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The 2013
Corridor Capacity Report

The 12th edition of the annual *Congestion Report*

Published November 2013

Lynn Peterson, Secretary of Transportation

WSDOT’s comprehensive annual multi-modal analysis of state highway system performance

Table of Contents

MAP-21 and Results Washington

WSDOT has been proactive in working with the American Association of State Highway and Transportation Officials (AASHTO) and U.S. Department of Ttansportation to propose performance measures for the Moving Ahead for Progress in the 21st Century (MAP-21) federal law. WSDOT supports the inclusion of air quality, congestion, system performance, and capacity-related performance measures in MAP-21.

Governor Jay Inslee's strategic plan for Washington state, called Results Washington, includes capacity-related transportation performance measures, as well as measures for sustainable transportation and infrastructure and clean energy use. WSDOT has been working closely with the Governor's Office to propose indicators in these areas. For more information about MAP-21 or Results Washington, see p. 30.

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Washington State Department of Transportation in partnership with communitytransit smile & ride INTERcity TRANSIT King County METRO Puget Sound Regional Council PSRC RTC Southwest Washington Regional Transportation Council SoundTransit SpokaneTransit STAR TRAC

Congestion remained below pre-recession levels in 2012

Statewide congestion data for the past six years (2007 through 2012) indicate that 2009 was the least congested year for Washington drivers. The statewide congestion indicators are still below pre-recession levels, as the economy continues to rebound.

In 2012, each person in the state was delayed in traffic for 4 hours and 30 minutes. This means an average household of two commuters spent 9 extra hours of time on the road due to traffic. This is 12 minutes lower than in 2010, when the per-person vehicle hours of delay on state highways was 4 hours and 42 minutes.

The delay on state highways cost Washington citizens and businesses $780 million in 2012. This is roughly $115 per person. For a household of two commuters this is $230 each year. To put it in perspective, this amount is equal to 60 gallons of gas ($3.84 per gallon) allowing the household to drive approximately 1,500 miles at 25 miles per gallon.

When miles traveled are averaged across the population, it is as if each Washingtonian drove 8,303 miles in 2012, of which 4,578 were on the state highway system. Even though this sounds like a lot, the person-miles traveled in 2012 were actually lower than 2010 by 2.4% on all roadways, and 3.1% on state highways.

WSDOT introduces new multi-modal measures

With this edition, WSDOT introduces new performance measures and a new graphical display of information, all with an emphasis on multi-modal and person-based metrics.

The new measures include park and ride (P&R) lot utilization, routinely congested highway segments, greenhouse gas (GHG) emissions, transit ridership, and the costs of congestion for commuters.

The graphical display shows key system performance information related to specific urban corridors, all aligned with a map of the corridor.

Park and ride lot utilization rates

The P&R lot locations are presented on the map, along with available spaces and percent occupied in a table to help tell the multi-modal system performance story. The P&R lots primarily cater to transit services on the corridor - other P&R lots exist as well.

Routinely congested highway segments

For the first time, WSDOT is presenting the routinely congested segments in graphical format on each of the corridors statewide (except I-90 in Spokane). The routinely congested segments are identified for morning and evening commutes by direction of travel, length of congested segment in miles, and duration of congestion in hours.

Greenhouse gas emissions estimated for corridors

The greenhouse gas emissions from vehicles on the 40 high-demand commute corridors in the central Puget Sound area totaled 12,156 metric tons of carbon dioxide (CO_2) each weekday in 2012. To put it in perspective, this means an average commuter who drives in the central Puget Sound area is responsible for emitting more than 13 pounds of CO_2 daily. This estimate is for a subset of all Seattle area daily travel. These emissions do not include principal arterials and surface streets in the area.

Transit takes more than 43,800 cars off the road daily

In 2012, there were nearly 70,600 daily transit riders during the peak commute periods, on the high-demand corridors in the central Puget Sound area. This took more than 43,800 cars off the road, which in turn avoided approximately 674,700 pounds of CO_2 emissions daily. For example, both buses and light rail from SeaTac to Seattle in the morning and from Seattle to SeaTac in the evening carried about 7,600 and 10,200 passengers each day during the peak periods, respectively.

Congestion costs increase on 21 corridors

The cost of commute congestion (wasted time and gas) in the central Puget Sound area, on the 40 high-demand commute routes, increased on 21, decreased on 14, and remained the same on 5 commutes. The largest reductions in commute congestion cost were on the SR 520 corridor. Tolls were implemented in December 2011, and a significant number of commuters choose to drive alternate routes rather than pay the toll.

For example, the cost of congestion for commute trips on the I-5 corridor in 2012, for a round trip to and from work, ranged from $400 to $1,500 annually for each person. The Everett-Seattle round trip had the highest commute congestion cost on this corridor in 2012.

Dashboard of Indicators

2013 *Corridor Capacity Report* Dashboard of Indicators *Dollar values are inflation-adjusted, measured in 2012 dollars*	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**Difference '10 vs. '12**
Demographic and economic indicators							
State population (thousands)	6,525	6,608	6,672	6,725	6,768	6,818	1.4%
Gasoline price per gallon (annual average)[1]	$3.29	$3.64	$2.76	$3.17	$3.80	$3.84	20.8%
Washington unemployment rate (annual)	4.6%	5.4%	9.4%	9.9%	9.2%	8.2%	-1.7%
Washington real per person income[2]	$46,265	$46,706	$44,386	$44,369	$45,197	$45,941	3.5%
Multi-modal performance measures							
Drive alone commuting rate[3]	73.1%	71.5%	72.1%	73.0%	73.3%	-	-
Carpooling commuting rate[3]	11.4%	12.2%	11.3%	10.5%	10.2%	-	-
Public transit commuting rate[3]	5.4%	5.5%	5.9%	5.5%	5.6%	-	-
Transit ridership[4] (in millions)	195.2	215.6	210.1	207.8	213.0	-	-
Washington State Ferries ridership[4] (in millions)	24.1	23.3	22.5	22.6	22.3	-	-
Bicycling and walking commuting rate[3]	4.1%	4.5%	4.3%	4.4%	4.2%	-	-
Statewide congestion indicators							
Per person, total vehicle miles traveled on all public roads, state highways only							
All public roads vehicle miles traveled (VMT), in billions	56.964	55.447	56.461	57.191	56.965	56.607	-1.0%
All public roads per person VMT, in miles	8,730	8,391	8,462	8,505	8,417	8,303	-2.4%
State highways VMT, in billions	31.970	30.742	31.456	31.764	31.455	31.214	-1.7%
State highways per person VMT, in miles	4,900	4,652	4,714	4,724	4,648	4,578	-3.1%
Congestion on state highway system							
Total state highway lane miles	18,425	18,500	18,571	18,630	18,642	18,659	0.2%
Lane miles of state highway system congested	1,032	962	966	1,025	1,007	1,026	0.0%
Percent of state highway system congested[5]	5.6%	5.2%	5.2%	5.5%	5.4%	5.5%	0.0%
Per person, total, and cost of delay on state highways							
Annual hours of per person delay on state highways[6]	5.4	5.3	4.2	4.7	4.8	4.5	-4.3%
Total vehicle hours of delay, in millions of hours[6]	35.1	34.8	28.1	31.6	32.5	30.9	-2.4%
Cost of delay on state highways (2012 dollars)[6]	$931	$890	$721	$800	$821	$780	-2.4%
Corridor specific congestion indicators (52 central Puget Sound area commutes)							
Annual Maximum Throughput Travel Time Index (MT^3I)[7]	1.45	1.25[8]	1.30	1.39	1.35	1.39	0.0%
Number of commute routes with $MT^3I > 1$[7]	46	41[8]	43	45	44	44	-1
WSDOT congestion relief projects							
Number of completed Nickel and TPA mobility projects as of December 31 of each year (cumulative)	33	43	65	73	82	91	18
Cumulative project value (dollars in millions)	$963	$1,289	$2,212	$2,596	$2,802	$3,851	$1,255

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

Notes: WSDOT's annual *Congestion Report* is renamed as the *Corridor Capacity Report* beginning with the 2013 publication. Analysis in the 2013 *Corridor Capacity Report* examines 2010 and 2012 annual data; 2007 is included to show pre-recession levels. All dollar values are inflation-adjusted using the Consumer Price Index (CPI). 1 Gas prices are reported in 2012 dollars and represent yearly averages. 2 Real per capita income is measured as total statewide personal income in 2012 dollars divided by state population. 3 Based on one-year estimates from the American Community Survey, commuting rates are of workers age 16 and older. 4 Ridership means the number of boardings, also called unlinked passenger trips. 5 Based on below 70% of posted speed. 6 Based on maximum throughput speed threshold (85% of posted speed). 7 MT^3I greater than one means the commute route experiences congestion. 8 2008 data not available for four of the 52 routes. For more information see gray box in the 2009 *Congestion Report*, p. 15.

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

The *Corridor Capacity Report's* detailed analysis shows where and how much congestion occurs, and whether it has grown on state highways. The report focuses on the most traveled commute routes in the urban areas of the state i.e., central and south Puget Sound areas, Vancouver, Spokane, and the Tri-Cities area and elsewhere around the state where data is available. WSDOT and University of Washington experts use a two-year span to more accurately identify changes and trends seen on the state highway system that may be missed by looking at a one-year comparison. For the 2013 *Corridor Capacity Report*, calendar year 2012 is the current analysis year data, while 2010 data is the baseline for comparison. Some exceptions were made to use 2011 data in place of 2010 due to data availability and data quality.

This year, WSDOT is introducing new performance metrics, listed below along with the standard metrics.

WSDOT's congestion measurement principles

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

Key congestion performance measures

Measure	Definition
NEW: Commute congestion cost	Cost due to wasted fuel and time associated with travel during congested conditions (speeds slower than 45 mph) that could have been spent productively elsewhere.
NEW: Greenhouse gas emissions	The pounds of carbon dioxide (CO_2) emitted during peak period commutes; The per-person emissions per trip during peak periods; The emissions avoided by use of transit services.
NEW: Transit ridership and used capacity	Ridership on buses, light rail, and commuter rail during the peak periods between commute route origins and destinations; Used capacity in percent of available seats that are used on transit already serving commute routes.
NEW: Park and Ride capacity and use	Number of parking spaces and percent of capacity used on an average annual weekday.
NEW: Routinely congested segments	Sections of roadway where traffic demand reaches capacity on at least 40% of the weekdays annually.
Average peak travel time	The average travel time on a route during the peak five-minute interval for all weekdays of the calendar year.
95th percentile reliable travel time	Travel time with 95% certainty (i.e. on-time 19 out of 20 work days).
Maximum Throughput Travel Time Index (MT^3I)	The ratio of average peak travel time compared to maximum throughput speed travel time.
Percent of days when speeds are less than 36 mph	Percent of days annually that observed speeds for one or more five-minute interval is less than 36 mph (severe congestion) on key highway segments.
Vehicle throughput	Measures how many vehicles move through a highway segment/spot location in an hour.
Lost throughput productivity	Percentage of a highway's lost vehicle throughput due to congestion when compared to the maximum five-minute weekday flow rate observed at a particular location of the highway for that calendar year.
Per person delay (other forms of delay such as total delay)	The average total daily hours of delay per person based on the maximum throughput speed (85% of posted speed) measured annually for weekdays.
Percent of the system congested	Percent of total state highway lane miles that drop below 70% of the posted speed limit.
Duration of congestion	The time period in minutes when speeds fall below 45 mph.
HOV lane reliability	An HOV lane is deemed "reliable" as long as it maintains an average speed of 45 mph for 90% of the peak hour.
Person throughput	Measures how many people, on average, move through a highway segment during peak periods.
Before and After analysis	Before and After performance analysis of selected highway congestion relief projects and strategies.
Average incident clearance time (Statewide)	Operational measure defined as the time from notification of the incident until the last responder has left the scene for all incidents responded to by WSDOT Incident Response personnel statewide.

Measuring cost of congestion, greenhouse gas emissions, and transit

WSDOT's new multi-modal system performance measures include commute congestion cost, trip-based vehicle emissions, transit usage, park and ride lot capacity and use, and locations that experience routine congestion.

NEW: WSDOT quantifies the congestion cost for individuals and commutes

With the 2013 *Corridor Capacity Report,* WSDOT is for the first time quantifying commute congestion cost at the individual commuter level to answer the question: "how much does congestion cost a daily commuter?" Commute congestion cost is based on the duration of congestion that represents the timeframe during which users can expect to travel at speeds below 45 mph (75% of posted speed) during their daily commute. While daily commuters may build extra time and operating costs into their routines and budgets to account for traveling during congested periods, congestion still represents costs, lost opportunities, and lost productivity that negatively affect individuals and society.

Commute congestion cost = (Average travel time – Travel time at threshold speed) X Traffic volume within the duration of congestion X Cost of travel

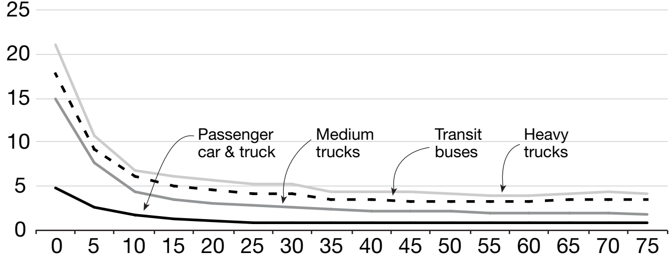
Commute congestion cost is computed for every five-minute interval within the time that a particular commute is experiencing congestion. This methodology underestimates commute congestion cost because it does not capture the periodic slowdowns (when speeds drop below 45 mph) briefly experienced during individual trips along the length of the commute. Commute congestion cost can be estimated using the equation above.

NEW: WSDOT quantifies greenhouse gas emissions from commuters on central Puget Sound area routes

WSDOT's new metric captures the approximate pounds of carbon dioxide (CO_2) emitted during a one-way commute trip. Total emissions during the peak period are reported, along with the emissions per person. The per-person metric takes into consideration the average number of people in each vehicle in the single-occupancy vehicle lanes.

Example greenhouse gas emissions factors for four categories of vehicles decline with increasing speed

Carbon dioxide emissions in pounds of CO_2 per vehicle mile traveled; Speed in miles per hour



Data source: Puget Sound Regional Council.

Note: Factors for 2012 restricted access urban roadways. Emissions factors do not reflect relative emissions per person mile traveled by the different modes of transportation.

CO_2 emissions from vehicles are directly related to the speed at which the vehicle is traveling. For speeds slower than 25 mph, the emissions quickly escalate to more than five times as many pounds of CO_2 per mile compared to at faster speeds (see example graph above, right). However, there is little variation in emissions per vehicle mile traveled between 35 and 65 mph, the typical range of speeds on Washington highways. Emissions also vary by the type of vehicles: medium and large trucks emit more CO_2 per mile than a typical passenger car. Total emissions on a roadway during the peak period fluctuate more with the volume of vehicles on the roadway year to year, than with the changes in average speed, unless the average speeds are slower than 25 mph.

CO_2 emissions are computed for every five-minute interval within the morning or evening peak period, applying emission factors based on the mix of trucks and passenger vehicles and the average speed during that time. CO_2 emissions can be estimated using the equation below:

CO_2 emissions during peak period = Sum for every 5 minutes during peak period: ((Truck% X Truck emission factor) + (1 - Truck%) X Car emission factor) X Traffic volume within the 5-minute interval X Trip length)

Per person, per trip CO_2 emissions are calculated using the emissions during the peak period, the average number of people in each vehicle in the single-occupancy vehicle lanes, and the total traffic volume on the commute corridor during the peak period. The per-person emissions can be estimated using the equation below:

CO_2 per person trip = (CO_2 emissions during peak period) / (Traffic volume during peak period X Average observed trip vehicle occupancy)

Emissions avoided by transit use are estimated with the following equation for commute trips during the peak periods:

CO_2 avoided = Number of transit riders during peak period X 0.62 SOV miles avoided per transit passenger mile X Trip length X 1.0 pound of CO_2 per mile traveled

WSDOT's congestion measurement principles in action

NEW: Quantifying the transit use along central Puget Sound area commute routes

WSDOT for the first time measures system capacity across modes along the central Puget Sound area commute routes. This includes the utilization of the HOV lanes compared to adjacent SOV lanes (see person-throughput analysis on p. 66), and the capacity used on public transit services. Sound Transit, King County Metro, and Community Transit provide public transportation services throughout the central Puget Sound area. WSDOT aligned the bus, light rail, and Sounder commuter rail routes with the 40 peak period commute trips (see pp. 49-52). WSDOT computed average daily transit statistics for each commute for ridership, average load (percent of seats used), vehicle trips off the SOV lanes, and greenhouse gas emissions avoided by transit ridership.

NEW: Park and ride lot use supports transit

Park and ride (P&R) lots provide locations for a commuter to meet up with carpool or vanpool participants, or to catch a bus to work if transit does not come close to their home. WSDOT tracks the average percent of available space used. P&R lots at or near capacity discourage potential transit users and ridesharers because they do not have a reliable place to park.

NEW: Routinely congested segments illustrate where demand exceeds capacity

Specific sections of the urban highway system experience routine congestion due to constrained conditions. WSDOT tracks how often demand exceeds capacity on the highway system, and documents the frequency and length of time (duration) the route is congested. This type of congestion is not related to incidents or collisions, although such occurrences accentuate the regular congestion.

NEW: WSDOT expands commute trip analysis coverage around the state

WSDOT's 2013 *Corridor Capacity Report* expands the commute trip analysis coverage to include south Puget Sound and Vancouver area commute trips, in addition to trips in the central Puget Sound and Spokane areas. This brings the total to 82 commute trips analyzed statewide.

WSDOT collects real-time traffic data

WSDOT collects real-time data for all 82 commute routes in urban areas around the state, including the central and south Puget Sound areas (52 and 20 routes, respectively), the Vancouver area (8 routes), the Spokane area (2 routes), and on other highways statewide.

In the central Puget Sound area alone, data is collected from about 6,800 loop detectors embedded in the pavement throughout 235 centerline miles (1,300 lane miles). Similarly, the south Puget Sound area has 128 active data sensors that stretch along 77 centerline miles (270 lane miles). Other urban areas of the state have loop detectors and other technologies used for traffic data collection. WSDOT for the first time uses private sector speed data for Vancouver area commute trip analysis to complement the existing WSDOT data set.

The data collected from these WSDOT loop detectors are quality controlled using a variety of software processes. WSDOT uses this data to analyze system performance. In tracking and communicating performance results, WSDOT adheres to congestion measurement principles including the use of more accurate, real-time data rather than modeled data, and uses language and terminology that is meaningful to the public ("plain English"). See p. 5 for a list of performance measures and principles.

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

Speed is a metric that carries importance not only with WSDOT, but with the general public, as well. Measuring the time to get from point A to point B is one of the most easily understood congestion measures. Travel time reliability also matters to commuters and businesses because it is important for people and goods to be on time all the time.

WSDOT's *Corridor Capacity Report* examines travel times on the 82 commute trips around the state, with a particular focus on 40 high-demand routes in the central Puget Sound area. Travel times for high occupancy vehicle (HOV) lanes along many of these same corridors are also reported.

The metrics used in the commute trip analysis include the average peak travel time, the 95th percentile reliable travel time, the duration of congestion, and the percent of weekdays when average travel speeds are below 36 mph. The performance of an individual route compares data with the current analysis year to the baseline year.

WSDOT's previously published person-based measures (per capita for statewide measures) include per person vehicle miles traveled and per person hours of delay in traffic (statewide, urban area, and corridor based), along with the per person trip travel time on commute corridors.

WSDOT expanded reliability analysis looks at a range

How do WSDOT's congestion performance measures work?

of travel time percentiles in the 2009 *Congestion Report*. This analysis allows WSDOT to examine travel time changes at a finer level of detail and better evaluate its operational strategies.

Real-time travel times for key commute routes in central and south Puget Sound areas, Spokane, and Vancouver are available to the public and updated every 5 minutes on the WSDOT website at: www.wsdot.wa.gov/traffic/seattle/traveltimes/.

Measuring vehicle miles traveled (VMT)

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

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

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

WSDOT uses maximum throughput to measure congestion performance

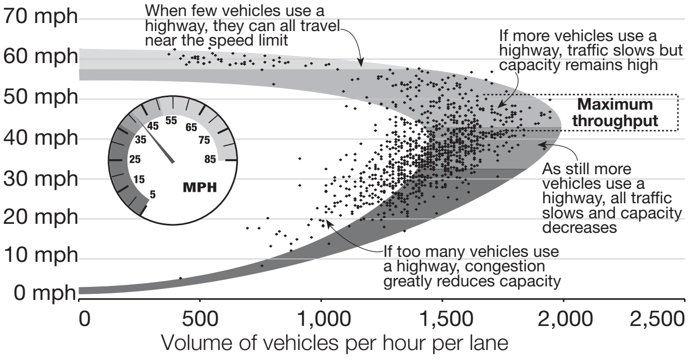
To operate the highway system as efficiently as possible, the speed at which the highest number of vehicles can move through a highway segment (maximum throughput) is more meaningful than posted speed as the basis of measurement. WSDOT aims to provide and maintain a system that yields the most productivity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

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

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

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

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



Data source: WSDOT Northwest Region Traffic Office.

Maximum throughput is achieved when vehicles travel at speeds between 42 and 51 mph (roughly 70% to 85% of a posted 60 mph speed). At maximum throughput speeds, highways are operating at peak efficiency because more vehicles are passing through the segment than at posted speeds. This happens because drivers at maximum throughput speeds can safely travel with a shorter distance between vehicles than they can at posted speeds.

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

WSDOT uses the maximum throughput standard as a basis for measurement to assess travel delay relative to a highway's most efficient condition at maximum throughput speeds (85% of posted speed). For more information on changes in travel delay performance, please see pp. 42-64.

WSDOT thresholds for system efficiency, maximum throughput

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

- Total delay and per person delay
- Percent of the system that is delayed and congested
- Lost throughput productivity
- Maximum Throughput Travel Time Index—MT^{3}I (for a more detailed discussion, see p. 46)
- Duration of the congested period
- Commute congestion cost

Measuring per person delay and total delay

Delay can be measured at various speed thresholds such as free flow speed, posted speed or maximum throughput speeds. WSDOT uses maximum throughput speeds, rather than free flow or posted speeds, to measure delay relative to the highway's most efficient operating condition. WSDOT measures travel delay statewide and on five major commute corridors in the central Puget Sound area. In addition to measuring total hours of delay, WSDOT also evaluates annual per person delay and the cost of delay to drivers and businesses.

Measuring the percentage of the highway system that is *delayed*

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

Measuring the percentage of the highway system that is *congested*

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

Evaluating vehicle throughput productivity

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

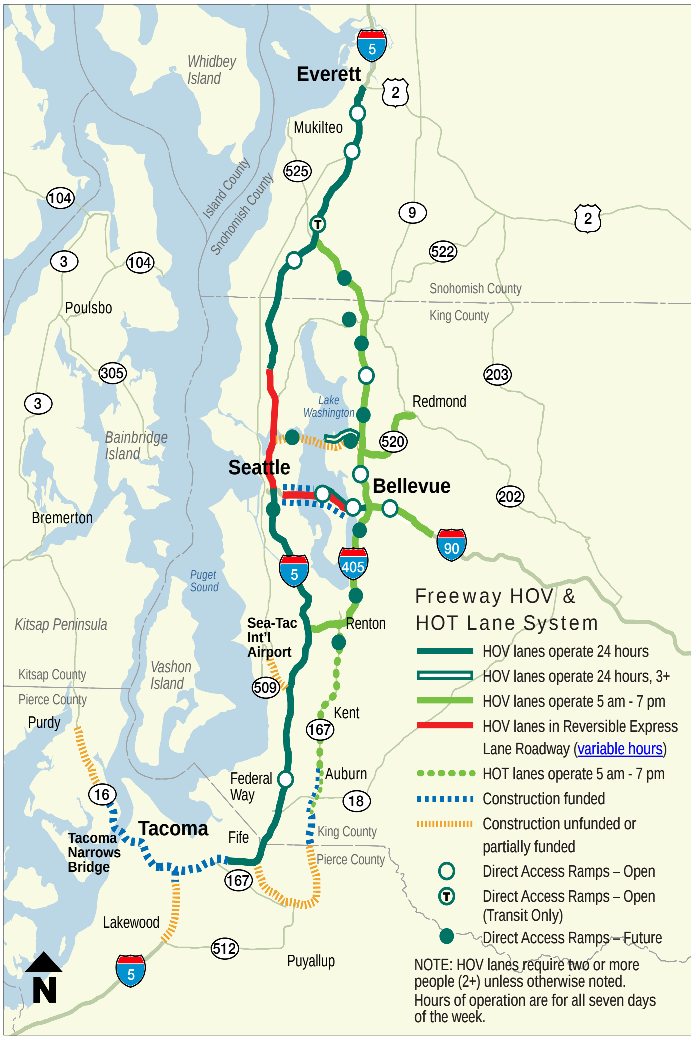
WSDOT state highway speed thresholds for congestion measurement

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

Measuring per person delay, vehicle throughput, reliability

Measuring travel time reliability

WSDOT uses the 95th percentile reliable travel time as its key reliability metric for the 82 commute trips monitored statewide. Travel time reliability is measured in percentiles: For example, 95th percentile travel times track the amount of time a traveler will need to plan in order to be on time 95% of the time (19 of 20 weekday trips); 80th percentile travel times will ensure the traveler is on time four out of five weekday trips. A benefit to using percentile measures is they are not affected by outlier values, generally the longest travel times. Using a range of percentiles – from the 50th (median) to the 95th – allows WSDOT to track changes in reliable travel times over the years at a finer level in order to evaluate operational improvements more accurately. Changes in the 80th and 90th percentiles are likely to represent travel times that are the result of routine incidents and other factors that the agency can influence with operational strategies. See pp. 46-48 for detailed reliability data and pp. 78-84 for more on operational strategies such as tolling, Active Traffic Management, Intelligent Transportation Systems (ITS), and Incident Response.



Freeway HOV and HOT lane systems in the greater Puget Sound area.

WSDOT examines high occupancy vehicle (HOV) trip performance

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

The map at left depicts the HOV and HOT lane system in the Puget Sound area. About 310 lane-miles of the planned 320-mile Puget Sound area HOV network have been completed. More information about the HOV lane network can be found starting on p. 65, or at http://www.wsdot.wa.gov/hov/.

Using Before and After analyses to review project performance

As of June 30, 2013, WSDOT completed 344 out of 421 projects funded by the 2003 and 2005 gas tax packages, of which 91 were congestion relief projects. To measure how well these investments are mitigating congestion, WSDOT has implemented Before and After project studies to analyze impacts on travel times and delay. On highway segments without in-pavement loop detectors, data is collected using automated license plate recognition (ALPR) cameras, blue tooth readers, or moving test vehicles. Before and After performance evaluations are performed on key congestion relief projects to evaluate the benefits of projects that improve system efficiency. See pp. 85-90.

Quantifying Incident Response benefits

WSDOT uses several measures to evaluate the performance of its Incident Response (IR) program. Beginning in the 2011 *Congestion Report*, WSDOT quantifies the annual economic benefits provided by the IR program. For details on the IR program and how it helps alleviate non-recurrent congestion, see pp. 81-84.

In Corridor Capacity:

Corridor Capacity Analysis 12

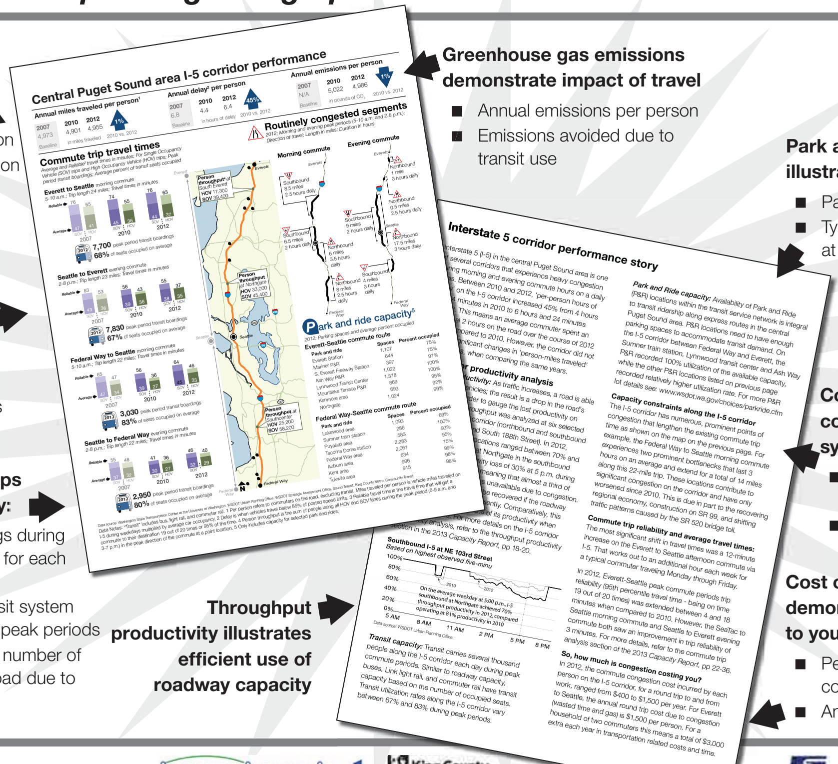
- *WSDOT introduces commute corridor performance maps and graphics with an emphasis on person trips and transit*
- *Pages in this section can serve as standalone performance documents for key corridors around the state*
- *Transit ridership, park and ride use, and greenhouse gas emissions per person are presented for each corridor*

Moving Ahead for Progress in the 21st Century (MAP-21) and Results Washington 30

- *Federal law ties spending of transportation aid to performance targets, ensuring state progress towards national goals*
- *New state performance system includes transportation-related outcomes that will help strengthen our economy*

Telling the corridor capacity and performance story ...

