understand the multitude of factors that influence VMT, now and in the future. Climate change legislation enacted in 2008 requires statewide per capita VMT to be reduced 18% by 2020, 30% by 2035, and 50% by 2050, based on a preliminary forecast of 75 billion VMT in 2050. Under Governor's Executive Order 09-05, WSDOT is refining VMT forecasts, evaluating potential changes to VMT

Travel Delay on Major Puget Sound Corridors

Annual per capita vehicle miles traveled
In thousands



Data Sources: WSDOT Transportation Data Office, Washington State Office of Financial Management.

reduction goals, and developing other strategies to reduce greenhouse gas emissions from the transportation sector. WSDOT will report to the Governor and Legislature on this work in December 2010.

Deceases in delay seen on major central Puget Sound corridors

Consistent with the statewide delay reduction pattern, there was a decrease in the overall daily vehicle hours of delay on major freeway corridors in the central Puget Sound region between 2006 and 2008. During this time period, vehicle hours of delay relative to the posted speed limit (60 mph) and maximum throughput speeds decreased by approximately 19% and 25% respectively. This is a sharp contrast to data reported in last year's Annual Congestion Report. In that report, from 2005 to 2007, overall delay on central Puget Sound freeways increased by nearly 12% relative to maximum throughput speeds and by 8% relative to the posted speed limit.

Individual corridors experienced decreases in delay ranging from 14% to 28% relative to posted speeds, and between 18% and 47% relative to maximum throughput speeds. SR 167 experienced the largest decrease in delay relative to posted speeds (-28%) and to maximum throughput speeds (-47%). Because the lengths and widths of these corridors are different, it is not meaningful to compare and rank the corridors.

Overall, VMT dropped in the central Puget Sound

Vehicle miles traveled (VMT) between 2006 and 2008 dropped overall in the central Puget Sound. The steepest drop was over 4% seen on SR 167, while VMT on I-5 dropped the least at just above 1%. The decrease in travel in part explains the decrease in travel delay.

Central Puget Sound freeways: average weekday delay comparison, 2006 and 2008

	Lane miles		Vehicle hours of delay: Relative to posted speed (60 mph)			Vehicle hours of delay: Relative to max flow speed (50 mph)			Vehicle miles traveled		
Corridor	2006	2008	2006	2008	%Δ	2006	2008	%Δ	2006	2008	%Δ
I-5	323	323	20,094	16,021	-20%	10,520	7,471	-29%	7,687	7,599	-1.1%
I-90*	101	101	2,114	n/a	n/a	824	n/a	n/a	1,464	n/a	n/a
SR 167	60	60	3,021	2,172	-28%	1,257	663	-47%	977	935	-4.3%
I-405	147	150	13,759	11,806	-14%	8,334	6,844	-18%	3,593	3,472	-3.4%
SR 520	61	61	3,670	3,033	-17%	2,224	1,699	-24%	1,053	1,026	-2.6%
Total**	**591**	**594**	**40,543**	**33,033**	**-19%**	**22,335**	**16,678**	**-25%**	**13,310**	**13,032**	**-2.1%**

Source: WSDOT Urban Planning Office

VMT: the Delay article examines individual corridors while the travel time analysis examines commutes which can include multiple corridors; and the delay article examines VMT for all weekdays, while the Travel time analysis looks at VMT for Tuesday-Thursday.

* 2008 data is not available for this route. For more information please see the gray box on p. 15.

** Totals do not include I-90.

Statewide delay estimates for prior years have been updated due to improvements in methodology

In 2008, WSDOT enhanced its methodology in defining highway segments. This new segmentation methodology has caused significant changes in estimated delay. To enable meaningful comparisons, delay estimates from 2004 through 2008 were recalculated using the new highway segment definition method. To view the updated estimates for all years dating back to 2004 please go to http://www.wsdot.wa.gov/accountability/congestion.

Throughput Productivity

When a highway is congested it is serving fewer vehicles than it is designed to carry. Lost throughput productivity measures the percentage of a highway's vehicle throughput capacity that is lost due to congestion. This is calculated as the difference between the optimal capacity of the roadway observed at maximum throughput speeds as compared to the number of vehicles that the road is actually serving at a particular time of day. Under ideal conditions, the maximum throughput of vehicles moving through a freeway segment can be as high as 2,000 vehicles per lane per hour (vplph). This is observed when traveling at speeds in the range of 70%-85% of the posted speed (42-50 mph). Under congested conditions (below 70% of the posted speed limit), however, the volume of traffic moving through a given freeway segment can be as low as 700 vehicles per lane per hour. For more information on the concept of maximum throughput and why WSDOT uses it as a basis for measuring congestion please see p. 8.

WSDOT uses highest observed optimal flow rate to determine lost throughput productivity

One way to calculate lost throughput productivity is to compare the observed hourly volume to the ideal capacity of the roadway, which is can be as high as 2000 vehicle per lane per hour (vplph). However, not all lanes can achieve a maximum throughput of 2,000 vplph because highway capacity varies depending on prevailing roadway design and traffic conditions. For this reason, the Annual Congestion Report uses the highest average five minute flow rate recorded in the analysis year as the basis for measuring lost throughput productivity. By using the highest observed optimal flow rate as the maximum throughput value for each monitoring location, the lost throughput analysis can more realistically determine the loss in throughput productivity owed to changes in traffic conditions.

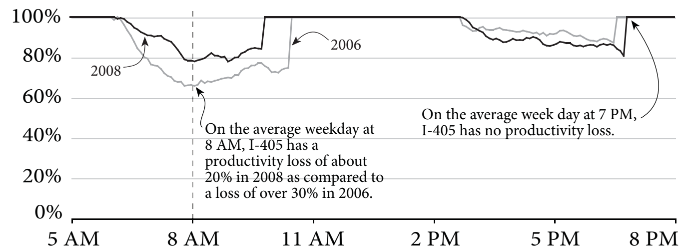
Losses in throughput productivity on major Puget Sound freeways less severe in 2008

Overall, although the monitoring locations on the major Puget Sound corridors continued to experience lost throughput productivity, losses in 2008 were less severe than in 2006. For example, lost throughput on I-90 at SR 900 and on SR 520 Evergreen Floating Bridge were noticeably less severe in 2008. The lost throughput severity decreased on I-5 at S 188th St., SR 167 at 84th Avenue SE, and I-405 at NE 160th Street SB in the AM. The only obvious exception was seen at I-405 at NE 160 St. NB in the PM. This increase was likely due to the opening of the new lane between NE 70th and NE 16th St that shifted the bottleneck north to this location.

I-405 at SR 169 in Renton continues to experience the greatest loss in throughput productivity, whereby congested conditions resulted in an approximate 45% reduction in vehicle throughput during the morning peak period. At this location, although the severity of lost throughput stayed about the same from 2006 to 2008, the duration of the productivity loss shortened noticeably in the PM peak period.

Lost vehicle throughput productivity: example

Based on the highest average five minute flow rates observed on I-405 at NE 160th Street MP 22.5, for both directions of traffic in 2006 and 2008.



Lost vehicle throughput at selected Puget Sound locations

Highest observed loss in throughput at each location

Location	Percent loss in vehicle throughput 2006	2008	Difference
I-5 at S 188th Street, near Sea-Tac (MP 153.0)	22%	18%	-4%
I-5 at I-90 (MP 164.0)	14%	15%	+1%
I-5 at NE 103rd Street, near Northgate (MP 172.0)	23%	13%	-10%
I-90 at SR 900, in Issaquah (MP 16.5)	18%	10%	-8%
SR 167 at 84th Avenue SE (MP 21.5)	18%	15%	-3%
I-405 at SR 169, in Renton (MP 4.0)	44%	45%	+1%
I-405 at NE 160th Street, in Kirkland (MP 22.5)	30%	19%	-11%
SR 520 at Evergreen Point Floating Bridge (MP 1.5)	25%	22%	-3%

Source: WSDOT Urban Planning Office.

Throughput Productivity

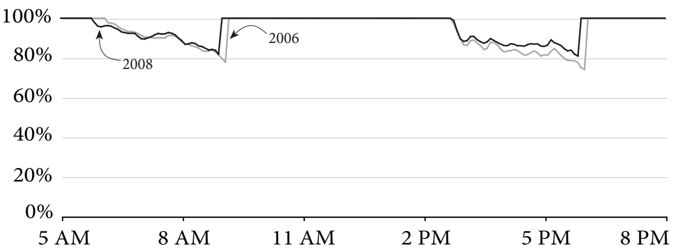
Lost throughput productivity at selected Puget Sound freeway locations

Based on the highest observed five minute flow rates, 2006 and 2008; Vehicles Per Lane Per Hour (vplph)

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

Based on AM northbound 1940 vphpl and PM southbound 1675 vphpl

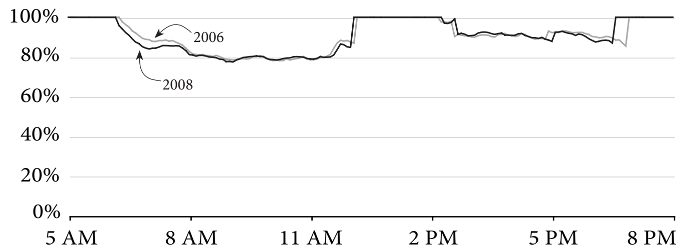
I-5 S at S 188th Street (MP 153.0)



I-5 S at I90 MP 164

Based on AM northbound 1720 vphpl and PM southbound 1515 vphpl

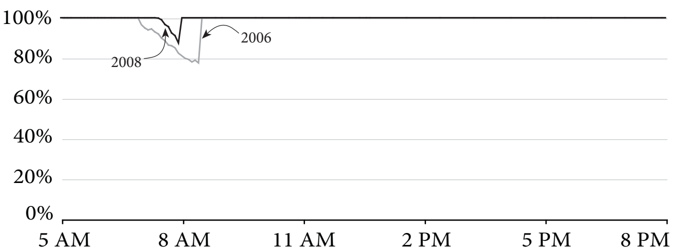
I-5 S at I-90 (MP 164)



I-90 at SR 900 (MP 16.5)

Based on AM westbound 1560 vphpl and PM eastbound 1620 vphpl

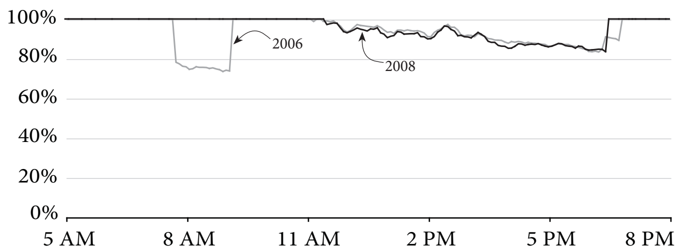
I-90 at SR 900 (MP 16.5)



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

Based on AM southbound 1530 vphpl and PM northbound 1570 vphpl

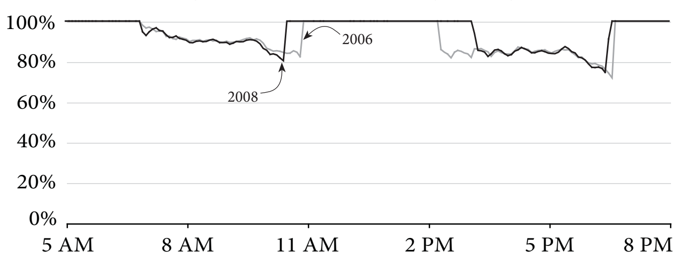
I-5 at NE 103rd Street (MP 172.0)



SR 520 at Evergreen Point Floating Bridge (MP 1.5)

Based on AM westbound 1740 vphpl and PM eastbound 1760 vphpl

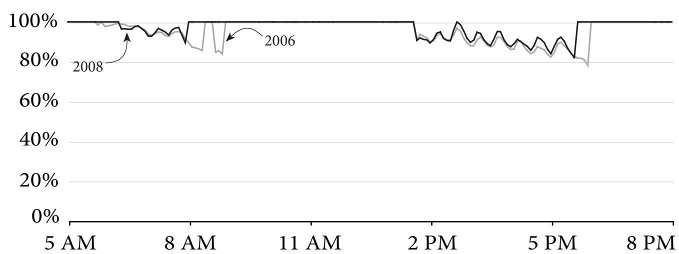
SR 520 at Evergreen Point Floating Bridge (MP 1.5)



SR 167 at 84th Avenue SE (MP 21.50)

Based on AM northbound 1550 vphpl and PM southbound 1630 vphpl

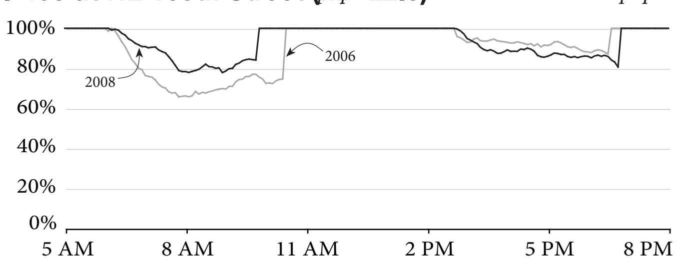
SR 167 at 84th Avenue SE (MP 21.50)



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

Based on AM southbound 1520 vphpl and PM northbound 1700 vphpl

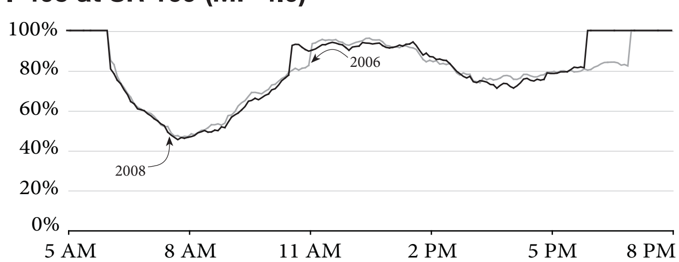
I-405 at NE 160th Street (MP 22.5)



I-405 at SR 169 (MP 4.0)

Based on AM northbound 1650 vphpl and PM southbound 1430 vphpl

I-405 at SR 169 (MP 4.0)



Data Source: WSDOT Urban Planning Office.

Travel Time Analysis of Major Puget Sound Commute Routes

In 2008, travel times dropped and fewer cars hit the road statewide, dissuaded by high fuel prices and the economic recession. Meanwhile, travelers in the heavily congested central Puget Sound and elsewhere around the state continued to see the benefits of WSDOT's *Moving Washington* program to fight congestion, which is providing significant congestion reduction at strategic locations on the state highway system.

WSDOT tracks congestion measures for 52 commutes in Puget Sound, including the 38 high demand commutes that have traditionally been the focus of the *Gray Notebook's* travel time analysis. For 2008, however, four routes that all travel on westbound I-90 did not have data available (please see gray box to the right for more information). Apart from the central Puget Sound, WSDOT also reports on two major commutes in Spokane. This year's travel time analysis includes a discussion of heavy truck traffic, an update on the 14 additional Puget Sound commutes, and an expanded travel time reliability analysis. 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. 35.

WSDOT uses the following performance measures as part of its travel time analysis for general purpose lanes:

- Average travel time;
- Reliable travel time based on a range of percentiles;
- Vehicle Miles Traveled (VMT) for traffic volume;
- Average duration of the congested period;
- Maximum throughput travel time index (MT^3I).

These measures are reported in the travel time tables on pp. 17-18, and definitions can be found on p. 7. In addition to these measures, the travel time analysis also includes the percent of days when speeds fell below 35 mph, which WSDOT defines as severe congestion (see stamp graphs on pp. 26-27). This year's report compares calendar year 2008 data with 2006 data.

Average travel times drop on 30 of the most-congested Puget Sound commute routes

In 2008, travel times showed drops across the most congested Puget Sound routes. Of the surveyed commute routes, 30 experienced decreasing average travel times, two stayed the same, and two increased. This reversal follows several years of steady increases in travel time that began to level-off in intensity in 2007. The reasons behind these decreases in travel times are discussed in more detail on pp. 16-20.

Of the two routes that increased in average travel time, one had increased by less than one minute. The other, Bellevue to Tukwila evening commute, increased by about 2.5 minutes. This route has experienced heavy construction since Fall 2007 as part of the ongoing, multi-stage I-405 widening project.

I-90 travel time and VMT data unavailable for 2008

2008 travel time and vehicle miles traveled data is unavailable for four commute routes:

- *Issaquah to Seattle morning commute*
- *Issaquah to Seattle evening commute*
- *Bellevue to Seattle morning commute*
- *Bellevue to Seattle evening commute*

During construction of the HOV Two-Way Transit Widening project, westbound traffic lanes were shifted and cars no longer lined up over the sensors. Seven data collectors, from just past the I-405 junction to the middle of Mercer Island, were unable to reliably read vehicles passing over them for roughly nine months out of the year. The issue has been resolved and data for 2009 are available. The I-90 Homer Hadley construction mitigation case study on pp. 51-52 uses 2009 data.

Overall, evening commutes dropped between one to four minutes in average travel time, while morning commutes experienced larger drops, ranging from one to nine minutes. The route with the largest decrease in average travel time was Everett to Seattle morning commute, which went from 50 minutes to 41 minutes. The second-largest decrease was seen on the Everett to Bellevue morning commute, which benefitted from the Kirkland Nickel Stage I Project, which added a travel lane through Kirkland on I-405. WSDOT will continue examine the reasons for these improvements.

Reliability improves on 26 of the surveyed high demand Puget Sound commute routes

The 95% reliable travel time performance measure represents the amount of time necessary to make it to a destination on time on an average of 19 out of 20 work days. This measure also experienced a decrease on most of the surveyed commute routes: 26 went down, three stayed the same, and five went up. The largest increase was on the Bellevue to Tukwila evening commute, which increased by seven minutes. This was also the same route that experienced a two-minute increase in average travel time, likely related to the construction discussed above.

The drop in reliable travel times on evening commutes ranged from one to nine minutes, while again the morning commutes experienced a larger drop between one to 16 minutes. The route

Travel Time Analysis of Major Puget Sound Commute Routes (Continued)

with the largest decrease in reliable travel time was the Everett to Bellevue morning commute, which dropped 16 minutes from 84 minutes to 68 minutes, while the Everett to Seattle morning commute dropped by 14 minutes, from 81 minutes to 67 minutes. Both of these routes are showing a benefit from the addition of the *Moving Washington* capacity improvements discussed previously.

The duration of the congested period dropped on 31 of the surveyed high demand Puget Sound commute routes

The duration of the congested period is defined as the period of time in which average speeds fall below 45 mph, which is the midpoint of the maximum throughput range of 85% and 70% of the posted speed limit of 60 mph considered to be the speed at which the maximum number of cars can move through a given segment. This threshold has been raised from the 42 mph threshold used in previous years for greater consistency with other measures in the annual Congestion Report. The durations for all previous years have been recalculated to use the 45 mph value.

This year, the duration of congestion decreased on 31 routes, and stayed the same on one. Two route do not have speeds that regularly drop below 45 mph. The shoulders of the congested periods are contracting meaning that congestion is starting later and ending earlier than it has in past years. Again, this trend reverses what has occurred in previous years, when growth in the duration of congestion was the general trend.

The amount of time that the duration of congestion decreased was roughly the same across both morning and evening commutes. In 2008, the duration of congestion in the morning period ranged from 20 minutes to 4 hours 35 minutes, while on evening commutes, the duration ranged from 1 hour 10 minutes to 6 hours 25 minutes. The morning commute period tends to last for a shorter period of time than evening commutes.

Factors affecting travel times in 2008 include gas prices, the beginning of the economic recession, and WSDOT mobility projects

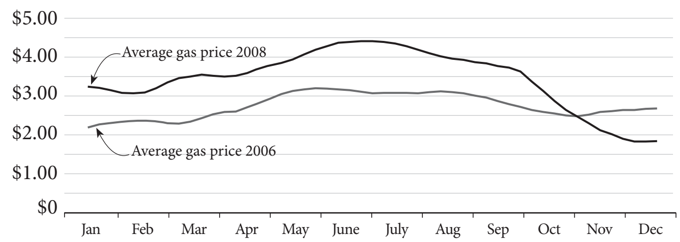
High gas prices depress travel in the first half of 2008

For most of 2008 gas prices in Washington State stood approximately $1 more per gallon than prices in 2006. Average gas prices peaked at $4.41 per gallon in late June and early July of 2008. As noted in WSDOT's report on the first six months of 2008, this depressed gas sales in the state and led to less travel (see September 30, 2008 *Gray Notebook* pp. 12-16). Sales of gas in 2008 were lower than 2006 sales for most of the year, despite a statewide population increase of more than 200,000 people (3.3%) over that same time. Washington's experience with gas prices and declining travel mirrored trends seen nationally and regionally, as noted by several reports (see gray box on p. 25).

During the first six months of the year, off-peak and weekend traffic volumes declined, implying that drivers were curtailing discretionary trips for shopping or recreation in order to save on gas.

Gas prices in Washington State reach record levels in 2008

Average gas prices per gallon by month; 2006 vs. 2008



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

MT³I facilitates comparisons between different routes

When comparing travel times, the maximum throughput travel time index (MT³I) measure enables WSDOT to make "apples to apples" comparisons of travel times between routes of varying distances. For instance, the *Bellevue to Seattle I-90 evening commute* and the *Issaquah to Seattle evening commute* both have average travel times of 28 minutes. However, the first route is 11 miles long and the second is 15; using average travel times alone would not be a very meaningful comparison. By contrast, the MT³I value incorporates the expected travel time under maximum throughput conditions, which takes into account the length of the route. An MT³I of 1.0 would indicate a highway operating at maximum efficiency, and anything above that is working at lower efficiency due to congestion. As the MT³I value increases, travel time performance deteriorates. In this example, the *Bellevue to Seattle I-90 evening commute* has an MT³I of 2.23, which means that the commute route takes 123% longer than the time it would normally take at maximum throughput speeds. The *Issaquah to Seattle evening commute* has an MT³I of 1.54, which means that the commute will take 54% longer than the commute route would take at maximum throughput speeds. Therefore, the *Bellevue to Seattle I-90 evening commute* is considered to be the "worse" commute of the two.

Travel Time Analysis of Major Puget Sound Commute Routes (Continued)

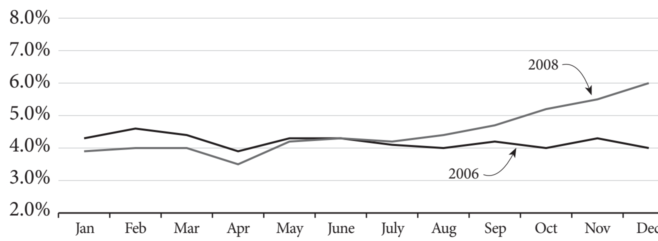
Gas prices finally began declining during the sudden financial drop in autumn 2008, beginning with a steep drop in October that brought prices to below-2006 levels by the beginning of November. As gas prices eased, however, economic woes worsened.

Economic recession picked up where gas prices left off

The first part of 2008 showed a positive employment situation in the central Puget Sound. King, Pierce, and Snohomish counties added 40,000 jobs through the middle of 2008, and the unemployment rate in the first half of the year was below

Unemployment rate for the Seattle-Bellevue-Everett metropolitan area

2006 vs. 2008



Data Source: U.S. Dept. of Labor Bureau of Labor Statistics.