A new feature: incorporating "infographics" with narrative to tell the whole story



Per-person metrics tell the story and what it means to you:

- Miles traveled per person
- Hours of delay per person
- Emissions per person

Trip travel times help people and goods arrive on schedule:

- Average trip time
- Trip time for HOV lanes
- Reliable trip travel times

Transit performance helps capture system capacity:

- Transit system boardings during peak commute periods for each commute trip
- Percent of existing transit system capacity utilized during peak periods
- Emissions avoided and number of vehicles taken off the road due to transit ridership

Throughput productivity illustrates efficient use of roadway capacity

Greenhouse gas emissions demonstrate impact of travel

- Annual emissions per person
- Emissions avoided due to transit use

Park and Ride lot utilization illustrates supply and demand:

- Parking capacity
- Typical use of parking spaces at Park and Ride lots

Congestion trouble-spots constrain the highway system's capacity:

- Locations of recurrent congestion
- How long congestion lasts

Cost of congestion demonstrates impact to your pocketbook:

- Per person cost of congestion per trip
- Annual cost of congestion

Washington State Department of Transportation in partnership with communitytransit smile & ride King County METRO SoundTransit & Puget Sound Regional Council PSRC

Corridor Capacity Analysis

At a glance

- ***WSDOT introduces commute corridor performance maps and graphics with emphasis on person trips and transit***
- ***Pages in this section can serve as standalone performance documents for key corridors around the state***
- ***Transit ridership, park and ride use, and greenhouse gas emissions per person are presented for each corridor***
- ***When commute trip travel times using HOV and single occupancy lanes are compared, HOV trips are generally faster***

WSDOT for the first time is introducing the system analysis from a corridor perspective using GIS maps and infographics to communicate technical information in an easy to understand format. Along with this, WSDOT is introducing new performance measures that are geared towards telling the system performance story across modes and facilities. As part of this effort, WSDOT has partnered with transit agencies (Sound Transit, King County Metro, Community Transit, Intercity Transit, and Spokane Transit Authority) Metropolitan Planning Organizations (MPOs) (Puget Sound Regional Council and Southwest Washington Regional Transportation Council) to conduct person throughput capacity analysis.

In the corridor capacity analysis section, each urban corridor (statewide) is analyzed for three annual measures on a per-person basis:

- Annual person miles traveled on the corridor
- Annual person hours of delay on the corridor
- Annual emissions per person on the corridor or delay per person mile traveled

Emissions information is presented for the central Puget Sound area; 'Delay per person mile traveled' is presented for the other urban corridors such as in the Spokane, Vancouver, and south Puget Sound areas.

In addition to the above mentioned over all measures (banner metrics) four other main pieces of information are presented along with the corridor map:

- Commute trip analysis for peak period travel
  a. Average and reliable travel times for SOV and HOV trips
  b. Transit ridership on commute trips
  c. Average percent of transit seats occupied
- Person throughput information along SOV and HOV lanes
- Routinely congested segments during morning and afternoon commutes by direction of travel
- Park and ride lot capacity and utilization rates along the commute corridors

The graphical display of information helps tie together the different facets of the system performance and capacity to tell the corridor story in a more succinct fashion. The other side of the page has a brief description of the different elements that helps explain the corridor story along with the vehicle throughput on the corridor.

This section presents the performance of specific congested corridors around the state, each on its own double-sided page. Each page is intended to serve as a standalone document on a specific corridor. For example, the I-5 corridor performance on the next page has a map of the I-5 corridor with various performance measures discussed above in the form of charts and tables on one side of the page, while the other side tells the congestion and capacity story with key takeaway messages for that corridor.

One of the pages in this section also looks at marine highways served by Washington State Ferry routes: the existing capacity, on-time performance, reliability, and ridership by route. In the next annual edition, WSDOT anticipates reporting ferry vessel utilization rates for passenger and vehicular traffic.

Central Puget Sound area I-5 corridor performance

Annual miles traveled per person[1]

2007	2010	2012	
4,973	4,901	4,955	1%
Baseline	in miles traveled		2010 vs. 2012

Annual delay[2] per person

2007	2010	2012	
6.8	4.4	6.4	45%
Baseline	in hours of delay		2010 vs. 2012

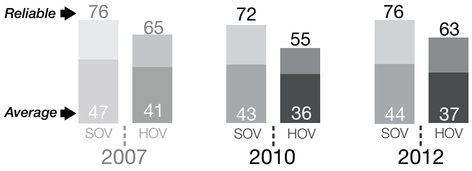
Annual emissions per person

2007	2010	2012	
N/A	5,022	4,986	1%
Baseline	in pounds of CO_2		2010 vs. 2012

Commute trip travel times

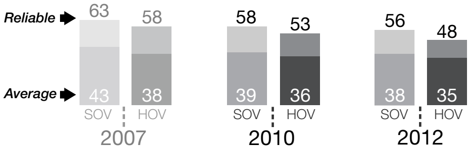
Average and Reliable[3] travel times in minutes; For single occupancy vehicle (SOV) trips and high occupancy vehilce (HOV) trips; Peak period transit ridership; Average percent of transit seats occupied

Everett to Seattle morning commute
Weekdays; 5-10 a.m.; Trip length 24 miles; Travel times in minutes



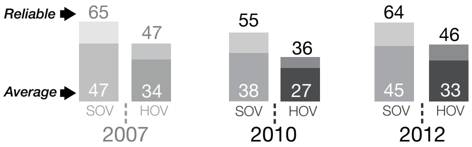
2012 **5,770** peak period transit ridership
63% of seats occupied on average

Seattle to Everett evening commute
Weekdays; 2-8 p.m.; Trip length 23 miles; Travel times in minutes



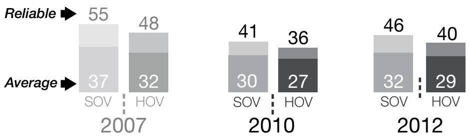
2012 **5,650** peak period transit ridership
62% of seats occupied on average

Federal Way to Seattle morning commute
Weekdays; 5-10 a.m.; Trip length 22 miles; Travel times in minutes

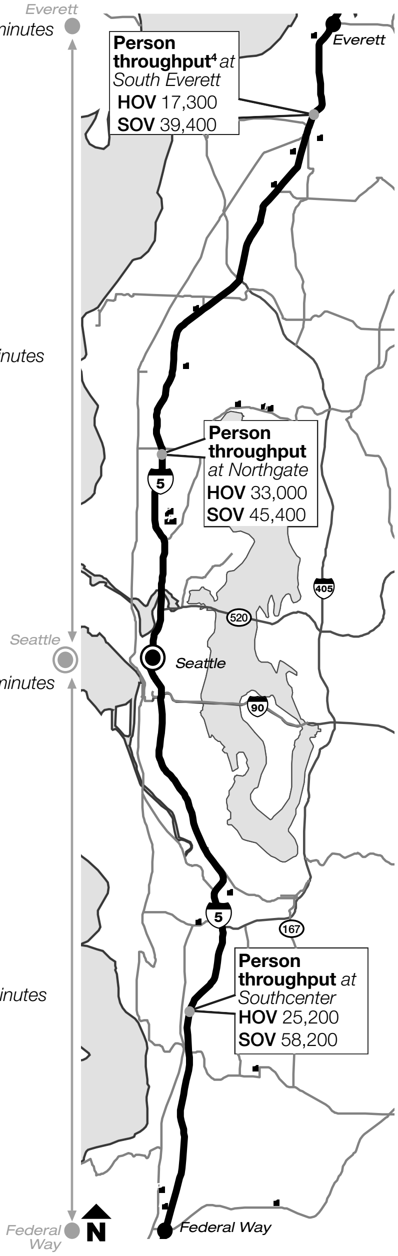


2012 **2,710** peak period transit ridership
81% of seats occupied on average

Seattle to Federal Way evening commute
Weekdays; 2-8 p.m.; Trip length 22 miles; Travel times in minutes

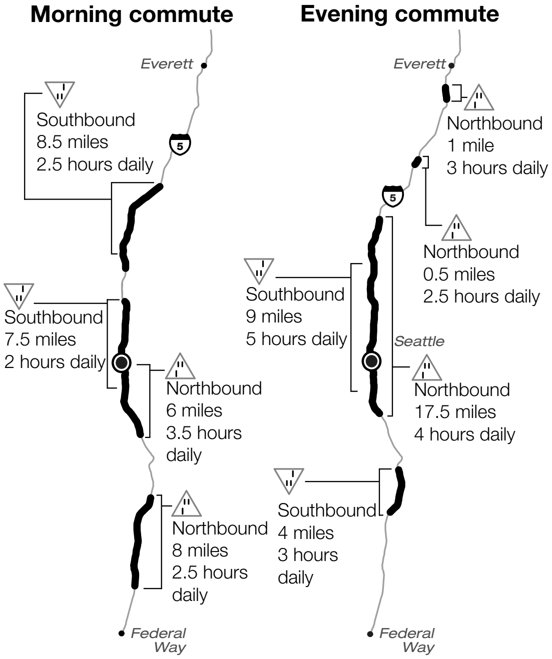


2012 **2,530** peak period transit ridership
77% of seats occupied on average



Routinely congested segments

2012; Weekday morning and evening peak periods (5-10 a.m. and 2-8 p.m.); Direction of travel; Length in miles; Duration of congestion in hours


Morning commute

Evening commute

[illegible]ark and ride capacity[5]

2012; Parking spaces and average percent of spaces occupied

Everett-Seattle commute route

Park and ride	Spaces	Percent occupied
Everett Station	1,107	75%
Mariner P&R	644	75%
S. Everett Freeway Station	397	97%
Ash Way P&R	1,022	100%
Lynnwood Transit Center	1,378	100%
Mountlake Terrace P&R	869	95%
Kenmore area	693	92%
Northgate area	1,024	99%

Federal Way-Seattle commute route

Park and ride	Spaces	Percent occupied
Lakewood area	1,093	69%
Sumner train station	286	100%
Puyallup area	583	93%
Tacoma Dome station	2,283	95%
Federal Way area	2,067	75%
Auburn area	634	99%
Kent area	996	98%
Tukwila area	915	98%

Created in partnership with

Data source: Washington State Transportation Center at the University of Washington, WSDOT Urban Planning Office, WSDOT Strategic Assessment Office, Sound Transit, King County Metro, Community Transit

Notes: Per person, all day annual metrics at the top of the page are for the entire I-5 central Puget Sound area corridor between Everett and Federal Way. "Transit" includes bus, light rail, and commuter rail. 1 Per person refers to commuters on the road, excluding transit. Miles traveled per person is vehicle miles traveled on I-5 during weekdays multiplied by average car occupancy. 2 Delay is when vehicles travel below 85% of posted speed limits. 3 Reliable travel time is the travel time that will get a commuter to their destination 19 out of 20 times or 95% of the time. 4 Person throughput is the sum of people using all HOV and SOV lanes from 6-9 a.m. and 3-7 p.m. in the peak direction of the commute at a point location. 5 Only includes capacity for selected park and rides. Lakewood, Auburn, and Puyallup area not shown on map.

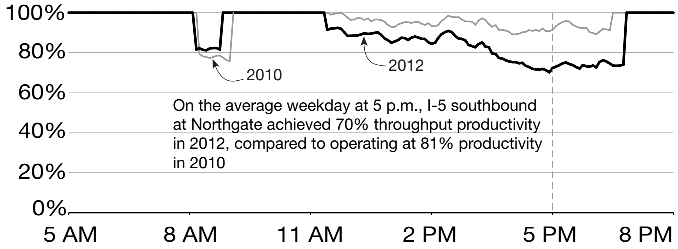
I-5 corridor performance story - central Puget Sound area

Interstate 5 (I-5) in the central Puget Sound area is one of several corridors that experience heavy congestion during morning and evening commute hours on a daily basis. Between 2010 and 2012, “per-person hours of delay” on the I-5 corridor increased 45% from 4 hours and 24 minutes in 2010, to 6 hours and 24 minutes in 2012. This means an average commuter spent an additional 2 hours on the road over the course of 2012, compared to 2010. However, the corridor did not see any significant changes in “person-miles traveled” or emissions per person in the same timeframe.

I-5 corridor productivity analysis:

Highway productivity: As traffic increases, a road is able to carry fewer vehicles; the result is a drop in the road’s productivity. In order to gauge the lost productivity on the I-5 corridor, throughput was analyzed at six selected locations along the corridor (northbound and southbound at Northgate, I-90, and South 188th Street). In 2012, productivity at these locations ranged between 70% and 84%. For example, I-5 at Northgate in the southbound direction saw a productivity loss of 30% at 5 p.m. during the evening peak period, meaning that almost a third of the roadway’s capacity was unavailable due to congestion. This lost productivity could be recovered if the roadway could be operated more efficiently. This location lost an additional 6% of its productivity when compared to 2010. For more details on the I-5 corridor productivity analysis, see pp. 38-40.

Southbound I-5 at NE 103rd Street (Northgate)
Based on highest observed five-minute flow rate; 1,745 vphpl



Data source: WSDOT Urban Planning Office.

Transit capacity: Transit carries several thousand people along the I-5 corridor each day during peak commute periods. Buses, Link light rail, and commuter rail have transit capacity based on the number of occupied seats. Transit utilization rates along the I-5 corridor vary between 62% and 81% during peak periods. During the peak transit hours (6-9 a.m. and 3-6 p.m.) there is frequently standing-room only on the most heavily-used buses.

Park and ride capacity: Availability of park and ride (P&R) locations within the transit service network is integral to transit ridership on express routes in the central Puget Sound area. P&R locations need to have enough parking spaces to accommodate transit demand. On the I-5 corridor between Federal Way and Everett, the Federal Way transit center, Lynnwood transit center and Ash Way P&R recorded 100% utilization of the available P&R capacity. The other P&R locations (listed on the previous) page also recorded relatively high utilization rates. For more P&R lot details see: www.wsdot.wa.gov/choices/parkride.cfm

Capacity constraints along the I-5 corridor:
The I-5 corridor has numerous, prominent points of congestion that lengthen the existing commute trip time as shown on the map on the previous page. For example, the Federal Way to Seattle morning commute experiences two prominent bottlenecks that last 3 hours on average and extend for a total of 14 miles along this 22-mile trip. These locations contribute to significant congestion on the corridor and have only worsened since 2010. This is due in part to the recovering regional economy, construction on SR 99, and shifting traffic patterns caused by the SR 520 bridge toll.

Commute trip reliability and average travel times:
The most significant shift in travel times was a 12-minute increase on the Everett to Seattle afternoon commute via I-5. That works out to an additional hour each week for a typical commuter traveling Monday through Friday.

In 2012, the reliable travel time for trips between Everett and Seattle during the peak commute periods (95th percentile travel time - being on time 19 out of 20 times) was extended between 4 and 18 minutes compared to in 2010. However, trip reliability improved 3 minutes on both the SeaTac to Seattle morning commute and Seattle to Everett evening commute. For more details, see pp. 42-56.

So, how much is congestion costing you?
In 2012, the commute congestion cost incurred by each person on the I-5 corridor, for a round trip to and from work, ranged from $400 to $1,500 per year. For Everett to Seattle, the annual round trip cost due to congestion (wasted time and gas) was $1,500 per person. For a household of two commuters this means a total of $3,000 extra each year in transportation related costs and time.

Central Puget Sound area I-405 corridor performance

Annual miles traveled per person[1]

2007	2010	2012	
3,295	3,327	3,283	↓ 1%
Baseline	in miles traveled		2010 vs. 2012

Annual delay[2] per person

2007	2010	2012	
7.2	5.1	5.8	↑ 14%
Baseline	in hours of delay		2010 vs. 2012

Annual emissions per person

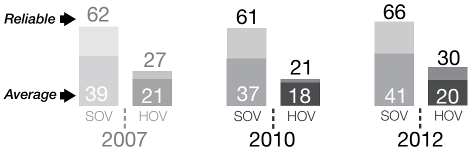
2007	2010	2012	
N/A	4,162	4,092	↓ 2%
Baseline	in pounds of CO$_2$		2010 vs. 2012

Commute trip travel times

Average and Reliable[3] travel times in minutes; For single occupancy vehicle (SOV) trips and high occupancy vehicle (HOV) trips; Peak period transit ridership; Average percent of transit seats occupied

Lynnwood to Bellevue morning commute

Weekdays; 5-10 a.m.; Trip length 16 miles; Travel times in minutes

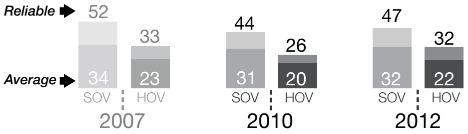


2012 **350** peak period transit ridership

71% of seats occupied on average

Bellevue to Lynnwood evening commute

Weekdays; 2-8 p.m.; Trip length 16 miles; Travel times in minutes

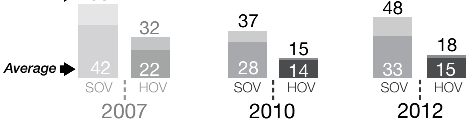


2012 **370** peak period ridership

58% of seats occupied on average

Tukwila to Bellevue morning commute

Weekdays; 5-10 a.m.; Trip length 13 miles; Travel times in minutes

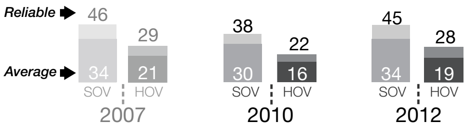


2012 **240** peak period transit ridership

66% of seats occupied on average

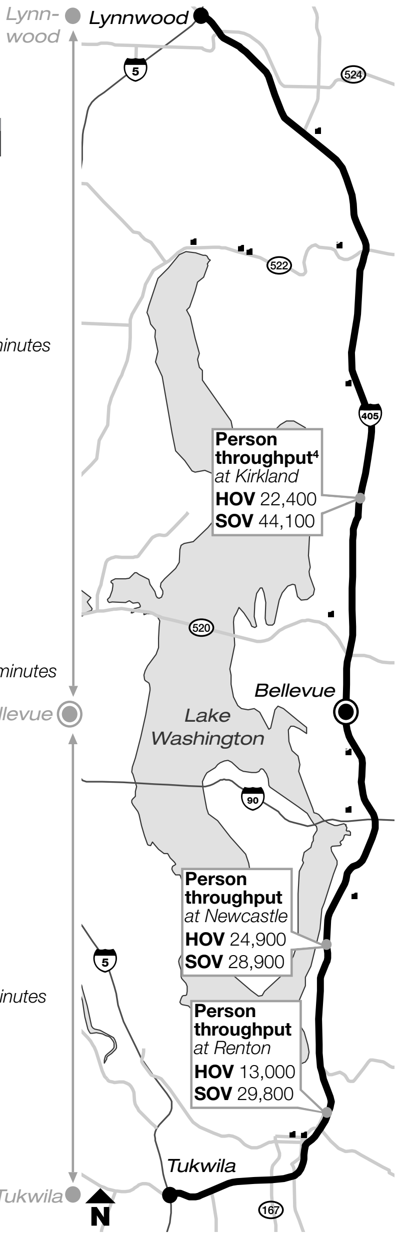
Bellevue to Tukwila evening commute

Weekdays; 2-8 p.m.; Trip length 13 miles; Travel times in minutes



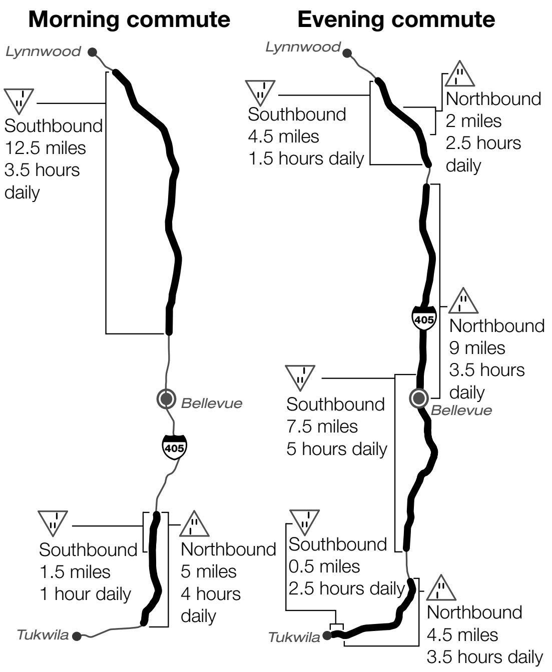
2012 **330** peak period transit ridership

78% of seats occupied on average



Routinely congested segments

2012; Weekday morning and evening peak periods (5-10 a.m. and 2-8 p.m.); Direction of travel; Length in miles; Duration of congestion in hours



■ark and ride capacity[5]

2012; Parking spaces and average percent of spaces occupied

Lynnwood-Bellevue commute route

Park and ride	Spaces	Percent occupied
Ash Way P&R	1,022	100%
Canyon Park P&R	302	98%
Kenmore area	693	92%
Brickyard P&R	443	80%
Bothell P&R	220	99%
South Kirkland P&R	325	100%

Tukwila-Bellevue commute route

Park and ride	Spaces	Percent occupied
Wilburton P&R	186	82%
South Bellevue P&R	519	100%
Newport Hills	275	72%
Renton P&R	150	96%
Renton City Municipal P&R	200	90%

Created in partnership with

Data source: Washington State Transportation Center at the University of Washington, WSDOT Urban Planning Office, WSDOT Strategic Assessment Office, Sound Transit, King County Metro, Community Transit

Notes: Per person, all day annual metrics at the top of the page are for the entire I-405 central Puget Sound area corridor between Tukwila and Lynnwood. “Transit” includes bus, light rail, and commuter rail. 1 Per person refers to commuters on the road, excluding transit. Miles traveled per person is vehicle miles traveled on I-405 during weekdays multiplied by average car occupancy. 2 Delay is when vehicles travel below 85% of posted speed limits. 3 Reliable travel time is the travel time that will get a commuter to their destination 19 out of 20 times or 95% of the time. 4 Person throughput is the sum of people using all HOV and SOV lanes from 6-9 a.m. and 3-7 p.m. in the peak direction of the commute at a point location. 5 Only includes capacity for selected park and rides. Ash Way park and ride not shown on map.

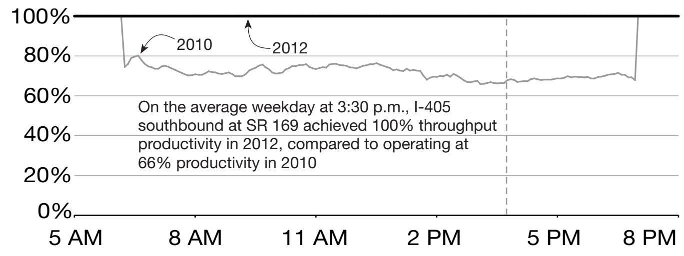
I-405 corridor performance story - central Puget Sound area

I-405 in the central Puget Sound area runs parallel to I-5 and is one of several corridors that experience heavy congestion during morning and evening commute hours on a daily basis. Between 2010 and 2012, "per-person hours of delay" on the I-405 corridor increased 14% from 5 hours and 6 minutes in 2010 to 5 hours and 48 minutes in 2012. This means an average commuter spent an additional 42 minutes on the road over the course of 2012, compared to 2010. However, the corridor did not see any significant changes in "person-miles traveled" or emissions in the same timeframe.

I-405 corridor productivity analysis:

Highway productivity: As traffic increases, a road is able to carry fewer vehicles; the result is a drop in the road's productivity. In order to gauge the lost productivity on the I-405 corridor, throughput was analyzed at four locations along the corridor (northbound and southbound at Renton, and Kirkland). In 2012, productivity at these locations ranged between 47% and 100%. For example, I-405 at SR 169 in Renton, in the southbound direction saw the greatest gain, achieving maximum vehicle throughput (black line in the graph below). The same location had continuous loss in vehicle throughput due to congestion in 2010 (gray line). Travel performance at that location benefited from WSDOT completing projects along the southern segment of I-405, including stages 1 and 2 of the I-405/I-5 to SR 169 project. That project added another single-occupancy vehicle lane in each direction between the I-5 Southcenter interchange and SR 169, as well as a new interchange to relieve congestion and improve access to and from the Renton area. See the 2011 *Congestion Report*, p. 60.

Southbound I-405 at SR 169 (MP 4.0)
Based on highest observed five-minute flow rate; 1,790 vphpl



On the average weekday at 3:30 p.m., I-405 southbound at SR 169 achieved 100% throughput productivity in 2012, compared to operating at 66% productivity in 2010

Data source: WSDOT Urban Planning Office.

Transit capacity: Transit carries several hundred people along the I-405 corridor each day during peak commute periods. Transit capacity is based on the number of occupied seats. Transit utilization rates along the I-405 corridor vary between 58% and 78% during peak periods. During the transit peak hours (6-9 a.m. and 3-6 p.m.) there is frequently standing-room only on the most heavily-used buses.

Park and ride capacity: Availability of park and ride (P&R) locations within the transit service network is integral to transit ridership along express routes in the central Puget Sound area. P&R locations need to have enough parking spaces to accommodate transit demand. On the I-405 corridor between Tukwila and Lynnwood, the South Kirkland P&R, Ash Way P&R, and South Bellevue P&R recorded 100% utilization of the available capacity. The other P&R locations (listed on previous page) also recorded high utilization rates with Newport Hills being the lowest at 72%. For more P&R lot details see: www.wsdot.wa.gov/choices/parkride.cfm

Capacity constraints along I-405 corridor:

The I-405 corridor has numerous, prominent points of congestion that lengthen the existing commute trip time as shown on the previous page. For example, the Lynnwood to Bellevue morning commute experiences a 12.5-mile long backup between Damson Road and south of NE 70th Place that lasts more than 3 hours and 30 minutes on average for this 16-mile trip. The nine routinely congested segments contribute to significant congestion on I-405 and have only worsened since 2010. This is due in part to the recovering regional economy, construction on SR 99, and shifting traffic patterns caused by the SR 520 bridge toll.

Commute trip reliability and average travel times:

One of the significant shifts in travel times on I-405 was a 4-minute increase on the Lynnwood to Bellevue morning commute. That adds up to an extra 20 minutes each week for a typical commuter traveling Monday through Friday.

In 2012, 95th percentile reliable trip travel times on I-405 between Lynnwood and Tukwila grew between 3 and 11 minutes, compared to 2010 peak periods (95th percentile travel time means commuters can plan on being on time 19 out of 20 weekday trips). For more details see pp. 42-56.

So how much is congestion costing you?

In 2012, the commute congestion cost incurred by each person on the I-405 corridor, for a round trip to and from work, ranged from $400 to $2,000 per year. The Lynnwood-Bellevue round trip claimed the highest annual cost due to congestion (wasted time and gas) per person, at $2,000. For a household of two commuters this means a total of $4,000 extra each year in transportation related costs and time.