Morning commutes: changes in travel time performance on the 38 high demand commutes

2006 AM peak vs. 2008 AM peak

			Travel time (minutes)		Average peak travel time, based on peak time (minutes)			95% reliable travel time (in minutes)			Ratio of peak travel time to maximum throughput travel time		Traffic volume peak period	Duration of congestion (hours and minutes that average speed falls below 45 mph)		
											MT3I					
Route/Route Description	Peak time	Length (Miles)	At Peak Efficiency	At Posted Speed	2006	2008	%Δ	2006	2008	%Δ	2006	2008	VMT %Δ	2006	2008	%Δ
To Seattle																
I-5–Everett to Seattle	7:25 AM	23.7	28	24	50	41	-18%	81	67	-17%	1.80	1.47	1%	2:45	2:15	-0:30
I-5–Federal Way to Seattle	7:30 AM	21.8	26	22	46	39	-15%	68	58	-15%	1.80	1.52	1%	3:45	3:35	-0:10
I-90/I-5–Issaquah to Seattle[1]	7:45 AM	15.5	18	15	26	n/a	n/a	38	n/a	n/a	1.43	n/a	-2%[1]	1:40	n/a	n/a
SR 520/I-5–Redmond to Seattle	7:50 AM	14.8	17	15	23	21	-9%	33	29	-12%	1.33	1.21	-1%	1:05	0:20	-0:45
I-5–SeaTac to Seattle	8:35 AM	12.9	15	13	27	25	-7%	40	40	0%	1.77	1.64	1%	5:00	3:55	-1:05
I-405/I-90/I-5–Bellevue to Seattle[1]	8:40 AM	10.7	13	11	17	n/a	n/a	30	n/a	n/a	1.36	n/a	-2%[1]	1:20	n/a	n/a
I-405/SR 520/I-5–Bellevue to Seattle	7:55 AM	10.5	12	10	18	16	-11%	26	24	-8%	1.46	1.30	-1%	1:45	1:20	-0:15
To Bellevue																
I-5/I-405–Everett to Bellevue	7:25 AM	23.4	28	23	51	43	-16%	84	68	-19%	1.85	1.56	3%	3:10	2:20	-0:50
I-405–Lynnwood to Bellevue	7:30 AM	16.0	19	16	41	34	-17%	67	53	-21%	2.18	1.81	5%	3:35	2:30	-1:05
1-405–Tukwila to Bellevue	7:50 AM	13.5	16	13	42	41	-2%	63	59	-6%	2.65	2.59	-1%	4:35	4:35	0:00
I-5/I-90/I-405–Seattle to Bellevue	8:45 AM	10.6	12	11	18	17	-6%	26	27	4%	1.45	1.37	-1%	2:05	1:55	-0:20
I-5/SR 520/ I-405–Seattle to Bellevue	8:30 AM	10.1	12	10	23	22	-4%	33	32	-3%	1.94	1.86	-1%	3:10	2:40	-0:30
I-90/I-405–Issaquah to Bellevue	7:50 AM	9.5	11	9	18	16	-11%	27	23	-15%	1.62	1.44	1%	3:05	2:30	-0:35
SR 520/I-405–Redmond to Bellevue	7:50 AM	7.1	8	7	8	9	13%	9	10	11%	0.95	1.07	-1%	*	*	*
To Other Locations																
I-405–Bellevue to Tukwila	7:40 AM	13.5	16	13	22	21	-5%	32	29	-9%	1.39	1.33	-2%	1:00	0:55	-0:05
SR 167–Auburn to Renton	7:40 AM	9.8	12	10	17	16	-6%	29	24	-17%	1.48	1.39	-1%	4:05	2:30	-1:35
I-5/I-90–Seattle to Issaquah	8:45 AM	15.7	18	16	21	20	-5%	30	28	-7%	1.14	1.08	-3%	*	*	*
I-5/SR 520–Seattle to Redmond	8:30 AM	14.7	17	15	28	26	-7%	38	37	-3%	1.62	1.50	-1%	2:45	2:30	-0:15

Data Source: WSDOT Traffic Operations and the Washington State Transportation Center (TRAC) at the University of Washington.

Note: An asterisk (*) indicates that speeds did not fall below 45 MPH of posted speed on a route. In 2009, WSDOT changed its threshold for duration of congestion to begin at 45 mph, instead of 42 mph. Duration figures for 2006 were re-calculated at this new threshold.

2006 figures have been recalculated since publication in the 2007 annual congestion update, using a more refined data quality control process.

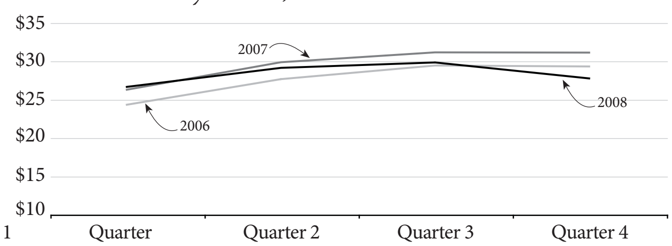
[1] 2008 data not available for this route; please see gray box on p. 15. Spot volume data are included instead of VMT which was not available.

Travel Time Analysis of Major Puget Sound Commute Routes (Continued)

that of 2006. Full-year statistics show that most major cities within King County added jobs during the year. Seattle and Bellevue, the two major hubs of employment in the county, increased jobs by 25,900 (5.5%) and 9,700 (8.2%), respectively.

However, a closer look at the data shows the unemployment rate began a steady rise in July of 2008, when it surpassed 2006 levels, and increased to over 5% in October, to its highest level since 2005. This coincided with a drop in taxable retail sales and an overall drop in consumer confidence across the state.

Taxable retail sales in Washington down in 2008*
Statewide calendar year data; Dollars in billions



Data Source: Washington State Department of Revenue.
* Not adjusted for inflation.

Evening commutes: changes in travel time performance on the 38 high demand commutes
2006 PM peak vs. 2008 PM peak

Route/Route Description	Peak time	Length (Miles)	Travel time (minutes) At Peak Efficiency	At Posted Speed	Average peak travel time, based on peak time (minutes) 2006	2008	%Δ	95% reliable travel time (in minutes) 2006	2008	%Δ	Ratio of peak travel time to maximum throughput travel time MT³I 2006	2008	Traffic volume peak period VMT %Δ	Duration of congestion (hours and minutes that average speed falls below 45 mph) 2006	2008	change (min.)
From Seattle																
I-5–Seattle to Everett	4:55 PM	23.7	28	24	43	39	-9%	61	56	-8%	1.54	1.40	0%	3:20	2:35	-0:45
I-5–Seattle to Federal Way	4:10 PM	22.1	26	22	38	34	-11%	58	50	-14%	1.46	1.31	2%	2:55	1:55	-1:00
I-5–Seattle to SeaTac	4:10 PM	12.9	15	13	19	19	0%	29	29	0%	1.25	1.25	0%	1:15	1:10	-0:05
I-5/I-90/I-405–Seattle to Bellevue	5:30 PM	10.6	12	11	18	15	-17%	32	24	-25%	1.45	1.21	-3%	1:10	*	-1:10
I-5/SR 520/I-405–Seattle to Bellevue	5:35 PM	10.1	12	10	21	19	-10%	32	30	-6%	1.77	1.60	-2%	3:25	2:50	-0:35
I-5/SR 520–Seattle to Redmond	5:35 PM	14.7	17	15	30	29	-3%	45	41	-9%	1.73	1.68	-2%	3:40	2:10	-1:20
I-5/I-90–Seattle to Issaquah	5:30 PM	15.7	18	16	23	20	-13%	37	31	-16%	1.25	1.08	-2%	0:35	*	-0:35
From Bellevue																
I-405/I-5–Bellevue to Everett	4:45 PM	23.4	28	23	44	40	-9%	60	56	-7%	1.60	1.45	2%	3:50	3:00	-0:50
I-405–Bellevue to Lynnwood	5:25 PM	16.0	19	16	31	32	3%	43	45	5%	1.65	1.70	2%	3:45	3:20	-0:25
1-405–Bellevue to Tukwila	3:55 PM	13.5	16	13	33	35	6%	45	52	16%	2.08	2.21	-2%	6:25	5:50	-0:35
I-405/I-90/I-5–Bellevue to Seattle[1]	5:20 PM	10.7	13	11	28	n/a	n/a	46	n/a	n/a	2.23	n/a	-3%[1]	4:15	n/a	n/a
I-405/SR 520/ I-5–Bellevue to Seattle	5:20 PM	10.5	12	10	27	25	-7%	39	33	-15%	2.19	2.03	-1%	5:20	4:45	-0:35
I-405/I-90–Bellevue to Issaquah	5:30 PM	9.3	11	9	19	17	-11%	24	23	-4%	1.74	1.55	-1%	4:10	3:50	-0:20
I-405/SR 520–Bellevue to Redmond	5:35 PM	6.8	8	7	16	15	-6%	24	24	0%	2.01	1.88	-1%	4:00	2:25	-1:35
To other locations																
I-5–Everett to Seattle	3:35 PM	23.7	28	24	41	39	-5%	61	60	-2%	1.47	1.40	-1%	3:35	2:50	-0:45
I-90/I-5–Issaquah to Seattle[1]	5:20 PM	15.5	18	15	28	n/a	n/a	48	n/a	n/a	1.54	n/a	-3%[1]	1:45	n/a	n/a
SR 520/I-5–Redmond to Seattle	5:25 PM	14.8	17	15	37	33	-11%	61	52	-15%	2.13	1.90	-1%	4:40	4:15	-0:25
SR 167–SeaTac to Seattle	5:20 PM	12.9	15	13	21	20	-5%	37	30	-19%	1.38	1.31	-2%	2:40	2:05	-0:35
I-5–Renton to Auburn	3:50 PM	9.8	12	10	20	16	-20%	35	26	-26%	1.74	1.39	0%	3:50	2:55	-0:55
I-405–Tukwila to Bellevue	5:15 PM	13.5	16	13	20	20	0%	27	28	4%	1.26	1.26	-2%	3:20	1:45	-1:35

Data Source: WSDOT Traffic Operations and the Washington State Transportation Center (TRAC) at the University of Washington.

Note: An asterisk (*) indicates that speeds did not fall below 45 MPH of posted speed on a route. In 2009, WSDOT changed its threshold for duration of congestion to begin at 45 mph, instead of 42 mph. Duration figures for 2006 were re-calculated at this new threshold.

2006 figures have been recalculated since publication in the 2007 annual congestion update, using a more refined data quality control process.

[1] 2008 data not available for this route; please see gray box on p. 15. Spot volume data are included instead of VMT which was not available.

Travel Time Analysis of Major Puget Sound Commute Routes (Continued)

The loss of jobs and decrease in consumer spending imply that in the latter part of the year, fewer people and consumer goods were traveling on state highways.

WSDOT's six month reports for 2008 showed the decrease in travel times was sharper in the second half of the year. This was likely due to the combination of the two trends—high gas prices rose above $4 per gallon in late June and early July and then the recession hit the central Puget Sound, continuing to depress travel demand.

Population trends in 2008 reflect the slowing economy

Statewide population trends for 2008 reflects the nation's and state's slow economic growth during the year. The Washington State Office of Financial Management reports a slowing in statewide population growth since 2006. Trends in population indicate that fewer people are moving to Washington due to the economic downturn. These trends are consistent with trends reported in last year's congestion report looking at 2007 calendar year data.

Population and employment changes at selected Puget Sound locations

2006 vs. 2008

	Population			Number of jobs		
	2006	2008	%Δ	2006	2008	%Δ
Seattle	578,700	592,800	2.44%	470,698	496,585	5.50%
Bellevue	117,000	119,200	1.88%	118,632	128,305	8.15%
Southwestern King County cities						
Auburn	43,820	60,400	37.84%	37,543	39,839	6.12%
Des Moines	29,020	29,180	0.55%	5,607	5,463	-2.57%
Federal Way	86,530	88,040	1.75%	30,248	31,056	2.67%
Kent	85,650	86,980	1.55%	63,382	64,908	2.41%
Renton[1]	58,360	78,780	34.99%	50,703	56,416	11.27%
SeaTac	25,230	25,720	1.94%	28,696	28,072	-2.17%
Tukwila	17,930	18,080	0.84%	44,185	47,383	7.24%
Total[3]	*302,720*	*310,780*	*2.66%*	*222,821*	*233,298*	*4.70%*
Eastern King County cities						
Issaquah[2]	19,570	26,320	34.49%	18,668	19,158	2.63%
Kirkland	47,180	48,410	2.61%	32,050	32,717	2.08%
Newcastle	9,175	9,720	5.94%	1,573	1,754	11.53%
Redmond	49,890	51,320	2.87%	81,814	89,599	9.52%
Sammamish	39,730	40,550	2.06%	4,809	4,916	2.22%
Total[3]	*165,545*	*172,620*	*4.27%*	*138,913*	*148,144*	*6.64%*
Northern King County and Snohomish County						
Snohomish Co.	671,800	696,600	3.69%	228,518	254,185	11.23%
Shoreline	52,830	53,440	1.15%	16,360	17,035	4.13%

Source: Puget Sound Regional Council and Washington State Office of Financial Management.

1. Renton annexed over 16,000 people in March 2008. Actual population growth between 2006 and 2008 was approximately 4,400 people (7.6%).
2. Shortly after the official population count on April 1, 2006, Issaquah annexed approximately 3,700 people. Actual population growth between 2006 and 2008 was approximately 3,000 people (15.6%).
3. Total population numbers for 2008 were adjusted to reflect actual growth, not growth from annexations.

WSDOT's *Moving Washington* projects also contributed to faster travel times in 2008

Apart from the impacts of high fuel prices and the economic recession, WSDOT's congestion mitigation strategies and projects under the agency's *Moving Washington* program to fight congestion, also helped improve travel times in the central Puget Sound. For example, two major projects completed in 2007 and 2008 have improved travel times above and beyond the general drops seen on most routes due to gas prices and the start of the economic recession.

I-5 - Everett, SR 526 to US 2 HOV Lanes

Completed June 2008. WSDOT widened northbound and southbound I-5 to add about 10 miles of new HOV lanes on I-5 from Boeing Freeway (SR 526) to US 2 at the Hewitt Avenue Trestle. For more information on this project please see the September 30, 2008 *Gray Notebook*, p. 44.

This additional capacity between SR 526 and US 2 may have in part contributed to improved travel times on the Seattle to Everett evening commute and the Bellevue to Everett evening commute. Both routes had a four minute improvement in average travel times, and a five to six minute improvement in 95% reliable travel times. WSDOT will continue to examine the data to see to what extent this project may have impacted the travel times for these commute routes.

Travel Time Analysis of Major Puget Sound Commute Routes (Continued)

Kirkland Nickel Stage I

Completed November 2007: WSDOT addressed the "Kirkland Crawl" in a Nickel project adding one northbound and one southbound lane between NE 85th Street and NE 124th Street, improving access into and out of Bellevue. This project will continue until all of I-405 north of SR 520 to I-5 is widened by an additional lane.

An analysis of southbound I-405 showed a noticeable improvement in the intensity of congestion between the northern I-405/I-5 junction and NE 124thStreet. This contributed to the travel time improvements on the *Everett to Bellevue morning commute* and the *Lynnwood to Bellevue morning commute*. Both of these routes experienced a seven to eight minute improvement in average travel times, and a 14-16 minute improvement in 95% reliable travel times.

The *Bellevue to Lynnwood evening commute* did not experience any substantial improvements in travel times. The Kirkland Nickel project is in the first stage of a series of improvements along this corridor. Although Stage I alleviated some congestion, the bottleneck still remains farther north of the project and still affects evening northbound traffic. The long range plan for this series of projects is to complete widening through SR-527 and eventually all the way to the northern I-5 junction, removing the bottleneck all together. WSDOT anticipates that this route should start seeing travel time improvements as more sections along I-405 are widened.

The commutes that traverse these two project locations showed the biggest improvements during morning commutes; evening commutes show smaller improvements and in one case, a slight increase in travel times. Overall, as seen in these examples, WSDOT's congestion relief projects have contributed to improvements on many of the state's most congested routes, above and beyond the general drops due to gas prices and the start of the economic recession. For more information on the congestion relief benefits WSDOT's *Moving Washington* strategies and projects please see pp. 40-52.

Will these drops in travel times be sustained?

WSDOT's recent 6-month report on travel time trends looking at the first six months of 2009 found that 13 of 18 surveyed routes analyzed have dropped even further from 2008 data; only one rose by more than a minute. It is still not clear what the second half of 2009 will bring, especially since unemployment is still much higher compared to previous years (8.6% as of September 2009). However, it is likely that 2009 will be another low year for travel times. Although high fuel prices are no longer a factor, the economic recession and the continued completion of WSDOT congestion relief projects will clearly have positive impact on travel times. WSDOT will continue to study recent travel time trends in the central Puget Sound as part of the *Gray Notebook*. The next travel time trends 6 month report will be published as part of the December 31, 2009 *Gray Notebook*, and will look at changes in travel times for July-December 2009.

The "worst" route: Tukwila to Bellevue morning commute, but relief is on the way

In 2008, the *Tukwila to Bellevue morning commute* remained the route with the most lopsided average travel time. Average travel time on the route was 41 minutes in 2008, more than two and a half times greater than the typical 16 minutes that the trip would take under peak efficiency speeds. This route has the highest ratio of average travel time to peak efficiency travel time (Maximum Throughput Travel Time Index, or MT^3I) of all 38 routes. The good news, reported on page 43, is that an auxiliary lane opened on I-405 in January 2009, dropping average travel times by 12 minutes on this route. This new capacity, coupled with the end of construction, will lead to a long-term improvement and likely remove *Tukwila to Bellevue morning commute* from its extended run as the worst of the 38 commute routes.

Traffic volumes drop on the central Puget Sound commute routes

Continuing a trend that began in 2007, vehicle miles traveled (VMT) during peak periods dropped on nearly all of the surveyed high demand commute routes in 2008. Morning routes experienced drops on 12 of the 18 reported commute routes, and evening routes showed a drop or steady state on 17 of the 20 reported commute routes. Total daily volumes were down or steady at most locations on 38 routes.

This region-wide decrease indicates that overall travel demand shrank in 2008 in the face of gas prices and the recession. The drop in traffic volume meant that severe congestion occurred less often, resulting in improved annual travel times. The trend of dropping VMT in the Puget Sound mirrors Washington's statewide numbers for 2008, which report an approximate 2% decrease between 2006 and 2008.

A few routes are experiencing increases in VMT during peak periods, including the *Everett to Bellevue morning commute* and the *Lynnwood to Bellevue morning commute*. VMT is up

Travel Time Analysis of Major Puget Sound Commute Routes (Continued)

Drop in Fatality and Serious Injury Collisions Likely Improving Travel Times

Recurrent congestion is caused by simply having too many cars on the same highway at the same time. Non-recurrent congestion results from occurrences such as traffic incidents, inclement weather, or sporting events, and can exacerbate recurrent congestion. Fatality and serious injury collisions are a major cause of non-recurrent congestion, often disrupting traffic for extended periods while emergency crews care for the injured and law enforcement officers perform investigations. These events have an impact on the reliability of travel times.

In 2008, Washington experienced a drop in these types of collisions compared to previous years. In King County, fatal and serious injury collisions declined over 20% from 2006, an especially sharp drop. The total number of all collision types on state highways in King County decreased by 11.4% from 2006 levels This reduction in collisions is likely decreasing non-recurrent congestions and contributing to the improvement in reliable travel times on central Puget Sound highways.

There was a similar drop in fatal collisions nationally, with the National Highway Traffic Safety Administration (NHTSA) reporting 2008 as having the lowest number of national fatalities since 1961. This included a very low fatality rate of 1.27 deaths for 100 million VMT. The Washington State fatality rate was .94 per 100 million VMT.

Fatal and serious injury collisions, all roads

YEAR	Statewide	2008 is lower by...	King County	2008 is lower by...
2005	2,998	-10.7%	787	-10.7%
2006	3,085	-13.2%	882	-20.3%
2007	2,874	-6.8%	744	-5.5%
2008	2,678	n/a	703	n/a

Total number of collisions on state highways

YEAR	Statewide	2008 is lower by...	King County	2008 is lower by...
2005	53,384	-9.2%	17,644	-10.9%
2006	53,481	-9.3%	17,718	-11.4%
2007	52,258	-7.2%	16,851	-5.9%
2008	48,497	n/a	15,909	n/a

Source: WSDOT Transportation Data Office

3%-5% as a result of the dramatic travel time improvements from the added capacity and improved traffic flow from the Kirkland Nickel project. The corresponding northbound *Bellevue to Everett evening commute* and *Bellevue to Lynnwood evening commute* also show slight (2%) increases in VMT, although these evening commutes do not share the dramatic travel time improvements of their morning counterparts.

VMT also increased slightly for the *Federal Way to Seattle morning commute* and the *Seattle to Federal Way evening commute*. The southbound evening commute has seen an increase in VMT and a decrease in travel time due the HOV lane extension between S 320th St and the King-Pierce county line that opened in May 2007. This improvement relieved a bottle neck in the south end and improved southbound traffic flow. The northbound morning commute saw similar improvements as a result of less congested days with consistent volume throughput, similar to other routes in the region.

Two routes are not reported on in this year's tables: *Issaquah to Seattle morning commute* and *Bellevue to Seattle morning commute* because construction lane shifts on westbound I-90 between I-405 and I-5 affected data quality. Although there is not sufficient data for the full year, the data available shows both travel times and VMT dropping slightly, a similar trend that matches the rest of the region. For a discussion of statewide VMT trends, please see p. 11-12.

Trends on other modes in 2008

WSDOT is trying to collect data on mode split: the number of commuters traveling on the system using different modes. Data is available for single occupancy vehicles, Sound Transit and Community Transit Express bus ridership, and vanpools. (Data is not available for carpoolers.)

This data shows that a considerable proportion of commuters using state highways are in buses or on vanpools. By not driving alone in the general purpose lanes, these commuters help smooth the flow of traffic on the highways. As WSDOT has noted for many years, even small shifts of vehicles out of general purpose lanes can have a large effect. The data from 2008 shows small drops in VMT leading to significant improvements in general purpose lane travel times.

At this time only 2008 system data is available. However, data is available for Sound Transit Express buses, which experienced a 29.5% increase in ridership between 2006 and 2008, and vanpool ridership, which increased 21.4% during this same time period.

Travel Time Analysis of Major Puget Sound Commute Routes (Continued)

These numbers have been derived in the following ways:

- Single Occupancy Vehicles: volumes from seven different sensor locations were gathered for commute travels in the dominant direction. See map to the right. Although this is not the entirety of people on the roads, it is a good, if conservative, approximation of the number of single-occupancy vehicles on the road.
- Buses: Daily ridership numbers from the Spring schedule were taken from buses passing the same locations on the highway.
- Vanpool riders: Transit agencies track daily ridership on all vanpools. These figures might include some vanpools that do not pass along highway routes.

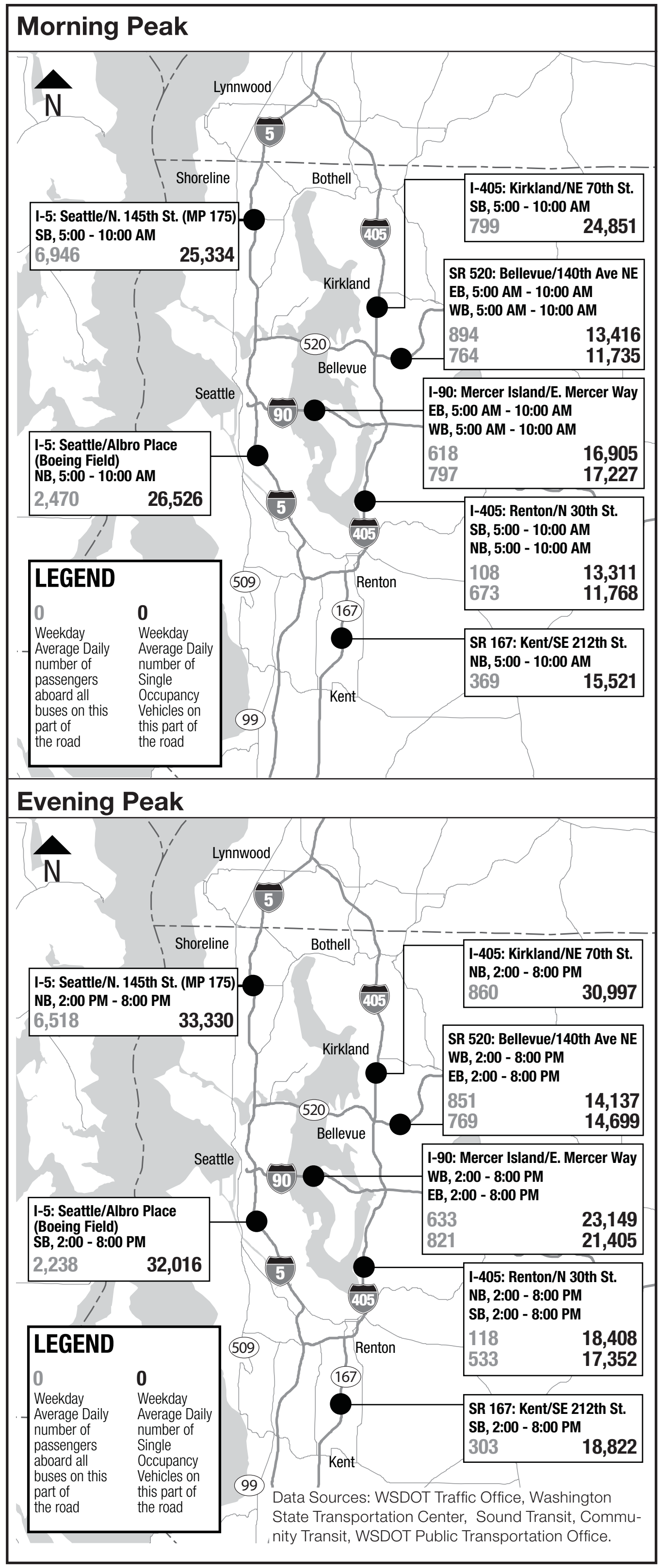
Puget Sound Commuters: Average daily numbers in 2008 Morning peak (5 am to 10 am), by mode

Mode	2008
Single Occupancy vehicle drivers	176,594
Bus Riders	14,438
Vanpools Riders	14,946

Puget Sound Commuters: Average daily numbers in 2008 Evening peak (2 pm to 8 pm), by mode

Mode	2008
Single Occupancy vehicle drivers	224,315
Bus Riders	13,642
Vanpools Riders	14,946

Data Sources: WSDOT Traffic Office, Washington State Transportation Center, Sound Transit, Community Transit, WSDOT Public Transportation Office.