Central Puget Sound area SR 520 corridor performance

Annual miles traveled per person[1]

2007	2010	2012	
1,426	1,196	1,035	↓ 13%
Baseline	in miles traveled		2010 vs. 2012

Annual delay[2] per person

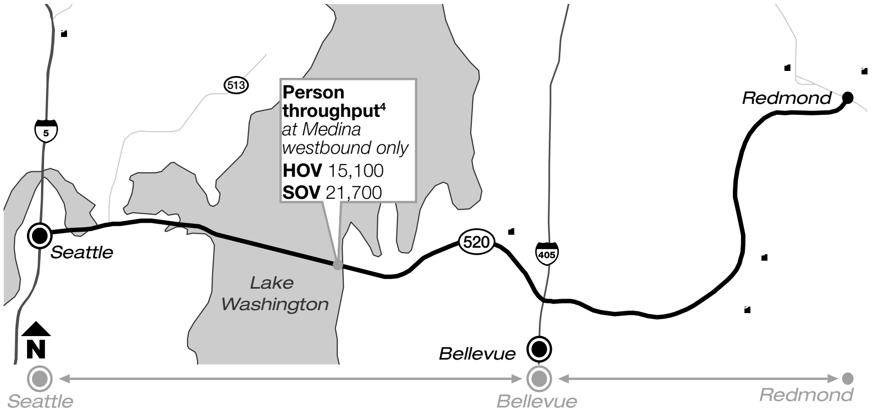
2007	2010	2012	
3.1	1.9	0.4	↓ 79%
Baseline	in hours of delay		2010 vs. 2012

Annual emissions per person

2007	2010	2012	
N/A	1,871	1,880	↑ 0.5%
Baseline	in pounds of CO_2		2010 vs. 2012

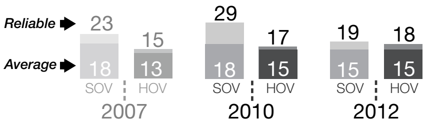
Commute trip travel times

Average and Reliable[3] travel times in minutes; For single occupancy vehicle (SOV) trips and high occupancy vehicle (HOV) trips; Peak period transit ridership; Average percent of transit seats occupied



Bellevue to Seattle morning commute

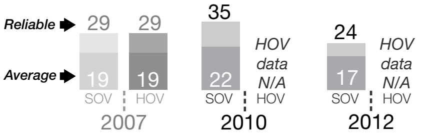
Weekdays; 5-10 a.m.; Trip length 10 miles; Travel times in minutes



2012 **610** peak period transit ridership
52% of seats occupied on average

Seattle to Bellevue evening commute

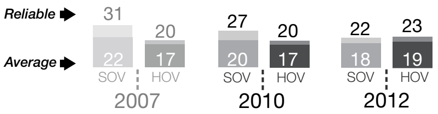
Weekdays; 2-8 p.m.; Trip length 10 miles; Travel times in minutes



2012 **1,390** peak period transit ridership
60% of seats occupied on average

Redmond to Seattle morning commute

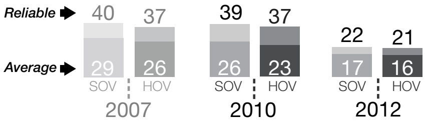
Weekdays; 5-10 a.m.; Trip length 13 miles; Travel times in minutes



2012 **2,330** peak period transit ridership
73% of seats occupied on average

Seattle to Redmond evening commute

Weekdays; 2-8 p.m.; Trip length 13 miles; Travel times in minutes

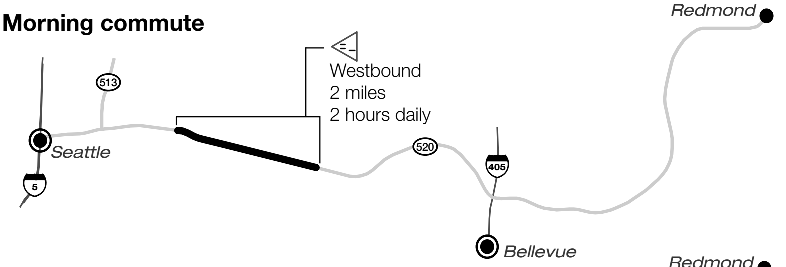


2012 **2,480** peak period transit ridership
70% of seats occupied on average

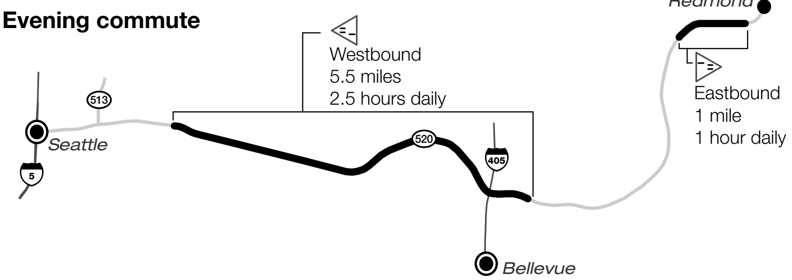
Routinely congested segments

2012; Weekday morning and evening peak periods (5-10 a.m. and 2-8 p.m.); Direction of travel; Length in miles; Duration of congestion in hours

Morning commute



Evening commute



ark and ride capacity[5]

2012; Parking spaces and average percent of spaces occupied

Seattle-Bellevue commute route

Park and ride	Spaces	Percent occupied
South Kirkland P&R	325	100%
Greenlake P&R	411	93%

Redmond-Bellevue commute route

Park and ride	Spaces	Percent occupied
Overlake Transit Center	222	100%
Overlake P&R	203	41%
Redmond P&R	377	91%
Bear Creek P&R	283	100%

Created in partnership with
community transit smile & ride
King County METRO
Puget Sound Regional Council PSRC
SOUNDTRANSIT

Data source: Washington State Transportation Center at the University of Washington, WSDOT Urban Planning Office, WSDOT Strategic Assessment Office, Sound Transit, King County Metro, Community Transit

Notes: Per person, all day annual metrics at the top of the page are for the entire SR 520 central Puget Sound area corridor between Redmond and Seattle. "Transit" includes bus, light rail, and commuter rail. No HOV lane is availalbe on SR 520 eastbound between I-5 and I-405. 1 Per person refers to commuters on the corridor. Miles traveled per person is vehicle miles traveled on SR 520 multiplied by average car occupancy. 2 Delay is when vehicles travel below 85% of posted speed limits. 3 Reliable travel time is the travel time that will get a commuter to their destination 19 out of 20 times or 95% of the time. 4 Person throughput is the sum of people using all HOV and SOV lanes from 6-9 a.m. and 3-7 p.m. in the peak direction of the commute at a point location. 5 Only includes capacity for selected park and rides.

SR 520 corridor performance story - central Puget Sound area

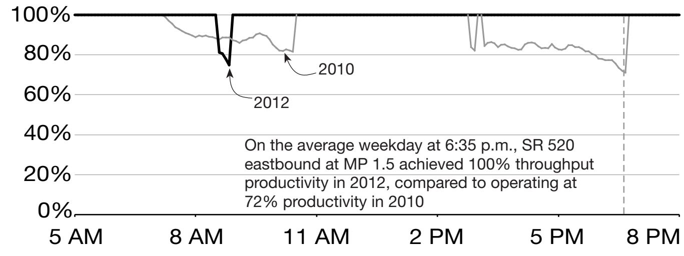
State Route (SR) 520 in the central Puget Sound area was the most congested corridor until the start of tolling in December 2011. SR 520 runs parallel to I-90 across Lake Washington. Between 2010 and 2012, "per-person hours of delay" on the SR 520 corridor decreased 79% from 1 hour and 54 minutes in 2010 to 24 minutes in 2012. This means an average commuter saved 1 hour and 30 minutes on the road over the course of 2012, compared to 2010 using the tolled roadway. Similarly, as a result of tolling "person-miles traveled" decreased 13% on the corridor while there were no significant changes in emissions per person.

SR 520 corridor productivity analysis:

Highway productivity: As traffic increases, a road is able to carry fewer vehicles; the result is a drop in the road's productivity. In order to gauge the lost productivity on the SR 520 corridor, throughput was analyzed at two locations along the corridor (eastbound and westbound at Montlake). In 2012, productivity at these locations ranged between 75% and 100%. For example, eastbound SR 520 at 6:35 p.m. had productivity 28% below maximum throughput in 2010, compared to 100% productivity in 2012. Similarly, the westbound direction had 100% vehicle throughput in 2012, up from 95% in 2010. For more details on the SR 520 corridor productivity analysis, see pp. 38-40.

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

Based on highest observed five-minute flow rate; 1,800 vphpl



Data source: WSDOT Urban Planning Office.

Transit capacity: Transit carries several thousand people along the SR 520 corridor each day during peak commute periods. Transit capacity is based on the number of occupied seats. Transit utilization rates along the SR 520 corridor across Lake Washington vary between 52% and 73%. During the peak transit hours (6-9 a.m. and 3-6 p.m.) there is frequently standing-room only on the most heavily-used buses.

Park and ride capacity: Availability of park and ride (P&R) locations within the transit service network is integral to transit ridership along express routes in the central Puget Sound area. P&R locations need to have enough parking spaces to accommodate transit demand. On the SR 520 corridor between Seattle and Bellevue, the South Kirkland P&R and Greenlake P&R recorded 100% and 93% utilization of the available capacity, respectively. The P&R lots along SR 520 between Bellevue and Redmond experienced utilization rates ranging between 41% and 100%. For more P&R lot details see: www.wsdot.wa.gov/choices/parkride.cfm

Capacity constraints along SR 520 corridor:
The SR 520 corridor has three routinely congested segments that lengthen the existing commute trip time as shown on the previous page. For example, the SR 520 westbound evening commute from 124th Avenue NE to just after the western end of the floating bridge experiences congestion that extended 5.5 miles and lasted 2 hours and 30 minutes.

Commute trip reliability and average travel times:
SR 520 tolling resulted in improved average and reliable travel times for most of the commute trips that use SR 520. SR 520 commute trips generally experienced noticeably faster average peak travel times in 2012 compared to 2010: the morning commute saw 10% to 17% faster westbound trips, and 28% to 35% faster eastbound trips, while the evening commute saw 6% to 16% faster westbound trips, and 20% to 35% faster eastbound trips. Similarly, reliable travel times on SR 520 also improved by 31% to 44%. For more details, see pp. 42-56.

So how much is congestion costing you?
In 2012, the commute congestion cost incurred by each person on the SR 520 corridor, for a round trip to and from work, ranged from $100 to $800 per year. The Seattle-Bellevue round trip annual cost due to congestion (wasted time and gas) per person was $800. For a household of two commuters this means a total of $1,600 extra each year in transportation related costs and time.

Toll rate displayed on overhead signs alert drivers to the current cost of crossing the SR 520 floating bridge

Central Puget Sound area I-90 corridor performance

Annual miles traveled per person[1]

2007	2010	2012	
1,535	1,718	1,672	3%
Baseline	in miles traveled		2010 vs. 2012

Annual delay[2] per person

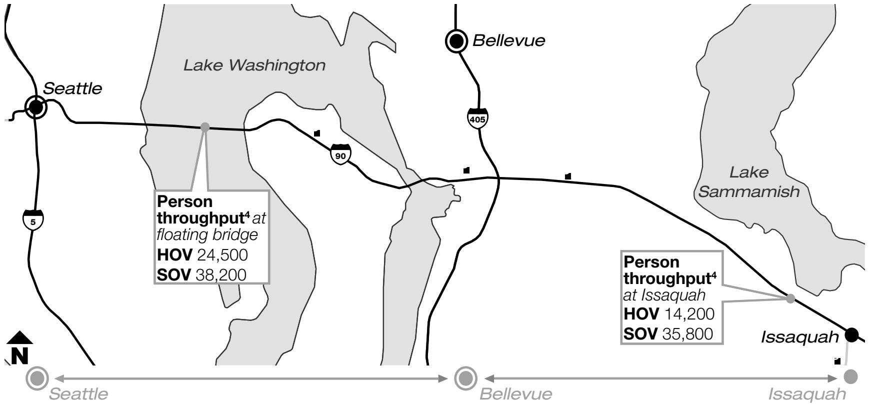
2007	2010	2012	
0.6	0.5	0.8	70%
Baseline	in hours of delay		2010 vs. 2012

Annual emissions per person

2007	2010	2012	
N/A	2,219	1,963	12%
Baseline	in pounds of CO_2		2010 vs. 2012

Commute trip travel times

Average and Reliable[3] travel times in minutes; For single occupancy vehicle (SOV) trips and high occupancy vehicle (HOV) trips; Peak period transit ridership; Average percent of transit seats occupied

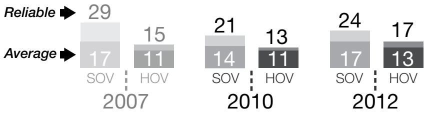


Person throughput[4] *at floating bridge*
HOV 24,500
SOV 38,200

Person throughput[4] *at Issaquah*
HOV 14,200
SOV 35,800

Bellevue to Seattle morning commute

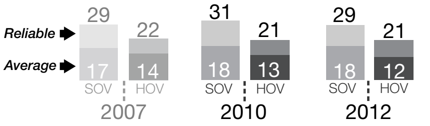
Weekdays; 5-10 a.m.; Trip length 10 miles; Travel times in minutes



2012 **2,670** peak period transit ridership
82% of seats occupied on average

Seattle to Bellevue evening commute

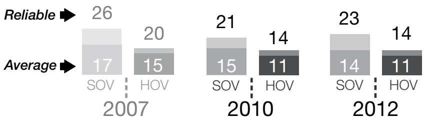
Weekdays; 2-8 p.m.; Trip length 10 miles; Travel times in minutes



2012 **3,130** peak period transit ridership
71% of seats occupied on average

Issaquah to Bellevue morning commute

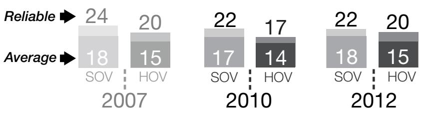
Weekdays; 5-10 a.m.; Trip length 9 miles; Travel times in minutes



2012 **510** peak period ridership
67% of seats occupied on average

Bellevue to Issaquah evening commute

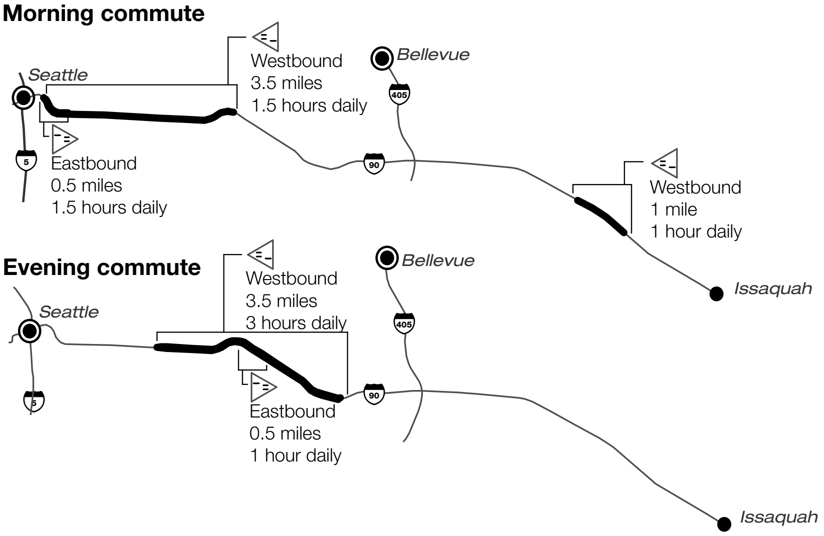
Weekdays; 2-8 a.m.; Trip length 9 miles; Travel times in minutes



2012 **430** peak period transit ridership
60% of seats occupied on average

Routinely congested segments

2012; Weekday morning and evening peak periods (5-10 a.m. and 2-8 p.m.); Direction of travel; Length in miles; Duration of congestion in hours



Morning commute

Westbound
3.5 miles
1.5 hours daily

Eastbound
0.5 miles
1.5 hours daily

Westbound
1 mile
1 hour daily

Evening commute

Westbound
3.5 miles
3 hours daily

Eastbound
0.5 miles
1 hour daily

Park and ride capacity[5]

2012; Parking spaces and average percent of spaces occupied

Seattle-Bellevue commute route

Park and ride	Spaces	Percent occupied
South Bellevue P&R	519	100%
Mercer Island P&R	447	100%

Issaquah-Bellevue commute route

Park and ride	Spaces	Percent occupied
Issaquah Highlands P&R	1,010	86%
Issaquah Transit Center	819	96%
Eastgate P&R	1,614	93%

Created in partnership with communitytransit smile & ride; King County METRO; Puget Sound Regional Council PSRC; SOUNDTRANSIT

Data source: Washington State Transportation Center at the University of Washington, WSDOT Urban Planning Office, WSDOT Strategic Assessment Office, Sound Transit, King County Metro, Community Transit

Notes: Per person, all day annual metrics at the top of the page are for the entire I-90 central Puget Sound area corridor between Issaquah and Seattle."Transit" includes bus, light rail, and commuter rail. 1 Per person refers to commuters on the corridor. Miles traveled per person is vehicle miles traveled on I-90 multiplied by average car occupancy. 2 Delay is when vehicles travel below 85% of posted speed limits. 3 Reliable travel time is the travel time that will get a commuter to their destination 19 out of 20 times or 95% of the time. 4 Person throughput is the sum of people using all HOV and SOV lanes from 6-9 a.m. and 3-7 p.m. in the peak direction of the commute at a point location. 5 Only includes capacity for selected park and rides. Issaquah Highlands park and ride not shown on map.

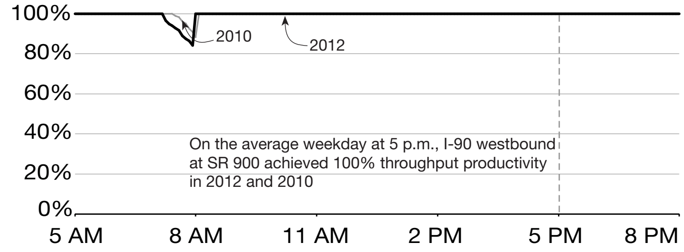
I-90 corridor performance story - central Puget Sound area

I-90 in the central Puget Sound area is one of several corridors that experience heavy congestion during morning and evening commute hours on a daily basis. I-90 and SR 520 run parallel to each other across Lake Washington between Seattle and Bellevue. Between 2010 and 2012, "per-person hours of delay" on the I-90 corridor increased 70% from 30 minutes in 2010, to 48 minutes in 2012. This means an average commuter spent an additional 18 minutes on the road over the course of 2012, compared to 2010. Even though the vehicle miles traveled and corridor traffic volume increased 4% and 7%, respectively, the "person-miles traveled" declined 3% in 2012 compared to 2010. Similarly, the corridor saw a 12% decline in emissions per-person, in the same timeframe.

I-90 corridor productivity analysis:

Highway productivity: As traffic increases, a road is able to carry fewer vehicles; the result is a drop in the road's productivity. In order to gauge the lost productivity on the I-90 corridor, throughput was analyzed at two locations along the corridor (eastbound and westbound at SR 900 in Issaquah). In 2012, productivity at these locations ranged between 84% and 100%. For example, I-90 in the eastbound direction had 100% productivity in 2010 and 2012. However, the westbound direction continues to see a slight loss (16%) in vehicle throughput in 2012. Tolling SR 520 did not impact vehicle throughput eastbound, while it contributed to a 4% decrease in vehicle throughput westbound in 2012 compared to 2010.

Westbound I-90 at SR 900 (MP 16.5)
Based on highest observed five-minute flow rate; 1,630 vphpl



Data source: WSDOT Urban Planning Office.

Transit capacity: Transit carries several thousand people along the I-90 corridor each day during peak commute periods. Transit capacity is based on the number of occupied seats. Transit utilization rates along the I-90 corridor vary between 60% and 83% during peak periods. During the peak transit hours (6-9 a.m. and 3-6 p.m.) there is frequently standing-room only on the most heavily-used buses.

Park and ride capacity: Availability of park and ride (P&R) locations within the transit service network is integral to transit ridership along express routes in the central Puget Sound area. P&R locations need to have enough parking spaces to accommodate transit demand. On the I-90 corridor between Seattle and Bellevue, the South Bellevue P&R and Mercer Island P&R recorded 100% utilization of the available capacity. The P&R lots along I-90 between Bellevue and Issaquah experienced utilization rates ranging between 86% and 96%. For more P&R lot details see: www.wsdot.wa.gov/choices/parkride.cfm

Capacity constraints along I-90 corridor:

The I-90 corridor has five prominent points of congestion that lengthen the existing commute trip time as shown on the previous page. Three of the five congested segments are in the westbound direction while two shorter segments form in the eastbound direction. For example, during the 10-mile long Bellevue to Seattle morning commute, backups extend 3.5 miles along the I-90 floating bridge and last on average 1 hour and 30 minutes daily. The same commute during evening peak period experiences a 3.5-mile long backup in the Mercer Island area extending to the western portion of the floating bridge that lasts for 3 hours on average weekdays. The three routinely congested westbound segments contribute to significant congestion on I-90. This is due in part to the recovering regional economy and shifting traffic patterns caused by the SR 520 bridge toll.

Commute trip reliability and average travel times:

The westbound trips using I-90 across Lake Washington were slower in 2012 than in 2010, as some travelers chose to divert to I-90 (non-tolled option) for cross-lake travel. The morning travel times to Seattle on I-90 grew by 20% over the two-year period, while evening commute travel times to Seattle were up 8%. WSDOT completed the Two-Way Transit and HOV Operations project, which extended the eastbound HOV lane to 80th Avenue Southeast in the middle of Mercer Island. This project resulted in additional capacity and slight travel time improvements during the eastbound morning and evening commutes from Seattle using I-90. For more details, see pp. 42-56.

So how much is congestion costing you?

In 2012, the commute congestion cost incurred by each person on the I-90 corridor, for a round trip to and from work, ranged from $600 to $1,000 per year. The Bellevue-Seattle round trip annual cost due to congestion (wasted time and gas) per person was $1,000. For a household of two commuters this means a total of $2,000 extra each year in transportation related costs and time.

Central Puget Sound area SR 167 corridor performance

Annual miles traveled per person[1]

2007	2010	2012	
2,198	2,348	2,383	▲ 2%
Baseline	in miles traveled		2010 vs. 2012

Annual delay[2] per person

2007	2010	2012	
2.6	1.6	1.8	▲ 10%
Baseline	in hours of delay		2010 vs. 2012

Annual emissions per person

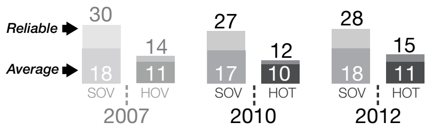
2007	2010	2012	
N/A	2,320	2,285	▼ 2%
Baseline	in pounds of CO_2		2010 vs. 2012

Commute trip travel times

Average and Reliable[3] travel times in minutes; For single occupancy vehicle (SOV) trips and high occupancy toll (HOT) trips; Peak period transit ridership; Average percent of transit seats occupied

Auburn to Renton morning commute

Weekdays; 5-10 a.m.; Trip length 10 miles; Travel times in minutes



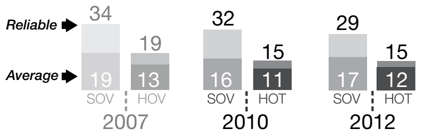
2012

380 peak period transit ridership

51% of seats occupied on average

Renton to Auburn evening commute

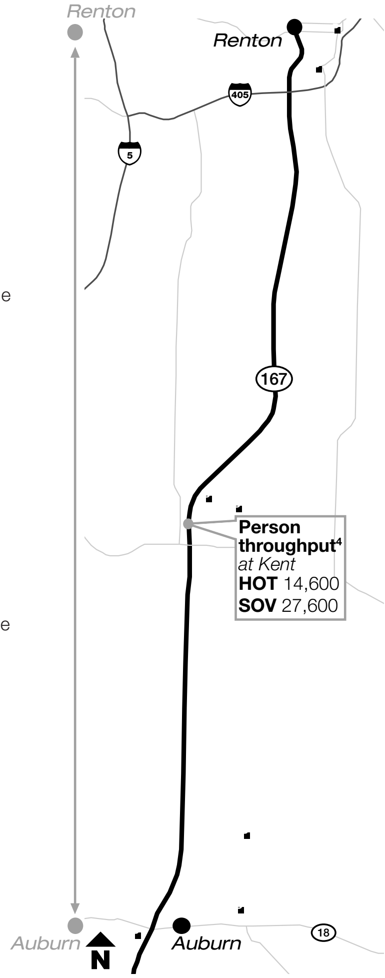
Weekdays; 2-8 p.m.; Trip length 10 miles; Travel times in minutes



2012

410 peak period transit ridership

41% of seats occupied on average

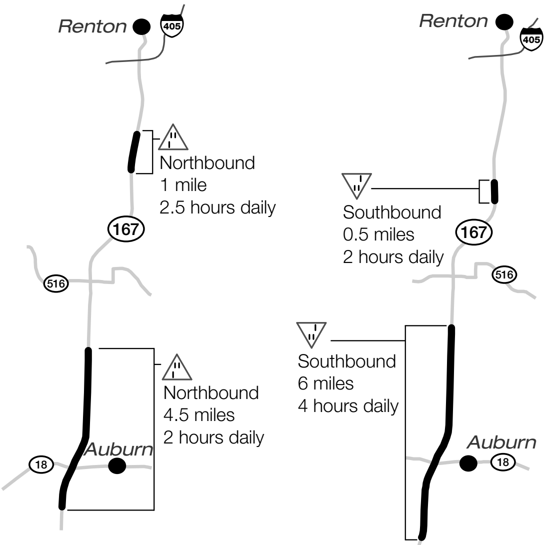


Person throughput[4]
at Kent
HOT 14,600
SOV 27,600

Routinely congested segments

2012; Weekday morning and evening peak periods (5-10 a.m. and 2-8 p.m.); Direction of travel; Length in miles; Duration of congestion in hours

Morning commute **Evening commute**



Morning commute:

Northbound
1 mile
2.5 hours daily

Northbound
4.5 miles
2 hours daily

Evening commute:

Southbound
0.5 miles
2 hours daily

Southbound
6 miles
4 hours daily

ark and ride capacity[5]

2012; Parking spaces and average percent of spaces occupied

Auburn-Renton commute route

Park and ride	Spaces	Percent occupied
Auburn Station	634	99%
Auburn P&R	358	48%
Kent/James St P&R	713	21%
Kent Station	996	97%
Peasley Canyon P&R	54	89%
Renton Municipal Garage	200	90%
Renton P&R	150	96%
South Renton P&R	373	98%

Created in partnership with community transit, King County METRO, Puget Sound Regional Council PSRC, SOUND TRANSIT

Data source: Washington State Transportation Center at the University of Washington, WSDOT Urban Planning Office, WSDOT Strategic Assessment Office, Sound Transit, King County Metro, Community Transit

Notes: Per person, all day annual metrics at the top of the page are for the entire SR 167 central Puget Sound area corridor between Auburn and Renton. “Transit” includes bus, light rail, and commuter rail. 1 Per person refers to commuters on the corridor. Miles traveled per person is vehicle miles traveled on SR 167 multiplied by average car occupancy. 2 Delay is when vehicles travel below 85% of posted speed limits. 3 Reliable travel time is the travel time that will get a commuter to their destination 19 out of 20 times or 95% of the time. 4 Person throughput is the sum of people using all HOV and SOV lanes from 6-9 a.m. and 3-7 p.m. in the peak direction of the commute at a point location. 5 Only includes capacity for selected park and rides.

SR 167 corridor performance story - central Puget Sound area

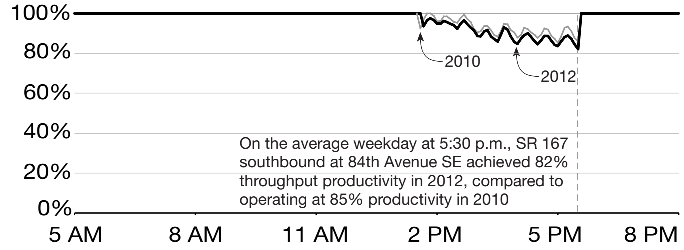
SR 167 in the central Puget Sound area is an extension to I-405 and runs between Renton and Auburn. The SR 167 high occupancy toll (HOT) lanes are high occupancy vehicle (HOV) lanes open to solo drivers who choose to pay a toll. Drivers who opt to use the HOT lanes save time and reduce the stress associated with their daily commute, while also reducing the volume of the traffic in the single-occupancy vehicle (SOV) lanes.

Between 2010 and 2012, “per-person hours of delay” on the SR 167 corridor increased 10% from 1 hour and 36 minutes in 2010 to 1 hour and 48 minutes in 2012. This means an average commuter spent an additional 12 minutes on the road in 2012, compared to 2010. “Person-miles traveled” and emissions per person each changed by 2%.

SR 167 corridor productivity analysis:

Highway productivity: As traffic increases, a road is able to carry fewer vehicles; the result is a drop in the road’s productivity. In order to gauge the lost productivity on the SR 167 corridor, throughput was analyzed at two locations along the corridor (northbound and southbound at 84th Avenue SE). In 2012, productivity at these locations ranged between 82% and 89%. For example, SR 167 at 84th Avenue SE in the southbound direction saw a productivity loss of 18% at 5:30 p.m. during the evening peak period, 3% worse than in 2010. This productivity could be recovered if the roadway could be operated more efficiently. For more details on the SR 167 corridor productivity analysis, see pp. 38-40.

Southbound SR 167 at 84th Avenue SE (MP 21.5)
Based on highest observed five-minute flow rate; 1,620 vphpl



On the average weekday at 5:30 p.m., SR 167 southbound at 84th Avenue SE achieved 82% throughput productivity in 2012, compared to operating at 85% productivity in 2010

Data source: WSDOT Urban Planning Office.

Transit capacity: Transit carries several hundred people along the SR 167 corridor each day during peak commute periods. Transit capacity is based on the number of occupied seats. Transit utilization rates along the SR 167 corridor vary between 41% and 51% during peak periods.

Park and ride capacity: Availability of park and ride (P&R) locations within the transit service network is integral to transit ridership. P&R locations need to have enough parking spaces to accommodate transit demand. On the SR 167 corridor between Auburn and Renton, the majority of P&R lots have utilization rates close to 90% or more of the available capacity. For more P&R lot details see: www.wsdot.wa.gov/choices/parkride.cfm

Capacity constraints along SR 167 corridor: Even though the implementation of high occupancy toll (HOT) lanes on the SR 167 corridor greatly improved corridor performance there are still four prominent points of congestion that lengthen the existing commute trip time as shown on the previous page. For example, the southbound evening commute experiences a 6-mile backup between the Green River bridge and SR 18 that lasts 4 hours on an average weekday.

Commute trip reliability and average travel times: In 2012, the northbound HOT lane saved weekday drivers an average of 7 minutes of travel time during the peak period. Average travel time in the HOT lane was 11 minutes compared to 18 minutes in the SOV lanes. The weekday southbound HOT lane saved drivers 5 minutes during the evening peak, with average travel times of 12 minutes in the HOT lane and 17 minutes in the SOV lane.

The 95th percentile reliable travel time in the HOT lanes is 15 minutes, while the SOV trip takes 28 minutes from Auburn to Renton in the morning and 29 minutes from Renton to Auburn in the evening. This means that drivers who carpool or pay a toll to use the HOT lane can leave with just about half the time for their trip and still arrive early or on time for 19 of 20 weekday trips compared to those who use the SOV lanes for the same trip. For exclusive SR 167 HOT lane analysis, see p. 79.

So how much is congestion costing you? In 2012, the commute congestion cost incurred by each person on the SR 167 corridor, for a round trip between Auburn and Renton, was $700 per person annually. For a household of two commuters this means a total of $1,400 extra each year in transportation related costs and time.

Toll rate displayed on overhead signs alert drivers to the current cost of using the SR 167 HOT lanes as a solo driver. High occupancy vehicles can always use the lanes for free.