About the trends on other modes map

The illustration below provides additional information on how to read the data at the spot locations on the map on this page. Each spot location includes data concerning the average weekday number of bus riders and the estimated average weekday number of single occupancy vehicles at each spot location during either the AM or PM peak period. For example:

I-5: Seattle/N. 145th St. (MP 175)
SB, 5:00 - 10:00 AM
6,946 **25,334**

This number represents the actual weekday average daily number of passengers aboard all buses that travel past this spot location during the respective peak period.

This number represents the estimated weekday average daily number of Single Occupancy Vehicles on this part of the road during the respective peak period. This data is collected using imbedded loop detectors in the general purpose lanes at this spot location.

Travel Time Analysis of Major Puget Sound Commute Routes (Continued)

This year, WSDOT is introducing a new analysis of reliability to complement the existing average travel time and 95% reliable travel time discussion. This new analysis includes the median, 80th percentile, and 90th percentile values for the 38 most congested routes, in addition to the standard 95th percentile that the annual congestion report has measured for many years.

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. The 95th percentile data shows travel times

Reliability percentiles in plain English

	Definition	Why do we measure this?
Average travel time (Mean)	Average of all travel times.	Describes the "average" experience on the road that year.
50th percentile travel time (Median)	Half of the weekday travel time values are above, half are below this value.	Is not affected by very large values like the mean is, so gives a better sense of actual conditions.
80th percentile travel time	80% of all weekday travel time values are below this value.	Allows commuters to plan how much time to leave in order to be late one day per week, on average (on-time 16 of 20 days).
90th percentile travel time	90% of all weekday travel time values are below this value.	Allows commuters to plan how much time to leave in order to be late two days per month, on average (on-time 18 of 20 days).
95th percentile travel time	95% of all weekday travel time values are below this value.	Allows commuters to plan how much time to leave in order to be late one day per month, on average (on-time 19 of 20 days).

Travel time reliability percentiles for morning commute routes

In minutes

		Travel times at:		2006 percentiles				2008 percentiles				Difference 2006 vs. 2008			
Route	Peak Time	Peak Efficiency	Posted Speeds	50th Median	80th	90th	95th	50th Median	80th	90th	95th	50th Median	80th	90th	95th
To Seattle															
Everett to Seattle	7:25 AM	28	24	46	61	74	81	38	51	56	67	-8	-10	-18	-14
Federal Way to Seattle	7:30 AM	26	22	45	55	62	68	38	47	51	58	-7	-8	-11	-10
Issaquah to Seattle	7:45 AM	18	15	25	32	35	38	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Redmond to Seattle	7:50 AM	17	15	21	26	29	33	20	24	26	29	-2	-2	-4	-4
SeaTac to Seattle	8:35 AM	15	13	26	31	35	40	24	30	33	40	-2	-1	-2	0
Bellevue to Seattle via I-90	8:40 AM	13	11	15	20	26	30	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Bellevue to Seattle via 520	7:55 AM	12	10	18	21	23	26	15	19	21	24	-2	-2	-3	-2
To Bellevue															
Everett to Bellevue	7:25 AM	28	23	48	63	75	84	41	52	60	68	-8	-11	-15	-16
Lynnwood to Bellevue	7:30 AM	19	16	40	53	61	67	32	44	50	53	-8	-9	-11	-14
Tukwila to Bellevue	7:50 AM	16	13	42	53	58	63	42	51	56	59	0	-2	-2	-4
Seattle to Bellevue via I-90	8:45 AM	12	11	17	22	24	26	16	20	24	27	-1	-2	0	1
Seattle to Bellevue via 520	8:30 AM	12	10	23	28	31	33	21	27	29	32	-1	-1	-2	-1
Issaquah to Bellevue	7:50 AM	11	9	18	22	25	27	15	18	21	23	-3	-4	-4	-4
Redmond to Bellevue	7:50 AM	8	7	8	9	9	9	9	9	9	10	0	0	0	1
To other locations															
Bellevue to Tukwila	7:40 AM	16	13	21	25	28	32	20	24	27	29	-1	-1	-1	-3
Auburn to Renton	7:40 AM	12	10	15	19	25	29	16	18	20	24	1	-1	-5	-5
Seattle to Issaquah	8:45 AM	18	16	20	24	26	30	19	22	26	28	-2	-2	0	-2
Seattle to Redmond	8:30 AM	17	15	28	33	36	38	26	32	34	37	-1	-1	-1	-1

Source: WSDOT Traffic Office, Washington State Transportation Center (TRAC).

Note: 2006 figures have been recalculated since publication in the 2007 annual congestion update, using a more refined data quality control process.

Travel Time Analysis of Major Puget Sound Commute Routes (Continued)

under the worst conditions – events that WSDOT has little control over, such as weather events. Meanwhile, changes in the 80th and 90th percentile are more likely to represent travel times that are the result of routine incidents and other factors that DOT can control with operational strategies. WSDOT will continue to publish the percentile data in the annual congestion report, and track changes as part of the "Operating Efficiently" aspect of *Moving Washington*.

Reliability is an important statistic for travel times, because it allows highway users to plan for consistency in their travels. The 80th, 90th, and 95th percentiles give travelers a sense of the expected travel time so they can plan to be late to their destinations only once a week, once every two weeks, or once a month, respectively. These statistics have real value for peak-period highway users: a commuter can plan her trip to work, a parent can plan the pick-up of a child at day care, a company can plan for a just-in-time shipment, and a transit agency can develop a resilient schedule.

Each of the routes published below is built on approximately 260 weekdays worth of data, including the quickest travel days – generally holidays – and the slowest – generally days with snowstorms or major events such as semi rollovers. The percentile measures are resistant to outlier values, generally the highest values.

Travel time reliability percentiles for evening commute routes
In minutes

		Travel times at:		2006 percentiles				2008 percentiles				DIfference 2006 vs. 2008			
Route	Peak Time	Peak Efficiency	Posted Speeds	50th Median	80th	90th	95th	50th Median	80th	90th	95th	50th Median	80th	90th	95th
From Seattle															
Seattle to Everett	4:55 PM	28	24	41	52	56	61	38	46	51	56	-3	-6	-5	-5
Seattle to Federal Way	4:10 PM	26	22	36	47	54	58	31	39	44	50	-5	-8	-10	-8
Seattle to SeaTac	4:10 PM	15	13	17	23	27	29	18	22	25	29	1	-1	-2	0
Seattle to Bellevue via I-90	5:30 PM	12	11	16	22	26	32	13	17	21	24	-3	-5	-5	-8
Seattle to Bellevue via 520	5:35 PM	12	10	20	25	28	32	18	23	27	30	-2	-3	-1	-2
Seattle to Redmond	5:35 PM	17	15	29	37	40	45	28	34	38	41	-1	-2	-2	-4
Seattle to Issaquah	5:30 PM	18	16	22	28	32	37	19	24	27	31	-3	-4	-5	-6
From Bellevue															
Bellevue to Everett	4:45 PM	28	23	41	51	55	60	39	46	52	56	-2	-5	-4	-4
Bellevue to Lynnwood	5:25 PM	19	16	30	36	40	43	32	38	42	45	2	2	2	2
Bellevue to Tukwila	3:55 PM	16	13	32	38	42	45	34	42	47	52	2	4	5	7
Bellevue to Seattle via I-90	5:20 PM	13	11	27	37	44	46	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Bellevue to Seattle via 520	5:20 PM	12	10	27	29	34	39	25	28	31	33	-1	-1	-3	-6
Bellevue to Issaquah	5:30 PM	11	9	19	21	23	24	16	20	21	23	-2	-2	-2	-1
Bellevue to Redmond	5:35 PM	8	7	15	19	22	24	15	18	21	24	0	-1	-1	0
From Other Locations															
Everett to Seattle	3:35 PM	28	24	39	47	54	61	37	46	54	60	-2	-1	0	-1
Issaquah to Seattle	5:20 PM	18	15	26	38	44	48	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Redmond to Seattle	5:25 PM	17	15	36	48	56	61	30	40	48	52	-6	-7	-8	-9
SeaTac to Seattle	5:20 PM	15	13	20	25	30	37	19	24	27	30	-1	-1	-3	-7
Renton to Auburn	3:50 PM	12	10	17	26	31	35	14	19	22	26	-3	-7	-9	-9
Tukwila to Bellevue	5:15 PM	16	13	19	22	25	27	20	22	24	28	1	0	-1	1

Source: WSDOT Traffic Office, Washington State Transportation Center (TRAC)

Note: 2006 Figures have been recalculated since their last publication in the 2007 annual congestion update, using a more refined data quality control process.

Travel Time Analysis of Major Puget Sound Commute Routes (Continued)

2008 Reliability numbers are improving

Consistent with the findings of the average travel time report, the percentile numbers show reliability improving or staying steady on nearly all routes.

- *Everett to Seattle morning commute* and *Federal Way to Seattle commute* show the largest improvements.
- *Everett to Bellevue morning commute* and *Lynnwood to Bellevue morning commute* also show major improvements, with reliability improvements accelerated by the Kirkland Nickel Stage I project.
- *Bellevue to Tukwila evening commute*, experiencing construction impacts from the I-405 widening project on that leg of the route, was the only route to experience substantial increases across the percentiles.

What others are saying about congestion

The Road… Less Traveled

Brookings Institute, December 2008:
This report analyzed national vehicle miles traveled for the past several years and determined that rural driving has been decreasing since 2004, while urban driving began decreasing in 2007. The year 2007 was also identified as a turning point in WSDOT's congestion report and in the TTI Urban Mobility Report, discussed below. Washington is identified as the only state with a drop in VMT between 1991 and 2006.

INRIX National Travel Time Scorecard

INRIX, a private traffic-data-collection company, determined that "peak hour congestion on the major roads in urban America decreased nearly 30% in 2008 versus 2007." They linked the drop to high gas prices and the start of the economic recession. INRIX also found that peak hour congestion dropped more in the morning than in evenings.

Urban Mobility Report

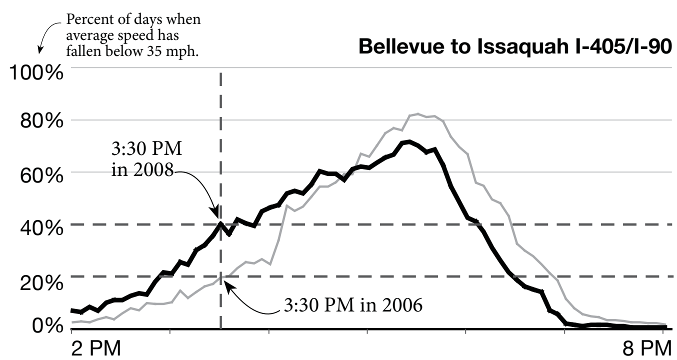
Texas Transportation Institute (TTI), Texas A&M, July 2009:
TTI's biannual national report analyzed 2007 data and found that delay per traveler dropped in 2006 and 2007, the first time since 1991. Total delay and total fuel wasted dropped in 2007, for the first time since they started recording data in 1982. Similarly, last year's congestion report by WSDOT also identified 2007 as the beginning of a change in the ongoing growth trend in the central Puget Sound, when growth began flattening on the 38 busiest commute routes.

Stamp graphs show the duration and frequency of severe congestion

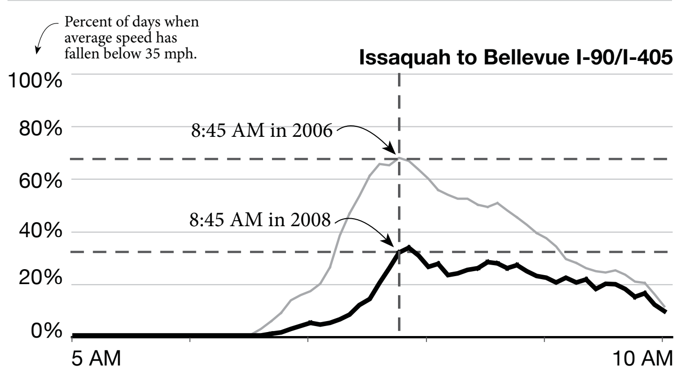
The most visual evidence to show whether the peak period is spreading or contracting can be seen in the "stamp graphs" on the following two pages. The stamp graphs show the frequency of severe congestion on the 38 high demand central Puget Sound commute routes. These graphs, comparing 2006 and 2008 data, show the percentage of days annually that observed speeds fell below 35 MPH on the key highway segments. For specific information on how to read stamp graphs, see the illustrations below. As discussed earlier four routes that travel on westbound I-90 did not have data available (see p. 15).

How to Read a Stamp Graph: Percent of Days When Speeds Were Less Than 35 MPH

How frequently (and when) did the average trip speed drop under 35 mph? How have those conditions changed from 2006 to 2008?



At 3:30 pm in 2006, you had about a 20% chance that traffic would be moving less than 35 mph. In 2008, the situation became worse (black line above the gray line); your chance that traffic would be moving slower than 35 mph was about 40% in 2008.



At 8:45 am in 2006, you had about a 67% chance that traffic would be moving less than 35 mph. In 2008, the situation was better (black line below the gray line); your chance that traffic would be moving slower than 35 mph was about 32%.

Travel Time Analysis of Major Puget Sound Commute Routes (Continued)

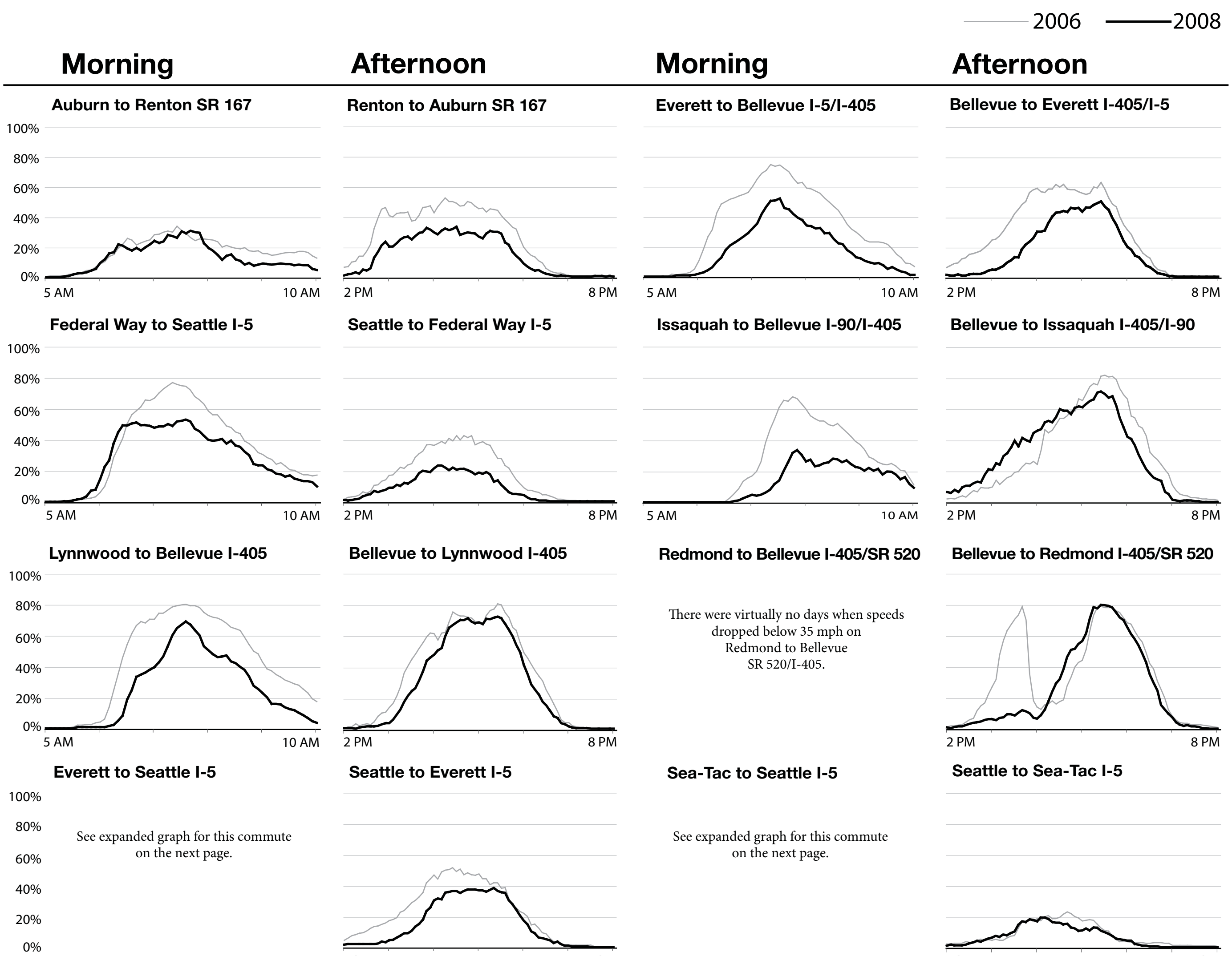
Stamp Graphs: Frequency and duration of severe congestion drops in 2008

A comparison of the frequency and duration of severe congestion on the surveyed high demand commute routes for all years dating back to 2003 shows a substantial reduction in the number of days that experience severe congestion in 2008. Comparing 2008 data with data from 2003-2007 on the surveyed commute routes the following is seen:

- 20 routes resemble 2003 data or earlier, with some at their lowest ever;
- 2 commute routes resemble 2004 data;
- 7 commute routes resemble 2005 data;
- 6 commute routes were unchanged;
- 3 routes data for prior years were unavailable to make comparisons.

Stamp Graphs: Percentage of weekdays with average speeds of 35 mph or less

The following "stamp graphs" show how often severe congestion occurs on the 38 key central Puget Sound commute routes that are shown in the tables on pages 17 and 18. These graphs, comparing 2006 and 2008 data, show the percentage of days annually when speeds fell below 35 mph on these key commute routes. For more on how to read a stamp graph please see the illustration on page 25.

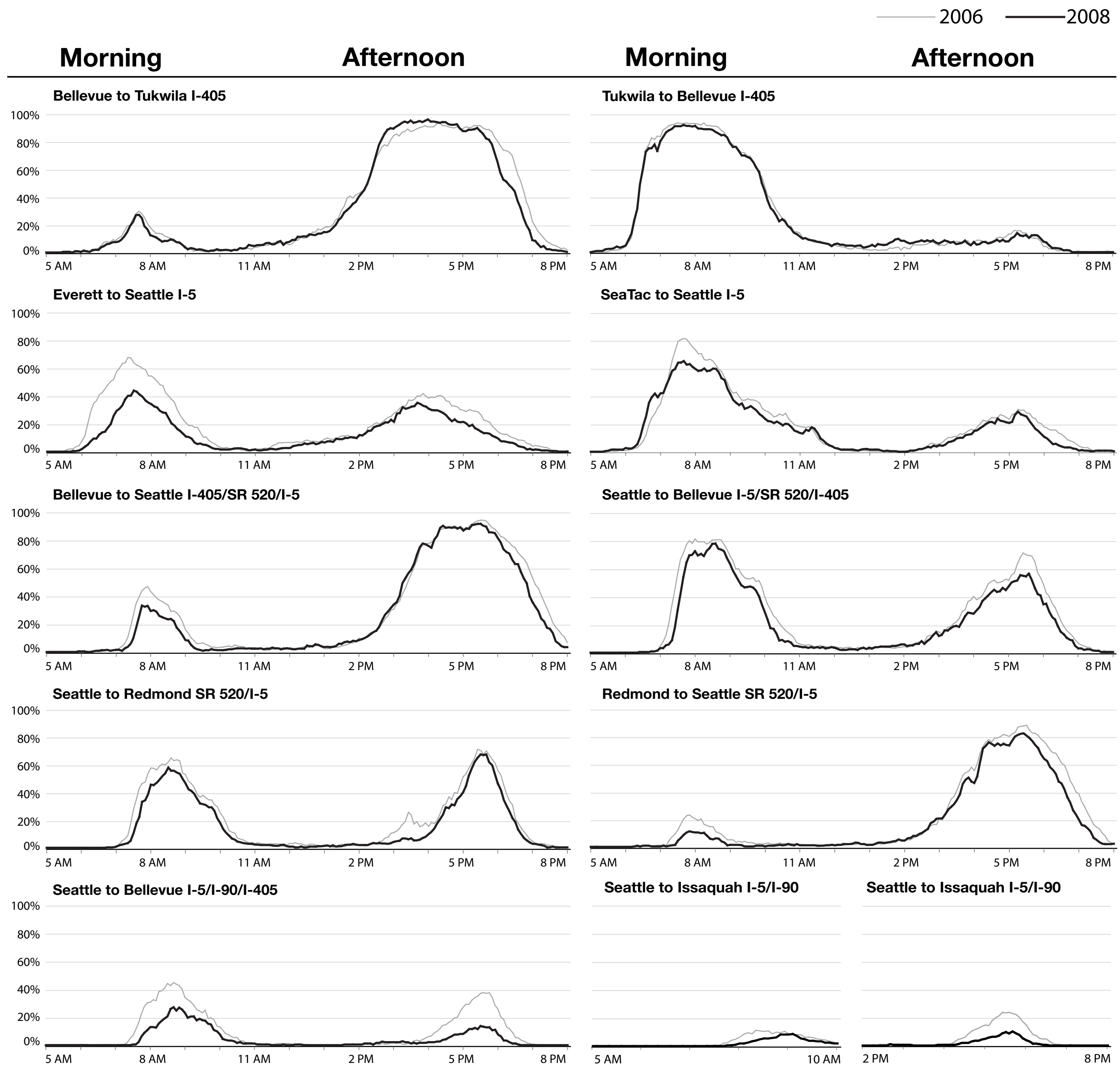


Data Source: WSDOT Traffic Office

Travel Time Analysis of Major Puget Sound Commute Routes (Continued)

Stamp Graphs: Percentage of weekdays with average speeds of 35 mph or less

The following "stamp graphs" show how often severe congestion occurs on the 38 key central Puget Sound commute routes that are shown in the tables on pages 17 and 18. These graphs, comparing 2006 and 2008 data, show the percentage of days annually when speeds fell below 35 mph on these key commute routes. For more on how to read a stamp graph please see the illustration on page 25.



Data Source: WSDOT Traffic Office

Travel Time Analysis of Major Puget Sound Commute Routes (Continued)

Comparison of general purpose and HOV lane travel times in 2008-Seattle work locations

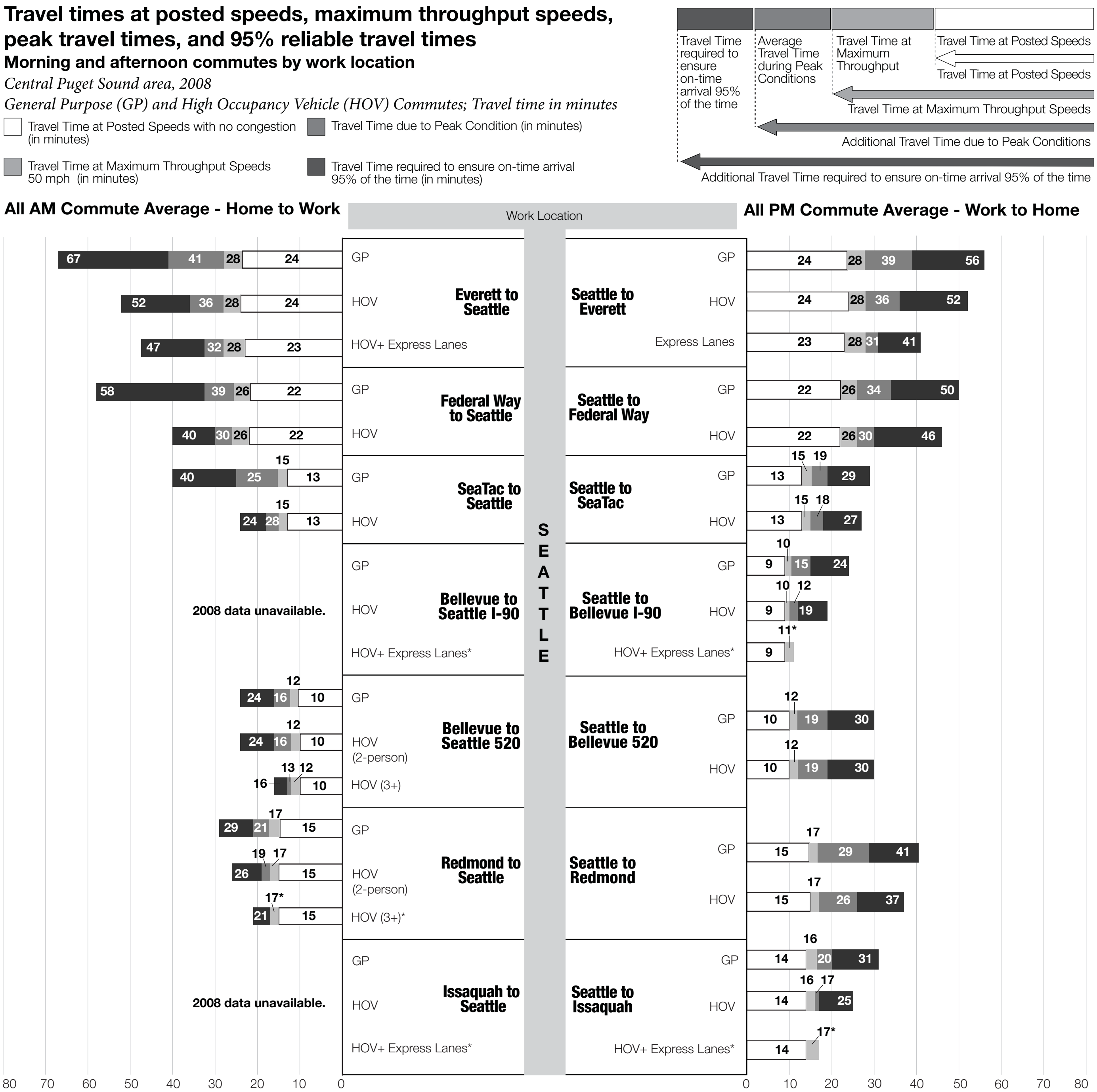
Below is a graphical representation of the tables from pp. 17-18, showing four of the travel times performance indicators: travel times at posted speeds, travel time at maximum throughput speeds (50 MPH), average peak travel times, and 95% reliable travel times. For each commute general purpose (GP) and HOV travel times are shown. For more information on HOV lane travel times please see pages 35-39.

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

Morning and afternoon commutes by work location

Central Puget Sound area, 2008

General Purpose (GP) and High Occupancy Vehicle (HOV) Commutes; Travel time in minutes



Route	Lane (AM)	AM: 95% reliable	AM: Average peak	AM: Max throughput	AM: Posted speeds	Lane (PM)	PM: Posted speeds	PM: Max throughput	PM: Average peak	PM: 95% reliable
Everett / Seattle	GP	67	41	28	24	GP	24	28	39	56
	HOV	52	36	28	24	HOV	24	28	36	52
	HOV+ Express Lanes	47	32	28	23	Express Lanes	23	28	31	41
Federal Way / Seattle	GP	58	39	26	22	GP	22	26	34	50
	HOV	40	30	26	22	HOV	22	26	30	46
SeaTac / Seattle	GP	40	25	15	13	GP	13	15	19	29
	HOV	24	28	15	13	HOV	13	15	18	27
Bellevue / Seattle I-90	GP	2008 data unavailable.				GP	9	10	15	24
	HOV					HOV	9	10	12	19
	HOV+ Express Lanes*					HOV+ Express Lanes*	9	11*		
Bellevue / Seattle 520	GP	24	16	12	10	GP	10	12	19	30
	HOV (2-person)	24	16	12	10	HOV	10	12	19	30
	HOV (3+)	16	13	12	10					
Redmond / Seattle	GP	29	21	17	15	GP	15	17	29	41
	HOV (2-person)	26	19	17	15	HOV	15	17	26	37
	HOV (3+)*	21		17*	15					
Issaquah / Seattle	GP	2008 data unavailable.				GP	14	16	20	31
	HOV					HOV	14	16	17	25
	HOV+ Express Lanes*					HOV+ Express Lanes*	14	17*		

* Note: Average Travel Times and 95% Reliable Travel Times were equal to or faster than maximum throughput travel times on this route.

Travel Time Analysis of Major Puget Sound Commute Routes (Continued)

Comparison of general purpose and HOV lane travel times in 2008-Bellevue work locations

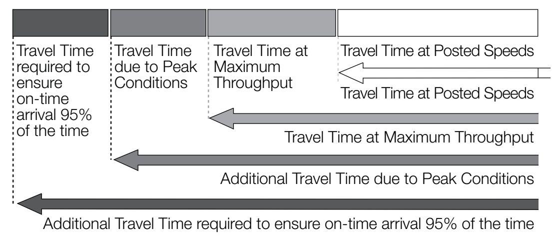
Below is a graphical representation of the tables from pp. 17-18, showing four of the travel times performance indicators: travel times at posted speeds, travel time at maximum throughput speeds (50 MPH), average peak travel times, and 95% reliable travel times. For each commute general purpose (GP) and HOV travel times are shown. For more information on HOV lane travel times please see pages 35-39.

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

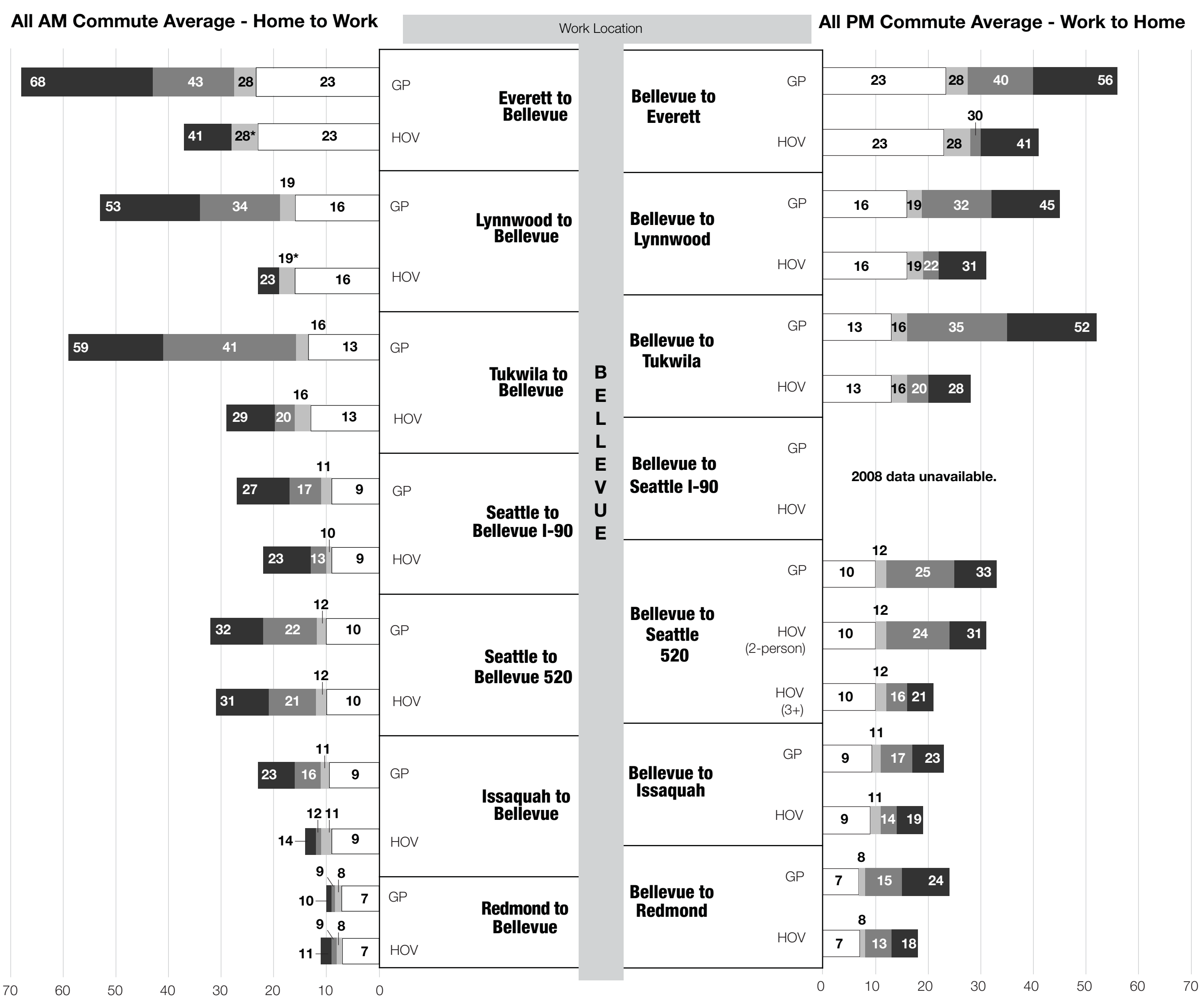
Morning and afternoon commutes by work location

Central Puget Sound area, 2008

General Purpose (GP) and High Occupancy Vehicle (HOV) Commutes; Travel time in minutes



- Travel Time at Posted Speeds with no congestion (in minutes)
- Travel Time due to Peak Condition (in minutes)
- Travel Time at Maximum Throughput Speeds 50 mph (in minutes)
- Travel Time required to ensure on-time arrival 95% of the time (in minutes)



* Note: Average Travel Times and 95% Reliable Travel Times were equal to or faster than maximum throughput travel times on this route.

Travel Time Analysis of Major Puget Sound Commute Routes (Continued)

Comparison of general purpose and HOV lane travel times in 2008-Other work locations

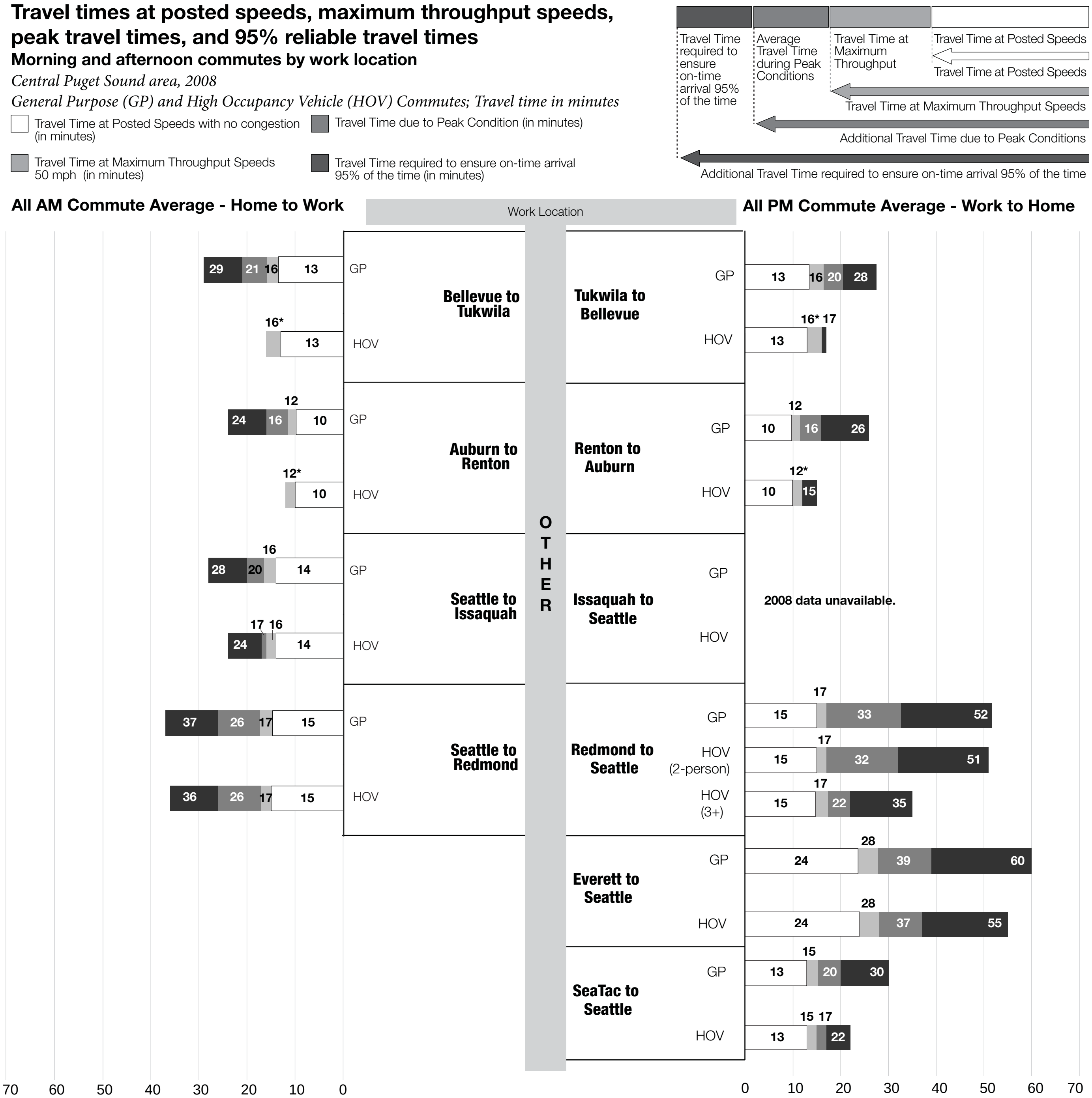
Below is a graphical representation of the tables from pp. 17-18, showing four of the travel times performance indicators: travel times at posted speeds, travel time at maximum throughput speeds (50 MPH), average peak travel times, and 95% reliable travel times. For each commute general purpose (GP) and HOV travel times are shown. For more information on HOV lane travel times please see pages 35-39.

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

Morning and afternoon commutes by work location

Central Puget Sound area, 2008

General Purpose (GP) and High Occupancy Vehicle (HOV) Commutes; Travel time in minutes



* Note: Average Travel Times and 95% Reliable Travel Times were equal to or faster than maximum throughput travel times on this route.

Travel Time Analysis: 14 Additional Puget Sound Commute Routes

WSDOT tracks 14 additional routes for congestion – and finds none

WSDOT tracks a total of 52 commute routes annually representing morning and evening commutes between major population and work centers. Thirty-eight of those routes regularly experience congestion (pp. 15-22). The additional 14 routes, listed on this page, represent the relatively uncongested routes for which WSDOT tracks travel time and volume data. Twelve of the 14 routes do not regularly experience congestion.

The 95% reliable travel time is the only measure that is showing any indications of congestion. For the seven evening routes, all of the 95% reliable travel times are trending downwards, a change from last year, which saw a slight increase. Only three of the eight morning commutes are trending upwards on this measure. The rest are unchanged from 2006. Because the 95% reliable travel time is heavily influenced by a few "very bad days", it is likely that overall conditions on the routes are not changing much, as evidenced by the flat average travel times on all routes.

WSDOT monitors these commutes to see if they are developing congested characteristics. Three years ago, several routes that had previously been considered "non-congested" moved to the "congested list" as housing sales boomed in the Puget Sound region. No additional routes have developed significant congestion problems in the past year, so the list of congested routes did not grow this year. WSDOT will continue to monitor these 14 routes.

Those living in Bellevue and working in Redmond experience some highway traffic congestion

The two exceptions are *Bellevue to Redmond morning commute* and the *Redmond to Bellevue evening commute*, the routes traveled by those living in Bellevue and working in Redmond. The distance between the two cities is approximately 6.8 miles. The evening commute experiences substantial travel time and reliability issuer; however, most of the trouble on this route is caused by backups from the *Redmond to Seattle evening commute*. Since there are several local roads between Redmond and Bellevue which offer non-highway alternatives to commuters, WSDOT does not track these two routes in its analysis of the 38 high demand commute routes.

Changes in travel time performance on 14 additional central Puget Sound commute routes

2006 peak periods versus 2008 peak periods

				Travel time (minutes)		Average peak travel time, based on peak time (minutes)			95% reliable travel times (minutes)			Ratio of peak travel time to maximum throughput travel time (MT³I)		Traffic volume peak period	Duration of congestion (hours and minutes that average speed falls below 45 mph)		
Route/Commute		Peak time	Length (Miles)	At Peak Efficiency	At Posted Speed	2006	2008	Δ	2006	2008	Δ	2006	2008	VMT % Δ	2006	2008	change (min.)
Morning																	
I-5	Seattle to Everett	8:40 AM	23.7	28	24	27	26	-1	32	32	0	0.97	0.93	-1%	*	*	N/A
I-5	Seattle to SeaTac	7:45 AM	12.9	15	13	14	14	0	16	16	0	0.92	0.92	-2%	*	*	N/A
I-405	Bellevue to Lynnwood	9:10 AM	16.0	19	16	17	17	0	18	18	0	0.90	0.90	-4%	*	*	N/A
SR-167	Renton to Auburn	9:45 AM	9.8	12	10	11	11	0	13	12	-1	0.96	0.96	-4%	*	*	N/A
SR-520	Bellevue to Redmond	8:55 AM	7.1	8	7	10	10	0	13	12	-1	1.25	1.25	-2%	0:25	1:25	+1:00
I-90	Bellevue to Issaquah	8:30 AM	9.3	11	9	11	10	-1	16	12	-4	1.01	0.91	-4%	*	*	N/A
I-5	Seattle to Federal Way	7:45 AM	22.1	26	22	23	24	1	26	26	0	0.88	0.92	-2%	*	*	N/A
I-405	Bellevue to Everett	9:15 AM	23.4	28	23	25	25	0	26	26	0	0.91	0.91	-3%	*	*	N/A
Evening																	
I-405	Lynnwood to Bellevue	5:15 PM	16.0	19	16	22	21	-1	32	30	-2	1.17	1.12	-3%	*	*	N/A
SR 167	Auburn to Renton	2:40 PM	9.8	12	10	12	11	-1	16	15	-1	1.04	0.96	-4%	*	*	N/A
SR 520	Redmond to Bellevue	5:20 PM	7.1	8	7	16	14	-2	38	31	-7	1.91	1.67	-1%	3:20	3:05	-0:15
I-90	Issaquah to Bellevue	3:40 PM	9.5	11	10	12	11	-1	17	15	-2	1.08	0.99	-4%	*	*	N/A
I-5	Federal Way to Seattle	5:10 PM	21.8	26	22	31	29	-2	46	39	-7	1.21	1.13	-2%	0:15	*	-0:15
I-5	Everett to Bellevue	5:15 PM	23.4	28	23	31	30	-1	40	38	-2	1.13	1.09	-2%	*	*	N/A

Data Source: WSDOT Traffic Operations and the Washington State Transportation Center (TRAC) at the University of Washington.

Note: An asterisk (*) indicates that speeds did not fall below 45 mph on a route; and n/a means that no information is available for a route.
Last year WSDOT mistakenly printed data for the Issaquah to Seattle PM commute route instead of the Bellevue to Redmond AM commute route.
2006 figures have been recalculated since publication in the 2007 annual congestion update, using a more refined data quality control process.

Travel Time Analysis: Spokane

Spokane travel time analysis

Beyond the central Puget Sound WSDOT also tracks two commutes in Spokane as part of the Annual Congestion Report's travel time analysis. Spokane traffic volumes decreased this past year with a peak flow near Altamont Street of 110,000 vehicles per day. This is a decrease of 2.6% since 2006. An overall decrease was measured not only in volume but also vehicle miles traveled which decreased by 3% from 2006 during the peak periods. A similar trend was seen on a statewide level as well and is primarily attributed to the slowdown in the economy and gas remaining at an increased cost.

Incidents remain the major cause of delay and congestion on the corridor as reflected in the increase in the 95% reliable travel time and measured hours of congestion during the evening peak. However, it should be noted that the 95% reliable travel time is no more than two minutes above travel times at posted speeds.

Changes in travel time performance on Spokane commute routes*

2006 peak periods versus 2008 peak periods

			Travel time (minutes)		Average peak travel time, based on peak time (minutes : seconds)			95% reliable travel times (minutes : seconds)			Traffic volume peak period
Route/Commute	Peak time	Length (Miles)	At Peak Efficiency	At Posted Speed	2006	2008	% Δ	2006	2008	% Δ	% Δ
I-90: Argonne Rd. to Division St.	7:50 AM	7.5	8	7	8:00	7:59	0%	8:00	9:18	+16%	-6%
I-90: Division St. to Argonne Rd.	5:20 PM	7.5	8	7	8:00	8:10	+2%	9:00	9:26	+5%	-5%

Source: WSDOT Eastern Region Traffic Office.

*The travel time data collection by PeMS began in December 2004. Baseline travel time data will be based on the reliable data collected after March 2005 for 12-month period.

2011-2030 Highway System Plan update under way to address mobility needs on the state highway system

WSDOT is currently in the process of developing the 2011-2030 update of the Washington State Highway System Plan (HSP). The HSP is the state highway component of the Washington State Multimodal Transportation Plan. The HSP is updated every two years and serves as the basis for the six-year highway program and the two-year biennial budget request to the State Legislature. To meet the Legislature's goals for transportation, the HSP encompasses the following elements: Maintenance, Traffic Operations, Preservation and Improvement Programs. WSDOT's goal is to create a long-range plan that provides decision makers with the most cost-effective strategies that provide the highest benefit at the lowest cost. This is accomplished through a continual system-wide performance measuring and monitoring program, where WSDOT collects and analyzes data to determine current and future performance of the highway system.

This update of the HSP will address each of the following elements as follows:

- Description of the issues;
- Identification of needs and performance criteria;
- Strategies to address identified needs;
- Performance measures to determine the effectiveness of the identified strategies.

The mobility focus of this update of the Highway System Plan includes the following elements:

Integrate Moving Washington: 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. Moving Washington focuses on improving performance on our State's transportation corridors by: Managing Demand, Operating Efficiently, and Adding Capacity Strategically.

Address Partially Funded Corridors with Unfunded Components: The 2003 and 2005 revenue packages funded a specific list of projects throughout Washington State. Some of these projects will complete portions of larger corridor projects. The unfunded portions or components of these larger corridors projects will be reviewed by WSDOT to confirm that the need still exists based on current mobility criteria.

Address Bottlenecks: Previously identified locations included in the HSP will be reviewed to ensure these locations still meet the performance criteria (locations that currently impact the flow of mainline through-traffic which operate at or below 70 % of the posted speed). WSDOT will review and update the analysis to reflect current conditions and update benefit/cost analysis.

Additional Corridor Analysis: WSDOT has identified locations that currently are or are projected to operate at below 70% of the posted speed in the future. WSDOT will conduct analysis to develop only the most cost-effective alternatives.

Before and After project analyses and the HSP

WSDOT conducts before and after performance analyses for all completed mobility projects. This analysis is based on the performance criteria, the needs identification process, strategies, and the analysis used to develop the HSP.

HOV Lane Performance

The freeway HOV system in the Central Puget Sound region is a network of freeway lanes that are used by travelers who rideshare using carpools, buses, or vanpools. The HOV network enhances the efficiency of the freeway network by facilitating the movement of more travelers in fewer vehicles than the adjacent general-purpose lanes. HOV lanes provide a faster, more reliable, less congested travel option to freeway users. Approximately 225 lane-miles of the planned 320-mile HOV system have been built. More information about the HOV lane system can be found at http://www.wsdot.wa.gov/hov/.

WSDOT monitors two important aspects of HOV lane performance: 1) the number of people traveling via HOV lanes as compared to the general purpose lanes, and 2) travel time and reliability benefits to their users.