South Puget Sound area I-5 corridor performance

Annual miles traveled per person[1]

2007	2010	2012	
11,231	11,352	11,400	↑ 0.4%
Baseline	in miles traveled		2010 vs. 2012

Annual delay[2] per person

2007	2010	2012	
11	18	17	↓ 6%
Baseline	in hours of delay		2010 vs. 2012

Delay per person mile traveled

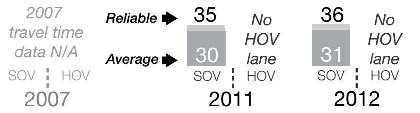
2007	2010	2012	
3.1	5.0	4.7	↓ 6%
Baseline	in seconds		2010 vs. 2012

Commute trip travel times

Average and Reliable[3] travel times in minutes

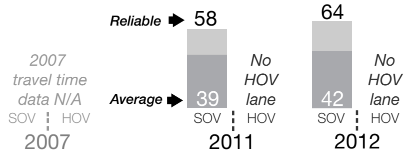
Olympia to Tacoma morning commute

Weekdays; 5-10 a.m.; Trip length 27 miles; Travel times in minutes



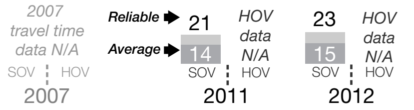
Tacoma to Olympia evening commute

Weekdays; 2-8 p.m.; Trip length 28 miles; Travel times in minutes



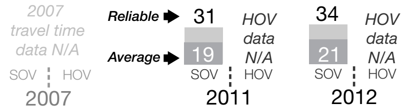
Tacoma to Federal Way morning commute

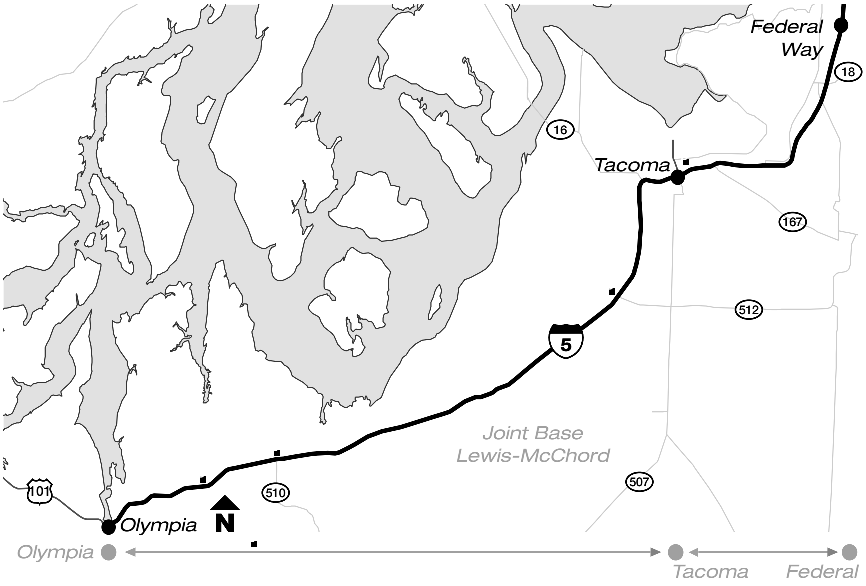
Weekdays; 5-10 a.m.; Trip length 11 miles; Travel times in minutes



Federal Way to Tacoma Evening commute

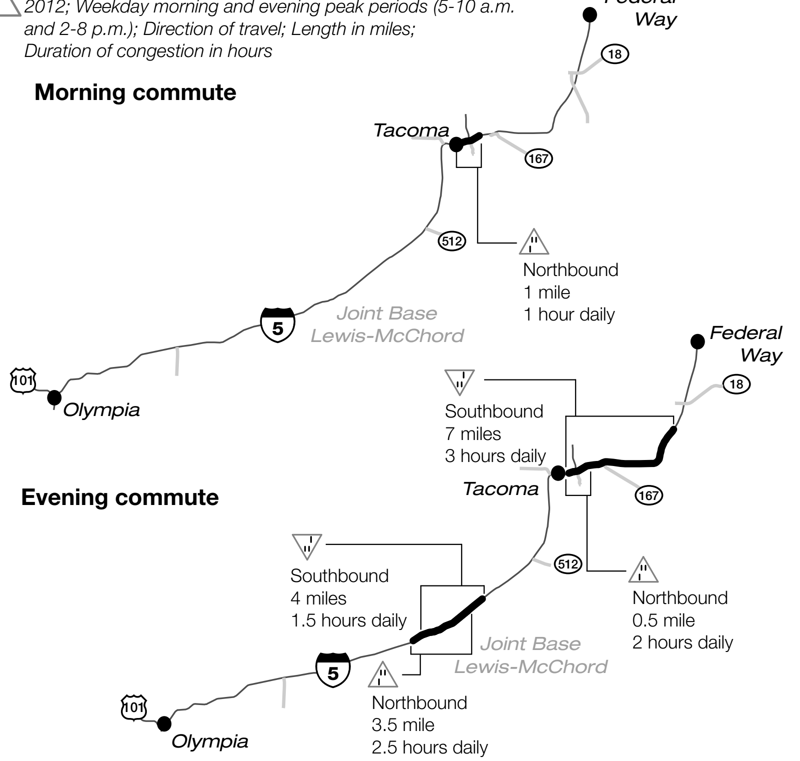
Weekdays; 2-8 p.m.; Trip length 9 miles; Travel times in minutes





Routinely congested segments

2012; Weekday morning and evening peak periods (5-10 a.m. and 2-8 p.m.); Direction of travel; Length in miles; Duration of congestion in hours


Morning commute

Evening commute

Park and ride capacity[5]

2012; Parking spaces and average percent of spaces occupied

Olympia-Federal Way commute route

Park and ride	Spaces	Percent occupied
Martin Way P&R	318	50%
Hawks Prairie P&R	332	15%
DuPont P&R	125	60%
Lakewood Station	600	48%
SR 512 lakewood P&R	493	93%
Tacoma Dome Station	2,273	96%

Created in partnership with INTERcity TRANSIT

Data source: Washington State Transportation Center at the University of Washington, WSDOT Strategic Assessment Office, WSDOT Olympic Region, Intercity Transit

Notes: Per person, all day annual metrics at the top of the page are for the entire I-5 south Puget Sound area corridor between Olympia and Federal Way. "Transit" includes bus, light rail, and commuter rail. 1 Per person refers to commuters on the road, excluding transit. Miles traveled per person is vehicle miles traveled on I-5 during weekdays multiplied by average car occupancy. 2 Delay is when vehicles travel below 85% of posted speed limits. 3 Reliable travel time is the travel time that will get a commuter to their destination 19 out of 20 times or 95% of the time. 4 Only includes capacity for selected park and rides.

I-5 corridor performance story - south Puget Sound area

This report for the first time includes travel time trends for the south Puget Sound area. This addition expands the existing coverage of the central Puget Sound area for a more comprehensive understanding of statewide commute trends. The I-5 commuting corridor for the south Puget Sound area is the 38-mile stretch between Olympia and Federal Way, divided into smaller segments based on the job centers in the area.

The corridor experiences moderate to heavy congestion during the evening commute period on a daily basis. Between 2011 and 2012, "per-person hours of delay" on this section of the I-5 corridor decreased 6% from 18 hours in 2011 to 17 hours in 2012. This means an average commuter spent one hour less on the road in 2012, compared to 2011. A 6% reduction was observed in delay per person miles traveled. However, the corridor did not see any significant changes in "person-miles traveled."

In 2012, delay on the I-5 corridor in the central Puget Sound and in the south Puget Sound area were similar in terms of the vehicle hours of delay experienced on a daily basis (around 10,000 vehicle hours of delay). However, daily traffic volumes on I-5 in the central Puget Sound area (approximately 334,000) are much higher than in the south Puget Sound area (135,000). Thus, the delay per person is higher in the south Puget Sound area.

Capacity constraints along I-5 corridor:
The I-5 corridor has prominent points of congestion that lengthen the existing commute trip time as shown on the previous page. For example, the congestion through the Joint Base Lewis-McChord (JBLM) has made headlines in the recent past due to unprecedented traffic jams experienced in 2010 after Labor Day. Leaders from WSDOT, JBLM administrators, Washington State Patrol (WSP) and local municipalities formed the Traffic Circulation Committee to identify and resolve traffic operations issues. The initial efforts of this committee were successful in creating interim congestion relief. However, more efforts are on the way to handle the JBLM congestion issues. For more details, see the 2012 *Congestion Report*, pp. 63-65.

In 2012, the evening commute through JBLM experienced congestion in both northbound and southbound directions. Congestion northbound extended 3.5 miles between Steilacoom DuPont Road and Thorne Lane; it lasted about 2 hours and 30 minutes. Similarly, southbound in the evening congestion extended 3 miles and lasted for an hour.

One other prominent congestion location is between the King-Pierce county line and Portland Avenue in Tacoma. This 7-mile segment experiences 3 hours of delay southbound on a daily basis. During the morning northbound commute, there is 1 hour of congestion for 1 mile between Pacific and Portland avenues.

Commute trip reliability and average travel times:
Travel times on 19 of 20 morning commutes on I-5 to and from cities between Olympia and Federal Way remained relatively steady, changing less than 2 minutes in 2012 compared to 2011. The evening commute on I-5 from Tacoma to Olympia saw a 3-minute increase in average travel time in 2012 compared to 2011.

The 95th percentile reliable travel time changed less than 2 minutes on 11 of the 20 routes. The other nine routes experienced travel time changes of more than 2 minutes during that period: seven of those routes saw longer reliable travel times, and two routes saw shorter reliable travel times. The largest deterioration in reliable travel time of 9 minutes was on the Lakewood to Lacey commute. The largest improvement of 4 minutes was on the evening commute northbound from Tacoma to Federal Way. For more details, see pp. 57-60.

Transit, park and ride:
Transit ridership on this stretch of I-5 was not included as part of the analysis. Starting next year, transit analysis is planned for this urban area. Park and ride (P&R) lot information is presented. P&R locations need to have enough parking spaces to accommodate transit demand. Availability of P&R locations within the transit service network is integral to transit ridership. On the I-5 corridor between Olympia and Federal Way, the Tacoma Dome station and SR 512 Lakewood P&R recorded utilization of more than 90% of the available capacity, while the other P&R locations recorded relatively lower utilization rates.

The Martin Way park and ride lot in Lacey serves commuters in the south Puget Sound area who are interested in sharing the ride.

Vancouver area I-5 and I-205 corridor performance

Annual miles traveled per person[1]

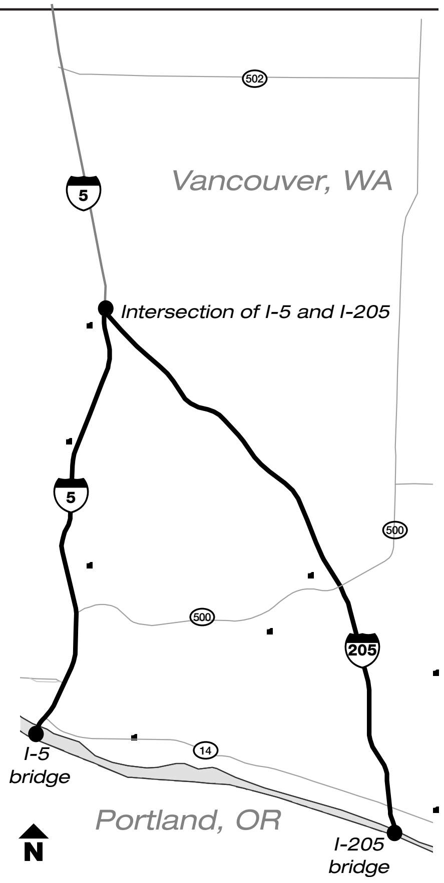
2007	2010	2012	
4,969	4,958	4,956	0%
Baseline	in miles traveled		2010 vs. 2012

Annual delay[2] per person

2007	2010	2012	
0.88	0.80	0.82	3%
Baseline	in hours of delay		2010 vs. 2012

Delay per person mile traveled

2007	2010	2012	
0.54	0.49	0.51	2%
Baseline	in seconds		2010 vs. 2012



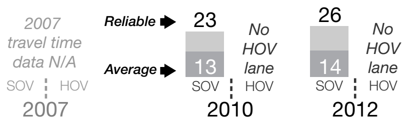
Commute trip travel times

Average and Reliable[3] travel times in minutes

Interstate 5

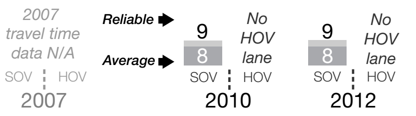
I-205 to I-5 bridge morning commute

Weekdays; 7-10 a.m.; Trip length 8 miles; Travel times in minutes



I-5 bridge to I-205 evening commute

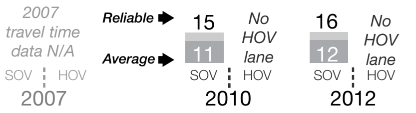
Weekdays; 3-6 p.m.; Trip length 8 miles; Travel times in minutes



Interstate 205

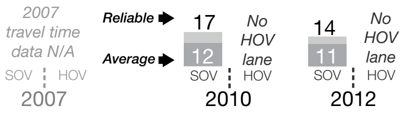
I-5 to I-205 bridge morning commute

Weekdays; 7-10 a.m.; Trip length 11 miles; Travel times in minutes



I-205 bridge to I-5 evening commute

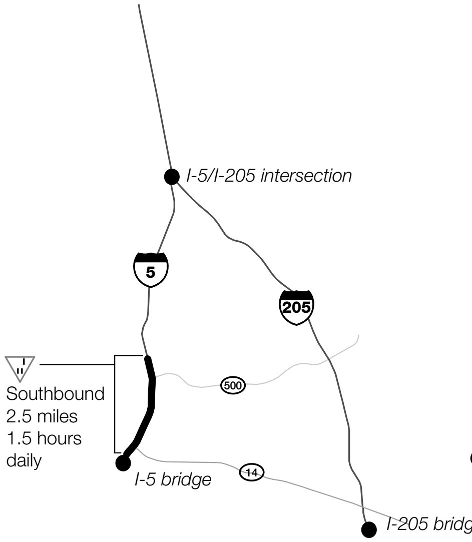
Weekdays; 3-6 p.m.; Trip length 11 miles; Travel times in minutes



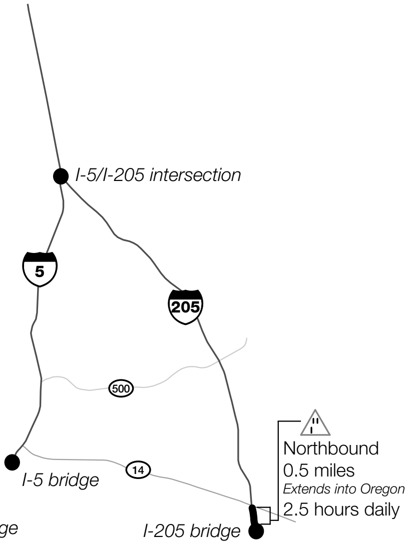
Routinely congested segments

2012; Weekday morning and evening peak periods (7-10 a.m. and 3-6 p.m.); Direction of travel; Length in miles; Duration of congestion in hours

Morning commute



Evening commutes



Park and ride capacity[4]

2012; Parking spaces and average percent of spaces occupied

Interstate 5 commute route

Park and ride	Spaces	Percent occupied
Columbia House P&R	35	89%
BPA P&R	162	27%
99th Street Transit Center	488	56%
Salmon Creek P&R	563	37%

Interstate 205 commute route

Park and ride	Spaces	Percent occupied
Vancouver Mall Transit Center	N/A[5]	N/A[5]
Evergreen P&R	244	16%
Fisher's Landing Transit Center	428	76%
Living Hope Church P&R	60	N/A[5]

Created in partnership with RTC Southwest Washington Regional Transportation Council

Data source: Starlab at the University of Washington, WSDOT Southwest Region Planning Office, WSDOT Strategic Assessment Office, Southwest Washington Regional Transportation Council

Notes: Per person, all day annual metrics at the top of the page are for the the Vancouver area which includes Clark County. 1 Per person refers to commuters on the road, excluding transit. Miles traveled per person is vehicle miles traveled on I-5 and I-205 during weekdays multiplied by average car occupancy. 2 Delay is when vehicles travel below 85% of posted speed limits. 3 Reliable travel time is the travel time that will get a commuter to their destination 19 out of 20 timesor 95% of the time. 4 Only includes capacity for selected park and rides. 5 Parking spaces also serve a private entity so total number or utilization for park and ride purposes is not available.

I-5 and I-205 corridor performance story - Vancouver area

For the first time this report includes travel time trends for the Vancouver-Portland metropolitan area for a more comprehensive understanding of statewide commute trends. The Vancouver-area commutes include an 8-mile stretch of I-5 between the I-5/I-205 junction down to the I-5 Columbia River Bridge, and the parallel I-205 route 11 miles long down to the Glenn Jackson Bridge. These sections of the I-5 and I-205 corridors are reported in smaller segments based on the commuting patterns in the area.

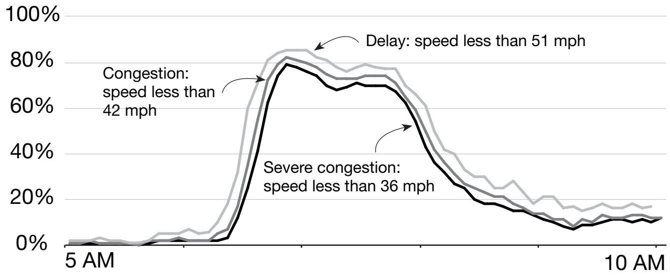
These Vancouver-area corridors experience moderate to heavy congestion during commute hours on a daily basis. Between 2010 and 2012, "per-person hours of delay" on the I-5 corridor increased 3% from 48 minutes in 2010 to 49 minutes in 2012. This means an average commuter spent an additional minute on the road each day over the course of 2012, compared to in 2010. Similarly, a 2% increase was observed in delay per person mile traveled. However, the corridor did not see any change in "person-miles traveled", in the same timeframe.

Capacity constraints along I-5 corridor:
The southbound I-5 Columbia River Bridge is the prominent point of congestion that lengthens the existing commute trip time to Oregon. The number of through lanes and posted speed limit are reduced as traffic approaches the I-5 bridge. In addition, there are closely spaced access points (weave between Mill Plain and SR 14) and short merge locations (SR 14 on-ramp). These route characteristics lead to a reduction in the capacity of the corridor. Congestion routinely occurs starting at the I-5 bridge, delaying southbound drivers, and causing a backup extending 2.5 miles north from the bridge and lasting for more than 1 hour and 30 minutes during the morning peak period.

The northbound I-5 Columbia River Bridge is a bottleneck during the evening peak direction, which creates congestion in Oregon for drivers heading into Washington.

Capacity constraints along I-205 corridor:
The I-205 corridor experiences congestion in the evening peak period (3-6 p.m.) at the off-ramp to SR 14 due to the high volume of northbound traffic exiting to SR 14 eastbound. The tight curve of this ramp (advisory speed 30 mph posted) inherently reduces its capacity compared to a typical ramp. Even if the ramp did not have this tight curve, the demand would require an additional lane to accommodate the number of vehicles exiting I-205. The length of the queue extends far beyond the state line and lasts about 2 hours and 30 minutes.

I-5 morning commute from SR 500 to the I-5 bridge
Percent of weekdays delayed or congested in 2012



Data source: Private sector speed data provided through WSDOT Southwest Region Planning.

Some other congestion locations in the Vancouver area that are not displayed on the previous page are important but do not have significant congestion durations: I-205/ SR 500 to Padden Parkway, I-205 southbound on-ramp from SR 500, I-205 northbound off-ramp to SR 500.

Commute trip reliability and average travel times:
Commuters traveling from Vancouver to Portland on I-5 during the morning (7-10 a.m.) peak period experience travel times more than twice as long as during free-flowing conditions. At the peak of the morning commute (7:40 a.m.), it took an average of 7 minutes (at a speed of about 17 mph) in both 2010 and 2012 to drive the two-mile southbound trip on I-5 from SR 500 to the I-5 Columbia River Bridge. This congestion is caused by the narrow I-5 bridge, the congestion created by the on-ramp near the approach to the bridge and the ingress points between SR 500 and the I-5 Columbia River Bridge.

For the I-205 evening commute, VMT increased 4% between 2010 and 2012 on the northbound section of I-205 between the Glenn Jackson Bridge and the interchange with I-5. This increase is due to typical growth and possible diversion of drivers to I-205 to avoid the congestion south of the I-5 bridge. For more details see pp. 61-62.

Transit, park and ride:
Transit ridership on this stretch of I-5 and I-205 was not included as part of the analysis. Starting next year, transit analysis is planned for this urban area. Park and ride (P&R) lot information is presented. These locations need to have enough parking spaces to accommodate transit demand. On the I-5 corridor between the I-5/I-205 junction down to the I-5 Columbia River Bridge, the Columbia House P&R and 99th Street Transit Center have utilization rates of 89% and 56% respectively. Similarly, on the I-205 corridor Fisher's Landing Transit Center has a utilization rate of 76%, while the Evergreen P&R recorded 16% utilization rate.

Marine highways performance - Washington State Ferries

Annual ridership[1]

	2010	2012
passengers	12.35	12.23
vehicles	10.10	9.98

▼ 1%

in millions of passengers and vehicles

Annual trip reliability[2]

2010	2012
99.6%	99.5%

▼ 0.1%

of scheduled trips sailed

Annual fuel usage + use per service mile

FY2010[3]	FY2012
17.21	17.47

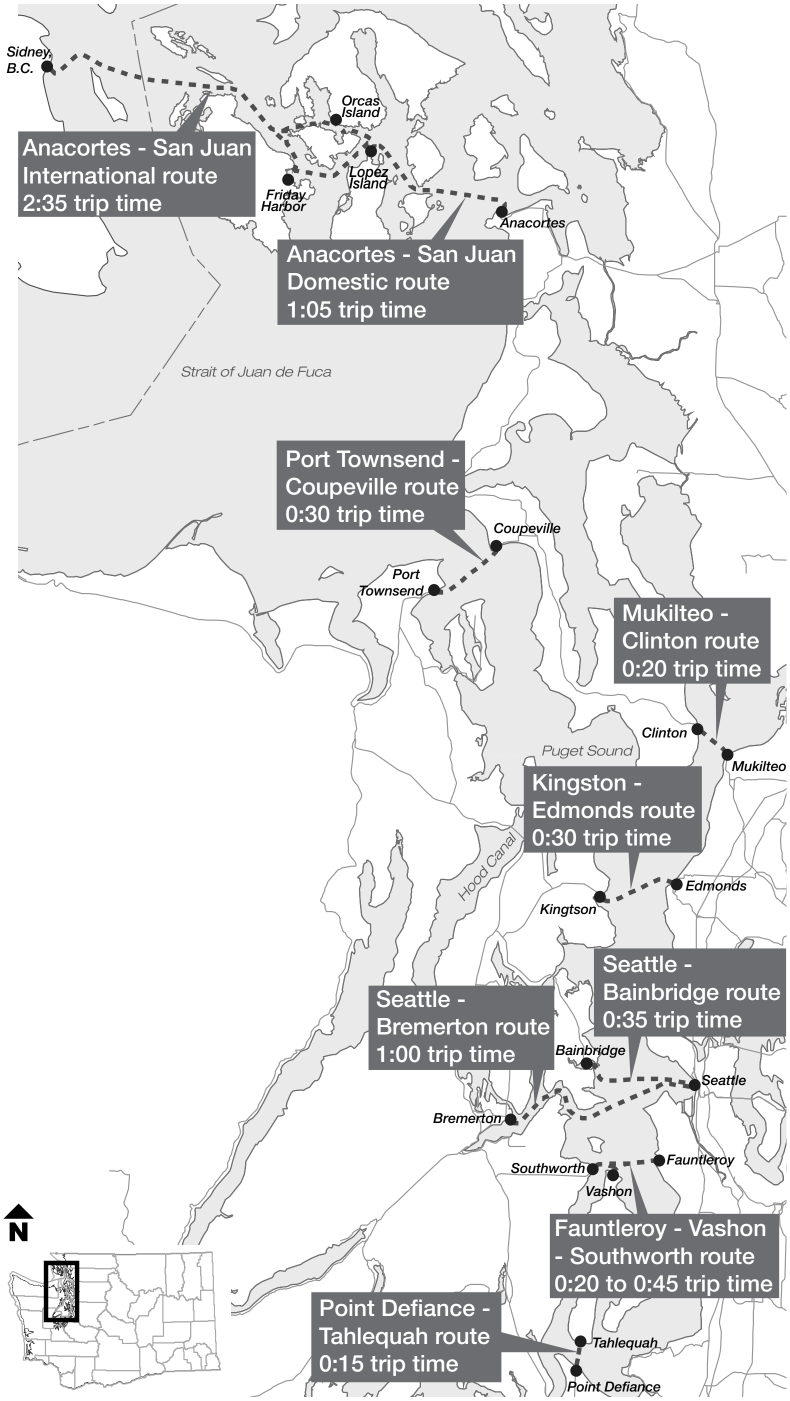
in millions of gallons

▲ 2%

▼ 1%

FY2010	FY2012
19.6	19.3

in gallons per mile



On-time[4] performance by route

2010 and 2012; Annual percent of trips that departed on time; Goal: 95% of trips depart on time annually

Ferry route

Route	2010	2012	Δ
Anacortes - San Juan domestic	83.2%	88.0%	4.8%
Anacortes - San Juan - Sidney, B.C.	82.2%	88.8%	6.6%
Edmonds - Kingston	89.1%	99.3%	10.2%
Fauntleroy - Vashon - Southworth	87.4%	95.6%	8.2%
Mukilteo - Clinton	92.6%	98.7%	6.1%
Point Defiance - Tahlequah	89.3%	99.4%	10.1%
Port Townsend - Coupeville	87.2%	93.3%	6.1%
Seattle - Bainbridge	89.6%	97.3%	7.7%
Seattle - Bremerton	92.7%	97.9%	5.2%
System-wide	**88.4%**	**95.7%**	**7.3%**

Ferry route capacity[5]

As of August 2013; Number of cars and passengers allowed per route on a weekday based on cumulative daily average capacity of vessels serving the route

Ferry route

Route	Passengers	Vehicles
Anacortes - San Juan domestic	68,708	5,900
Anacortes - San Juan - Sidney, B.C.	4,304	496
Edmonds - Kingston	109,000	9,388
Fauntleroy - Vashon - Southworth	120,308	11,313
Mukilteo - Clinton	93,600	9,672
Point Defiance - Tahlequah	28,500	2,432
Port Townsend - Coupeville	22,500	1,920
Seattle - Bainbridge	115,000	9,292
Seattle - Bremerton	47,200	4,000

Ferry trip travel times

Scheduled travel times by ferry route in hours and minutes

Ferry route

Route	Trip time
San Juan domestic	1:05
International route	2:35
Edmonds - Kingston	0:30
Fauntleroy - Vashon - Southworth[6]	0:20 to 0:45
Mukilteo - Clinton	0:20
Point Defiance - Tahlequah	0:15
Port Townsend - Coupeville	0:30
Seattle - Bainbridge	0:35
Seattle - Bremerton	1:00

Data source: WSDOT Ferries Division.

Notes: Data for the San Jaun inter-island route is combined with the San Juan domestic route. 1 Passenger ridership includes vehicle drivers and passengers, as well as walk-on passengers and bicyclists. 2 Trip reliability is the percent of scheduled sailings that sailed. 3 FY2010 stands for Fiscal Year 2010, starting July 1, 2009 and ending June 30, 2010. 4 A vessel is considered on time if it departs within 10 minutes of its scheduled departure. 5 Route capacity includes the cumulative capacity on all vessels serving that route. 6 Some trips are direct between two locations (with shorter trip times) and others serve all three locations.

Marine highway corridor performance story - Washington State Ferries

For the first time, WSDOT is including ferry service performance in the annual report on highway performance. The Washington State Ferries (WSF) service routes are defined as marine highways; they are integral links across the Puget Sound, connecting island and peninsula communities with the major employment centers on the mainland.

Annual ridership decreased 1%, with about 124,000 fewer passengers, and 126,000 fewer vehicles in 2012 than in 2010. The annual trip reliability decreased by 0.1%, meaning that there were slightly more canceled trips in 2012 than in 2010. However, the trip reliability system wide still met the goal of at least 99% of scheduled sailings being completed.

Fuel use is related to the number of sailings, the type and size of vessel, and route characteristics. The 2% increase in fuel use in 2012 was in part a result of adding a second boat to the Port Townsend - Coupeville route, and using the new, larger Kwa-di Tabil class Motor/Vessel (M/V) *Chetzemoka* vessel on the Point Defiance – Tahlequah route, after the M/V *Rhododendron* was retired in January 2012. Fuel use per service mile decreased 1% between 2010 and 2012.

Marine highway corridor analysis:

On-time performance: There were more than 159,000 sailings in 2012, and while this is 640 fewer than in 2010, it still represents an impressive average of 435 sailings every day of the year. WSF strives to keep vessels sailing on time, with a goal of at least 95% of all sailings departing within 10 minutes of their scheduled departure. In 2012, on-time performance improved at least 4.8% on all routes, with a maximum improvement of 10.2% on the Edmonds – Kingston route. Six of the nine routes surpassed the goal of at least 95% of their sailings departing on time in 2012, while in 2010, the highest on-time performance was 92.7%.

Ferry route capacity: WSF owns and operates 22 ferry vessels, serving nine routes, with stops at 19 ferry terminals in Washington and one in Sidney, B.C. Seven of the nine ferry routes are served by at least two vessels – typically operating simultaneously in order to keep terminal wait times low. The route capacity is defined as the cumulative passenger and vehicle capacities of each vessel serving a particular route.

During the peak summer season, three vessels serve as maintenance spares, ready to replace a vessel that is taken out of service for planned or emergency maintenance. The replacement vessels may have a reduced capacity compared to the vessel typically serving a route. Another capacity constraint relates to staffing. The U.S. Coast Guard sets the number of crew required onboard for each vessel in order to sail. Some of the larger vessels could operate with fewer crew members during off-peak sailings on some routes, by closing the upper level passenger decks to reduce capacity. These scenarios illustrate that the capacity on a route may fluctuate.

Ridership by route: Passenger and vehicle ridership increased on four routes by 1% to 27%. The largest ridership increase was on the Port Townsend – Coupeville route, which was restored to two-boat service in July 2011, resulting in 1,560 more trips made in 2012 than in 2010. The Anacortes – San Juan Islands route had 874 fewer trips made, but the ridership still increased 1% to 2%. This is likely due to the limited transportation options between the Islands and from the Islands to the mainland.