HOV lane performance: Person throughput

The WSDOT HOV lane monitoring program tracks volume in the HOV and general purpose lanes at 10 locations around the Central Puget Sound area that are representative of freeway use on all major freeway corridors in the region. Vehicle and person volumes are measured in both directions at each of these locations for both HOV and general purpose lanes during the peak periods.

The change in the number of vehicles in the HOV and GP lanes from 2007 to 2008 varied among the spot locations. Overall, the locations showed a combined net change in peak direction HOV vehicle volume of slightly less than -5%, while the peak direction GP volume showed a combined net change of less than +2%. The results were also mixed for the total (combined GP and HOV) volumes, with year-to-year combined volume change varying from about -4% to +3% at the selected locations; overall, though, there was almost no net change in the combined total vehicle volumes of all the selected locations. These vehicle volumes are only for the spot locations, in contrast to the travel time analysis (pp 20-21) which analyzes the aggregate changes in vehicle-miles traveled (VMT) based on a series of locations along commute routes.

The percentage of vehicles observed using the HOV lane that did not meet the HOV occupancy requirement is relatively low compared to other locations around the country. While HOV compliance varies from location to location in the system, the overall average observed violation rate across all sampling locations during the AM and PM peak periods was slightly less than 3%.

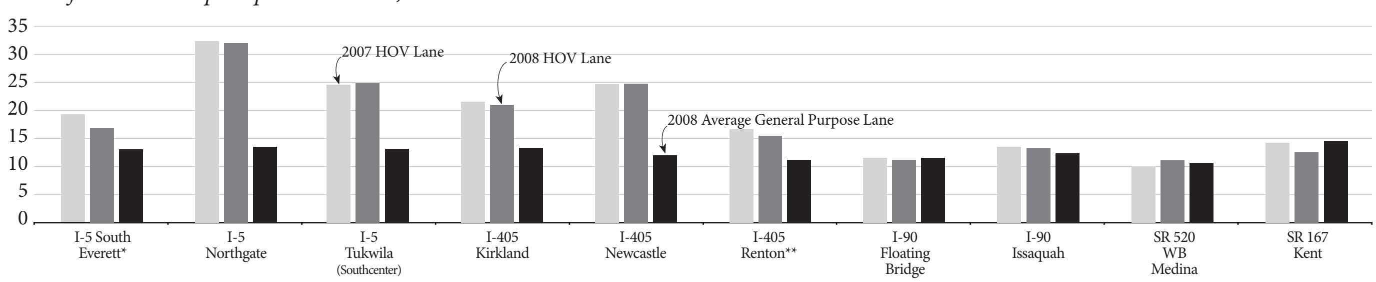
HOV lanes are effective at moving people

HOV lanes provide an incentive for travelers to rideshare via transit, carpool, or vanpool by offering a faster, more reliable travel option. By encouraging ridesharing, HOV lanes are designed to enable the more efficient movement of more people in fewer vehicles. WSDOT analyses have shown that the Seattle-area network of HOV lanes (usually one lane in each direction) generally does a good job at attracting a significant number of ridesharing travelers. At the monitoring locations, the average HOV lane carries about 35% of the people on the freeway in the morning and evening peak periods.

HOV lanes are not equally used throughout the region. The highest HOV lane use occurs where HOV lanes have a time advantage over general purpose lanes or where excellent transit service encourages use of the HOV lanes. I-5 near Northgate is an example of the person moving capability of an HOV lane combined with comprehensive transit service. In the morning peak period the southbound HOV lanes move about 14,100 people, or 43% of the people on that section of I-5, in only 20% of the vehicles. The HOV lane carries an average of 3.5 people in each vehicle, making it nearly three times as effective at moving people as the average general purpose lane next to it.

Comparison of HOV lane and general purpose lane person throughput

Total of AM and PM peak period volumes, In thousands



Data Source: Washington State Transportation Center (TRAC)
Note: Volumes are for peak period directions only.

* In 2007 the monitoring location changed because of construction.
** The monitoring location changed from I-405 Tukwila to I-405 Renton. (Cedar Ave.)

HOV Lane Performance: Person Throughput

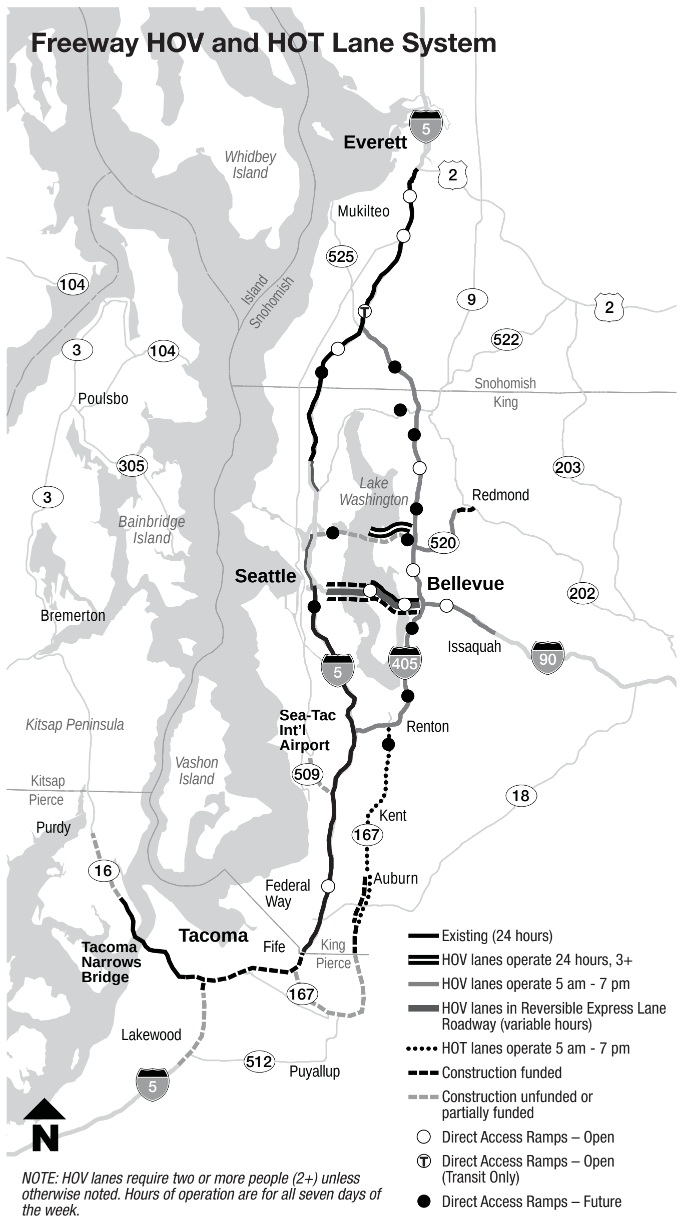
While not all HOV lanes in the region carry such a high percentage of freeway travelers, the overall trend since 2004 has been toward generally increasing HOV lane person volume. In 2008, nearly every monitoring location experienced increasing transit ridership, while changes in overall HOV person volume varied depending on the location, with an average year-to-year change of slightly less than -3%. This change was influenced in part by lower overall vehicle volumes in general that were observed throughout the region during that year. The graph on page 33 shows how HOV lane use compares to general purpose lane use on the major corridors during the peak periods.

HOV lanes continue to carry more people than adjacent general purpose lanes

One of the methods used to track HOV lane performance at the monitoring locations is a comparison of person throughput in the HOV lane with the person throughput of the average adjacent GP lane. Previous *Gray Notebook* reports on HOV lanes (2005 through 2007) noted a trend toward continued progress in that area; the 2005 and 2006 reports noted that at six of the sampling locations, HOV person throughput was exceeding adjacent GP per-lane throughput.

Four monitoring locations, however, had not reached that threshold: the I-90 Floating Bridge, I-90 in Issaquah, SR 520 Westbound at Medina, and SR 167 in Kent. These four locations have all generally experienced growth in HOV person volumes in recent years:

- The I-90 Issaquah location's continued growth enabled it to reach the point where HOV person volume was exceeding adjacent GP per-lane volume in 2007; this continued to be the case in 2008 as well.
- On SR 520 westbound approaching the floating bridge, HOV person volume continued to grow, surpassing the adjacent GP per-lane person volume in 2008. Even though that location experienced a slight drop in HOV vehicle volumes this past year, and the 3+ person occupancy restriction further reduces the number of vehicles eligible to use that HOV lane, a significant growth in transit and vanpool ridership in 2008 contributed to another year of net growth in overall person volume.
- HOV person volumes on SR 167 in Kent surpassed the adjacent GP per-lane levels in 2007; however, in 2008 the HOV person volume dropped back below the corresponding GP level, primarily because of a drop in peak period vehicle volume (possible reasons for this include reduced travel because of regional economic conditions, and effects of construction in and around the HOV lane during its conversion to a HOT lane for the SR 167 HOT Lane pilot project).
- The person volume in the center lanes of the I-90 Floating Bridge location is very close to reaching parity with the adjacent GP lanes; the location is unique among the monitoring locations in that it is a two-lane limited-access HOV/express facility that allows single-occupant vehicles (between Mercer Island and Seattle).



HOV Lane Performance: Reliability

HOV lane performance: Reliability

WSDOT and the Puget Sound Regional Council adopted a performance standard for freeway HOV lanes that states that 90% of the time, the HOV lane should be able to maintain an average speed of 45 mph or greater during the peak hour. Reliability is an important factor for transit and other modes to maintain reliable schedules and time advantages over general purpose lanes. Speed and reliability of the HOV lanes are monitored; results are published annually at http://depts.washington.edu/hov/.

Eight HOV corridors do not meet the performance reliability standard in 2008

The 2008 performance results for the Puget Sound HOV lane system indicate that significant portions of the freeway HOV lane system continue to experience reduced performance during the peak periods. Five of the seven HOV corridors in the peak direction during the evening peak period have high enough traffic volumes that the corridors fail the HOV performance standard, and three of the seven corridors in the peak direction during the morning peak period fail the performance standard. At the same time, there has been a reversal of the general trend toward reduced performance that was seen during the past few years. Each of the nine HOV corridors that did not meet the performance standard in 2007 has experienced improved travel performance reliability in 2008, with five of those corridors returning to travel reliability levels not seen since at least 2005. The performance on one of those corridors, southbound I-405 from Lynnwood to Bellevue during the AM peak, now meets the state standard after being below the standard for several years. The accompanying table illustrates which corridors in the peak direction of travel meet or fail the performance standard during the morning peak period and evening peak period.

Even when HOV corridors do not meet the state performance standard, they continue to provide trip time benefits for freeway travelers. In addition, the state HOV standard is based on performance during the peak hour of the day; during the non-peak periods, performance exceeds the reliability standard.

HOV lane reliability performance on major central Puget Sound corridors

2006 - 2008, based on reliability goal of the HOV lane maintaining a speed of 45 mph for 90% of the peak hour[1]

Numbers represent percent of the peak hour when the 45 mph goal is met.	Did Not Meet the Standard[2]: **x** 2006	2007	2008
Morning peak direction commutes			
I-5, Everett to Seattle SB	35% **x**	35% **x**	60% **x**
I-5, Federal Way to Seattle NB	47% **x**	33% **x**	67% **x**
I-405, Lynnwood to Bellevue SB	70% **x**	76% **x**	92%
I-405, Tukwila to Bellevue NB	49% **x**	31% **x**	49% **x**
I-90, Issaquah to Seattle WB	100%	99%	100%
SR 520, Redmond to Bellevue WB	97%	97%	99%
SR 167, Auburn to Renton NB	99%	96%	99%
Evening peak direction commutes			
I-5, Seattle to Everett NB	54% **x**	51% **x**	64% **x**
I-5, Seattle to Federal Way SB	46% **x**	47% **x**	57% **x**
I-405, Bellevue to Lynnwood NB	69% **x**	53% **x**	58% **x**
I-405, Bellevue to Tukwila SB	44% **x**	30% **x**	35% **x**
I-90, Seattle to Issaquah EB	100%	100%	100%
SR 520, Redmond to Bellevue WB	61% **x**	59% **x**	68% **x**
SR 167, Renton to Auburn SB	93%	91%	98%

Source: Washington State Transportation Center (TRAC).

Data Notes: 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 not detectors at the very beginnings and ends of the HOV lanes.

NB = Northbound; SB = Southbound; EB = Eastbound; WB = Westbound

[1]HOV reliability performance standards are based on the peak hour. Peak hour is the one-hour period during each peak period when average travel time is slowest.

[2]Numbers represent the percentage of the peak hour when speeds are above 45 mph.

*Performance on this corridor was close to the standard; the corridor's failed performance was borderline.

2008 Average HOV travel times beat GP travel times on 38 out of 44 surveyed routes

During the morning peak period, 17 of 23 morning HOV commutes have better average travel times then their GP counterparts. The HOV lane travel time advantage ranged from one to 21 minutes. Four routes had the same travel times for HOV and GP commutes. On 19 of the routes the HOV lanes provided better 95% reliable travel times than the adjacent GP lanes. The HOV reliability advantage ranged from 1 to 30 minutes.

Twenty-one of 25 evening HOV commutes had better average travel times than their GP counterparts. The HOV-travel time advantage ranged from one to 15 minutes. The remaining two routes had the same travel times. Twenty-two of the 25 offered an advantage in reliable travel times ranging from one to 24 minutes.

Six routes offered no HOV benefit in average travel times. These six trips were also on the list last year of trips that did not provide a travel time advantage in the HOV lanes. As noted in the September 30, 2008 *Gray Notebook* (p. 35), all six of these trips fall in to one or more of the following categories: they have an incomplete HOV lane, they run alongside GP lanes that do not experience much congestion, or the HOV lane is not easily accessible for the trip.

HOV Lane Performance: HOV Lane Travel Times for Morning Commutes

These tables show travel times for the 48 HOV routes on 38 Puget Sound commutes, and where necessary, the use of reversible Express Lanes. On four westbound routes that use SR 520, travel times are provided for 2-person and 3+ HOVs, since part of the HOV system on that highway is open only to 3+ person HOVs.

Average travel times on the majority of HOV lanes improved between 2006 and 2008

Of the 48 HOV routes that run parallel to the 38 most congested General Purpose lane routes, 32 show improved average travel times from 2006 to 2008. In the morning commute, improvement ranged from one to three minutes, with the two Everett to Seattle routes experiencing seven to eight minute improvements. These routes are likely benefiting from the addition of ten miles of HOV lanes from I-5 - Everett, SR 526 to US 2 HOV Lanes, a WSDOT congestion relief project.

Evening commute improvements on HOV lanes also ranged between one to three minutes, with one route, Redmond to Seattle 2 person HOV, experiencing an improvement of four minutes.

HOV lane travel time performance compared to general purpose lanes

A.M. peak

		Average Travel Times (minutes)					95% Reliable Travel Times (minutes)				
		HOV Lanes		Change	GP Lanes	Difference	HOV Lanes		Change	GP Lanes	Difference
Commute Route	Peak time	2006	2008	2006 HOV vs. 2008 HOV	2008	2008 HOV vs. 2008 GP	2006	2008	2006 HOV vs. 2008 HOV	2008	2008 HOV vs. 2008 GP
To Seattle											
I-5–Everett to Seattle - Regular HOV lane[2]	7:25	44	36	-8	41	-5	72	52	-20	67	-15
Reversible lanes[2]	7:25	39	32	-7	41	-9	58	47	-11	67	-20
I-5–Federal Way to Seattle	7:30	32	30	-3	39	-9	44	40	-4	58	-18
I-90–Issaquah to Seattle - HOV & GP lanes[1,4]	7:45	17	n/a	n/a	n/a	n/a	23	n/a	n/a	n/a	n/a
HOV & reversible lanes[1]	7:45	16	15	-1	19	-4	19	17	-2	26	-9
SR-520–Redmond to Seattle-2-person[3 (a,b)]	7:50	23	19	-3	21	-2	34	26	-7	29	-3
3+	7:50	18	17	0	21	-4	21	21	0	29	-8
I-5–SeaTac to Seattle	8:35	20	18	-3	25	-7	28	24	-4	40	-16
I-90–Bellevue to Seattle - HOV & GP lanes[1,4]	8:20	11	n/a	n/a	n/a	n/a	16	n/a	n/a	n/a	n/a
HOV & reversible lanes[1]	8:20	10	9	-1	11	-2	11	10	-1	16	-6
SR-520–Bellevue to Seattle - 2-person[3 (a,c)]	7:55	18	16	-2	16	0	25	24	-2	24	0
3+	7:55	13	13	0	16	-3	16	16	0	24	-8
To Bellevue											
I-405–Everett to Bellevue	7:25	31	28	-3	43	-15	49	37	-12	68	-31
I-405–Lynnwood to Bellevue	7:30	22	19	-3	34	-15	33	23	-10	53	-30
I-405–Tukwila to Bellevue	7:50	21	20	-1	41	-21	35	29	-6	59	-30
I-90–Seattle to Bellevue - HOV & GP lanes[1]	8:50	14	13	-1	14	-1	23	22	-1	22	-1
SR-520–Seattle to Bellevue[3 (a,c)]	8:30	22	21	-1	22	-1	33	31	-1	32	-1
I-90–Issaquah to Bellevue	7:50	13	12	-1	16	-4	16	14	-2	23	-9
SR 520–Redmond to Bellevue[3 (b,c)]	7:50	9	9	1	9	0	10	11	1	10	1
To other locations											
I-405–Bellevue to Tukwila	7:40	14	14	0	21	-7	15	14	-1	29	-15
SR 167–Auburn to Renton	7:40	11	10	-1	16	-6	13	12	-1	24	-12
SR 520–Seattle to Redmond[3 (a,b)]	8:30	27	26	-1	26	0	39	36	-3	37	-1
I-90–Seattle to Issaquah - HOV & GP lanes[1, 3 (a,b)]	8:50	18	17	-1	17	0	25	24	-1	25	-1

Source: WSDOT Traffic Operations and the Washington State Transportation Center (TRAC) at the University of Washington.

[1] Trips that are to/from Seattle on I-90 in the general purpose lanes are slightly shorter than those used for the traditional routes. This allows for an apples-to-apples comparison of the GP and HOV lanes on I-90. However, travel times for trips in the GP lanes will not match travel times in the tables on pages 17-18.

[2] The I-5 trips between Everett and Seattle using the reversible lanes are shorter by 0.3 miles than their GP counterparts. No adjustment was made to the travel time calculations.

[3] This HOV lane does not provide travel time benefits over GP lanes because: a) The HOV lane does not run along the entire route; b) There is no congestion in the general purpose lanes on some segments of this route; and/or c) The HOV lane is inconveniently located for use on this commute route.

Note: HOV Trips with the same endpoints as GP lane trips, but differing lengths, do not require any adjustment, since the difference in lengths is the result of HOVs using different roadways than GPs (e.g., an HOV-only interchange ramp).

[4] 2008 data unavailable for these routes. See page 15 for more information.

HOV Lane Performance: HOV Lane Travel Times for Evening Commutes

The travel time benefits of using HOV lanes

For both morning and evening commutes, HOV lanes are generally still providing faster and more reliable travel times, although they offer slightly less advantage than they did in 2006. This is true for both average travel times and reliable travel times. However, this is due largely to the slightly larger improvements in GP travel times, rather than deterioration in HOV lane travel times. The highly congested condition of the GP lanes gave them more room for improvement than the HOV lanes.

On the morning routes, the average travel time improvement on HOV lanes is generally within one to two minutes of the average travel improvement on GP lanes. A few routes in the morning

HOV lane travel time performance compared to general purpose lanes

P.M. peak

Commute Route	Peak time	Average travel times (minutes): HOV Lanes 2006	HOV Lanes 2008	Change 2006 HOV vs. 2008 HOV	GP Lanes 2008	Difference 2008 HOV vs. 2008 GP	95% Reliable travel times (minutes): HOV Lanes 2006	HOV Lanes 2008	Change 2006 HOV vs. 2008 HOV	GP Lanes 2008	Difference 2008 HOV vs. 2008 GP
From Seattle											
I-5–Seattle to Everett - Regular HOV lanes [2]	4:55 PM	38	36	-2	38	-2	56	52	-4	55	-3
Reversible lanes [2]	4:55 PM	33	31	-2	38	-7	49	41	-8	55	-14
I-5–Seattle to Federal Way	4:10 PM	33	30	-3	34	-4	51	46	-5	50	-4
I-5–Seattle to SeaTac	4:10 PM	18	18	1	19	-1	27	27	0	29	-2
I-90–Seattle to Bellevue - HOV & GP lanes[1, 3(a)]	5:30 PM	15	12	-3	12	0	23	19	-4	20	-1
HOV & reversible lanes[1]	5:30 PM	10	10	0	12	-2	11	10	-1	20	-10
SR-520–Seattle to Bellevue[3 (a,c)]	5:35 PM	21	19	-2	19	0	32	30	-2	30	0
SR 520–Seattle to Redmond	5:35 PM	28	26	-1	29	-3	40	37	-3	41	-4
I-90–Seattle to Issaquah - HOV & GP lanes[1]	5:35 PM	20	17	-3	18	-1	28	25	-3	26	-1
HOV & reversible lanes[1]	5:35 PM	14	14	0	18	-4	15	15	0	26	-11
From Bellevue											
I-405–Bellevue to Everett	5:25 PM	32	30	-2	40	-10	49	41	-8	53	-12
I-405–Bellevue to Lynnwood	5:25 PM	22	22	1	32	-10	30	31	1	45	-14
I-405–Bellevue to Tukwila	3:55 PM	20	20	0	35	-15	28	28	1	52	-24
I-90–Bellevue to Seattle - HOV & GP lanes[1,4]	5:20 PM	17	n/a	n/a	n/a	n/a	24	n/a	n/a	n/a	n/a
SR-520–Bellevue to Seattle - 2 person[3(a,c)]	5:20 PM	26	24	-1	25	-1	36	31	-5	33	-2
3+	5:20 PM	17	16	-1	25	-9	22	21	-1	33	-12
I-90–Bellevue to Issaquah	5:30 PM	15	14	-1	17	-3	20	19	-1	23	-4
SR 520–Bellevue to Redmond	5:35 PM	13	13	0	15	-2	16	18	2	24	-6
To Other Locations											
I-5–SeaTac to Seattle	5:20 PM	17	17	0	20	-3	23	22	-1	30	-8
I-5–Everett to Seattle - Regular HOV lane [2]	3:35 PM	38	37	-1	39	-2	52	55	3	60	-5
I-405–Tukwila to Bellevue	5:15 PM	14	15	1	20	-5	15	17	2	28	-11
SR 167–Renton to Auburn	3:50 PM	12	11	-1	16	-5	16	15	-2	26	-11
SR-520–Redmond to Seattle - 2 person	5:25 PM	36	32	-4	33	-1	57	51	-6	52	-1
3+	5:25 PM	24	22	-1	33	-11	39	35	-3	52	-17
I-90–Issaquah to Seattle - HOV & GP lanes[1,4]	5:20 PM	18	n/a	n/a	n/a	n/a	23	n/a	n/a	n/a	n/a

Source: WSDOT Traffic Operations and the Washington State Transportation Center (TRAC) at the University of Washington.
1 Trips that are to/from Seattle on I-90 in the general purpose lanes are slightly shorter than those used for the traditional routes. This allows for an apples-to-apples comparison of the GP and HOV lanes on I-90. However, travel times for trips in the GP lanes will not match travel times in the tables on pages 17-18.
2 The I-5 trips between Everett and Seattle using the reversible lanes are shorter by 0.3 miles than their GP counterparts. No adjustment was made to the travel time calculations.
3 This HOV lane does not provide travel time benefits over GP lanes because: a) The HOV lane does not run along the entire route; b) There is no congestion in the general purpose lanes on some segments of this route; and/or c) The HOV lane is inconveniently located for use on this commute route.
Note: HOV Trips with the same endpoints as GP lane trips, but differing lengths, do not require any adjustment, since the difference in lengths is the result of HOVs using different roadways than GPs (e.g., an HOV-only interchange ramp).
4 2008 data unavailable for these routes. See page 15 for more information.

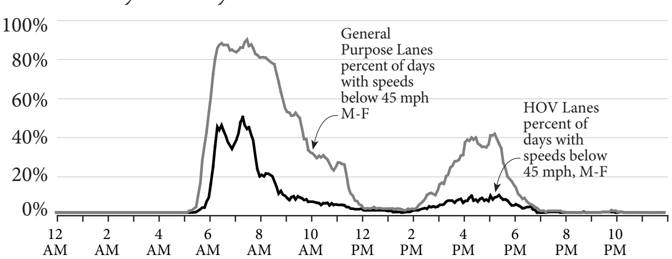
HOV Lane Performance: HOV Lane vs. GP Lane Travel Times

commute period had noticeably bigger improvement in GP travel times. The general purpose lanes on the *Lynnwood to Bellevue morning commute* and the *Everett to Bellevue morning commute* both achieved greater benefits from the Kirkland Stage 1 Nickel Project than their HOV lane counterpart routes, and the *Federal Way to Seattle morning commute* also experienced a more dramatic decrease in travel time on general purpose lanes than on the HOV lane. The comparison of travel time reliability shows mixed results; sometimes reliability improved more on the GP lanes, sometimes it improved more on the HOV lanes. In many cases the improvement in reliability was similar, often within one to two minutes.

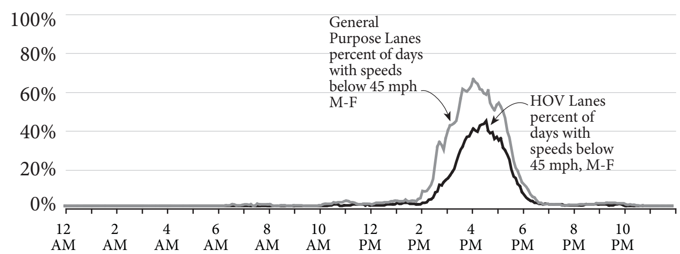
Evening commutes showed even or slightly larger improvements in average GP lane travel times compared with average HOV travel times. The change was usually between one to three minutes. Travel time reliability for the evening commutes showed improvement for both the HOV and GP lanes, though reliability tended to improve more for the GP lanes.

Note: The graphs below show the existing HOV lane system's performance versus the performance of the adjacent general purpose (GP) lanes for selected Puget Sound commutes. The line graphs represent the percent of days when average vehicle speeds fell below 45 mph (the HOV lane reliability performance standard), throughout the course of the day. The dark line represents the HOV lanes, while the gray line represents the general purpose lanes.

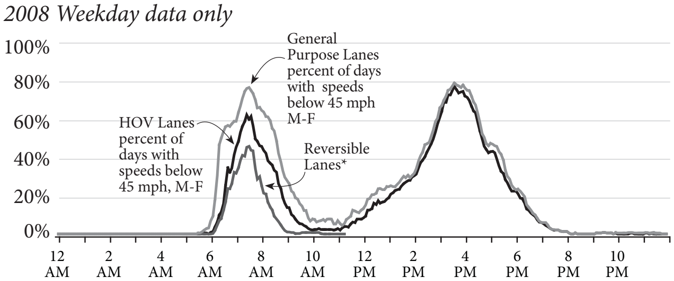
I-5 Federal Way to Seattle
2008 Weekday data only



I-5 Seattle to Federal Way
2008 Weekday data only

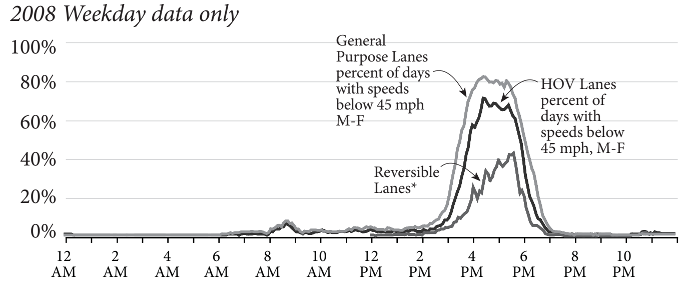


I-5 Everett to Seattle
2008 Weekday data only



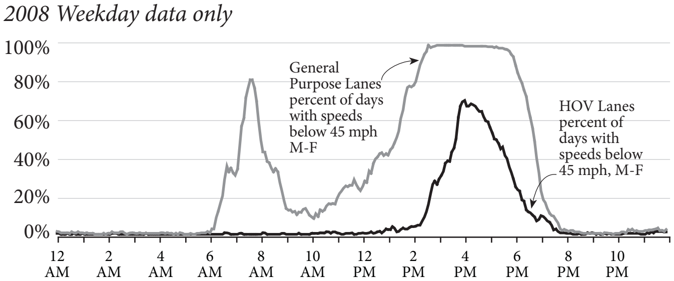
* Monday-Friday Hours of Operation: Southbound - 5 am to 11:15 am; Northbound - Noon to 11 pm; Closed - 11 pm to 5 am.

I-5 Seattle to Everett
2008 Weekday data only

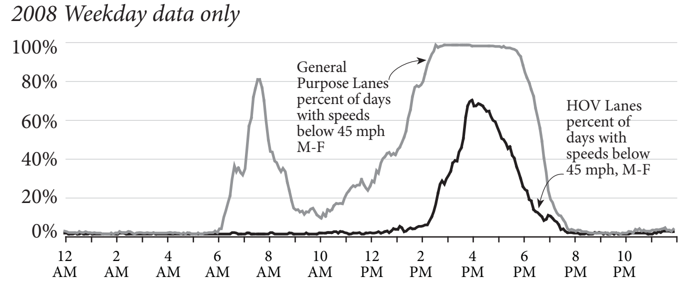


* Monday-Friday Hours of Operation: Southbound - 5 am to 11:15 am; Northbound - Noon to 11 pm; Closed - 11 pm to 5 am.

I-405 Bellevue to Tukwila
2008 Weekday data only



I-405 Bellevue to Tukwila
2008 Weekday data only



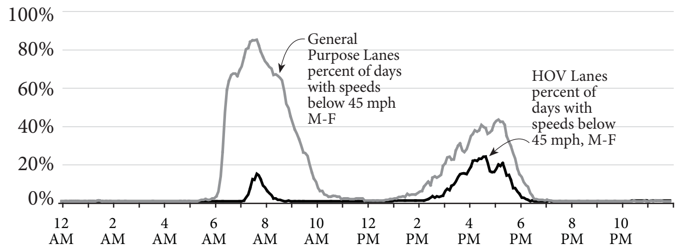
Data Source: WSDOT Traffic Office

HOV Lane Performance: HOV Lane vs. GP Lane Travel Times

Note: The graphs below show the existing HOV lane system's performance versus the performance of the adjacent general purpose (GP) lanes for selected Puget Sound commutes. The line graphs represent the percent of days when average vehicle speeds fell below 45 mph (the HOV lane reliability performance standard), throughout the course of the day. The dark line represents the HOV lanes, while the gray line represents the general purpose lanes.

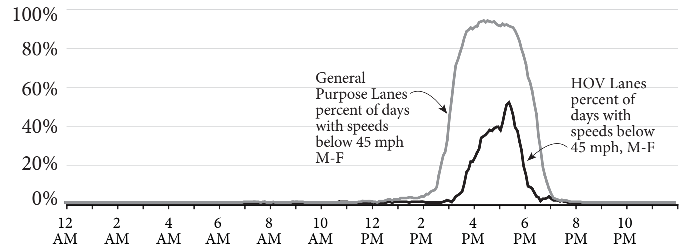
I-405 Lynnwood to Bellevue

2008 Weekday data only



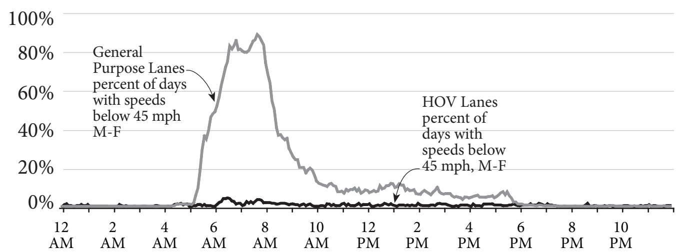
I-405 Bellevue to Lynnwood

2008 Weekday data only



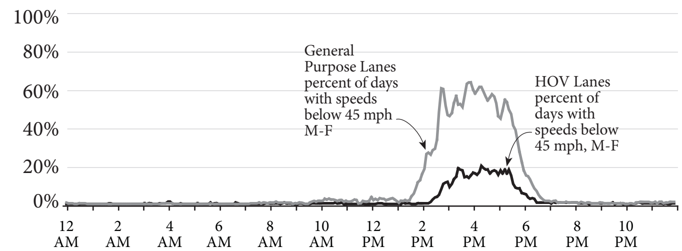
SR 167 Auburn to Renton

2008 Weekday data only



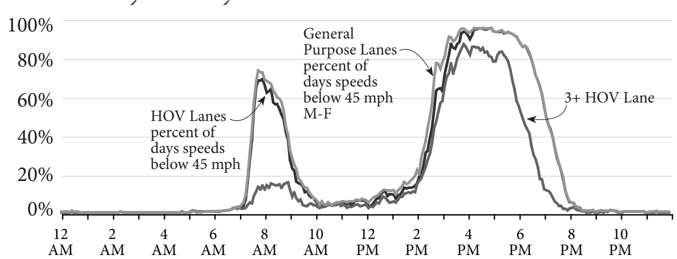
SR 167 Renton to Auburn

2008 Weekday data only



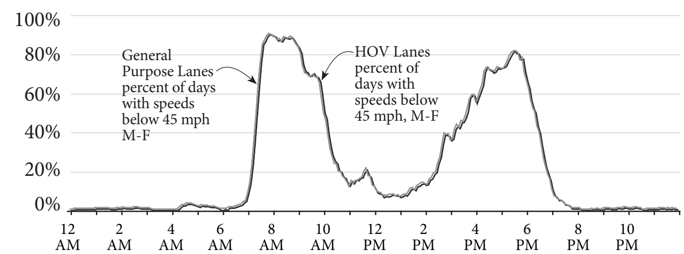
I-405/SR 520/I-5 Bellevue to Seattle

2008 Weekday data only



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

2008 Weekday data only

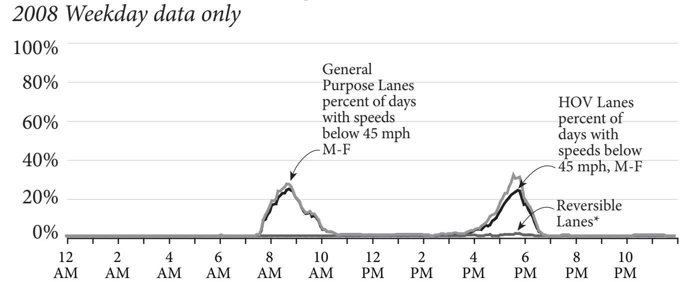


Note: The GP and HOV routes track each other nearly perfectly in this graph.

I-90/I-5 Issaquah to Seattle data unavailable for 2008 (see p. 15)

I-5/I-90 Seattle to Issaquah

2008 Weekday data only



* Monday-Friday Hours of Operation: Westbound - 1am to 12:30 pm; Eastbound - 2 pm to Midnight.

Data Source: WSDOT Traffic Office

What WSDOT is doing to fight congestion: Add Capacity Strategically

WSDOT's program for addressing congestion is *Moving Washington*—a three part strategy comprised of adding highway capacity strategically, operating the system more efficiently, and managing demand. WSDOT performs before and after studies to assess the effectiveness of *Moving Washington* projects and strategies in reducing congestion and to report their impacts to the public. Governor Gregoire challenged WSDOT to broaden its reporting of Nickel and TPA project outcomes important to Washington citizens, specifically, measuring the results from the driver's perspective for each completed project. This includes measuring congestion benefits.

Moving Washington: Add Capacity Strategically

As our state continues to grow, it is necessary to develop additional traffic capacity. 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.

Delivering congestion relief on state highways: Benefits of the 2003 and 2005 funding packages

Highway mobility projects funded by the 2003 and 2005 transportation funding packages include 133 projects statewide, of which 46 have been completed as of September 30, 2009. These completed projects carry a value of $1.15 billion.

These projects are having an impact: a study of 15 completed Nickel and TPA projects statewide resulted in a 15% improvement in combined peak period travel times through these segments after construction was completed. These projects showed a 7 mph average improvement in travel speeds during peak periods with travel times through the project segments improving by up to 2.5 minutes. The improvements occurred despite the fact that volumes increased by 14% on these segments. These 15 projects, shown in the table below, do not include all completed mobility projects, but are limited to those with the data needed to perform the analysis.

Before and After results of 15 selected Nickel and TPA funded projects*

Data for peak direction and period for given segments

		Speed (MPH)			Travel Time Per Vehicle (Minutes)			Vehicle Volume		
	Length (Miles)	Before	After	% Faster	Before	After	Time Saved	Before	After	% More Vehicles
SR 161/204th St to 176th St - Widen Roadway	2.03	36	42	17%	3.38	2.90	0.48	800	1,080	35%
SR 16/36th St to Olympic Dr NW - Add HOV Lanes	1.24	41	43	5%	1.81	1.73	0.08	3,450	4,100	19%
SR 270/Pullman to Idaho State Line - Add Lanes	6.20	40	53	33%	9.30	7.02	2.28	840	870	4%
SR 161/234th St to 204th St E - Add Lanes	2.32	36	43	19%	3.87	3.24	0.63	800	1,080	35%
SR 161/Jovita Blvd to S 360th St, Stage 2 - Add Lanes	1.94	26	41	58%	4.48	2.84	1.64	1,240	1,160	-6%
SR 9/228th St SE to SR 524, Stage 2 - Add Lanes	1.00	29	40	38%	2.07	1.50	0.57	1,060	1,250	18%
SR 16/I-5 to Tacoma Narrows Bridge - Add HOV Lanes	5.00	41	42	2%	7.32	7.14	0.17	3,400	4,160	22%
SR 3/SR 303 Interchange - Construct Ramp	3.73	45	45	0%	5.00	4.00	1.00	3,742	4,734	27%
SR 240/Richland Y to Columbia Center I/C - Add Lanes	3.63	41	49	20%	5.31	4.44	0.87	2,970	3,030	2%
US 12/Attalia Vicinity - Add Lanes	4.82	47	55	17%	6.15	5.26	0.90	450	460	2%
I-5/Lexington Vicinity - Construct New Bridge	0.07	23	42	83%	0.18	0.10	0.08	N/A	N/A	N/A
SR 527/132nd St SE to 112th St SE - Add Lanes	1.47	46	47	2%	1.92	1.88	0.04	840	860	2%
I-405/SR 520 to SR 522 - Widening	9.00	39	41	5%	13.85	13.17	0.68	7,170	7,940	11%
SR 24/I-82 to Keys Rd - Add Lanes	1.53	41	53	29%	2.24	1.73	0.51	730	740	1%
SR 17/Pioneer Way to Stratford Rd - Add Lanes	10.61	38	45	18%	16.75	14.15	2.61	660	660	0%

Source: WSDOT Transportation Data Office

* Note: Volume information is based on traffic counts and speed information is based on modelled data.

What WSDOT is doing to fight congestion: Add Capacity Strategically

I-5/SR 502 interchange project in Clark Co. improves commute times during peak periods

This project constructed a new I-5 interchange at SR 502 in north Clark County providing a more direct connection from I-5 to SR 502 and the city of Battle Ground. Prior to construction, vehicles exiting from NB I-5 were backing up on the NB off ramp of the NE 179th Street interchange, and causing afternoon congestion.

The main purpose of this before-and-after project study was to measure travel time improvement during a typical weekday commute—from Battle Ground to Vancouver in the morning (6 AM-10 AM) and the reverse of the trip home in the afternoon (2 PM-6 PM). Travel time data was collected in two segments. The first segment was from the intersection of NE 10th Ave/SR 502 via interchanges onto I-5 to the I-5/I-205 interchange. The second segment was on SR 502 between the intersection of NE 10th Ave and the intersection of NW 20th Ave—the route connects the new interchange to the City of Battle Ground (Refer to the map to the right).

By using automated license plate reader (ALPR) technology, travel time data was collected prior to the start of construction (November 2007), and one month after the construction (November 2008). Traffic volume data was collected along with travel time data. In order to verify any change in the use of the new interchange, follow-up traffic volume data were collected seven months later at selected locations. It should be noted that some intersection changes at NE 10th Ave had been made previous to our data collection. Comparing previous years of traffic volume data we did not notice any change in volume due to the intersection changes.

Project improves morning peak travel time by 7 minutes on the I-5 mainline

Traffic Volume: The major change to I-5 mainline was the shift of traffic from the existing NE 179th St. interchange to the new SR 502 interchange located 2-miles north. An increase in the peak period volume (four-hour AM and four-hour PM) was also measured, increasing the southbound I-5 morning four-hour volume by 600 vehicles and the northbound I-5 afternoon four-hour volume by 460 vehicles.

Travel time and volume changes for the I-5/SR-502 interchange project

Southbound Morning Commute: 6 AM - 10 AM – From: Intersection of SR-502 and NE 10th Ave. To: I-5 MP 7 (I-5/I-205 Interchange)

Volume[1] (Peak period)			Commute length (Miles)		Travel times[2] (minutes)		Average speed[3] (MPH)	
Before	1 Month After	7 Months After	Before	After	Before	After	Before	After
1,650	2,460	2,510	3.92	5.00	12	5	19.4	54.9

Northbound Afternoon Commute: 2 PM - 6 PM – From: I-5 MP 7 (I-5/I-205 Interchange). To: Intersection of SR-502 and NE 10th Ave.

Volume[1] (Peak period)			Commute length (Miles)		Travel times[2] (minutes)		Average speed[3] (MPH)	
Before	1 Month After	7 Months After	Before	After	Before	After	Before	After
1,700	2,790	2,740	3.81	4.20	7	5	32.4	52.3

Source: WSDOT Transportation Data Office

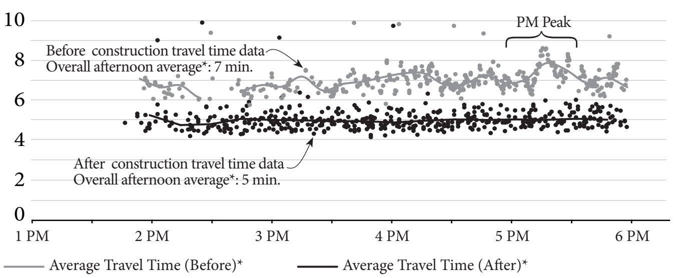
Note: Project was completed and opened to public on October 15, 2008. "After" project travel time and initial volume data were collected one month later, and seven months later, following project completion.
1 Volumes are measured at location on SR-502 east of NE 10th Ave.
2 Travel Times are overall median travel time in minutes for the specified period.
3 Average Speed is a calculated speed (MPH) based on the median travel time and the distance.

What WSDOT is doing to fight congestion: Add Capacity Strategically

Travel times: From the SR 502/NE 10th Ave intersection via I-5 to the I-5/I-205 interchange the southbound morning commute route length was 3.92 miles before construction using the NE 179th Street interchange and 5.00 miles after construction using the new SR 502 interchange. For the afternoon northbound commute (the reverse of the morning route), the route length was 3.81 mile long before construction and 4.20 miles after construction. Before the project, the morning commute took 12 minutes with an average speed of 19 mph to travel this route. After construction using the new interchange it only took 5 minutes with an average speed of 55 mph. In the afternoon before construction it took 7 minutes with an average speed of 32 mph and 5 minutes with an average speed of 52 mph after construction.

I-5/I-205 change in travel times: afternoon commute
From I-5 at I-205 Interchange to SR 502 at NE 10th Ave.

November 2007 (Before) Compared with November 2008 (After)
Route Length: 3.81 miles (Before) and 4.20 miles (After)
Travel time in minutes



* Average (or typical) Travel Times are defined at the 50th percentile of all individual vehicle travel time data within the valid data range.
Data Source: WSDOT Transportation Data Office.

Peak and Duration of Congestion: Before the construction, there were peak congestion times—e.g., after 5 pm in the afternoon (see chart above for the PM-northbound commute). After the construction, the data did not show any visible peaks in either direction, indicating travel times should have become more consistent (reliable)—closer to the expected (or average) travel time of 5 minutes in both morning and afternoon hours.

Eliminating the need to travel on 2-miles of local travel to and from NE 179th Street through traffic signals resulted in significant savings to travel times with increased reliability for the route, despite the fact that the physical route length had become slightly longer through new on- and off-ramps at the new interchange. Another contributor to the improved travel time was the intersection improvement of SR 502 at NE 10th Ave from 2-lane to 4-lanes to avoid backup at this intersection toward the interchange.

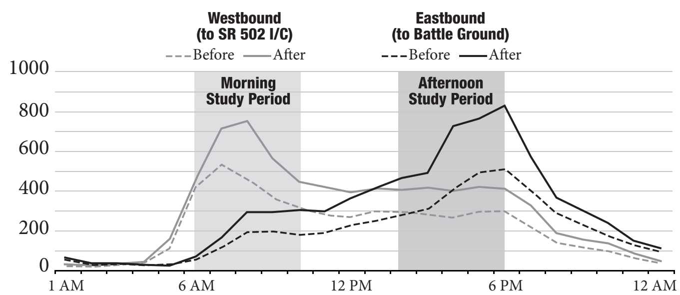
Impact on local route: trip from the SR 502 to Battle Ground sees increased demand due to new interchange

Often one of the impacts of capacity improvement projects is that it creates greater demand on other roadways near the improvement. That is why WSDOT carefully plans improvements to correct such issues, although the high cost of such improvements means they will often be completed in phases, rather than completed at the same time. Increased traffic volume for this local route from the new interchange was anticipated, and widening of the existing 2-lane road to 4-lanes was already planned as a second phase, following the new interchange construction.

The new interchange appears to have affected commuters route choice. At the SR 502/NE 10th Ave intersection the morning westbound four-hour peak period volume increased by 49% (1,650 to 2,460 vehicles), while the afternoon eastbound four-hour peak period volume increased by 64% (from 1,700 to 2,790).

Change in hourly traffic volume at intersection of SR 502 at NE 10th Ave. (West Leg)
By direction of travel and time of day

Before and after the construction; November 2007 vs. November 2008
Traffic volume (number of vehicles)



Data Source: WSDOT Transportation Data Office.

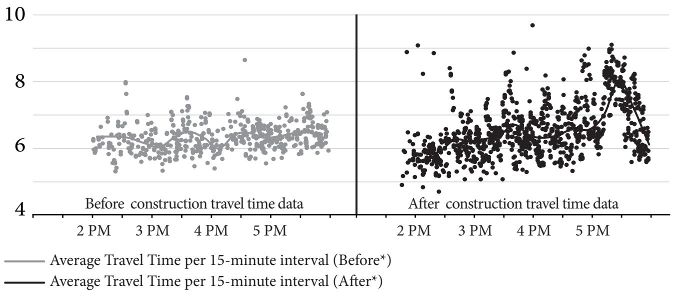
Travel Time: As a result of the increased demand for this route, heading back home toward Battle Ground on SR 502 has become more of a challenge. Data plots of travel times before and after (on the next page) show that change in the volume has created congestion that did not exist before. Before the new interchange, travel time for this route was consistently about 6.4 minutes throughout afternoon hours. After the construction, average travel time is still around 6.5 minutes for the most of the afternoon, except a slow down now occurs after 5 PM with an average travel time that slows to 8 minutes at its peak.

The result of this study (for the route between SR 502 and Battle Ground) will be used as a baseline measure when the widening project starts in 2012 to evaluate how this condition will be improved.

What WSDOT is doing to fight congestion: Add Capacity Strategically

Change in travel times: afternoon commute from SR 502 (at NE 10th Ave.) to Battle Ground (at NE 112th Ave.)

November 2007 (Before) Compared with November 2008 (After)
Route Length: 4.42 miles
Travel time in minutes



* Average (or typical) Travel Times are defined at the 50th percentile of all individual vehicle travel time data within the valid data range.
Data Source: WSDOT Transportation Data Office.

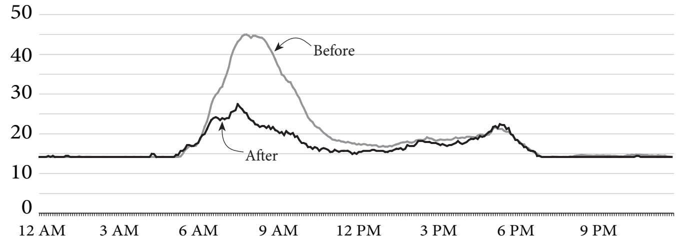
I-405 South Bellevue widening project improves travel times substantially during the morning peak period

The I-405 South Bellevue Widening Project, also known as the 112th Avenue SE to SE 8th Street Project, helps relieve congestion at one of the worst I-405 bottlenecks, the drive in and out of Bellevue. Construction began in July 2007 to add a northbound lane from 112th Ave SE to I-90 and add a lane in both directions from I-90 to SE 8th St. This project also includes widening the existing bridge over Coal Creek Pkwy in the northbound direction, widening the bridge over SE 8th in the southbound direction and removing the Wilburton Tunnel. The southern section was opened in January 2009 and the northern section was completed in September 2009.