Ferries' ridership, number of trips annually, and trip reliability

2010 and 2012; Ridership in thousands; Annual reliability goal = 99%

	Ridership (passengers)			Ridership (vehicle and driver)			Number of trips (actual trips sailed)			System wide reliability[1]		
Route	**2010**	**2012**	**%Δ**	**2010**	**2012**	**%Δ**	**2010**	**2012**	**Δ**	**2010**	**2012**	**Δ**
Anacortes – San Juan domestic	890	907	2%	836	848	1%	27,739	26,865	-874	99.7%	99.8%	0.1%
Anacortes – San Juan – Sidney, B.C.	79	87	10%	44	48	10%	736	756	20	100.0%	100.0%	0.0%
Edmonds – Kingston	1,917	1,783	-7%	2,157	2,025	-6%	17,600	17,066	-534	99.6%	100.0%	0.4%
Fauntleroy – Vashon – Southworth	1,231	1,212	-1%	1,709	1,674	-2%	41,061	40,960	-101	99.8%	99.4%	-0.4%
Mukilteo – Clinton	1,767	1,745	-1%	2,117	2,090	-1%	26,709	26,808	99	99.7%	99.8%	0.1%
Point Defiance – Tahlequah	274	267	-3%	376	383	2%	14,024	13,818	-206	99.9%	99.4%	-0.5%
Port Townsend – Coupeville	309	361	17%	255	323	27%	6,975	8,535	1,560	95.5%	96.9%	1.4%
Seattle – Bainbridge Island	4,026	4,178	4%	1,951	1,941	-1%	16,509	16,571	62	99.9%	100.0%	0.1%
Seattle – Bremerton	1,859	1,688	-9%	657	642	-2%	10,887	10,863	-24	99.9%	99.4%	-0.5%
Total	**12,350**	**12,227**	-1%	**10,101**	**9,975**	-1%	**162,240**	**162,242**	**2**	**99.6%**	**99.5%**	**-0.1%**

Data source: WSDOT Ferries Division.

Notes: Sum of routes may not equal total due to rounding. 1 Reliability is the percent of scheduled trips that sailed. "Δ" denotes change in a variable.

Spokane area I-90 corridor performance

Annual miles traveled per person[1]

2007	2011	2012	
12,113	12,170	11,946	2%
Baseline	in miles traveled		2010 vs. 2012

Annual delay[2] per person

2007	2011	2012	
0.79	1.08	0.86	21%
Baseline	in hours of delay		2010 vs. 2012

Delay per person mile traveled

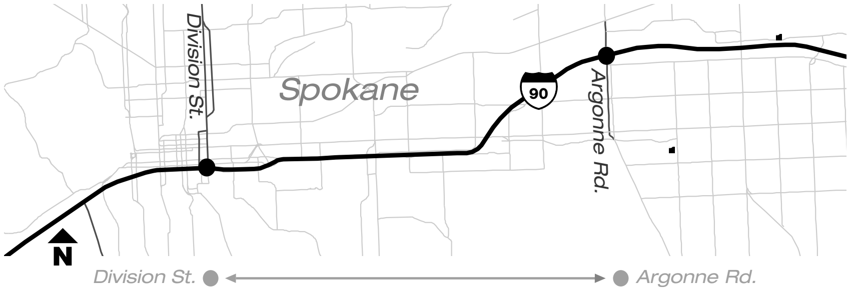
2007	2011	2012	
0.20	0.27	0.22	21%
Baseline	in seconds		2010 vs. 2012

Commute trip travel times

Average and Reliable[3] travel times in minutes

Argonne Rd. to Division St. morning commute

Weekdays; 7-10 a.m.; Trip length 7.5 miles; Travel times in minutes



Division St. to Argonne Rd. evening commute

Weekdays; 3-6 p.m.; Trip length 7.5 miles; Travel times in minutes

ark and ride capacity[4]

2012; Parking spaces and average percent of spaces occupied

Argonne Rd. - Division St. commute route

Park and ride	Spaces	Percent occupied
Valley Transit Center	236	50%
Mirabeau Point P&R	198	86%
Liberty Lake P&R	120	100%

Created in partnership with

Data source: Washington State Transportation Center at the University of Washington, WSDOT Eastern Region Traffic Office, Spokane Transit Authority, WSDOT Strategic Assessment Office.

Notes: Per person, all day annual metrics at the top of the page are for the the Spokane area which includes Spokane County. 1 Per person refers to commuters on the road, excluding transit. Miles traveled per person is vehicle miles traveled on I-90 during weekdays multiplied by average car occupancy. 2 Delay is when vehicles travel below 85% of posted speed limits. 3 Reliable travel time is the travel time that will get a commuter to their destination 19 out of 20 timesor 95% of the time. 4 Only includes capacity for selected park and rides. Liberty Lake park and ride is not shown on the map.

The I-90 corridor in Spokane experiences moderate congestion during commute hours on a daily basis. Between 2010 and 2012, "per-person hours of delay" on the I-90 corridor decreased 21% from 1 hour and 5 minutes in 2010 to 52 minutes in 2012. This means an average commuter spent 13 less minutes on the road in 2012, compared to 2010. A similar 21% decrease was observed in delay per person mile traveled. However, "person-miles traveled" decreased only 2% in this timeframe.

Capacity constraints along I-90 corridor: Congested conditions occur primarily at two locations westbound on I-90: The first bottleneck westbound is primarily due to backups at the Division Street off-ramp, which occasionally impedes mainline traffic during the morning and evening peak periods. The City of Spokane attempts to mitigate the backups by adjusting the traffic signal timing at the ramp terminal.

The second westbound backup occurs between the Freya off-ramp and Thor on-ramp. Traffic on the Freya off-ramp will occasionally back up onto I-90 causing weaving for mainline traffic. The weaving doesn't subside until after the Thor on-ramp traffic merges onto I-90. Currently, WSDOT is looking at options to realign the off-ramp to alleviate these backups. This bottleneck occurs during both morning and evening peak periods.

Commute trip reliability and average travel times: The average trip time westbound on I-90 in the morning increased 1% to almost 9 minutes, while the eastbound evening trip time increased 6% to nearly 10 minutes.

The 95th percent reliable trip time improved 18% in the morning from almost 14 minutes down to 11 minutes from 2011 to 2012, meaning commuters could leave 3 minutes later in 2012 than in 2011, while still ensuring they arrived early or on-time for 95% of their trips. The evening trip time reliability worsened 16% from 13 minutes to more than 15 minutes. Commuters needed to plan an extra 2 minutes to ensure they arrived on time. For more details, see p. 63.

Transit, park and ride: Transit ridership on this stretch of I-90 was not included as part of the analysis. Starting next year, transit analysis is planned for this urban area. Park and ride (P&R) lot information is presented. P&R locations need to have enough parking spaces to accommodate transit demand. The Liberty P&R utilization rate is 100% while Mirabeau Point P&R and Valley Transit Center utilization rates are 86% and 50%, respectively.

Moving Ahead for Progress in the 21st Century (MAP-21) and Results Washington

At a glance

- ***Federal law ties spending of transportation aid to performance targets, ensuring state progress towards national goals***
- ***New state performance system includes transportation-related outcomes that will help strengthen our economy***

New Federal law puts emphasis on performance: Moving Ahead for Progress in the 21st Century

The Moving Ahead for Progress in the 21st Century (MAP-21) Federal law transitions federal transportation aid to a performance and outcome-based program. MAP-21 ensures states invest funds in transportation projects that make progress toward achieving national transportation goals. The MAP-21 law sets performance measure requirements for states to adhere to in various areas, including air quality, congestion, system performance, and highway system capacity. The national MAP-21 goals are:

- Improve safety
- Maintain and improve infrastructure condition
- Reduce congestion
- Improve system reliability
- Support freight movement and economic vitality
- Ensure environmental sustainability
- Reduce project delivery delays

WSDOT has been proactive in working with the American Association of State Highway and Transportation Officials (AASHTO) and the U.S. Department of Transportation to propose performance measures for MAP-21. Federal rule-making will determine performance measures for several areas, including freight movement and congestion-related measures; states will set targets within one year of final rule-making. For more information about the timeline for MAP-21, see *Gray Notebook* 49, pp. vii-viii.

Washington introduces new performance and accountability system: Results Washington

Governor Jay Inslee's strategic plan for Washington State includes a robust performance management and improvement system, called Results Washington. The Governor's plan focuses on key goals that will strengthen the economy, improve schools, and make Washington an ideal place to live and do business.

Highway system capacity and multi-modal performance measures proposed for Results Washington include increasing the percent of commuters using transportation methods other than driving alone, improving travel and freight reliability, reducing transportation-related greenhouse gas emissions, and increasing renewable energy use per vehicle mile traveled.

Sustainable and efficient infrastructure, bicycle and pedestrian safety, and clean transportation energy indicators will also measure progress toward the Governor's strategic goals.

WSDOT has worked closely with the Governor's Office to propose indicators of progress in these transportation-related areas.

At the time of this publication, Results Washington performance measures are under public review and planned to be finalized in the fall 2013. For more information about Results Washington, see http://www.results.wa.gov.

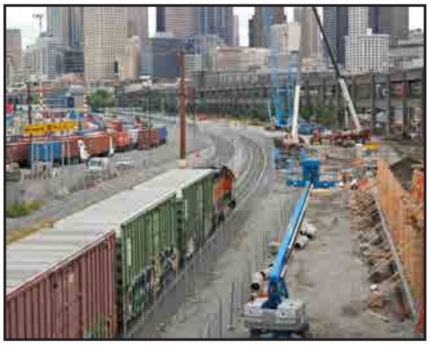
Capacity-related MAP-21 federal performance reporting requirements

MAP-21 goals by program area[1]	Federal threshold	MAP-21 target[2]	Existing WSDOT performance measures for this program area
National Freight Movement Program measures	No	TBD	WSDOT's freight mobility plan will address trucking, rail and marine freight. See *Gray Notebook* 49, p. 41, for MAP-21 freight implications
Congestion Mitigation and Air Quality (CMAQ) Program measures	No	TBD	This report (2013 *Corridor Capacity Report*) details the highway travel time and congestion trends in Washington state, see pp. 38-52.
Congestion Mitigation and Air Quality (CMAQ) Program - measures for on-road mobile source emissions	No	TBD	Greenhouse gas emissions by source, including fleet vehicles and ferry vessel operations. Greenhouse gas emissions by corridor route are measured for the first time in this report, see pp. 49-52.

Data source: WSDOT Strategic Assessment Office.

Notes: 1 Measures for MAP-21 goals shown in this table will be determined through federal rule-making. 2 Performance targets to be set for each performance measure by WSDOT in coordination with Metropolitan Planning Organizations (MPOs) statewide. TBD = To be determined.





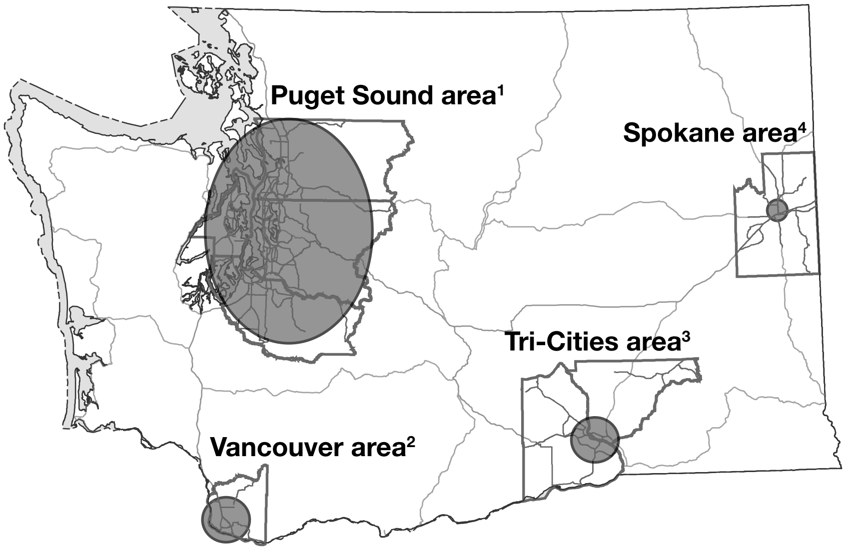
In Statewide Indicators:

Statewide Congestion Indicators 32

- *In 2012, per person vehicle miles traveled was 8,303 miles annually on all public roads, the lowest since 1988*
- *Approximately 1,978 lane miles of the state highway network experienced delay in 2012*
- *In 2012, the average Washingtonian spent 4 hours and 30 minutes in traffic, which is 12 minutes less than they did in 2010*
- *Statewide travel delayed costs drivers and businesses in Washington $780 million in 2012*

Factors Affecting Congestion 35

- *Washington's unemployment rate fell from 9.9% to 8.2% between 2010 and 2012*
- *Since 2007, about 73% of Washington workers commuted in a single-occupant vehicle*
- *Statewide gas prices rose 21% between 2010 and 2012, from $3.17 to $3.84 per gallon*
- *Washington per capita income was $45,941 in 2012, 3.8% more than in 2010*



Puget Sound area[1]
123,000 daily hours of delay in 2010
120,680 daily hours of delay in 2012
97.6% of statewide delay

Vancouver area[2]
630 daily hours of delay in 2010
640 daily hours of delay in 2012
0.5% of statewide delay

Tri-Cities area[3]
620 daily hours of delay in 2010
564 daily hours of delay in 2012
0.5% of statewide delay

Spokane area[4]
390 daily hours of delay in 2010
310 daily hours of delay in 2012
0.3% of statewide delay

Data source: WSDOT Urban Planning Office.

Notes: Symbols showing amount of congestion for urban areas are not directly proportional and are meant to be illustrative of relative amounts of delay. The four urban areas account for 98.9% of statewide delay. The other 1.1% occurs on roads outside of these defined areas. 1 Puget Sound area includes Snohomish, Kitsap, King and Pierce counties. 2 Vancouver area includes Clark county. 3 Tri-Cities area includes Benton and Franklin counties. 4 Spokane area includes Spokane county.

Statewide Congestion Indicators

At a glance

- *In 2012, per person vehicle miles traveled was 8,303 miles annually on all public roads, the lowest since 1988*
- *In 2012, the average Washington driver spent 4 hours and 30 minutes in traffic, which is 12 minutes less than they did in 2010*

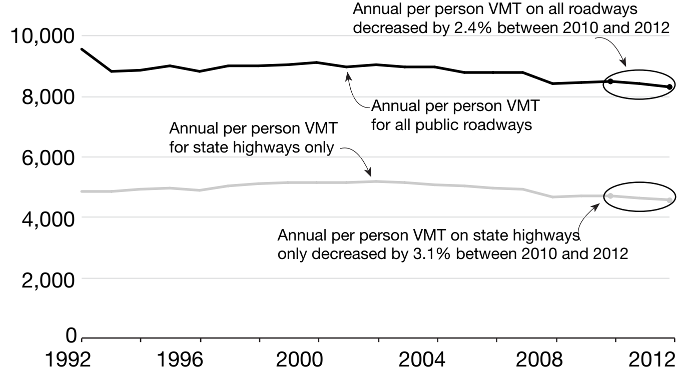
Per person vehicle miles traveled hit lowest levels in Washington since 1988

Per person (per capita) vehicle miles traveled (VMT) decreased for the third year in a row. In 2012, per person VMT hit a record low of 8,303 miles annually on all public roads and 4,578 on state highways; these are the lowest observed per person VMT values in the past quarter century. This does not mean the VMT is at its lowest, but rather the 2012 ratio between VMT and statewide population is the lowest recorded since 1988.

The VMT on all public roads shows the average Washingtonian drove 202 fewer miles in 2012 than in 2010, and 114 fewer miles than in 2011. Similarly, for VMT exclusively on state highways, Washingtonians drove 146 fewer miles in 2012 than in 2010 and 70 fewer miles than in 2011.

The per person VMT on all public roads decreased by 2.4% between 2012 and 2010. A similar trend was observed between 2012 and 2011, with a 1.4% decrease in per person VMT. The per person VMT measured exclusively for state highways showed a decrease of 3.1% in 2012 compared to 2010. The table on this page lists the annual vehicle miles traveled and per capita VMT since 2007.

Annual per person vehicle miles traveled hits record low
1992 through 2012

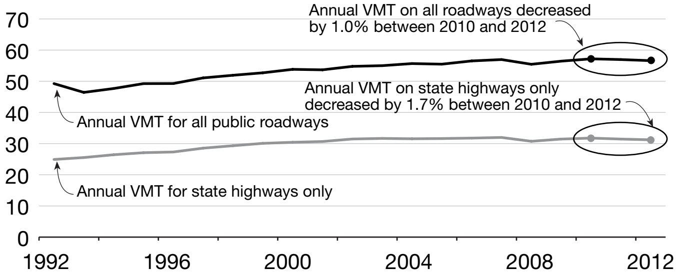


Data source: Statewide Travel and Collision Data Office (STCDO), Washington State Office of Financial Management.

Statewide vehicle miles traveled decreases for the third year in a row

In 2012, vehicle miles traveled statewide on all public roads decreased for the third year in a row. The average annual VMT on all public roadways in Washington decreased by 1% in 2012 (56.607 billion) compared to 2010 (57.191 billion). The 2012 annual VMT decreased by 0.6% compared to 2011 for all public roadways. The VMT only on state highways in 2012 decreased by 1.7% compared to 2010 and decreased by 0.8% compared to 2011.

Annual vehicle miles traveled decline three years in row
1992-2012; In billions
1992 through 2012; VMT in billions



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

Total and per person vehicle miles traveled continue to decline for third consecutive year
2007 through 2012; Population in thousands

	Total vehicle miles traveled (billions)		Per person vehicle miles traveled	
Year (population)	**State highways**	**All public roads**	**State highways**	**All public roads**
2007 (6,525)	31.970	56.964	4,900	8,730
2008 (6,608)	30.742	55.447	4,652	8,391
2009 (6,672)	31.456	56.461	4,714	8,462
2010 (6,725)	31.764	57.191	4,724	8,505
2011 (6,768)	31.455	56.965	4,648	8,417
2012 (6,818)	31.214	56.607	4,578	8,303
Δ 2012 vs. 2010	-0.550	-0.584	-146	-202
%Δ 2012 vs. 2010	-1.7%	-1.0%	-3.1%	-2.4%

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

Note: The population estimates for 2006 through 2009 do not match those published in previous reports. OFM revised the numbers based on the 2010 Census actual births data.

Statewide travel delay costs $780 million in 2012

Statewide per person vehicle hours of delay decreases slightly in Washington

In 2012, each Washingtonian spent an extra 4 hours and 30 minutes delayed due to traffic, which is 12 minutes less than the 4 hours and 42 minutes spent in 2010. Commuters in the Puget Sound area spent more than 8 hours in traffic while the commuters in other urban centers across the state (such as Spokane and Vancouver) spent less than 30 minutes delayed due to traffic in 2012. Delay is still equal to or lower than the pre-recession levels in 2007, with the exception of the Tri-Cities.

Per person annual hours of delay decreases 4.3%
2007 through 2012; Annual delay in hours

Urban areas/Year	2007	2008	2009	2010	2011	2012	2012 vs. 2010
Puget Sound	9.5	9.3	7.4	8.3	8.6	8.1	-2.4%
Spokane	0.2	0.2	0.1	0.2	0.1	0.2	0.0%
Tri-Cities	0.3	0.3	0.4	0.6	0.6	0.5	-16.7%
Vancouver	0.4	0.4	0.6	0.4	0.3	0.4	0.0%
Statewide	**5.4**	**5.3**	**4.2**	**4.7**	**4.8**	**4.5**	**-4.3%**

Data source: WSDOT Urban Planning Office, Washington State Office of Financial Management.

Puget Sound area contributes to 98% of statewide average daily vehicle hours of delay

On an average weekday, Washingtonians spent less time delayed in traffic in 2012 than in 2010. Between 2010 and 2012, average statewide delay decreased 2.5% while the Puget Sound area delay decreased by 1.9%. The Puget Sound area contributes about 98% to the statewide delay, while the rest of the state highway system along with the urban centers such as Spokane, the Tri-Cities, and Vancouver contribute to the remaining 2%.

Delayed travel costs Washington drivers and businesses $780 million in 2012

Statewide travel delay cost drivers and businesses in Washington $780 million in 2012 compared to $800 million in 2010 (see table below). As the Puget Sound area contributes to 98% of total statewide delay, it is estimated that $762 million in delay costs occur in the Puget Sound area.

Calculating the cost of delay

It is generally recognized that delay has a variety of direct and indirect impacts. The cost of delay is calculated using the first two factors mentioned below, 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.

Delay imposes costs for the lost time of travelers and 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. Some of the direct and indirect impacts include:

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

Conditions improve or hold steady in terms of percent of lane miles delayed or congested

The total number of state highway lane miles statewide is 18,659; urban highways account for 5,354 lane miles, and the remaining 13,305 are on rural highways. To put things in perspective, in 2012 approximately 1,978 lane miles of the state highway network experienced delay, and slightly more than half of those lane miles experienced recurrent congestion on an average weekday (1,026 lane miles).

Estimated annual travel delay and cost of delay on state highways by urban area
2007 through 2012; Delay in hours; Cost of delay in millions

Urban area	2007	2008	2009	2010	2011	2012	%Δ 2012 vs. 2010
Puget Sound	34,253,250	33,900,000	27,236,023	30,750,000	31,790,000	30,170,000	-1.9%
Spokane	70,750	71,750	39,000	97,500	40,000	77,500	-20.5%
Tri-Cities	61,250	60,750	86,750	155,000	156,750	141,000	-9.0%
Vancouver	176,750	182,000	272,500	157,500	114,750	160,000	1.6%
Statewide Annual	**35,092,500**	**34,774,500**	**28,085,000**	**31,645,000**	**32,497,500**	**30,900,000**	**-2.4%**
Annual Cost of delay	$931	$890	$721	$800	$821	$780	-2.5%

Data source: WSDOT Urban Planning Office.
Note: Inflation adjusted using the Consumer Price Index (CPI).

SR 520 saw significant reduction in vehicle delay in 2012

Percent of the state highway system that is delayed or congested
2007 through 2012; By percent of total state highway system

	% of system delayed[1]			% of system congested[2]		
	All	**Urban**	**Rural**	**All**	**Urban**	**Rural**
2007	12.5%	10.9%	1.6%	5.6%	5.1%	0.5%
2008	11.6%	10.1%	1.5%	5.2%	4.7%	0.5%
2009	11.5%	10.0%	1.5%	5.2%	4.7%	0.5%
2010	11.6%	9.8%	1.8%	5.5%	4.9%	0.6%
2011	11.3%	10.0%	1.3%	5.4%	4.9%	0.5%
2012	10.6%	9.0%	1.6%	5.5%	4.9%	0.6%

Data source: WSDOT Urban Planning Office.

Notes: 1 The percent of the system *delayed* uses 85% of posted speed as the threshold (roughly 51 mph). 2 The percent of the system *congested* uses 70% of posted speed as the threshold (roughly 42 mph).

Fewer urban highway miles experiencing delay

The percent of total state highway lane miles that experienced delay decreased from 11.6% in 2010, to 10.6% in 2012. See the table above for the decreasing trend during the past six years.

Between 2010 and 2012, the percent of state highway lane miles delayed in urban areas decreased from 9.8% to 9%, while the percent of the system delayed in rural area decreased from 1.8% to 1.6%.

Definition: *The percent of state highway lane miles delayed/congested was calculated by dividing delayed/congested lane miles by total lane miles. Delay means the roadway's operational speed drops below 85% of its posted speed limit, congested means the roadway's operational speed drops below 70% of its posted speed.*

Percent of state highway miles congested holds steady

The percent of state highway lane miles that experienced congestion in 2012 and 2010 held steady at 5.5%, approaching the value of 5.6% last seen in 2007 before the recession. Urban and rural congestion also hold steady in this timeframe.

Puget Sound area freeway corridors together experiences 20% more delay in 2012 than in 2010

WSDOT tracks delay on five specific freeway corridors in the central Puget Sound area. Travel delay on all of these corridors except SR 520 left motorists behind the wheel longer in 2012 than in 2010. Tolling on SR 520 began December 29, 2011, and had a significant impact on travel trends in the central Puget Sound area. Vehicle delay on the SR 520 corridor dropped from 1,496 hours in 2010, to 277 hours in 2012, an 81.5% improvement. Furthermore, the decrease in vehicle delay on SR 520 exceeded the corresponding increase in delay on I-90 (375-hour increase) during the same timeframe. I-90 serves as the non-tolled alternatives for travel across Lake Washington.

At the same time, overall vehicle miles traveled on Puget Sound area corridors decreased 1.5% in 2012 compared to 2010. SR 520 VMT decreased more than 22% in 2012 compared to 2010. The VMT on I-90 increased 4.5% while the VMT changes on remaining central Puget Sound area corridors were minor (within 2%).

Major central Puget Sound area freeways: average weekday delay and vehicle miles traveled comparison
2007 through 2012; Vehicle hours of delay per day; Vehicle miles traveled in thousands per day

	Delay							Vehicle miles traveled (VMT)						
State route	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2012 vs. 2010**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2012 vs. 2010**
I-5	10,568	7,324	6,684	7,033	6,849	9,888	**40.6%**	7,744	7,583	7,676	7,835	7,675	7,683	**-1.9%**
I-90	659	282	212	455	388	830	**82.3%**	1,580	1,414	1,511	1,649	1,536	1,722	**4.5%**
SR 167	1,138	618	350	723	536	785	**8.5%**	947	921	947	1,060	947	1,058	**-0.2%**
I-405	7,654	6,864	4,478	5,605	5,413	6,574	**17.3%**	3,507	3,500	3,616	3,656	3,616	3,723	**1.8%**
SR 520	2,180	1,518	1,334	1,496	1,058	277	**-81.5%**	1,019	932	901	933	901	723	**-22.5%**
Total	**22,199**	**16,606**	**13,058**	**15,312**	**14,244**	**18,353**	**19.9%**	**14,797**	**14,350**	**14,651**	**15,133**	**14,675**	**14,910**	**-1.5%**

Data source: WSDOT Urban Planning Office.

Notes: The article on delay examines individual corridors while the commute trip analysis (pp. 41-64) examines work trips, which include multiple corridors. The delay article examines VMT for all day during weekdays, while commute trip analysis looks at VMT for weekdays during morning peak (5-10 a.m.) and evening peak (2-8 p.m.) periods. The reported VMT numbers are only a partial representation for reasons such as only single occupancy vehicle lanes (SOV lanes) are analyzed, data station malfunction, work zone traffic diversion, etc. To make accurate comparisons, the 2010 data was recalculated for this report.

Factors Affecting Congestion

At a glance

- *Washington's unemployment rate fell from 9.9% to 8.2% between 2010 and 2012*
- *Since 2007, about 73% of Washington workers commuted in a single-occupant vehicle*
- *Statewide gas prices rose 21% between 2010 and 2012, from $3.17 to $3.84 per gallon*
- *Washington per capita income was $45,941 in 2012, 3.8% more than in 2010*

Economy impacts commutes

Traffic congestion, travel times and delay are influenced by a number of factors, including the availability of non-private automobile modes of transport (such as transit and bicycling), the rate of carpooling, and the overall economy. Congestion tends to worsen as the economy improves due to an increased number of commuters, especially when these workers are driving alone. According to the American Community Survey, since 2007, approximately 73% of Washington workers commuted in single-occupant vehicles, and 27% take a variety of other modes such as transit and carpooling. The percentage of commuters who carpool to work declined two percentage points between 2008 and 2011.

Population growth slows in recent years

Between 2010 and 2012, Washington's total population grew 1.4%. According to the Washington State Office of Financial Management, the state's population grew at an average annual rate of 1.6% between 1990 and 2012, from 4.87 million to 6.82 million residents. This population growth rate has slowed in recent years, increasing annually by less than 1% since 2009.

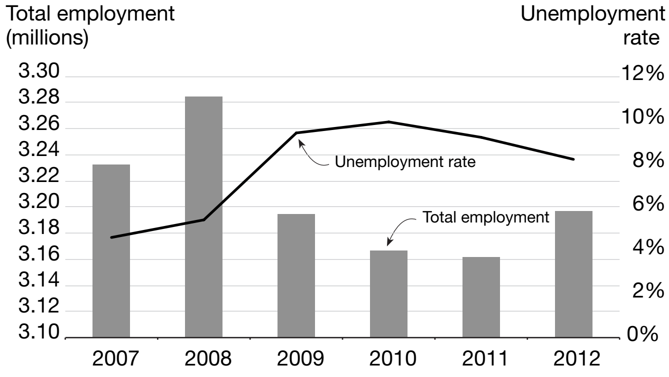
Despite consistent population growth, total and per person vehicle miles travelled in Washington declined annually since 2010. The amount of driving does not increase strictly as population increases. Instead, it also depends on other factors such as unemployment rate, personal income, gas prices, and transportation mode choices.

Unemployment falls to 8.2% in 2012

Washington's economy continued to improve at a slow pace in 2012, as indicated by a decrease in the unemployment rate. The jobless portion of Washington's labor force fell by 1.7 percentage points between 2010 and 2012, declining from 9.9% to 8.2%. This is slightly higher than the national unemployment rate of 8.1%. In addition, the number of initial unemployment insurance claims in Washington hit a five-year low of 499,017 claims in 2012, decreasing 18.2% from 610,052 claims in 2010.

Washington unemployment rate declines

2007 through 2012; Total employees in thousands; Percent of total labor force unemployed



Data source: Bureau of Labor Statistics - Local Area Unemployment Statistics.

The annual unemployment rate in Washington peaked in 2010 at 9.9%. Despite decreasing for two consecutive years, the statewide unemployment rate remains substantially higher than the 2007 pre-recession rate of 4.6%.

Annual growth in total employment, defined as the number of Washington residents who are employed at least part-time, was positive in 2012, for the first time in four years. Total employment increased from 3.17 million to 3.20 million workers between 2010 and 2012, a growth of 1%.

Between 2010 and 2012, employment in King and Snohomish counties grew at rates higher than the statewide average, increasing by 3.3% and 2.5%, respectively. The unemployment rates for King and Snohomish counties were 6.8% and 7.8% in 2012, lower than the statewide average unemployment rate.