The new northbound auxiliary lane from 112th Ave SE to I-90 was opened to traffic on January 16, 2009. The graph to the upper right shows the average travel time on weekdays (Tuesday-Thursday) from Tukwila to Bellevue before and after the phase was completed.

I-405 widening project: Before and After Tukwila to Bellevue average commute times

Time in minutes, Tuesday-Thursday



Data Source: WSDOT Northwest Region.

The peak morning commute in 2008 was 45 minutes from 7:30 AM-8:30 AM. After the new lane was opened to traffic, that peak morning commute was reduced to less than 30 minutes.

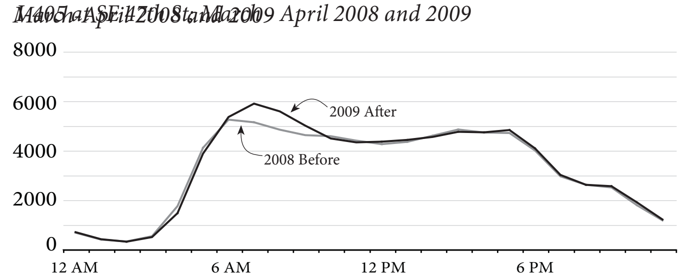
The new lane changed the number of lanes between 112th Ave SE and Coal Creek Parkway from three to four and from Coal Creek Parkway to I-90 from four to five lanes. The increase in the number of lanes resulted in an increase of capacity.

Before the new lane was opened, hourly volume during the morning peak reached just over 5,000 vehicles. When congestion built up, vehicle speeds slowed resulting in lower throughput for the rest of the morning. The new lane alleviated congestion at the bottleneck resulting in an increase in throughput of about 1600 vehicles during the peak period. The graph below shows the average hourly volume (Tuesday-Thursday) before and after the project was completed.

Along this 1.95 mile corridor there is an average collision rate of 53 collisions per year, with 25% of them occurring on weekdays between 6:00 AM and 10:00 AM The additional lane decreases congestion which should help to decrease the number of collisions in the future.

I-405 Before and After comparison of volumes

I-405 at SE 47th St, March April 2008 and 2009



Data Source: WSDOT Northwest Region.

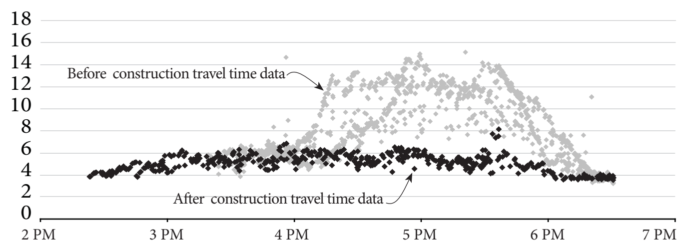
Measuring Delay and Congestion Annual Report

What WSDOT is doing to fight congestion: Operate Efficiently

Moving Washington: Operate Efficiently

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 our roads safer will go a long way toward easing 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 and integrated traffic signals.

Travel times improve on NB I-5 in Everett as a result of hard shoulder running and ramp metering
Individual vehicle travel times scatter plots
Afternoon commute: NB I-5 at 41st St to the US 2/SR 204 interchange
Travel time, in minutes



Data Source: WSDOT Northwest Region.

Hard shoulder running and ramp metering low cost enhancements prove highly effective on I-5 to US 2 in Everett

Two low cost enhancement projects intended to reduce congestion and improve traffic flow on I-5 through Everett and across the US 2 trestle were recently completed. WSDOT installed ramp meters on northbound and southbound I-5 as part of the Everett HOV project, and the ramp meters were activated on March 2, 2009. WSDOT also added signs and re-striped the US 2 trestle to allow shoulder use during the evening peak beginning April 6, 2009. The project cost was under $100,000.

Nine ramp meters were added to the on ramps on northbound and southbound I-5 between SR 526 and US 2. Ramp meters have been shown to decrease travel time and congestion by breaking up platoons of traffic entering the freeway.

Morning and evening peak southbound traffic congestion is not heavy enough to require ramp meter activation. Southbound ramp meters will be activated only in extreme conditions. However, in the northbound direction, congestion begins at about 2:00 p.m. The northbound ramp meters are activated daily along the corridor.

The eastbound US 2 section became the first peak period shoulder lane in Washington state when opened in 2009. The roadway was re-striped from two 12-foot lanes and a 10-foot shoulder to two 11-foot lanes and a 14-foot shoulder, with the left side shoulder changing from four feet to two feet. The 1.5 mile long corridor allows vehicles to use the shoulder lane between 3:00 PM and 7:00 PM, Monday-Friday.

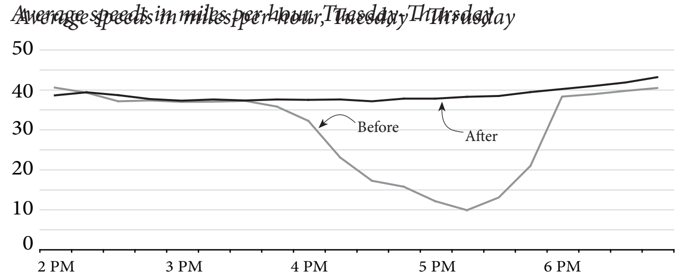
The opening of these two projects has significantly reduced congestion on northbound I-5 and eastbound US 2. During the evening peak hour, these projects have reduced travel times by six minutes, a reduction of greater than 50%. The graph above shows before and after travel time results from the peak period shoulder project at the I-5 at the 41st Street on-ramp to the US 2/SR 204 interchange.

Prior to the improvements, the travel time along this 3.3 mile corridor reached up to 15 minutes with an average of 11 minutes during the peak hour (4:30 - 5:30 PM). After the projects were complete, most trips were less than seven minutes, with an average of five minutes during the peak hour.

Another illustration of the benefit is the improvement of speeds on the exit ramp from northbound I-5 to US 2. The graph below shows the change in speed on the ramp between 2:00 PM and 7:00 PM.

The free-flow speed on the ramp is about 42 mph, as dictated by the curvature of the ramp. The average speed after the projects were complete was very close to free flow for the entire evening peak period. Before the projects were in place, speeds were low from 3:30 p.m. until about 6:00 p.m., reaching a low of 10 mph.

Before and After speed comparison at NB I-5 exit to US 2
Average speeds in miles per hour, Tuesday - Thursday



Data Source: WSDOT Northwest Region.

What WSDOT is doing to fight congestion: Operate Efficiently

The corridor from SR 526 on I-5 to US 2/SR 204 is 6.92 miles long and has seen an average of 331 collisions per year since 2006. Forty-six percent (46%) of the collisions occurred during the evening peak on weekdays between 2:00 p.m. and 7:00 p.m., with 96% of those being rear-end collisions and sideswipes. With the decrease in congestion, the number of collisions should also decrease along the corridor in the future.

The combination of the I-5 ramp meters and the US 2 peak period shoulder project helped improve congestion and travel time through Everett during the evening peak.

SR 167 High Occupancy Tolling lanes show substantial benefits one year into the pilot project

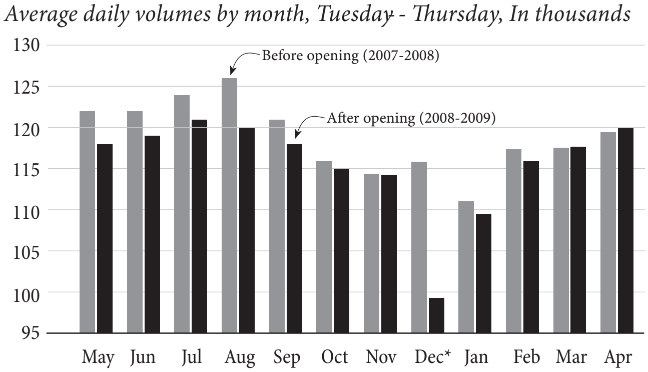
In the first year of the pilot project, the High Occupancy Tolling (HOT) lanes made SR 167 smarter and more efficient by opening road space that went under-used as an HOV lane even when the general purpose (GP) lanes were heavily congested. The HOT lane effectively manages the flow of additional traffic into the carpool lane when space is available. The system preserves free-flowing traffic conditions for carpools and buses at virtually all times, and smooths traffic flow through the entire corridor.

Volumes on the HOT lanes

Average daily traffic volumes on SR 167 declined roughly 2% in the first year of HOT lanes operations (excluding December 2008 snow-related effects). Contributing factors to this decline likely included rising gas prices, the economic downturn, and an increase in transit ridership. Declining roadway volumes are consistent with regional and national trends, however traffic volumes in April 2009 returned to April 2008 levels. The drop in December traffic volumes (and tolled trips) is likely due to reduced travel associated with multiple year-end storms.

Comparison of average daily volumes on the SR 167 HOT Lanes before and after opening

Average daily volumes by month, Tuesday - Thursday, In thousands



Data Source: WSDOT Toll Division.

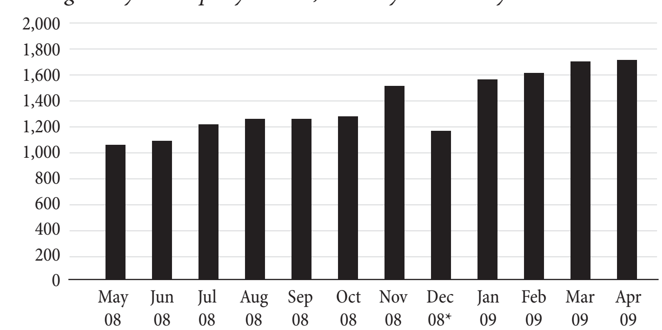
* The drop in December traffic volumes (and tolled trips) is likely due to reduced travel associated with multiple year-end storms.

Number of tolled trips on the SR 167 HOT Lanes continue to increase

Aside from the snow events during December 2008, the number of tolled trips continues to increase from month to month. During the northbound peak-hour (7 am – 8 am), the average number of tolled trips increased from 140 in May 2008 to 270 in April 2009, an increase of nearly 90%. The number of tolled trips in the southbound direction during the peak-hour increased by almost 60% during the afternoon peak-hour (4 pm – 5 pm).

Average daily tolled trips on SR 167 HOT lanes

Average daily toll trips by month, Tuesday - Thrusday



Data Source: WSDOT Toll Division.

* Drop in December 2008 related to a series of severe weather events.

Speeds remain above legislative goal

The enabling authorization passed by the Legislature requires that the HOT lane maintain average traffic speeds during the peak-hours (7 am–8 am and 4 pm–5 pm) of at least 45 mph, 90% of the time. The SR 167 HOT lanes exceeded this requirement, achieving the required speed 99.2% of the time.

HOT lane travel times

The project team measured travel times in the HOT and GP lanes northbound from SR 18 in Auburn to South 34th Street in Renton and southbound from South 34th Street in Auburn to 43rd Street northwest. The HOT lanes are approximately 11 miles northbound and nine miles southbound. Throughout the first year, HOT lane traffic consistently flowed freely during all hours of the day. The northbound peak-hour (7 a.m. – 8 a.m.) travel time was 11 minutes on average. The 95th percentile travel time (a reliability measure) was 11 minutes as well. The two travel time measures indicate that the HOT lanes successfully delivered reliable travel times and maintained traffic speeds, even on some of the most congested days.

Measuring Delay and Congestion Annual Report

What WSDOT is doing to fight congestion: Operate Efficiently

HOT lane time savings: pay a little to save a lot

- The northbound HOT lane provided weekday drivers with an average time savings of **8 minutes** in the peak-hour for an average toll of $1.
- The weekday southbound HOT lane provided drivers with an average savings of **4 minutes** during the peak-hour for an average toll of $1.

Travel time results are similar during the southbound peak-hour (4 p.m. – 5 p.m.); the HOT lane travel time was eight minutes, with the 95% reliable travel time at eight minutes as well. Again, the equivalent travel time measures confirm that the HOT lanes successfully delivered reliable travel times and maintained traffic speeds, despite the bottleneck caused by the lane drop at the south end of the southbound HOT lane.

General purpose lane travel times

The average weekday northbound peak-hour travel time was 19 minutes, and a 95th percentile travel time of 26 minutes. The average weekday southbound peak-hour travel time was 12 minutes. The 95th percentile travel time southbound was 19 minutes.

The SR 167 HOT lanes will have posted tolls that range from 50¢ to $9; in the first year, the average toll paid was 96¢. In both June and July 2008, the maximum toll rate of $9 was posted for the first time. The dynamic-pricing algorithm used for determining the toll level was not incorrect when the HOT lanes hit $9, but it was decided that an adjustment of the algorithm to ensure that it was less sensitive to volume fluctuations, and did correctly account for the volume of carpoolers and buses in the HOV lane was well. In Fall 2008, WSDOT completed the minor refinements to decrease sensitivity, and the algorithm's highest toll posted has been $2.25 in April 2009.

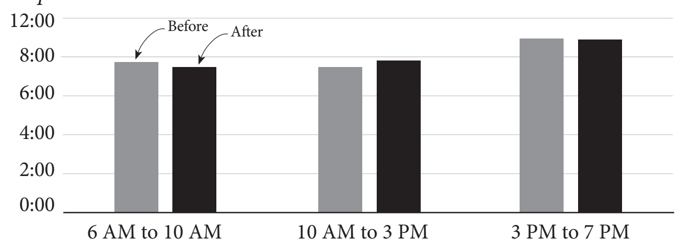
Signal coordination: a low cost improvement that can make a big difference in relieving congestion

Signal coordination is a technique used to move vehicles through a series of signalized intersections in the shortest amount of time by timing the signals to work together so that vehicles make the least number of stops. The following two case studies highlight the benefits of traffic signal coordination:

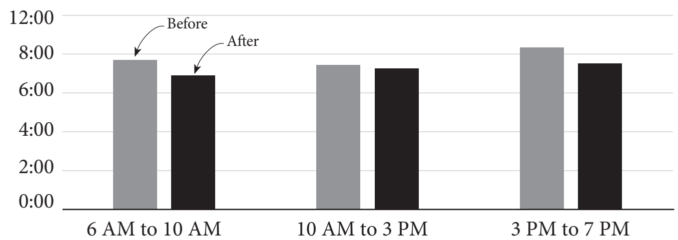
SR 104 between 244th Street Southwest and Northeast 175th Street.

WSDOT retimed nine signals along the SR 104 corridor in June of 2008. After signal coordination was implemented, travel times per vehicle decreased an average of 17 seconds throughout the day, reducing total vehicle delay by approximately 121 hours per day and 44,278 hours per year.

Westbound SR 104 Before and After coordination
Trip time in minutes



Eastbound SR 104 Before and After coordination
Trip time in minutes

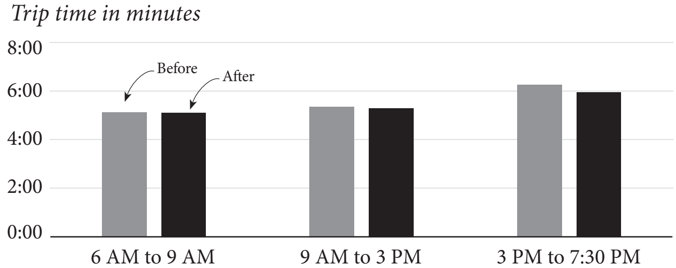


Data Source: WSDOT Traffic Office.

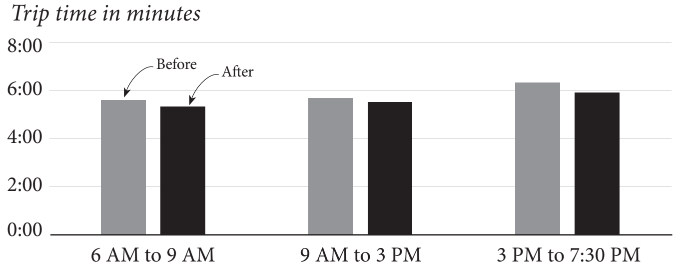
SR 525 between Lincoln Way and Paine Field Blvd.

Signal coordination of seven signals was implemented on SR 525 through Mukilteo in July 2008. Following implementation, travel times per vehicle decreased an average of 12 seconds throughout the day. This has helped reduce total vehicle hours of delay by 130 hours per day and 47,461 hours per year.

Northbound SR 525 Before and After coordination
Trip time in minutes



Southbound SR 525 Before and After coordination
Trip time in minutes



Data Source: WSDOT Traffic Office.

What WSDOT is doing to fight congestion: Operate Efficiently
Intelligent Transportation Systems/Smarter Highways

As a nationwide leader in implementing new traffic technology, WSDOT is making our roadways work as efficiently as possible by using new tools to reduce collisions and smooth-out traffic flow on the state's busiest routes. WSDOT's high-tech approach to active traffic management is called 'Smarter Highways'.

WSDOT continues to utilize advances in intelligent transportation systems to make Washington's highways smarter

WSDOT already uses several smarter highways tools, such as high-occupancy toll (HOT) lanes and reversible express lanes. Next year, WSDOT will be taking Smarter Highways to a new level, installing and activating a series of informational signs in central Puget Sound to improve highway safety and address congestion-causing collisions. This technology will also play an increasing role as capacity needs are constrained by two future mega projects, the ***SR 99 Alaskan Way Viaduct Replacement*** and the ***SR 520 Floating Bridge Replacement***, which will most likely re-channel existing traffic to nearby corridors such as I-5 and I-90, respectively.

What will smarter highways look like?

Smarter Highways detect changing traffic flows and automatically adapt to mitigate congestion and blockages by adjusting the speed limit. New overhead electronic signs will alert drivers with a lighted 'X' when the lane is closed ahead or will display a lighted decreased speed limit, such as '45,' to slow traffic before it reaches backed up or blocked traffic. Drivers will see varying speeds, alerts, or even blank signs, depending on traffic conditions.

In addition to the variable speed limit signs, each sign bridge will have either two changing message signs (one on each side of the road), or one larger message sign just above the far right lane. The two side signs will alert drivers about the cause of the slowing traffic. Giving drivers advance notice of incidents further ahead on the highway reduces stop-and-go traffic and the number and the severity of collisions associated with congestion.

An artist's rendering of what a 'Smarter Highway' ITS system over I-5 might look like. Signs alert drivers to reduced speeds to maintain traffic flow and which lanes are blocked due to collisions. Visit www.smarterhighways.com for more information.

In addition, new signs on I-5 will also provide travel time information to Seattle and Bellevue, which will allow drivers a better sense of their expected arrival time, as well as allow them to consider other routes for getting to their destination.

Variable speed limits on I-90

This year, WSDOT installed 14 electronic speed limit signs at 9 locations on westbound I-90 from just west of I-405 in Bellevue to Rainier Avenue in Seattle to allow varying speed limits to be displayed. WSDOT expects these signs will increase safety, decrease collisions, and keep traffic moving during construction on westbound I-90 by alerting drivers to reduce their speed when backups or collisions are on the road ahead. WSDOT is studying the effects of the signs and, in the next annual congestion report, will publish results for number of collisions, compliance rate, traffic volume, and travel times.

Dedicated travel time signs allow drivers to make better decisions

Dedicated travel time signs (see image below), give motorists information on how long it will take to reach their destinations from that point. WSDOT will place three signs on I-5, and has plans to place three more signs on I-405, SR 520 and SR 522 in 2010. These new signs free up the existing Variable Message Signs (VMSs), which carry travel time messages, to broadcast other important information such as notifications of accidents and Amber Alerts. The new dedicated message signs are cheaper, and have been placed at strategic decision-making points along the highway, where drivers can choose different routes or modes to continue their journeys.

An example of a dedicated travel time sign.

I-5 smarter highways project will help with SR 99 Alaska Way Viaduct Replacement traffic

Northbound I-5, between Boeing Access Road and I-90, is a habitual congestion chokepoint. Between 2004 and 2009, this 7.3-mile section of road experienced an average of 459 collisions per year: on average, 218 were rear-end collisions or side-swipes during commute hours (weekdays 5 a.m. to 7 p.m.). This segment of I-5 will likely face increased traffic as part of the SR

What WSDOT is doing to fight congestion: Operate Efficiently
Intelligent Transportation Systems/Smarter Highways

99 project. Accommodating the additional volume with advance notice of incidents further ahead will reduce stop-and go-traffic associated with collisions, and the number and the severity of secondary collisions associated with such congestion.

WSDOT will install 15 sign bridges over each lane on northbound I-5 between Boeing Access Road and I-90. After the sign bridges are in place, crews will start installing electronic signs that will be activated in the summer of 2010. Crews will also perform extensive upgrading on existing ITS, including traffic cameras and detection devices to create a communication network that will support these new signs. The two complimentary ITS will allow for reduced congestion, increase safety, and maintain mobility during construction. For more information, visit: http://www.wsdot.wa.gov/Projects/I5/VariableSpeedSafety/default.htm

Urban Partnership Agreement funds signs on SR 520 and I-90

These two Smarter Highways projects are federally funded through the Urban Partnership Agreement:

I-90 between I-5 and 150th Avenue Southeast

Between 2004 and 2009, this 9.0 mile section of highway experienced an average of 356 collisions per year; an average of 306 were rear-end collisions or sideswipes during commute hours (weekdays 5 a.m. to 7 p.m.). WSDOT will place new overhead electronic signs over each lane of traffic at 25 locations between I-5 and 150th Avenue Southeast., to be activated Spring 2011.

SR 520 between SR 520 floating bridge and just east of I-405

Between 2004 and 2009, this 7.9-mile section of road experienced an average of 413 collisions per year; an average of 218 were rear-end collisions or sideswipes during commute hours (weekdays 5 a.m. to 7 p.m.). WSDOT will install signs over each lane with variable message signs over each lane of traffic at 19 locations SR 520 between I-5 and 130th Avenue Northeast in Bellevue, to be activated Summer 2010. More information is available online at: http://www.wsdot.wa.gov/Projects/LkWaMgt/LkWaATM/.

Tracking the benefits of Smarter Highways

Smarter Highways technology has been shown to decrease congestion-related collisions by 30%. WSDOT expects to experience similar benefits on its I-5 installations. The agency's target is to reduce injury collisions on these corridors by one third, and total collisions by 15%. WSDOT will track the following outcomes and report on the three Smarter Highways corridors in approximately two years in the *Gray Notebook*:

- Major incidents and events that occurred within the corridor;
- Percentage of time each location varied from 60 mph;
- Average posted speed during morning and evening peaks at each sign location;
- Minimum posted speed and when for each lane sign; and
- A summary about congestion, the system's reaction, and drivers' reactions.

WSDOT's ITS inventory continues to grow

Making highways move more efficiently is a key element of WSDOT's congestion relief program, Moving Washington. Intelligent transportation systems uses technology to increase safety and efficiency on Washington's highways , and better prepare the transportation system for increasing traffic demands. As the table below shows, ramp meters, cameras, and data collection stations have formed a backbone of transportation system technology and communications in the state for many years. In 2007, WSDOT began publishing an official inventory of ITS elements in the *Gray Notebook* (see table below).

WSDOT's Intelligent Transportation Systems inventory
Statewide inventory as of September 30, 2009

Device Type	Number of devices or sites 2007	2008	2009	Approximate cost per-device or site
Closed circuit television cameras (CCTVs)	521	542	555	$15,000-$30,000
Variable message signs (VMSs)	179	181	186	$100,000 - $250,000
Highway advisory radio transmitters (HARS)	70	72	76	$50,000
Road/weather information systems (RWIS)	94	97	100	$25,000-$50,000
Metered ramps	137	137	143	$10,000-$100,000
Traffic data stations	530	554	565	$10,000-$20,000

Data Source: WSDOT Maintenance Office.

What WSDOT is doing to fight congestion: Operate Efficiently

Incident Response Program Update

The mission of WSDOT's Incident Response (IR) program is to safely and quickly clear traffic incidents on state highways. Quick clearance minimizes congestion and dangerous traffic blockages that can lead to secondary collisions. IR roving units, which operate during peak traffic periods, also offer a variety of free assistance that reduces motorists' exposure to risk, such as providing fuel and jump starts, changing flat tires, and moving blocking vehicles safely off the roadway. IR units are trained and equipped to assist Washington State Patrol (WSP) troopers at collisions and other traffic emergencies. Available for call out 24 hours a day, seven days a week, IR units assist WSP with traffic control, mobile communications, clean-up, and other incident clearance functions as needed during major incidents. More information on the IR program can be found at www.wsdot.wa.gov/Operations/IncidentResponse/.