In contrast, the economies of Clark, Pierce, Spokane and Thurston counties are rebounding at a slower pace than

Income and gas prices increase between 2010 and 2012

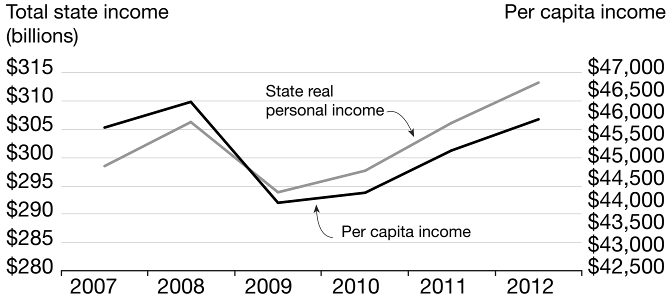
the overall state economy. Even though total employment in Clark County grew by 1.6% between 2010 and 2012, its unemployment rate exceeded the statewide rate by more than 2 percentage points, with 10.4% unemployment in 2012. Unemployment in Pierce and Spokane counties was 8.9% and 8.6%, respectively, in 2012. Despite the unemployment rate in Thurston County being 7.8% in 2012, less than the statewide average, total employment has fallen annually since 2008. Between 2010 and 2012, total employment in Thurston County declined 1.9%, partially due to residents dropping out of the labor force.

Personal income continues upward trend

Real personal income, defined as the total income in 2012 dollars earned by Washington households, increased 5.2% from 2010 levels. This exceeded the national growth rate of real personal income, which increased 3.4% between 2010 and 2012. Washington real personal income has increased annually since 2009, reaching $313.2 billion in 2012.

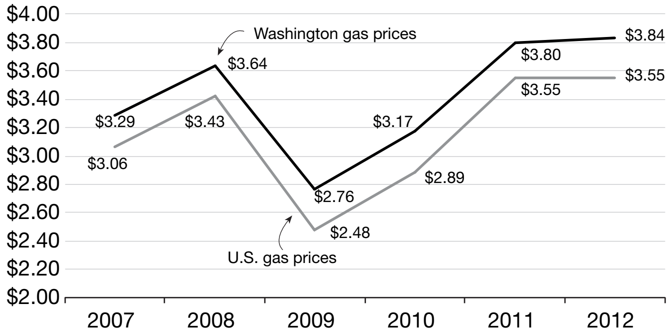
Per capita income, calculated as real personal income divided by population, has also improved annually since 2009. However, it has grown at a slower pace than real personal income over this three-year period. Per capita income (measured in 2012 dollars) was $45,941 in 2012, a 3.8% increase from $44,268 in 2010.

Real personal income rises for third year in a row
2007 through 2012; Total income in 2012 dollars



Data source: Bureau of Economic Analysis; Washington State Office of Financial Management.
Note: Per capita income is calculated as total state real personal income divided by population. Monetary values are adjusted for inflation using the Consumer Price Index (CPI).

Gas prices relatively stable between 2011 and 2012
2007 through 2012; Price per gallon in 2012 dollars



Data source: U.S. Energy Information Administration.
Note: Prices were adjusted for inflation using the Consumer Price Index (CPI).

Gas prices rise 21% between 2010 and 2012

Gasoline prices have a negative impact on per person vehicle miles traveled; per person travel tends to fall when gas prices rise. Real gas prices (adjusted for inflation and measured in 2012 dollars) increased 67 cents per gallon between 2010 and 2012 in Washington state, a 21% jump in price.

The majority of this price increase occurred between 2010 and 2011, as prices were relatively stable between 2011 and 2012. The price of gas in Washington averaged $3.84 per gallon in 2012, a 1% increase from 2011. This followed a price hike of more than $1.00 per gallon between 2009 and 2011. Gasoline prices in Washington exceeded the national average by 29 cents per gallon in 2012.

In Throughput Productivity:

- *Vehicle throughput improves at three locations and worsens at nine locations in 2012 compared to 2010*
- *I-405 at SR 169 in Renton saw no loss in throughput all day in 2012 compared to a 34% loss of throughput in 2010*

Throughput Productivity

At a glance

- *Vehicle throughput improves at three locations and worsens at nine locations in 2012 compared to 2010*
- *I-405 at SR 169 in Renton saw no loss in throughput all day in 2012 compared to a 34% loss of throughput in 2010*

Three of 16 locations achieved 100% throughput productivity in 2012

The central Puget Sound area monitoring locations on key highways continue to show throughput productivity below 100% during peak travel periods. Of the 16 locations monitored (eight in each direction), three locations showed improvements ranging from 4% to 34%, meaning more vehicles were able to travel past the location in 2012 than in 2010, within the same timeframe. Nine locations changed for the worse, and four held steady (changed 2% or less).

When a highway is congested, fewer vehicles pass the monitoring locations due to reduced speeds. Under ideal conditions, the maximum throughput of vehicles on freeway segments can be as high as 2,000 vehicles per hour per lane (vphpl). Under congested conditions, traffic volume can drop to as low as 700 vphpl. Throughput productivity measures the percentage of a highway's optimal capacity for vehicles that is lost due to congestion. Throughput productivity can be measured by duration and by severity, and is shown as a percentage of the achievable 100% throughput capacity.

Highest number of vehicles passing by a location determines optimal throughput

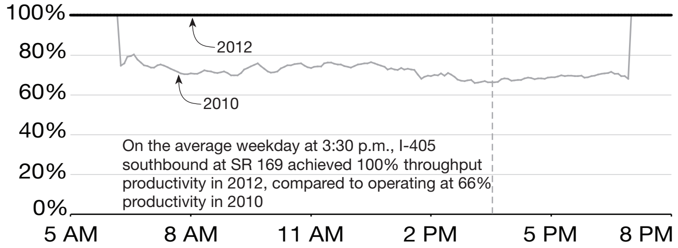
The optimal number of vehicles that move through a section of roadway varies depending on the prevailing traffic conditions and roadway design for each location. WSDOT uses the highest recorded number of vehicles passing through a location every 5 minutes (called the five-minute flow rate) as the basis for measuring throughput productivity lost to congestion. By using this threshold, throughput analysis realistically determines the loss in productivity owed specifically to changes in traffic conditions. The graphs on pp. 39-40 show throughput productivity for the 16 monitored locations.

Vehicle throughput productivity on southbound I-405 at SR 169 (MP 4.0) improves to 100% in 2012

2010 and 2012; Based on the highest observed five-minute flow rate; Vehicles per hour per lane (vphpl); Southbound = 1,790 vphpl

Example: Vehicle throughput productivity on southbound I-405 at SR 169 (MP 4.0)

Based on the highest observed 5 min. flow rate; 2010 and 2012; Vehicles per hour per lane (vphpl); southbound = 1790 vphpl



Data source: WSDOT Urban Planning Office.

In 2012, I-405 southbound at SR 169 in Renton showed the greatest gain, achieving maximum vehicle throughput (black line in the above graph). The same location had continuous loss in vehicle throughput due to congestion in 2010 (gray line). Travel performance at that location benefited from WSDOT completing projects along the southern segment of I-405, including stages 1 and 2 of the I-405/I-5 to SR 169 project. That project added another single occupancy vehicle lane in each direction between the I-5 Southcenter interchange and SR 169, as well as a new interchange to relieve congestion and improve overall access to and from the Renton area. (See p. 60 of the 2011 *Congestion Report*.)

Vehicle throughput worsens more than 2% at nine Puget Sound area locations

2012 and 2010; Maximum loss of vehicle throughput by commute direction

	Northbound/Eastbound			Southbound/Westbound		
Location description	**2010**	**2012**	**%Δ**	**2010**	**2012**	**%Δ**
I-5 at South 188th Street, near SeaTac	13%	16%	3%	16%	19%	3%
I-5 at I-90	24%	28%	4%	24%	23%	-1%
I-5 at NE 103rd Street, near Northgate	16%	19%	3%	24%	30%	6%
I-90 at SR 900, in Issaquah	0%	0%	0%	12%	16%	4%
SR 167 at 84th Avenue SE	13%	11%	-2%	15%	18%	3%
I-405 at SR 169, in Renton	45%	53%	8%	34%	0%	-34%
I-405 at NE 160th Street, in Kirkland	19%	19%	0%	23%	33%	10%
SR 520 at Montlake	29%	25%	-4%	5%	0%	-5%

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

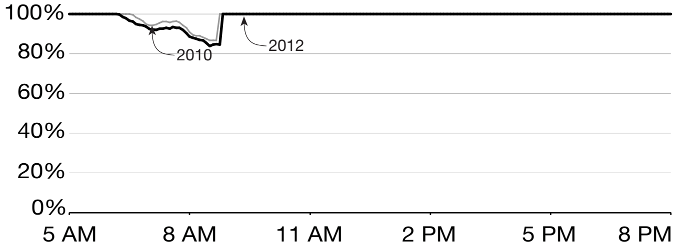
Note: Negative values indicate vehicle throughput improved in 2012 compared to 2010.

Vehicle throughput productivity on central Puget Sound area freeways

Throughput productivity at selected central Puget Sound area freeway locations by commute direction
2010 and 2012; Based on the highest observed five-minute flow rates; Vehicles per hour per lane (vphpl)

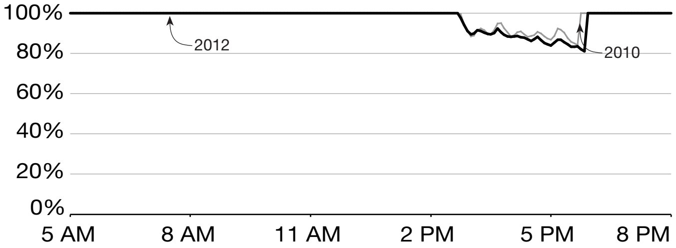
Northbound I-5 at South 188th Street (MP 153.0)

Based on the highest observed five-minute flow rate; 1,920 vphpl



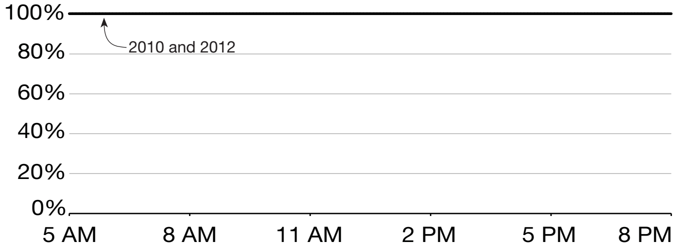
Southbound I-5 at South 188th Street (MP 153.0)

Based on the highest observed five-minute flow rate; 1,490 vphpl



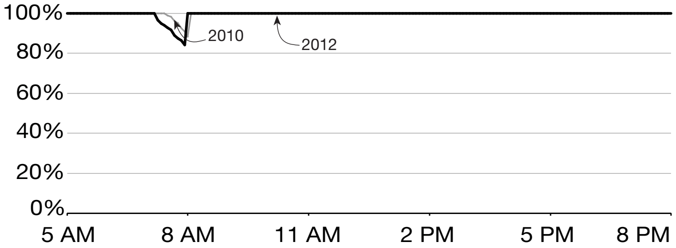
Eastbound I-90 at SR 900 (MP 16.5)

Based on the highest observed five-minute flow rate; 1,650 vphpl



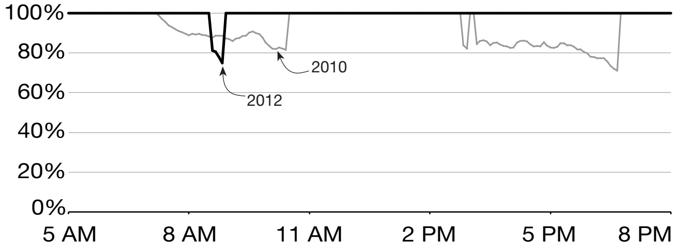
Westbound I-90 at SR 900 (MP 16.5)

Based on the highest observed five-minute flow rate; 1,630 vphpl



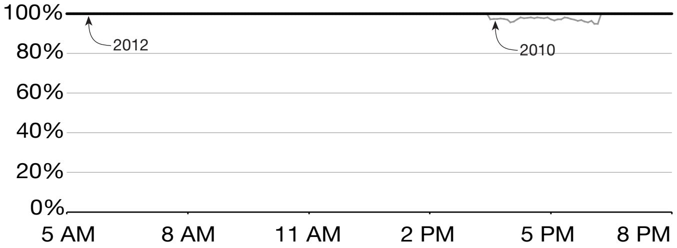
Eastbound SR 520 at Evergreen Point Floating Bridge (MP 1.5)

Based on the highest observed five-minute flow rate; 1,800 vphpl



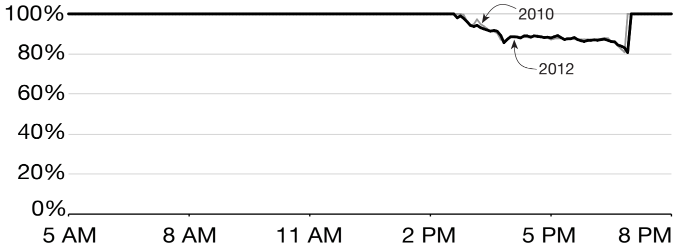
Westbound SR 520 at Evergreen Point Floating Bridge (MP 1.5)

Based on the highest observed five-minute flow rate; 1,710 vphpl



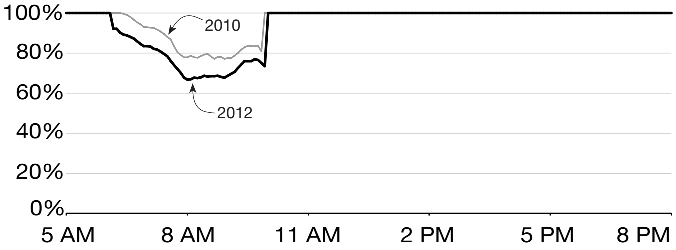
Northbound I-405 at NE 160th Street (MP 22.5)

Based on the highest observed five-minute flow rate; 1,710 vphpl



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

Based on the highest observed five-minute flow rate; 1,780 vphpl



Data source: WSDOT Urban Planning Office.

Definition of throughput productivity

Throughput productivity is measured as the difference between the highest observed average five-minute flow rate during the year and the flow rate that occurs when vehicles travel below the maximum throughput speed (42 to 51 mph).

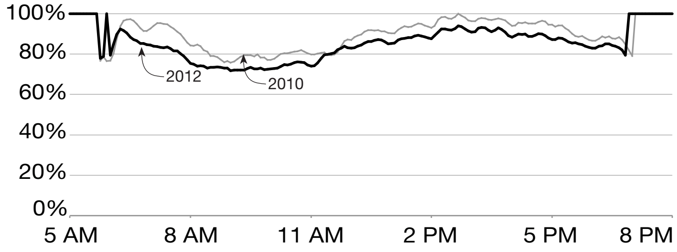
Vehicle throughput productivity on central Puget Sound area freeways

Throughput productivity at selected central Puget Sound area freeway locations by commute direction

2010 and 2012; Based on the highest observed five minute-flow rates; Vehicles per hour per lane (vphpl)

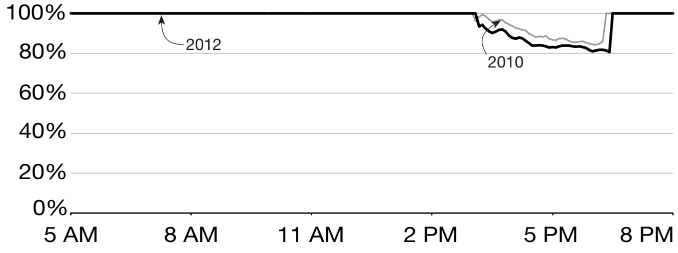
Northbound I-5 at I-90 (MP 164.0)

Based on the highest observed five-minute flow rate; 1,550 vphpl



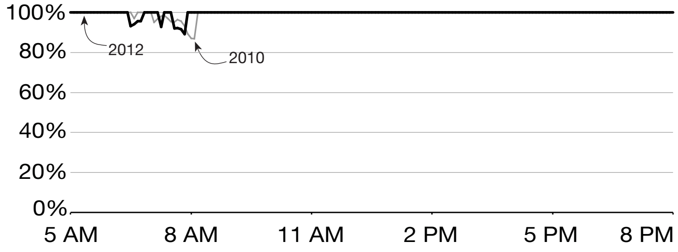
Northbound I-5 at NE 103rd Street (MP 172.0)

Based on the highest observed five-minute flow rate; 1,560 vphpl



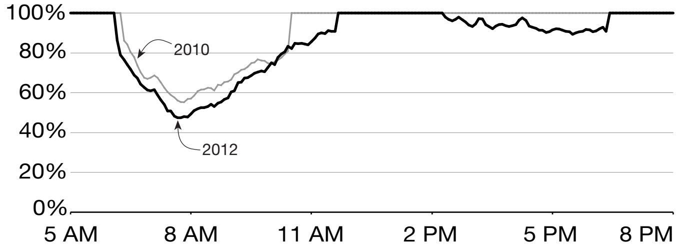
Northbound SR 167 at 84th Avenue SE (MP 21.5)

Based on the highest observed five-minute flow rate; 1,540 vphpl



Northbound I-405 at SR 169 (MP 4.0)

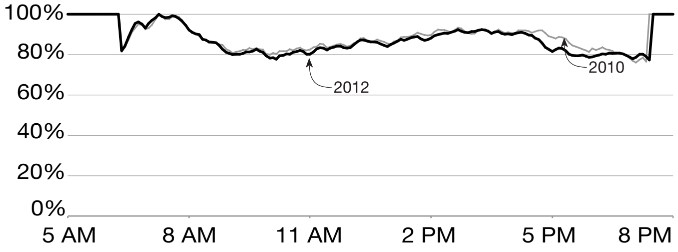
Based on the highest observed five-minute flow rate; 1,650 vphpl



Data source: WSDOT Urban Planning Office.

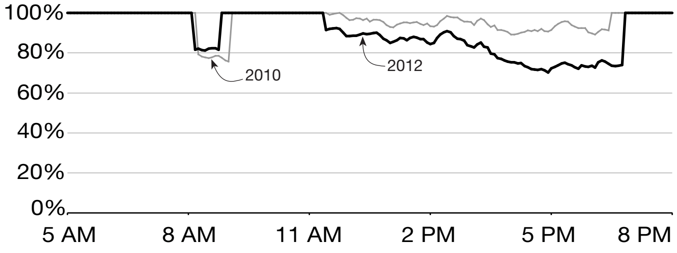
Southbound I-5 at I-90 (MP 164.0)

Based on the highest observed five-minute flow rate; 1,990 vphpl



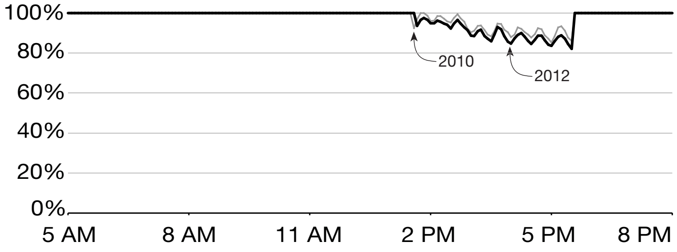
Southbound I-5 at NE 103rd Street (MP 172.0)

Based on the highest observed five-minute flow rate; 1,745 vphpl



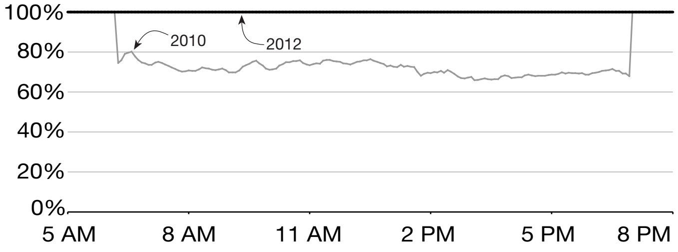
Southbound SR 167 at 84th Avenue SE (MP 21.5)

Based on the highest observed five-minute flow rate; 1,620 vphpl



Southbound I-405 at SR 169 (MP 4.0)

Based on the highest observed five-minute flow rate; 1,790 vphpl



Definition of throughput productivity

Throughput productivity is measured as the difference between the highest observed average five-minute flow rate during the year and the flow rate that occurs when vehicles travel below the maximum throughput speed (42 to 51 mph).

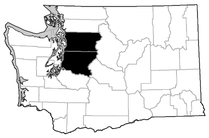
In Commute Trip Analysis:

Performance measures for trip analysis

- *WSDOT uses the following performance measures to develop its commute trip analysis for single occupancy vehicle (SOV) freeway lanes: Commute congestion cost; Greenhouse gas emission (GHG); Transit usage along commute corridors; Average travel time; Reliable travel time using multiple percentile thresholds; Vehicle miles traveled (VMT) for traffic volume; Average duration of the congested period; and the Maximum Throughput Travel Time Index (MT^{3}I).*

Commute Trip Analysis in urban areas and on Snoqualmie Pass

- ***Central Puget Sound area (52 commute trips)*** **42**
  - *Cross-lake trips using SR 520 after the start of tolling had faster travel times and reduced greenhouse gas emissions; I-90 travel times to Seattle grew by 8% to 21% after tolling started on the SR 520 bridge*
  - *There were more than 18.4 million transit riders during the peak periods on the 40 high-demand commutes in 2012*
- ***South Puget Sound area (20 commute trips)*** **57**
  - *Morning commutes between Olympia and Federal Way had little change in commute trip travel times between 2011 and 2012*
- ***Vancouver area (8 commute trips)*** **61**
  - *The I-5 Columbia River bridge results in more than 1 hour and 30 minutes of morning commute congestion, while I-205 operates at or near maximum throughput capacity during both the morning and evening commutes*
- ***Spokane area (2 commute trips)*** **63**
  - *Trip reliability improves 18% for morning commuters westbound on I-90, saving them up to 3 minutes every day*
- ***Snoqualmie Pass*** **64**
  - *In 2012, Snoqualmie Pass experienced the most traffic delay in January, with delay occurring 17.4% of the time*



Commute Trip Analysis for the Central Puget Sound Area

At a glance

- ***Travel times changed by more than 2 minutes on 16 of 40 high-demand commute trips in the central Puget Sound area***
- ***Cross-lake commute trips using SR 520 after the start of tolling had faster travel times and reduced greenhouse gas emissions***
- ***I-90 travel times to Seattle grew 8% to 21% after tolling started on the SR 520 bridge***
- ***All-day greenhouse gas emissions declined 3%***
- ***There were more than 18.4 million transit riders during the peak periods on the 40 high-demand commutes in 2012***

Significant changes noted in travel times from 2010 to 2012

The 2013 *Corridor Capacity Report* analyzes weekday conditions on 40 high-demand central Puget Sound area freeway commute trips during 2012, and compares them with corresponding results for 2010. Of the 40 high-demand trips monitored by WSDOT in the central Puget Sound area, 16 routes experienced average peak travel time changes of more than 2 minutes; 10 saw longer travel times, and six routes saw shorter travel times. This pattern represents greater travel time variability than was seen in last year's report (2012 *Congestion Report*), when 27 of the 40 high-demand commute routes had changes of less than 2 minutes from 2009 to 2011.

WSDOT's analysis shows that a number of routes experienced significant changes in travel patterns during 2012. These were reflected in the two-year comparison from 2010 to 2012. A key factor that affected 2012 travel times was the start of tolling on the SR 520 floating bridge. The tolling rates vary by time of day and day of the week, with the highest tolls during peak weekday commute periods. Initial changes in travel patterns for selected trips were previously documented by WSDOT in the six-month travel time updates in August 2012 (*Gray Notebook* 46, pp. 21-23) and May 2013 (*Gray Notebook* 49, pp. 18-23). The results for the full 2012 calendar year confirm the traffic patterns seen in those six-month periods.

SR 520 tolling resulted in improved travel times for most of the cross-lake commute trips

Among the most significant changes in travel times in the region were those observed on the cross-lake commute trips using SR 520 and I-90. Those trips were directly affected by shifting traffic patterns following the start of tolling operations on the SR 520 bridge in December 2011. SR 520 commute trips generally experienced noticeably faster average peak travel times in 2012 compared to 2010; the morning commute saw 10% to 17% faster westbound trips, and 28% to 35% faster eastbound trips, while the evening commute saw 6% to 16% faster westbound trips, and 20% to 35% faster eastbound trips. I-90 commute trips saw mixed results.

In addition to shifts in traffic patterns because of tolling operations, the travel times for cross-lake trips on SR 520 reflect the combined effect of other factors, including major ongoing construction activities at the east approach to the bridge span associated with the WSDOT Eastside Transit and HOV project, which began construction in 2011 and continued throughout 2012. Despite these activities, SR 520 cross-lake trip travel times still improved. Also, trips across the SR 520 bridge heading to and from Redmond benefited from the completion of WSDOT's SR 520 West Lake Sammamish Parkway to SR 202 project to expand capacity and relieve chokepoints in traffic flow; that project was completed in December 2010. The Before and After evaluation for this project was reported in the 2011 *Congestion Report,* p. 62.

Overall, a review of morning and evening commute trips in the central Puget Sound area showed that among those trips with the largest two-year percentage reduction in average peak travel times, the top four trips were cross-lake routes using SR 520. In fact, six of the top seven trips were cross-lake SR 520 trips, and the seventh trip was also on the SR 520 corridor (the eastbound SR 520 trip from Bellevue to Redmond during the evening commute).

I-90 commute trips show mixed results

The morning travel times to Seattle on I-90 grew by 21% over the two-year period, while evening commute travel times to Seattle were up 8%. These travel times likely increased as a result of travelers avoiding the toll on SR

Tolling results in reduced duration of congestion on SR 520

520, and diverting to the parallel I-90 bridge for travel across Lake Washington. The eastbound morning and evening commutes from Seattle using I-90 experienced slight travel time improvements. The completion of the WSDOT Two-Way Transit and HOV Operations project in early 2012 removed a construction distraction and resulted in additional capacity in the outer roadway with the extension of the eastbound HOV lane to 80th Avenue Southeast in the middle of Mercer Island.

Travel times grew by up to 32% for I-5 commute trips

The largest increase in peak travel times among the monitored routes was on the I-5 corridor, with a 32% change on the southbound evening trip from Everett to Seattle. There was an increase in peak period evening congestion in the southbound segment between Northgate and the southern portion of the Ship Canal bridge approaching downtown Seattle, from 2010 to 2012. In addition, the Federal Way to Seattle (and subset SeaTac to Seattle) morning routes on I-5 also experienced growing travel times, with congestion hot spots extending between Federal Way and Des Moines and on the approach to downtown Seattle. Factors influencing these changes include shifting traffic patterns following the start of SR 520 tolling, traffic diversion effects associated with the SR 99 Alaskan Way Viaduct replacement project, and general changes in traffic levels accompanying an improving regional economy. Refer to pp. 35-36 for factors affecting congestion.

Duration of congestion shows mixed results

WSDOT defines a trip's duration of congestion as the period of time during which average trip speeds fall below 45 mph (75% of posted speed). The 45 mph threshold is only used in calculating the duration of congested periods, which are in turn used in evaluating the cost of commute congestion. The results presented in the 2011 and 2012 *Congestion Reports* did not show a consistent trend. For this year's report on congestion, there was a stronger two-year trend when comparing the 2010 and 2012 data; the duration of congestion increased on 24 routes and decreased on 14 (two other routes did not regularly drop below an average speed of 45 mph in either year).

Of the 24 trips showing a longer period of congestion in 2012, five of the routes showed small changes (10 minutes or less). The largest change was on I-5 from Seattle to SeaTac (evening), where the duration of congestion grew from 10 minutes to more than 2 hours. This change is more attributed to the threshold value for how the duration of congestion is defined, rather than due to major changes in performance on the route. Further evaluation of the data shows the average speeds during the evening peak period have fluctuated, hovering around 44 to 47 mph between 2009 and 2011, and dipping to between 40 and 45 mph in 2012, below the "congestion" threshold.

The second largest change was on I-90 from Bellevue to Seattle (morning), where the duration of congestion doubled to 2 hours and 10 minutes; this trip was influenced by diversion from the SR 520 corridor. Also growing by 1 hour 5 minutes was the trip from Bellevue to Redmond on SR 520 (morning). This relatively short trip (5.5 miles) did not see a significant change in average peak travel times, though 80th, 90th, and 95th percentile travel times did grow noticeably (by 22%, 21%, and 41%, respectively).

Of the 14 trips showing shorter periods of congestion in 2012, the top seven trips were all on the SR 520 bridge, and they were influenced by the start of tolling; those trips all had their duration of congestion shrink by 1 to 3 hours.

Overall, five routes had no measurable duration of congestion in 2012. Two of these routes, Redmond to Bellevue (morning) and Seattle to Issaquah (morning), did not experience a period of congestion in 2010 either. The other three trips were all SR 520 routes (Redmond to Seattle on SR 520 morning, and Seattle to Redmond in the morning and evening commute); all had significant durations of congestion in 2010, ranging from 1 hour 20 minutes to 2 hours and 55 minutes, prior to the start of tolling. Travelers on these routes might still experience weekday congestion at some points during their trips; however, the average speed of the entire trip (which is the basis for the duration of congestion) did not drop below 45 mph in 2012.

Travel time from Bellevue to Seattle in the evening

Of the 40 high-demand commutes monitored by WSDOT, the Bellevue to Seattle evening route via SR 520 had held the top spot among the worst travel times (length-adjusted, based on the Maximum Throughput Travel Time Index (MT^{3}I) for the past three years. In 2012, however, following the start of tolling operations, that trip dropped to fifth place after its average peak travel time decreased by more than 5 minutes. For 2012, another cross-lake evening commute now holds the distinction of being the route with the worst travel time, relative to its length. That route, from Bellevue to Seattle on I-90, experienced a 2-minute increase in peak travel time from 2010 to 2012, and the duration of congestion grew by 45 minutes, to 4 hours and 40 minutes (fourth highest among the 40 commutes).