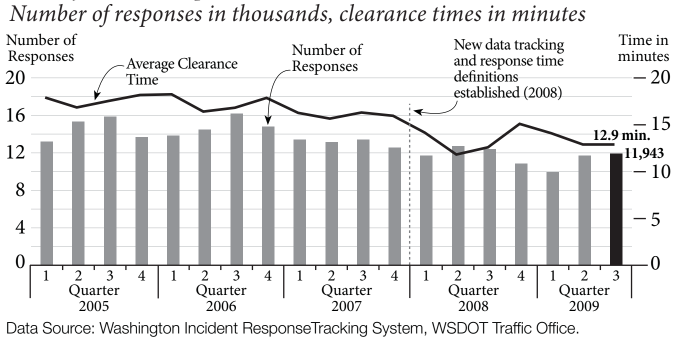
Third quarter 2009 response times the same as second quarter

In Q3, 2009, WSDOT's Incident Response Team cleared 11,943 incidents with an average clearance time of 12.9 minutes. This clearance time is the same as last quarter's clearance time of 12.9, and up 2.4% from 12.6 minutes in the same quarter of 2008. The number of incidents responded to is up 1.9% from last quarter's 11,721 incidents, and down 3.4% from the 12,383 incidents attended in Q3, 2008.

Fatality incident clearance times remain high

In Q3 2009, Incident Response (IR) units attended to 23 fatality events across the state. The average clearance time for these incidents was 210 minutes, down 8.8% from the Q2 2009 average of 231 minutes. This value is above the more recent trend of a 162-180 minute average clearance time in the past year and a half, with the exception of Q4 2008, which saw a similarly high average fatality clearance time of 242 minutes. It is not clear why fatality clearance times are periodically higher at select times. A statistical analysis showed that quarters with longer average clearance times are not statistically significantly different from quarters with shorter average times.

Number of responses and overall average clearance time
January 1, 2005 - September 30, 2009
Number of responses in thousands, clearance times in minutes

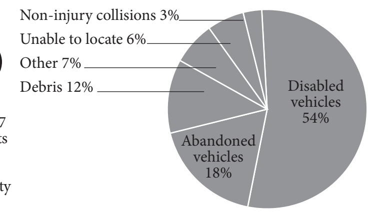


Data Source: Washington Incident ResponseTracking System, WSDOT Traffic Office.

Note: Program-wide data is available since January 2002. Prior to Q3 of 2003, the number of responses by IRT are shown. From Q3 2003 to Q2 2007, responses by Registered Tow Truck Operators and WSP Cadets have been reported in the total. From Q1 2002 to Q4 2007, Average Clearance Time do not include "Unable-to-Locate" (UTL) responses into calculation. Average number of responses does include UTLs, because this represents work performed on behalf of the Incident Response Program. 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.

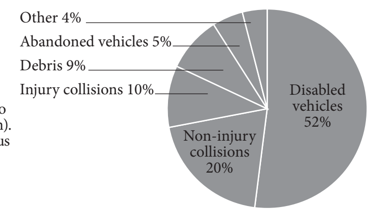
Number and percentage of responses by category
Third Quarter, July 1 - September 30, 2009

Incidents lasting less than 15 minutes (8,961)



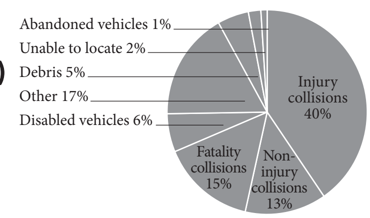
Injury and Police Activity were less than 1% (not shown). There were 27 Fires, 16 Hazardous Materials events involved incidents in addition to or as a result of above incidents. 13 incidents involved WSDOT property damage, and 480 were located in work zones.

Incidents lasting 15 to 90 minutes (2,852)



Fatality, Police Activity and Unable to Locate were less than 1% (not shown). There were 149 Fire, and 2 Hazardous Materials involved incidents in addition to or as a result of above incidents. 97 incidents involved WSDOT property damage, and 293 were located in work zones.

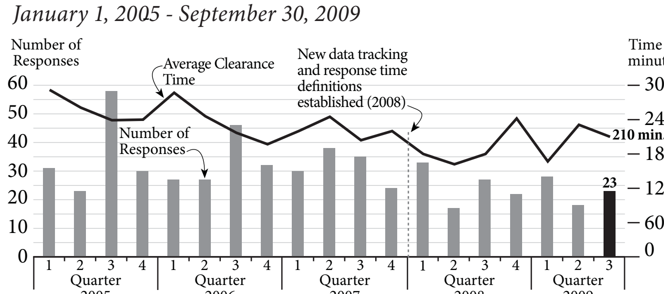
Incidents lasting 90 minutes and longer (130)



There were 20 Hazardous Materials and 37 Fire involved incidents in addition to or as a result of above incidents. 54 incidents involved WSDOT property damage, and 6 were located in work zones.

Data Source: WSDOT Traffic Office and Washington State Patrol

Number of responses and average clearance time of fatality collisions
January 1, 2005 - September 30, 2009



Data Source: Washington Incident Tracking System, 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.

What WSDOT is doing to fight congestion: Operate Efficiently
Incident Response Program Update

The Governor's GMAP goal for WSDOT and WSP responses to 90-minutes and over incidents

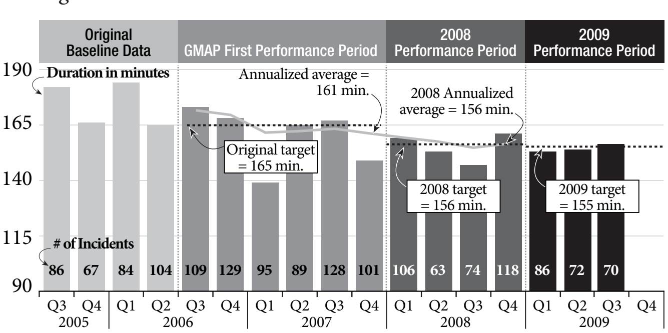
In 2006, under the Government, Management, Accountability and Performance program (GMAP), Governor Gregoire charged WSDOT and the Washington State Patrol (WSP) with reducing the average duration of 90-minute-and-longer blocking incidents on nine key highways in Washington state. WSDOT and WSP accepted that challenge and exceeded the 5% reduction goal at the end of 2007, coming in at 159 minutes. In 2008, the agencies agreed to an additional 7% reduction to 155 minutes, but missed that goal by one minute. The two agencies have re-committed to working toward the 155-minute goal in 2009.

Over-90 minute clearance times increase on key western Washington corridors

During the third quarter of 2009 70 over-90-minute incidents occurred on the nine key routes, producing an average duration of 156 minutes for the quarter. To date the annual 2009 average over 90 minute clearance time is 156 minutes, one minute above the annual goal.

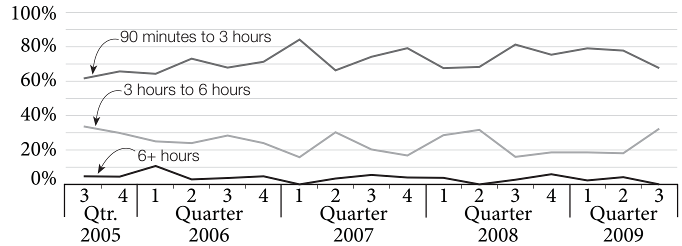
In Quarter 3, there were no extraordinary (6+ hour) incidents. However, one-third of the total number of over 90-minutes incidents lasted between three to five hours compared to only 20% lasting three to five hours during the first two quarters of the year. It is not clear why these medium-length incidents took such a jump in Quarter 3. WSDOT and WSP will continue to track and analyze these trends.

Progress toward the goal for reducing average clearance times for over-90 minute incidents on nine key western Washington highway segments
July 1, 2005 - September 30, 2009
Average duration in minutes



Data Source: Washington State Patrol and WSDOT Traffic Office.

Duration of blocking incidents by type & percentage
Quarter 3, 2005 - Quarter 3, 2009



Data Source: WSDOT Traffic Office and WSP.

Some Incident Response vehicles are equipped with variable message signs (VMS) that can inform motorists of incidents ahead.

What WSDOT is doing to fight congestion: Manage Demand

Moving Washington: Manage Demand

WSDOT can make the best use of the highways' capacity if it can better distribute the demand travelers place 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. Managing demand strategies encourage drivers to use less congested routes and times to travel by displaying real-time traffic information on the internet and intelligent transportation systems.

WSDOT's construction mitigation efforts prove effective in managing demand during the 2009 construction season

I-90 Homer Hadley Bridge repair

Replacement of the expansion joints on the Homer Hadley Bridge (commonly known as the I-90 floating bridge) required two major closures on I-90. The center roadway on I-90 was closed from May 4 - May 16, 2009 and the westbound mainline was closed from July 6 - July 18, 2009. During the mainline closure, the entrance and exit to the center roadway were re-striped to two lanes and all westbound traffic was moved to the center roadway. The graphs below show the peak travel time westbound from Issaquah to Seattle on I-90 during each weekday of the closures.

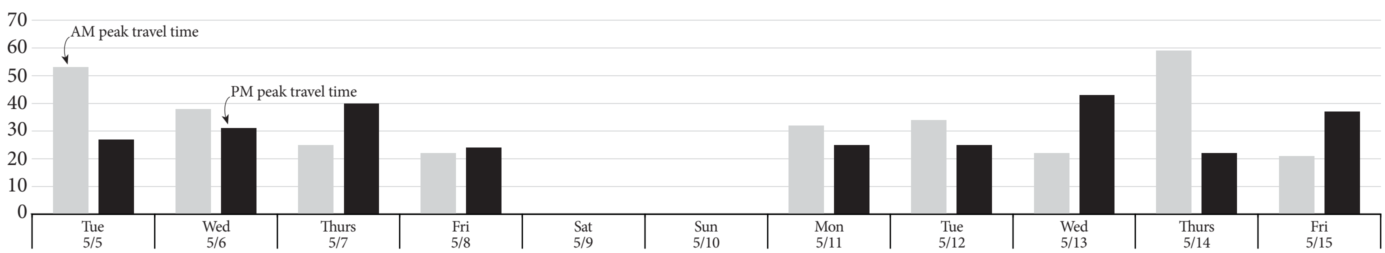
Eastbound I-90 in May and July 2009:

The I-90 floating bridge's express lanes usually run eastbound through the evening peak period. However, because the express lanes were closed to eastbound traffic, eastbound backups extended from the Mount Baker Tunnel and onto I-5. Eastbound traffic volumes in May were down by 0% - 10% during the a.m. peak and 10% - 25% during the p.m. peak compared to a typical weekday. Diversion in July was slightly higher during the a.m. peak at 10% - 20% but about the same as May during the p.m. peak.

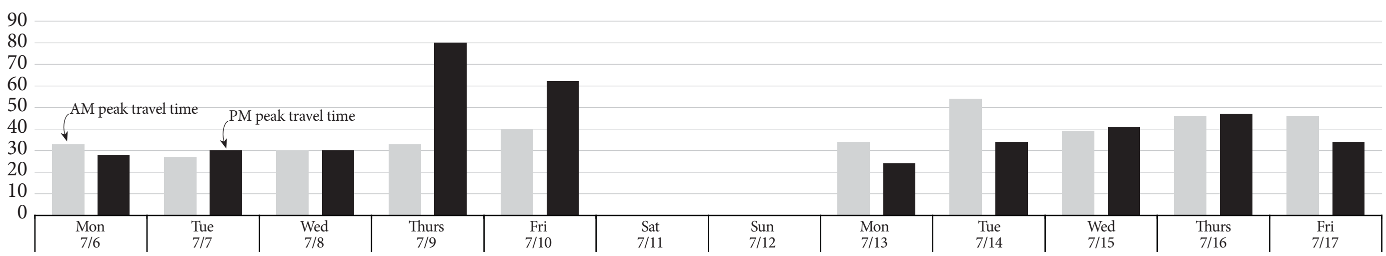
Westbound I-90 in May 2009:

The express lanes typically operate westbound during the a.m. commute hours. When they were closed in May, I-90 westbound delays varied greatly from day to day. More than once, the westbound queue extended beyond I-405 and the Issaquah to Seattle travel time reached almost 60 minutes. This route has a free-flow travel time of 16 minutes. Diversion during the peak hours varied from 0% - 20% throughout the closure, with higher diversion during the a.m. peak than the p.m. peak.

I-90 Westbound Issaquah to Seattle peak travel times, May 2009
Travel time in minutes



I-90 Westbound peak travel times through the work zone back-up, July 2009*
Travel time in minutes



Data Source: WSDOT Northwest Region.

* Travel time data collected from start of the queue to the end of the work zone.

What WSDOT is doing to fight congestion: Manage Demand

Westbound I-90 in July 2009:

In July, westbound delays varied less than in May due to more consistent throughput and diversion throughout the closure. Diversion during both peaks was 40%-60% every weekday. This high rate of diversion caused delays to be much lower than during the May closure, even though the capacity was nearly half. Travel time from Issaquah to Seattle varied between 25 and 45 minutes, with few exceptions. During the Thursday and Friday evening peak of the first week, travel time reached up to 80 minutes, in part due to heavy traffic around Mariners' home games. On Tuesday morning in the second week, travel time was very high, up to 55 minutes, due to multiple incidents.

Other WSDOT construction mitigation efforts during the 2009 construction season

In addition to the long term closures for the I-90 Homer Hadley Bridge repair project, two other construction projects had major impacts for weekend drivers in the central Puget Sound area. The ***I-5 Pavement Repair*** project replaced 440 concrete panels on I-5 between Boeing Access Road and the King/Snohomish county line. The ***SR 520 Bridge Approach Repair*** project repaved SR 520 between I-405 and West Lake Sammamish Parkway and replaced concrete slabs at the ends of five bridges. Both projects required multiple lane closures on nights and weekends and the resulting backups illustrated how congestion is dependent on diversion rates.

The ***I-5 Pavement Repair*** project reduced traffic on I-5 to two lanes over nine weekends from February through May. Seven of those weekends had delays of over 30 minutes during peak periods, with the longest delays reaching almost one hour. Diversion rates were closely related to delays, varying from a peak of 35% (when delays were less than 10 minutes), to a peak of 75% mid-day when delays were up to 45 minutes.

The ***SR 520 Bridge Approach Repair*** project had major lane closures during five weekends in March and April, reducing SR 520 east of I-405 to one or two lanes. Eastbound and westbound traffic were each reduced to one lane for one weekend. When traffic was reduced to one lane, motorists chose to take an alternate route or avoided the roadways, keeping delays low throughout the day. The SR 520 drivers started diverting very early in the day before congestion increased. On the Saturdays for both of these weekends, there were 35% fewer vehicles than usual on the roadway by 9:00 a.m. and 50% less by 11:00 a.m. Delays stayed below 10 minutes during the eastbound closure and below 25 minutes during the westbound closure.

Delays during major construction closures are a challenge to predict and depend upon the number of drivers that divert to other roadways or times of day or eliminate their trip altogether. Diversion rates varied greatly for each closure and can depend on location, weather, and public outreach, among other things. During the major weekend closures on I-5 and SR 520, WSDOT found that when drivers heard about the closure and avoided the area, diversion rates were high before congestion began to build, resulting in low delays throughout the delay. However, when drivers did not begin to divert until backups were already formed, there was heavy congestion and long delays throughout the day.

Growth & Transportation Efficiency Centers contribute to further drive-alone reductions

In 2006, the Legislature authorized the development of Growth Transportation Efficiency Centers (GTECs) based on the recommendations of a blue-ribbon panel on commute trip reduction policies, and the success of these programs in Portland, Oregon. These GTECs seek the coordinated participation of governments, private companies and organizations, and transit providers to find solutions to mobility issues where dense job and business cores exist in urban environments.

The centers have resulted in a shift from county-wide planning for reducing drive-alone behavior to targeting the areas that commuters are drawn to by providing reasonable accommodations and by refocusing long-term transit planning to make work-day commuting without cars easier. Areas around the state identified as GTECs under the 2006 legislation have received state funding and planning support, and a few of the centers are already reporting success in reducing drive-alone behavior.

The city of Spokane developed a four year plan to reduce drive-alone commutes and VMT into its central core (where many of the city's jobs and businesses are located). Their goal was a 10% cut in the drive-alone rate, and an 11% cut in VMT per-employee in the GTEC. Since the program began in 2007, the Spokane center has recorded a 12.2% reduction in its drive-alone rate, and a 10.6% reduction in VMT. The success of the Spokane center stems from both government planning and administrative support and the efforts of private employers/organizations. These partners have matched state funding on a 2:1 ratio. Several have drive-alone and VMT reduction rates that exceed (17%-20% and 13-%-19% for drive-alone and VMT, respectively), the average for the entire Spokane GTEC.

The centers are becoming a core component of commute trip reduction strategies and Moving Washington–Manage Demand goals. For more details, see the March 2009 *Gray Notebook* 33 (p 32).

WSDOT's balanced strategies to fight congestion

Washington depends on mobility

Effective transportation is critical to maintaining our economy, environment and quality of life. *Moving Washington* is the 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 five transportation priorities along with preserving our transportation infrastructure, making the system safe for all, protecting the environment, and practicing sound stewardship.

The transportation improvements outlined here are necessary for us to continue to enjoy all that our state has to offer. From the coastal rain forests of the Olympic Peninsula to the river gorges in the south and east, Washington State is rich with landscapes and a diverse economy. We depend on a reliable trip to work, and we want to spend time with our families when our work is done. Businesses from agriculture and manufacturing to retail and tourism rely on our transportation system. More information on *Moving Washington* can be found at: http://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 the benefits that these projects are having can be found on pages 40-52. Many more projects are under construction, and drivers will soon see their benefits as well.

What WSDOT is already doing to fight congestion

Building additional highway capacity:
- The 391 construction projects of the 2003 and 2005 transportation funding packages include more than 130 mobility projects to fight congestion, of which 46 have been completed.

Using intelligent transportation systems to operate the system more efficiently:
- 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

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 our state continues to grow, it is necessary to develop additional traffic capacity. However, budgetary constraints and other factors mean we cannot simply build our 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 116 mobility projects that add capacity where it makes the most sense statewide. 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.

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 our 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 metered freeway on-ramps, incident response teams, variable speed-limit systems, 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 our 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.

Measuring Delay and Congestion
Moving Washington

WSDOT's balanced strategies to fight congestion

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: http://www.wsdot.wa.gov/movingwashington.

Westside Corridor: I-5 between Arlington and Tumwater, SR 99, US 2

Corridor performance highlights

		2006	2008	%∆
Average Travel Times (minutes)				
I-5 Everett-Seattle (AM)		50	41	-18%
I-5 Seattle-Everett (PM)		43	39	-9%
I-5 Federal Way-Seattle (AM)		46	39	-15%
I-5 Seattle-Federal Way (PM)		38	34	-11%
*Delay**	I-5	10,520	7,471	-29%

Before and After Case Study: I-5 to US 2 hard shoulder running and ramp metering project helped reduce travel times by 6 minutes during the evening peak. (p. 44-45).

*Daily hours of delay relative to max throughput speeds.

Selected congestion relief projects programmed to improve corridor performance:

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.

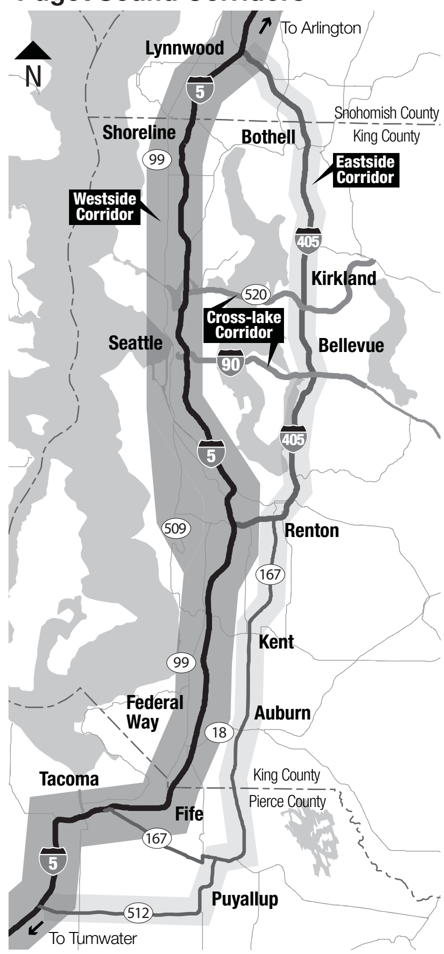
Operate Efficiently

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

Manage Demand

- WSDOT provides rights 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).

Moving Washington: Puget Sound Corridors



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

Corridor performance highlights

		2006	2008	%∆
Average Travel Times (minutes)				
I-90 Issaquah-Bellevue (AM)		18	16	-11%
I-90 Seattle-Bellevue (PM)		18	15	-17%
SR-520 Bellevue-Seattle (AM)		18	16	-11%
SR-520 Seattle-Bellevue (PM)		21	19	-10%
*Delay**	SR-520	2,224	1,699	-24%

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. (pp. 51-52).

*Daily hours of delay relative to max throughput speeds.

Selected congestion relief projects programmed to improve corridor performance:

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 I-405.

Manage Demand

- Begin variable time-of-day tolling on I-90 at I-5 to I-405.
- Support the implementation of Bus Rapid Transit service on SR 520.
- Increase capacity of Park & Ride lots

WSDOT's balanced strategies to fight congestion

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

Corridor performance highlights

		2006	2008	%∆
Average Travel Times (minutes)				
I-405 Tukwila-Bellevue (AM)		42	41	-2%
I-405 Bellevue-Tukwila (PM)		33	35	+6%
SR-167 Auburn-Renton (AM)		17	16	-6%
SR-167 Renton-Auburn (PM)		20	16	-20%
*Delay**	I-405	8,334	6,844	-18%
	SR 167	1,257	663	-47%

Before and After Case Study: Following completion of the I-405 South Bellevue widening project the peak morning commute was reduced to less than 30 min. as compared to 45 min. before construction. (p. 43).

*Daily hours of delay relative to max throughput speeds.

Selected congestion relief projects programmed to improve corridor performance:

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
- I-405/SR 167 Active Traffic Management.
- Use SR 512 shoulders during peak commuting periods as additional 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

Corridor performance highlights

	2006	2008	%∆
Average Travel Times (min : sec)			
I-90 Argonne-Division (AM)	8:00	7:59	0%
I-90 Division-Argonne (PM)	8:00	8:10	+2%

Before and After Case Study: Spokane's Growth and Transportation Efficiency Center has helped reduce drive alone rates by 12.2% and VMT by 10.6%. (p. 52)

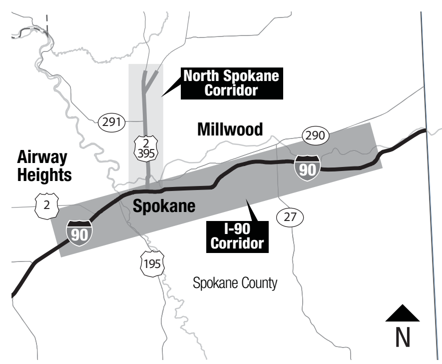
Selected congestion relief projects programmed to improve corridor performance:

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 Variable Speed Limit 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 and Conway.

Table of Tables & Graphs

Table of Tables & Graphs, continued

Americans with Disabilities Act (ADA) Information

Persons with disabilities may request this information be prepared and supplied in alternate formats by calling the Washington State Department of Transportation at (360) 705-7097. Persons who are deaf or hard of hearing may call Access Washington State Telecommunications Relay Service by dialing 7-1-1 and asking to be connected to (360) 705-7097.

Civil Rights Act of 1964, Title VI Statement to Public

Washington State Department of Transportation (WSDOT) hereby gives public notice that it is the policy of the department to assure full compliance with Title VI of the Civil Rights Act of 1964, the Civil Rights Restoration Act of 1987, and related statutes and regulations in all programs and activities. Persons wishing information may call the WSDOT Office of Equal Opportunity at (360) 705-7098.

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
- 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 this *Congestion Report* or the current or previous edition of the *Gray Notebook*, visit www.wsdot.wa.gov/accountability

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