Travel times on central Puget Sound area commutes increase

Morning commutes: Changes in travel time performance for 19 morning high-demand commute trips

2010 and 2012; Morning (AM) peak (5-10 a.m.) for an annualized average weekday; Five-minute peak of commuter rush (individual peak times vary); Length of route in miles; All travel times in minutes; Peak of commuter rush and duration of congestion expressed in hours and minutes

				Travel time on the route at		Average travel time at peak of AM rush			Maximum throughput travel time		Peak period VMT	Duration of congestion (how long is average speed below 45 mph)		
Route	Direction of travel	Length of route	Peak time of commuter AM rush	Posted speed	Maximum throughput speed	2010	2012	%Δ	MT^3 Index 2010	2012	%Δ in VMT	2010	2012	Δ
To Seattle														
I-5 Everett to Seattle	SB	24	7:20	24	28	43	44	2%	1.51	1.56	1%	2:05	2:30	0:25
I-5 Federal Way to Seattle	NB	22	7:30	22	26	38	45	18%	1.45	1.72	-1%	3:15	3:55	0:40
I-90/I-5 Issaquah to Seattle	WB/NB	15	7:40	15	19	22	26	18%	1.18	1.41	4%	1:15	1:50	0:35
SR 520/I-5 Redmond to Seattle	WB/SB	13	7:40	13	16	20	18	-10%	1.22	1.09	-8%	1:20	0:00	-1:20
I-5 SeaTac to Seattle	NB	13	7:45	13	16	24	29	21%	1.54	1.86	-2%	4:30	4:45	0:15
I-405/I-90/I-5 Bellevue to Seattle	SB/WB/NB	10	7:50	10	12	14	17	21%	1.16	1.39	8%	1:05	2:10	1:05
I-405/SR 520/I-5 Bellevue to Seattle	NB/WB/SB	10	7:40	10	12	18	15	-17%	1.49	1.22	-12%	3:10	2:35	-0:35
To Bellevue														
I-5/I-405 Everett to Bellevue	SB	24	7:20	24	28	47	52	11%	1.66	1.81	-3%	3:00	3:25	0:25
I-405 Lynnwood to Bellevue	SB	16	7:30	16	19	37	41	11%	1.93	2.12	-3%	3:15	3:30	0:15
I-405 Tukwila to Bellevue	NB	13	7:35	13	16	28	33	18%	1.70	2.05	4%	3:30	4:05	0:35
I-5/I-90/I-405 Seattle to Bellevue	SB/EB/NB	11	8:25	11	13	17	16	-6%	1.33	1.26	9%	2:00	1:55	-0:05
I-5/SR 520/ I-405 Seattle to Bellevue	NB/EB/SB	10	8:45	10	12	23	15	-35%	1.88	1.24	-10%	4:30	1:30	-3:00
I-90/I-405 Issaquah to Bellevue	WB/NB	9	7:45	9	11	15	14	-7%	1.29	1.28	3%	1:55	1:45	-0:10
SR 520/I-405 Redmond to Bellevue	WB/SB	6	8:50	6	7	8	8	0%	1.09	1.10	-4%	0:00	0:00	0:00
Other														
I-405 Bellevue to Tukwila	SB	13	7:40	13	16	20	18	-10%	1.27	1.12	9%	0:55	0:05	-0:50
I-405/SR 520 Bellevue to Redmond	NB/EB	5	9:00	5	7	8	8	0%	1.23	1.29	-3%	1:40	2:45	1:05
SR 167 Auburn to Renton	NB	10	7:40	10	12	17	18	6%	1.45	1.50	-3%	2:50	3:25	0:35
I-5/I-90 Seattle to Issaquah	SB/EB	16	8:20	16	19	20	20	0%	1.05	1.07	5%	0:00	0:00	0:00
I-5/SR 520 Seattle to Redmond	NB/EB	13	8:45	13	16	25	18	-28%	1.56	1.10	-7%	2:40	0:00	-2:40

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

Notes: The symbol “Δ” is used to denote change in a variable. Commute lengths and travel time values have been rounded to integer values for publication only. MT^3 Index values cannot be reproduced as published using the integer values in the table. Data quality review for 2010 data was updated using revised methodology first used in the 2011 *Congestion Report*.

Travel times on central Puget Sound area commutes, *continued*

Evening commutes: Changes in travel time performance for 21 evening high-demand commute trips

2010 and 2012; Evening (PM) peak (2-8 p.m.) for an annualized average weekday; Five-minute peak of commuter rush (individual peak times vary); Length of route in miles; All travel times in minutes; Peak of commuter rush and duration of congestion expressed in hours and minutes

				Travel time on the route at		Average travel time at peak of PM rush			Maximum throughput travel time		Peak period VMT	Duration of congestion (how long is average speed below 45 mph)		
									MT^3 Index					
Route	Direction of travel	Length of route	Peak time of commuter PM rush	Posted speed	Maximum throughput speed	2010	2012	%Δ	2010	2012	%Δ in VMT	2010	2012	Δ
From Seattle														
I-5 Seattle to Everett	NB	23	17:05	23	28	39	38	-3%	1.39	1.35	0%	2:50	2:45	-0:05
I-5 Seattle to Federal Way	SB	22	16:35	22	27	30	32	7%	1.14	1.20	0%	1:05	1:55	0:50
I-5 Seattle to SeaTac	SB	13	16:40	13	16	17	19	12%	1.12	1.24	-1%	0:10	2:05	1:55
I-5/I-90/I-405 Seattle to Bellevue	SB/EB/NB	11	17:25	11	13	18	18	0%	1.45	1.39	8%	2:10	2:20	0:10
I-5/SR 520/I-405 Seattle to Bellevue	NB/EB/SB	10	17:30	10	12	22	17	-23%	1.79	1.40	-17%	4:35	3:10	-1:25
I-5/SR 520 Seattle to Redmond	NB/EB	13	17:30	13	16	26	17	-35%	1.60	1.06	-10%	2:55	0:00	-2:55
I-5/I-90 Seattle to Issaquah	SB/EB	16	17:20	16	19	24	23	-4%	1.26	1.21	3%	1:10	1:20	0:10
From Bellevue														
I-405/I-5 Bellevue to Everett	NB	23	17:15	23	28	39	40	3%	1.41	1.44	0%	3:00	3:05	0:05
I-405 Bellevue to Lynnwood	NB	16	17:20	16	19	31	32	3%	1.61	1.66	1%	3:20	3:25	0:05
I-405 Bellevue to Tukwila	SB	13	16:45	13	16	30	34	13%	1.89	2.12	2%	5:45	5:40	-0:05
I-405/I-90/I-5 Bellevue to Seattle	SB/WB/NB	10	17:15	10	12	25	27	8%	2.03	2.24	0%	3:55	4:40	0:45
I-405/SR 520/I-5 Bellevue to Seattle	NB/WB/SB	10	17:30	10	12	31	26	-16%	2.50	2.06	-11%	7:30	5:35	-1:55
I-405/I-90 Bellevue to Issaquah	SB/EB	9	17:35	9	11	17	18	6%	1.56	1.59	-2%	3:40	4:10	0:30
I-405/SR 520 Bellevue to Redmond	NB/EB	5	17:40	5	7	10	8	-20%	1.55	1.26	2%	2:25	1:25	-1:00
Other														
I-5 Everett to Seattle	SB	24	16:25	24	28	37	49	32%	1.30	1.74	-5%	3:45	4:35	0:50
I-90/I-5 Issaquah to Seattle	WB/NB	15	17:15	15	19	27	29	7%	1.48	1.58	0%	2:20	3:00	0:40
SR 520/I-5 Redmond to Seattle	WB/SB	13	17:30	13	16	33	31	-6%	2.06	1.92	-10%	4:50	4:15	-0:35
SR 520/I-405 Redmond to Bellevue	WB/SB	6	17:25	6	7	13	16	23%	1.80	2.20	-10%	3:45	4:20	0:35
I-5 SeaTac to Seattle	NB	13	17:20	13	16	21	23	10%	1.36	1.48	-4%	2:35	2:50	0:15
SR 167 Renton to Auburn	SB	10	16:45	10	12	16	17	6%	1.38	1.45	-3%	3:25	3:35	0:10
I-405 Tukwila to Bellevue	NB	13	17:20	13	16	23	23	0%	1.44	1.45	6%	2:00	2:20	0:20

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

Notes: The symbol “Δ” is used to denote change in a variable. Commute lengths and travel time values have been rounded to integer values for publication only. MT^3 Index values cannot be reproduced as published using the integer values in the table. Data quality review for 2010 data was updated using revised methodology first used in the 2011 *Congestion Report*.

Travel time reliability trends are mixed from 2010 to 2012

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

Reliability is an important metric for highway users because it provides information that allows them to plan for on-time travel with a higher degree of certainty. Commuters can plan the daily trips to work during peak hours, parents can plan the afternoon run to the daycare center, businesses know when a just-in-time shipment must leave the factory, and transit agencies can develop reliable schedules.

How reliability percentiles are used

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

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

Reliability trends are mixed from 2010 to 2012

The trend for 95th percentile reliable travel times was mixed from 2010 to 2012; values on 10 of the 40 routes moved up or down by 2 minutes or less. The other 30 routes experienced travel time changes of more than 2 minutes during that period: 17 of those routes saw longer 95th percentile travel times, and 13 routes saw shorter 95th percentile travel times.

The most notable changes in reliability were observed on the SR 520 commutes, which showed significant improvements in reliability as well as average travel times, as suggested by the large percentage improvement in 95th percentile reliable travel time. Five of the 40 monitored trips showed improvement of 31% to 44%; all of those trips were SR 520 cross-lake routes. The factors mentioned earlier for average peak travel time trends for SR 520 trips (tolling, completion of Redmond area capacity improvements) affected the reliability of those trips as well. The percentage improvements seen in the 95th percentile reliable travel times were also seen across the board for median, 80th percentile, and 90th percentile travel times, indicating that the entire distribution of travel times for the year improved.

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

To accurately compare travel times on routes of different lengths, WSDOT uses an index to compare the maximum throughput travel times. For instance, the I-405/I-90/I-5 Bellevue to Seattle and the I-90/I-5 Issaquah to Seattle evening commutes (shown in the travel time table on p. 45) had average travel times of 27 and 29 minutes, respectively. At a glance, the routes appear roughly equal. However, the first route is 10 miles long and the second is 15 miles; this difference means that using average travel times alone is not a meaningful comparison.

The Maximum Throughput Travel Time Index (MT^{3}I) incorporates the expected travel time under maximum throughput conditions, taking into account the length of the route. An MT^{3}I of 1.0 would indicate a highway operating at maximum efficiency. As the MT^{3}I value increases, travel time performance deteriorates.

In this example, the Bellevue to Seattle via I-90 evening commute has an MT^{3}I of 2.24, which means that the commute on average takes two-and-a quarter times longer than it would normally take at the maximum throughput speed. On the other hand, the Issaquah to Seattle via I-90 evening route has an MT^{3}I of 1.58, which means that the commute on average takes 58% longer than at the maximum throughput speed. The Bellevue to Seattle via I-90 evening route is the slower commute of the two – and is currently the worst of the 52 monitored central Puget Sound area commute routes.

Travel time reliability fluctuates on central Puget Sound area commutes

Morning commutes: Changes in reliable travel time percentiles for 19 high-demand morning commute trips, 2010-2012
2010 and 2012; Morning (AM) peak (5-10 a.m.) for an annualized average weekday; Five-minute peak of commuter rush (individual peak times vary); Length of route in miles; All travel times and differences in minutes; Peak of commuter rush expressed in hours and minutes

			Travel times on the route at		2010 percentiles				2012 percentiles				Difference 2010 vs. 2012			
Route	Length of route	Peak time of commuter AM rush	Posted speed	Maximum throughput speed	Median 50th	80th	90th	95th	Median 50th	80th	90th	95th	Median 50th	80th	90th	95th
To Seattle																
I-5 Everett to Seattle	24	7:20	24	28	41	52	63	**72**	41	57	63	**76**	0	5	0	**4**
I-5 Federal Way to Seattle	22	7:30	22	26	36	46	51	**55**	46	54	60	**64**	10	8	9	**9**
I-90/I-5 Issaquah to Seattle	15	7:40	15	19	20	25	29	**33**	25	31	36	**40**	5	6	7	**7**
SR 520/I-5 Redmond to Seattle	13	7:40	13	16	19	22	25	**27**	17	18	20	**22**	-2	-4	-5	**-5**
I-5 SeaTac to Seattle	13	7:45	13	16	22	28	34	**41**	30	34	37	**38**	8	6	3	**-3**
I-405/I-90/I-5 Bellevue to Seattle	10	7:50	10	12	13	15	19	**21**	17	20	21	**24**	4	5	2	**3**
I-405/SR 520/I-5 Bellevue to Seattle	10	7:40	10	12	17	22	26	**29**	15	16	17	**19**	-2	-6	-9	**-10**
To Bellevue																
I-5/I-405 Everett to Bellevue	24	7:20	24	28	45	58	67	**76**	51	65	73	**81**	6	7	6	**5**
I-405 Lynnwood to Bellevue	16	7:30	16	19	36	47	54	**61**	42	53	59	**66**	6	6	5	**5**
I-405 Tukwila to Bellevue	13	7:35	13	16	28	32	35	**37**	33	39	44	**48**	5	7	9	**11**
I-5/I-90/I-405 Seattle to Bellevue	11	8:25	11	13	16	20	23	**26**	15	18	20	**22**	-1	-2	-3	**-4**
I-5/SR 520/I-405 Seattle to Bellevue	10	8:45	10	12	22	29	31	**34**	14	17	20	**22**	-8	-12	-11	**-12**
I-90/I-405 Issaquah to Bellevue	9	7:45	9	11	14	18	20	**21**	14	17	20	**23**	0	-1	0	**2**
SR 520/I-405 Redmond to Bellevue	6	8:50	6	7	8	8	9	**9**	8	9	9	**10**	0	1	0	**1**
Other																
I-405 Bellevue to Tukwila	13	7:40	13	16	20	23	25	**26**	17	20	23	**25**	-3	-3	-2	**-1**
I-405/SR 520/I-5 Bellevue to Redmond	5	9:00	5	7	8	9	10	**10**	7	11	12	**14**	-1	2	2	**4**
SR 167 Auburn to Renton	10	7:40	10	12	16	20	23	**27**	16	22	25	**28**	0	2	2	**1**
I-5/I-90 Seattle to Issaquah	16	8:20	16	19	18	23	26	**27**	19	22	24	**26**	1	-1	-2	**-1**
I-5/SR 520 Seattle to Redmond	13	8:45	13	16	24	31	33	**36**	16	20	23	**25**	-8	-11	-10	**-11**

Data source: WSDOT Strategic Assessment Office, WSDOT Northwest Region Traffic Office and Washington State Transportation Center (TRAC) at the University of Washington.
Note: Commute lengths and travel time percentile values have been rounded to integer values for publication purposes.

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

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

Reliability on central Puget Sound area commutes, *continued*

Evening commutes: Changes in reliable travel time percentiles for 21 high-demand evening commute trips, 2010-2012
2010 and 2012; Evening (PM) peak (2-8 p.m.) for an annualized average weekday; Five-minute peak of commuter rush (individual peak times vary); Length of route in miles; All travel times and differences in minutes; Peak of commuter rush expressed in hours and minutes

			Travel times on the route at		2010 percentiles				2012 percentiles				Difference 2010 vs. 2012			
Route	**Length of route**	**Peak time of commuter PM rush**	**Posted speed**	**Maximum throughput speed**	**Median 50th**	**80th**	**90th**	**95th**	**Median 50th**	**80th**	**90th**	**95th**	**Median 50th**	**80th**	**90th**	**95th**
From Seattle																
I-5 Seattle to Everett	23	17:05	23	28	38	47	53	**58**	38	45	50	**55**	0	-2	-3	**-3**
I-5 Seattle to Federal Way	22	16:35	22	27	28	35	37	**41**	30	36	42	**46**	2	1	5	**5**
I-5 Seattle to SeaTac	13	16:40	13	16	16	20	21	**25**	18	22	26	**30**	2	2	5	**5**
I-5/I-90/I-405 Seattle to Bellevue	11	17:25	11	13	17	23	26	**31**	16	22	26	**29**	-1	-1	0	**-2**
I-5/SR 520/I-405 Seattle to Bellevue	10	17:30	10	12	20	28	32	**35**	17	21	22	**24**	-3	-7	-10	**-11**
I-5/SR 520 Seattle to Redmond	13	17:30	13	16	25	32	36	**39**	16	19	21	**22**	-9	-13	-15	**-17**
I-5/I-90 Seattle to Issaquah	16	17:20	16	19	22	28	32	**35**	21	27	32	**34**	-1	-1	0	**-1**
From Bellevue																
I-405/I-5 Bellevue to Everett	23	17:15	23	28	39	45	49	**53**	41	48	53	**57**	2	3	4	**4**
I-405 Bellevue to Lynnwood	16	17:20	16	19	30	36	40	**44**	32	39	44	**47**	2	3	4	**3**
I-405 Bellevue to Tukwila	13	16:45	13	16	30	34	36	**38**	34	39	42	**45**	4	5	6	**7**
I-405/I-90/I-5 Bellevue to Seattle	10	17:15	10	12	24	33	36	**40**	27	36	40	**43**	3	3	4	**3**
I-405/SR 520/I-5 Bellevue to Seattle	10	17:30	10	12	32	36	38	**41**	26	30	34	**36**	-6	-6	-4	**-5**
I-405/I-90 Bellevue to Issaquah	9	17:35	9	11	17	19	20	**22**	18	20	21	**22**	1	1	1	**0**
I-405/SR 520 Bellevue to Redmond	5	17:40	5	7	10	12	17	**17**	8	10	11	**12**	-2	-2	-6	**-5**
Other																
I-5 Everett to Seattle	24	16:25	24	28	36	44	50	**55**	48	61	67	**73**	12	17	17	**18**
I-90/I-5 Issaquah to Seattle	15	17:15	15	19	25	36	44	**48**	28	37	41	**49**	3	1	-3	**1**
SR 520/I-5 Redmond to Seattle	13	17:30	13	16	30	42	50	**59**	28	39	48	**54**	-2	-3	-2	**-5**
SR 520/I-405 Redmond to Bellevue	6	17:25	6	7	10	19	23	**33**	14	23	30	**37**	4	4	7	**4**
I-5 SeaTac to Seattle	13	17:20	13	16	19	26	33	**36**	22	29	33	**38**	3	3	0	**2**
SR 167 Renton to Auburn	10	16:45	10	12	13	20	25	**32**	15	22	25	**29**	2	2	0	**-3**
I-405 Tukwila to Bellevue	13	17:20	13	16	23	27	30	**35**	22	30	33	**38**	-1	3	3	**3**

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

Note: Commute lengths and travel time percentile values have been rounded to integer values for publication purposes.

Cost of congestion, greenhouse gas emissions, and transit use trends

WSDOT introduces new multi-modal performance measures

WSDOT for the first time is introducing multi-modal performance measures that aid in a comprehensive system performance evaluation at commute trip and corridor levels. This includes computing cost of congestion, greenhouse gas emissions (carbon dioxide, CO_2), and transit-oriented performance measures on central Puget Sound area commute routes.

Cost of congestion increases for commuters on 21 of the 40 high-demand commute trips (53%)

WSDOT's "commute congestion cost" metric captures the approximate cost incurred by commuters based on the duration of congestion experienced on each commute route. These costs include extra gas used while idling and traveling at slower speeds, and the wasted time that could be used productively elsewhere. The daily, per-person commute congestion cost helps illustrate the individual's cost of being stuck in congestion.

During the morning peak period, the per-person cost of congestion increased for 9 of the 19 morning commute trips, while 6 decreased and 4 remained the same. Of the 9 that saw an increase, the Issaquah to Seattle trip cost increased the greatest percent, doubling from 90 cents each trip to $1.80. The highest cost of congestion in 2012 was $4.30 per person from Everett to Bellevue, which increased 24% from $3.50 in 2010.

The evening peak period per-person cost of congestion increased for 12 of the 21 evening commute trips, while 8 decreased and 1 remained the same. Everett to Seattle increased the greatest percent, more than doubling from $1.80 per person each trip in 2010, to $3.90 in 2012.

Cost of congestion on trips across Lake Washington on SR 520 declines after tolling begins in 2011

The SR 520 trip from Seattle to Redmond saw the largest decline in cost of congestion, following the implementation of tolls on the floating bridge in 2011. In 2010, each morning trip cost $2.00 per person and each evening trip cost $1.70. These costs were eliminated in 2012 for both morning and evening trips eastbound. The westbound trips on SR 520 also saw significant decreases in the cost of congestion. These results match the prior analysis that identified the SR 520 commute trips generally experienced noticeably faster average peak travel times in 2012 compared to 2010. SR 520 bridge toll rates vary by time of day, and were between $1.10 and $3.59 per two-axle vehicle in 2012. The cost of congestion on the Redmond to Seattle evening trip was $2.80 per person, which translates to approximately $3.26 per vehicle based on average observed vehicle occupancy.

All-day greenhouse gas emissions decline 3% from 2010 to 2012

WSDOT is introducing for the first time a new metric that captures the approximate pounds of carbon dioxide (CO_2) emitted during a one-way commute trip. Total emissions during the peak period are reported, along with the emissions per person, based on the average number of people in each vehicle (occupancy) in the single-occupancy vehicle lanes.

According to the Washington State Department of Ecology, transportation-related activities contributed 44% of all greenhouse gases released into the atmosphere in 2010. Transportation accounts for 27% nationally, according to the Environmental Protection Agency. The local percentage of all emissions is higher than the national average due to the relatively low emissions from hydroelectric power plants in Washington state that harness abundant renewable resources.

In 2012, the annual (all-day) greenhouse gas emissions from vehicles on the 40 high-demand commute corridors in the central Puget Sound area were estimated to be 12,156 metric tons of CO_2 (26.8 million pounds), 3% less than in 2010.

Emissions vary relative to length of trip, traffic volume

On central Puget Sound area commutes, per person emissions almost directly correlate with the length of the commute route, as average vehicular traffic speeds did not dip below 25 mph (see p. 6 for an explanation of the exponential increase in emissions at slow speeds). For example, the CO_2 emissions per person on the 22-mile trip from Federal Way to Seattle was 21.2 pounds, while it was 5.2 pounds on the 6-mile trip from Redmond to Bellevue. Some of the variation in per-person emissions per commute mile is due to the varying average number of people in each vehicle on these routes.

Peak period vehicle emissions (on commute routes) decreased 3% to 35% for 18 of the 40 high-demand commute routes between 2010 and 2012: 7 in the morning and 11 in the evening. The changes in total emissions on a commute route demonstrate the effect of fluctuating traffic volumes, in addition to any changes in speed due to congestion. On the other hand, per person emissions were less volatile, changing by 2% or less for 33 commutes (15 morning, 18 evening).

SR 520 cost of congestion and emissions improve after tolling

Greenhouse gas emissions for SR 520 trips improve after tolling begins in 2011

The greenhouse gas emissions during the peak period declined by 13% to 38% for all of the eight commute routes that use the SR 520 floating bridge. Similarly, per person emissions decreased or held steady for all eight routes. For comparison, on I-90 the total peak period emissions held steady or increased up to 11% for all seven commutes that use the I-90 floating bridge; per-person emissions changed 2% or less for each trip.

Transit ridership keeps cars off the road, emissions out of the environment

WSDOT worked closely with Sound Transit, King County Metro, and Community Transit to evaluate the ridership on public transit on the central Puget Sound area commute trips. Total daily ridership during the morning and evening peak periods on the 40 high-demand corridors exceeded 70,600 in 2012 on primarily express bus routes (long-distance freeway trips with limited stops), light rail, and Sounder commuter rail. This equaled about 60% of the total transit capacity available during the peak periods.

Morning peak period transit services keep 300,600 pounds of CO_2 out of the environment every day

More than 30,800 daily trips were taken on public transportation during the morning peak period on 19 central Puget Sound area commute routes in 2012, using about 61% of the capacity on buses, light rail, and the Sounder commuter trains during the same period. King County Metro estimates that for every transit passenger mile of transit service, 0.62 miles are not driven solo in personal vehicles. Based on this factor, WSDOT estimates public transportation use in the central Puget Sound area eliminates at least 19,200 personal vehicle trips from the road daily, and prevents approximately 300,600 pounds of CO_2 from being emitted daily during the morning peak period alone. This translates to roughly 35,600 metric tons of CO_2 each year (78.5 million pounds).

At least 21% of morning peak period buses and trains are operating at 90% of capacity or more on a daily basis; many regularly have standing room only.

Evening peak period transit services keep 374,100 pounds of CO_2 out of the environment every day

More than 39,800 daily trips were taken on public transportation during the evening peak period on 21 central Puget Sound area commute routes in 2012, using about 59% of the capacity on buses, light rail, and the Sounder commuter trains during the same peak period. WSDOT estimates public transportation use in the central Puget Sound area eliminates at least 24,700 personal vehicle trips off the road every weekday, and prevents approximately 374,100 pounds of CO_2 from being emitted daily during the evening peak period alone. This translates to roughly 44,300 metric tons of CO_2 each year (97.6 million pounds).

At least 17% of evening peak period buses and trains are operating at 90% of capacity or more on a daily basis; many regularly have standing room only.

Transit use has a significant positive effect in terms of avoiding greenhouse emissions

In 2012, the emissions avoided by transit use in the central Puget Sound area was about 79,900 metric tons, during the weekday peak commute periods only. According to the Center for Global Development's online database titled "Carbon Monitoring for Action" (CARMA), power plants in King and Snohomish counties emitted 3,400 metric tons of CO_2 annually in 2009. It would take shutting down the power plants for 23.5 years to eliminate the same amount of CO_2 emissions as a single year of transit ridership in the central Puget Sound area.

In 2009, (the latest year with available data through the CARMA database) the 11 power plants in King County were 97% hydroelectric (3% fossil fuels); the two power plants in Snohomish County were 69% hydroelectric, with the remaining energy from other renewable sources. The high use of renewable energy sources results in extremely low power plant CO_2 emissions compared to other regions in the U.S.

Transit ridership on SR 520 increases throughput - additional transit capacity remains

Transit ridership totaled 12,200 passengers for the morning and evening peak periods combined on the commute trips crossing the SR 520 floating bridge. The ridership varied widely for the different commute routes, ranging from about 610 passengers on the Bellevue to Seattle morning commute, up to 2,500 passengers on the Seattle to Redmond evening commute. About 62% of the transit capacity is used, which is in line with the total percent of seats used for all peak period transit routes evaluated. Buses on the SR 520 commute routes prevent approximately 93,100 pounds of CO_2 from being emitted daily during peak periods if transit passengers had driven personal vehicles instead.

Cost of congestion, greenhouse gas emissions, and transit use

Morning commutes: Cost of congestion, vehicle emissions and transit performance for 19 high-demand commute trips

2010 and 2012; Morning (AM) peak (5-10 a.m.) for an annualized average weekday; Length of route in miles; Cost of congestion in dollars; Emissions in pounds of carbon dioxide (CO_2); Average transit ridership, average load, and emissions avoided based on the average maximum load during the peak period

			Cost of congestion[1]			Greenhouse gas emissions[2] in pounds of CO_2						Daily transit performance[3]		
			Per person[4], per trip			Emitted during peak period			Emitted per person[4]			Total ridership	Average load[5]	Emissions avoided[6]
Route	**Direction of travel**	**Length of route**	**2010**	**2012**	**%Δ**	**2010**	**2012**	**%Δ**	**2010**	**2012**	**%Δ**	**2012**	**2012**	**2012**
To Seattle														
I-5 Everett to Seattle[7,9]	SB	24	$3.00	$3.30	$0.30	556,000	545,130	-2%	20.8	20.7	-1%	5,770	63%	84,430
I-5 Federal Way to Seattle	NB	22	$2.30	$3.70	$1.40	638,530	627,880	-2%	20.8	21.2	2%	2,710	81%	36,650
I-90/I-5 Issaquah to Seattle	WB/NB	15	$0.90	$1.80	$0.90	277,890	286,020	3%	13.4	13.4	0%	2,740	81%	26,180
SR 520/I-5 Redmond to Seattle	WB/SB	13	$1.00	$0.00	-$1.00	148,370	129,670	-13%	11.3	11.3	0%	2,330	73%	19,300
I-5 SeaTac to Seattle[8]	NB	13	$1.50	$2.50	$1.00	364,520	368,430	1%	12.5	12.9	3%	7,560	68%	61,050
I-405/I-90/I-5 Bellevue to Seattle	SB/WB/NB	10	$0.50	$1.10	$0.60	176,280	190,300	8%	9.2	9.2	0%	2,670	82%	16,930
I-405/SR 520/I-5 Bellevue to Seattle	NB/WB/SB	10	$1.30	$0.80	-$0.50	113,980	84,950	-25%	8.9	8.9	0%	610	52%	3,890
To Bellevue														
I-5/I-405 Everett to Bellevue	SB	24	$3.50	$4.30	$0.80	487,380	476,160	-2%	21.0	20.9	0%	680	79%	9,970
I-405 Lynnwood to Bellevue	SB	16	$3.20	$4.00	$0.80	338,750	332,500	-2%	14.6	14.6	0%	350	71%	3,500
I-405 Tukwila to Bellevue[9]	NB	13	$2.20	$3.20	$1.00	225,920	241,820	7%	12.8	13.1	2%	240	66%	2,000
I-5/I-90/I-405 Seattle to Bellevue	SB/EB/NB	11	$0.90	$0.80	-$0.10	164,270	176,780	8%	9.6	9.5	-1%	1,070	71%	7,040
I-5/SR 520/ I-405 Seattle to Bellevue	NB/EB/SB	10	$2.10	$0.70	-$1.40	119,440	87,720	-27%	9.1	8.8	-3%	830	64%	5,300
I-90/I-405 Issaquah to Bellevue[9]	WB/NB	9	$0.70	$0.70	$0.00	183,520	176,350	-4%	8.3	8.2	-2%	510	67%	2,980
SR 520/I-405 Redmond to Bellevue[9]	WB/SB	6	$0.00	$0.00	$0.00	70,070	71,260	2%	5.1	5.2	1%	150	32%	550
Other														
I-405 Bellevue to Tukwila[9]	SB	13	$1.00	$0.00	-$1.00	201,010	213,200	6%	12.0	11.6	-4%	120	32%	960
I-405/SR 520 Bellevue to Redmond[9]	NB/EB	5	$0.40	$0.40	$0.00	46,320	39,800	-14%	4.6	4.7	1%	110	14%	390
SR 167 Auburn to Renton[9]	NB	10	$1.00	$1.10	$0.10	166,780	158,400	-5%	9.6	9.5	-1%	380	51%	2,310
I-5/I-90 Seattle to Issaquah	SB/EB	16	$0.00	$0.00	$0.00	206,930	215,970	0%	13.5	13.4	-1%	370	51%	3,600
I-5/SR 520 Seattle to Redmond	NB/EB	13	$2.00	$0.00	-$2.00	132,750	107,290	-19%	11.4	11.1	-3%	1,640	65%	13,600

Data source: WSDOT Strategic Assessment Office, King County Metro, Sound Transit, Community Transit, and Puget Sound Regional Council (PSRC).

Notes: The symbol "Δ" is used to denote change in a variable. 1 Commute congestion cost based on $21.90 for every hour of congested conditions measured when commute speeds fell below 45 mph, applied to the volume of traffic during the congested conditions on an average annual weekday commute. 2 Greenhouse gas emissions were calculated based on emission factors developed by PSRC for different vehicle types at varying travel speeds for each analysis year. In addition, the emissions used the traffic volume and percent of trucks, the average speeds for every five-minute interval during the peak period, and the average vehicle occupancy on the freeway. 3 Transit performance: Ridership was reported for the peak commute periods during the Fall 2012 service period from September 30, 2012 through February 16, 2013. Annual statistics were estimated based on the ridership during this four-month period. 4 Per-person metrics were estimated based on vehicle occupancy observed on the freeway in the single occupancy vehicle lanes. 5 Average load represents utilization of the available transit capacity based on the average maximum load of each bus or train trip and the total seats on the bus or train. Individual trips could show a load greater than 100% if there was standing-room only. Averaging the load for each commute levels out this variation across multiple trips, and may under-represent the load experienced during the peak utilization of transit. 6 Greenhouse gas emissions avoided by transit use were estimated based on the following factors: a) the average maximum transit load; b) the assumption that for every transit passenger mile traveled, 0.62 miles of single-occupancy vehicle travel is avoided; c) the WSDOT-defined commute trip length (not the distance traveled by buses on their entire trip); and d) the average emissions of one pound of CO_2 for every mile traveled. Emissions from transit vehicle operations were not calculated. 7 Transit services include buses and Sounder commuter trains. 8 Transit services include buses and Link light rail trains. 9 Data for some bus routes on this commute were reported for 6-9 a.m. for the portion of the complete bus route that most closely aligned with WSDOT's commute trip.

Cost of congestion, emissions, and transit use, *continued*

Evening commutes: Cost of congestion, vehicle emissions and transit performance for 21 high-demand commute trips

2010 and 2012; Evening (PM) peak (2-8 p.m.) for an annualized average weekday; Length of route in miles; Cost of congestion in dollars; Emissions in pounds of carbon dioxide (CO_2); Average transit ridership, average load, and emissions avoided based on the average maximum load during the peak period

			Cost of congestion[1]			Greenhouse gas emissions[2] in pounds of CO_2						Daily transit performance[3]		
	Direction of travel	Length of route	Per person[4], per trip			Emitted during peak period			Emitted per person[4]			Total ridership	Average load[5]	Emissions avoided[6]
Route			2010	2012	Δ	2010	2012	%Δ	2010	2012	%Δ	2012	2012	2012
From Seattle														
I-5 Seattle to Everett[7,9]	NB	23	$2.30	$2.10	-$0.20	750,910	730,650	-3%	18.1	18.5	2%	5,650	62%	82,310
I-5 Seattle to Federal Way	SB	22	$1.00	$1.30	$0.30	827,770	817,100	-1%	19.0	19.0	0%	2,530	77%	34,790
I-5 Seattle to SeaTac[8]	SB	13	$0.00	$0.90	$0.90	475,830	466,730	-2%	11.2	11.2	0%	10,210	73%	82,460
I-5/I-90/I-405 Seattle to Bellevue	SB/EB/NB	11	$1.10	$1.00	-$0.10	240,500	260,050	8%	8.8	8.9	1%	3,130	83%	20,480
I-5/SR 520/I-405 Seattle to Bellevue	NB/EB/SB	10	$1.70	$1.00	-$0.70	154,250	100,200	-35%	8.4	8.6	1%	1,390	60%	8,830
I-5/SR 520 Seattle to Redmond	NB/EB	13	$1.70	$0.00	-$1.70	194,900	150,350	-23%	10.5	10.9	3%	2,480	70%	20,540
I-5/I-90 Seattle to Issaquah	SB/EB	16	$1.10	$1.00	-$0.10	377,880	387,950	3%	13.5	13.6	1%	2,550	76%	24,810
From Bellevue														
I-405/I-5 Bellevue to Everett	NB	23	$2.60	$2.70	$0.10	590,220	582,670	-1%	19.9	20.3	2%	670	78%	9,710
I-405 Bellevue to Lynnwood	NB	16	$2.40	$2.60	$0.20	408,920	404,230	-1%	13.8	14.0	1%	370	58%	3,630
I-405 Bellevue to Tukwila[9]	SB	13	$2.70	$3.40	$0.70	282,340	295,410	5%	12.0	11.8	-1%	330	78%	2,690
I-405/I-90/I-5 Bellevue to Seattle	SB/WB/NB	10	$2.00	$2.50	$0.50	238,020	239,680	1%	9.1	9.0	-1%	1,230	71%	7,820
I-405/SR 520/I-5 Bellevue to Seattle	NB/WB/SB	10	$2.40	$2.00	-$0.40	167,130	139,890	-16%	8.9	9.2	4%	1,190	59%	7,620
I-405/I-90 Bellevue to Issaquah[9]	SB/EB	9	$1.20	$1.30	$0.10	255,690	247,860	-3%	8.2	8.3	1%	430	60%	2,440
I-405/SR 520 Bellevue to Redmond[9]	NB/EB	5	$0.70	$0.40	-$0.30	79,680	75,010	-6%	4.5	4.5	0%	150	24%	510
Other														
I-5 Everett to Seattle[9]	SB	24	$1.80	$3.90	$2.10	671,770	631,050	-6%	19.0	18.7	-2%	890	38%	13,050
I-90/I-5 Issaquah to Seattle	WB/NB	15	$1.80	$2.20	$0.40	318,340	311,950	-2%	13.6	13.6	0%	540	53%	5,130
SR 520/I-5 Redmond to Seattle	WB/SB	13	$2.80	$2.30	-$0.50	190,170	172,650	-9%	11.3	11.4	1%	1,690	59%	14,000
SR 520/I-405 Redmond to Bellevue[9]	WB/SB	6	$0.00	$1.50	$1.50	75,670	72,640	-4%	5.3	5.0	-5%	280	29%	1,080
I-5 SeaTac to Seattle[8]	NB	13	$1.10	$1.40	$0.30	405,850	388,670	-4%	11.3	11.3	0%	3,500	40%	28,250
SR 167 Renton to Auburn[9]	SB	10	$1.00	$1.10	$0.10	204,810	196,060	-4%	8.8	8.9	1%	410	41%	2,470
I-405 Tukwila to Bellevue[9]	NB	13	$1.30	$1.30	$0.00	279,240	298,340	7%	11.1	11.2	1%	170	40%	1,430

Data source: WSDOT Strategic Assessment Office, King County Metro, Sound Transit, Community Transit, and Puget Sound Regional Council (PSRC).

Notes: The symbol "Δ" is used to denote change in a variable. 1 Commute congestion cost based on $21.90 for every hour of congested conditions measured when commute speeds fell below 45 mph, applied to the volume of traffic during the congested conditions on an average annual weekday commute. 2 Greenhouse gas emissions were calculated based on emission factors developed by PSRC for different vehicle types at varying travel speeds for each analysis year. In addition, the emissions used the traffic volume and percent of trucks, the average speeds for every five-minute interval during the peak period, and the average vehicle occupancy on the freeway. 3 Transit performance: Ridership was reported for the peak commute periods during the Fall 2012 service period from September 30, 2012 through February 16, 2013. 4 Per-person metrics were estimated based on vehicle occupancy observed on the freeway in the single occupancy vehicle lanes. 5 Average load represents utilization of the available transit capacity based on the average maximum load of each bus or train trip and the total seats on the bus or train. Individual trips could show a load greater than 100% if there was standing-room only. Averaging the load for each commute levels out this variation across multiple trips, and may under-represent the load experienced during the peak utilization of transit. 6 Greenhouse gas emissions avoided by transit use were estimated based on the following factors: a) the average maximum transit load; b) the assumption that for every transit passenger mile traveled, 0.62 miles of single-occupancy vehicle travel is avoided; c) the WSDOT-defined commute trip length (not the distance traveled by buses on their entire trip); and d) the average emissions of one pound of CO_2 for every mile traveled. Emissions from transit vehicle operations were not calculated. 7 Transit services include buses and Sounder commuter trains. 8 Transit services include buses and Link light rail trains. 9 Data for some bus routes on this commute were reported for 3-9 p.m. for the portion of the complete bus route that most closely aligned with WSDOT's commute trip.

When, where, and how often severe congestion affects commuters

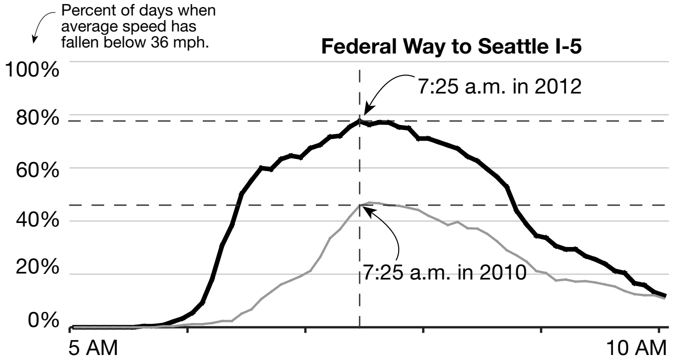
Stamp graphs show the duration and frequency of severe congestion

The best visual evidence to show whether the peak period is spreading or contracting can be seen in the "stamp graphs" on the following two pages. The stamp graphs show the frequency of severe congestion on the 40 high-demand central Puget Sound area commutes. These graphs, comparing 2010 and 2012 data, show the percentage of days annually with average speeds that were below 36 mph on the key highway segments. For information on how to read stamp graphs, see the illustrations at right.

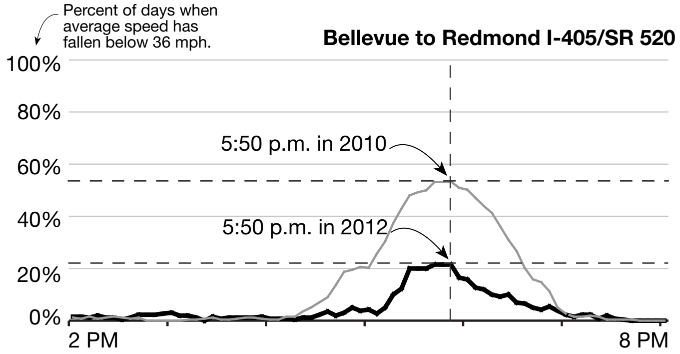
How to read a stamp graph:

How frequently (and when) did the average trip speeds drop under 36 mph? How have those conditions changed from 2010 to 2012?

How frequently (and when) did the average trip speed drop under 36 mph? How have those conditions changed from 2010 to 2012?



At 7:25 a.m. in 2010, you had about a 46% chance that traffic would be moving less than 36 mph. In 2012, the situation became worse (black line above gray line); your chance that traffic would be moving slower than 36 mph was about 78% in 2012.



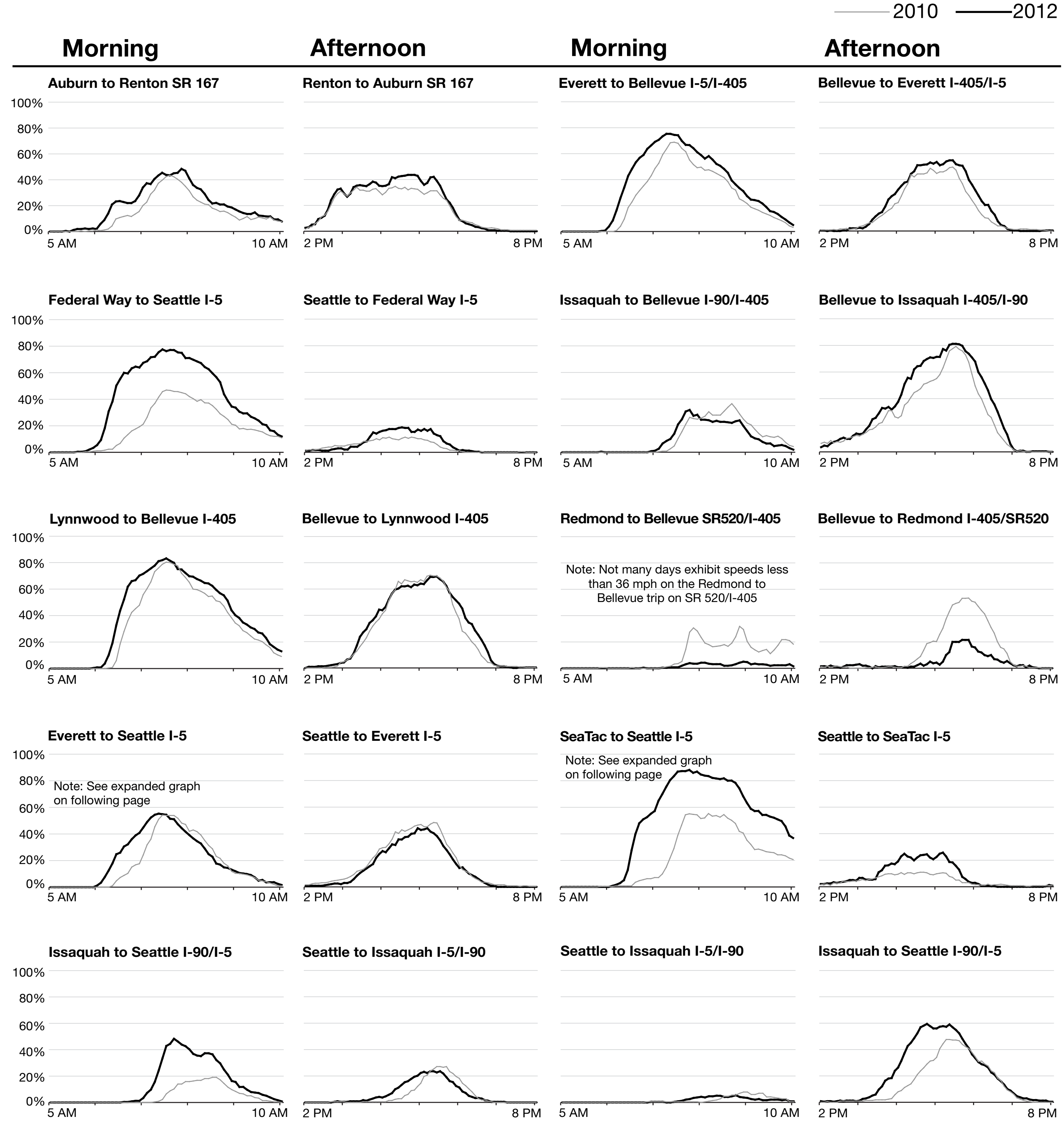
At 5:50 p.m. in 2010, you had about a 53% chance that traffic would be moving less than 36 mph. In 2012, the situation was better (black line below gray line); your chance that traffic would be moving slower than 36 mph was about 22% in 2012.

Data source: WSDOT Strategic Assessment Office.

Congestion worsened for most commutes from 2010 to 2012

Stamp graphs illustrate how often severe congestion affects commuters in the central Puget Sound area. They show the percent of days annually when average speeds fell below 36 mph. For more information on how to read them, see p. 53.

Percent of days when speeds are less than 36 mph for selected central Puget Sound area commute trips
2010 and 2012; Weekdays only; 0% on graph indicates average trip speed did not fall below 36 mph (60% of posted speed)



Auburn to Renton SR 167

Renton to Auburn SR 167

Everett to Bellevue I-5/I-405

Bellevue to Everett I-405/I-5

Federal Way to Seattle I-5

Seattle to Federal Way I-5

Issaquah to Bellevue I-90/I-405

Bellevue to Issaquah I-405/I-90

Lynnwood to Bellevue I-405

Bellevue to Lynnwood I-405

Redmond to Bellevue SR520/I-405

Note: Not many days exhibit speeds less than 36 mph on the Redmond to Bellevue trip on SR 520/I-405

Bellevue to Redmond I-405/SR520

Everett to Seattle I-5

Note: See expanded graph on following page

Seattle to Everett I-5

SeaTac to Seattle I-5

Note: See expanded graph on following page

Seattle to SeaTac I-5

Issaquah to Seattle I-90/I-5

Seattle to Issaquah I-5/I-90

Seattle to Issaquah I-5/I-90

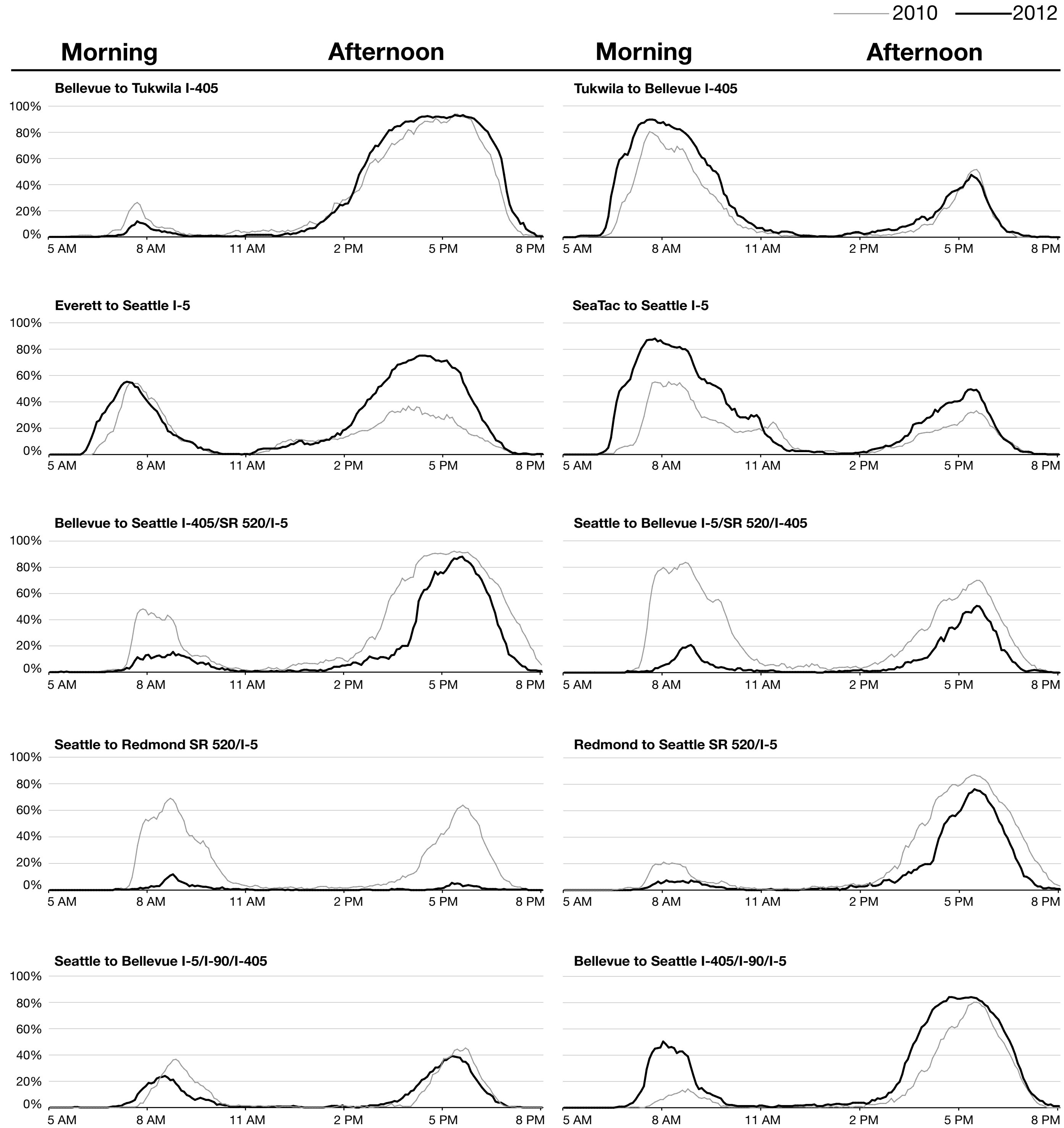
Issaquah to Seattle I-90/I-5

Data source: WSDOT Strategic Assessment Office.

Severe congestion on SR 520 declined after the start of tolling

Stamp graphs illustrate how often severe congestion affects commuters in the central Puget Sound area. They show the percent of days annually when average speeds fell below 36 mph. For more information on how to read them, see p. 53.

Percent of days when speeds are less than 36 mph for selected central Puget Sound area commute trips
2010 and 2012; Weekdays only; 0% on graph indicates average trip speed did not fall below 36 mph (60% of posted speed)



Data source: WSDOT Strategic Assessment Office.

Analysis of 12 additional central Puget Sound Area commutes

More congestion on three of 12 commute trips

WSDOT tracks a total of 52 central Puget Sound area commutes annually, representing morning and evening commutes between major population and work centers. Forty of those routes regularly experience congestion (pp. 42-55). The 12 routes listed on this page represent relatively uncongested routes that have potential for future congestion. WSDOT tracks travel performance on these commute trips.

Average peak travel times changed 2 minutes or less between 2010 and 2012 for 10 of the 12 routes; the other two routes worsened by 4 minutes during that two-year period. The 95th percentile reliable travel times changed 2 minutes or less on 9 of the 12 routes; two other routes worsened by 6 to 7 minutes, while one (northbound I-5 morning from Seattle to Everett) improved by 7 minutes, between 2010 and 2012.

Zero duration of congestion for 9 of the 12 trips

Two of the other three trips follow overlapping evening routes (southbound Everett to Bellevue via I-5 and I-405, and southbound Lynnwood to Bellevue via I-405), and had similar patterns of change for travel time and duration of congestion; they were also the top two trips on the list of 12 additional commute routes in terms of highest Maximum Throughput Travel Time Index (MT^3I). Both of those routes include the north part of the I-405 corridor from the Swamp Creek interchange to Bellevue, encountering southbound evening traffic congestion near SR 522 and downtown Bellevue.

WSDOT will monitor these largely uncongested trips to see if they develop congested characteristics and should be considered for inclusion in the list of congested routes.

Cost of congestion and greenhouse gas emissions

By definition, 9 of these 12 routes did not incur any cost associated with congestion in 2010 or 2012. Greenhouse gas emissions range between 7.9 and 25.1 pounds of CO_2 per person, per trip, and changed by no more than 4% from 2010 to 2012. Transit presence is very low on these routes, due to the lack of demand, and is not reported in the *Corridor Capacity Report* at this time.

Morning/evening commutes: Changes in travel time performance for 12 additional commute trips

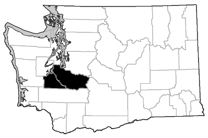
2010 and 2012; Morning (AM) peak (5-10 a.m.) and evening (PM) peak (2-8 p.m.) for an annualized average weekday; Five-minute peak of commuter rush (individual peak times vary); Length of route in miles; All travel times in minutes; Peak of commuter rush and duration of congestion expressed in hours and minutes

			Travel time on the route at		Average travel time at peak of rush			95th percentile reliable travel time			Maximum throughput travel time		VMT during peak period	Duration of congestion (how long average speed is below 45 mph)		
Route	Length of route	Peak time of commuter rush	Posted speed	Maximum throughput speed	2010	2012	%Δ	2010	2012	%Δ	MT^3 Index 2010	2012	%Δ in VMT	2010	2012	Δ
Morning (AM)																
I-5 Seattle to Everett	23	7:40	23	28	26	24	-8%	32	25	-22%	0.94	0.86	1%	*	*	*
I-5 Seattle to SeaTac	13	7:55	13	16	14	15	7%	17	17	0%	0.92	0.94	-1%	*	*	*
I-405 Bellevue to Lynnwood	16	8:30	16	19	17	17	0%	19	18	-5%	0.91	0.87	3%	*	*	*
SR 167 Renton to Auburn	10	9:35	10	12	10	10	0%	11	11	0%	0.88	0.89	1%	*	*	*
I-90 Bellevue to Issaquah	9	8:25	9	11	11	11	0%	11	11	0%	0.96	0.96	1%	*	*	*
I-5 Seattle to Federal Way	22	7:50	22	27	24	24	0%	26	26	0%	0.89	0.90	2%	*	*	*
I-405 Bellevue to Everett	23	8:30	23	28	25	25	0%	27	25	-7%	0.91	0.88	-1%	*	*	*
Evening (PM)																
I-405 Lynnwood to Bellevue	16	17:10	16	19	22	26	18%	34	41	21%	1.15	1.35	-1%	0:30	2:05	1:35
SR 167 Auburn to Renton	10	14:00	10	12	13	11	-15%	17	16	-6%	1.07	0.96	1%	*	*	*
I-90 Issaquah to Bellevue	9	17:15	9	11	12	12	0%	17	17	0%	1.09	1.09	2%	*	*	*
I-5 Federal Way to Seattle	22	17:10	22	26	30	32	7%	46	47	2%	1.16	1.22	-3%	0:35	1:35	1:00
I-5/I-405 Everett to Bellevue	24	17:05	24	28	31	35	13%	44	50	14%	1.10	1.24	-1%	*	1:45	1:45

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

Notes: Commute lengths and travel time values have been rounded to integer values for publication only. All the calculations are performed before the values are rounded to their respective integers, and MT^3 Index values cannot be reproduced as published using the integer values in the table. * Indicates that speed did not fall below 45 mph (75% of posted speed) on a route.

Commute Trip Analysis for the South Puget Sound Area



At a glance

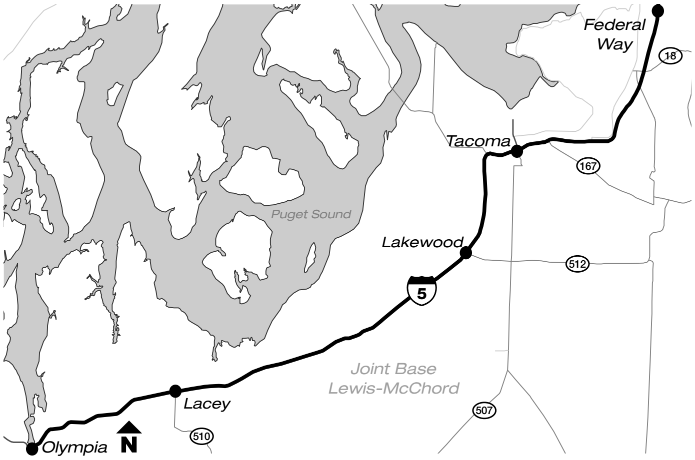
- ***Morning commutes between Olympia and Federal Way had little change in commute trip travel times between 2011 and 2012***
- ***Evening commutes in the south Puget Sound area continue to experience heavy congestion in 2012***

WSDOT introduces south Puget Sound area commute trip analysis

The 2013 *Corridor Capacity Report* includes travel time trends for the south Puget Sound area for the first time. This addition expands the existing coverage of the central Puget Sound area for a more comprehensive understanding of statewide commute travel time trends.

The I-5 commuting corridor for the south Puget Sound area is the 38-mile stretch between Olympia and Federal Way. In order to better explain commute travel patterns, this section of the I-5 corridor is divided into smaller segments based on the job centers in the area.

Although the analysis year of 2012 is typically compared to two years prior (2010) throughout this report, 2011 is used as the comparison year for the south Puget Sound area commute routes due to data quality and availability.



The commute routes in the south Puget Sound area span from Olympia to Federal Way, with major employment centers including Lacey, Lakewood and Tacoma in between.

Morning commute travel times remain relatively steady between Olympia and Federal Way

All 10 morning commutes on I-5 to and from cities between Olympia and Federal Way remained relatively steady, with less than 2 minutes of change in average travel times for all routes in 2012 compared to 2011.

The duration of congestion on the Tacoma to Federal Way morning commute lasted more than an hour in 2012 compared to having no duration of congestion in 2011. This means average speeds fell below 45 mph for more than an hour in 2012, while 2011 average speeds stayed above 45 mph throughout the morning peak commute. WSDOT continues to investigate the reason for the increase in the duration of congestion on this commute trip. The remaining morning commutes did not experience any duration of congestion in 2011 or 2012.

Evening commute trips experience routine congestion between Olympia and Federal Way

Six of the 10 evening commutes on I-5 between Olympia and Federal Way routinely experience congestion in both directions of travel.

Overall congestion on the evening northbound commutes from Lacey to Lakewood and Tacoma to Federal Way both have improved in 2012 compared to 2011. Although the evening Lacey to Lakewood commute remained heavily congested, the duration of congestion decreased by 15 minutes and average travel time improved by 1 minute in 2012 compared to 2011.

The northbound Tacoma to Federal Way evening commute had no congestion in 2012 (meaning average speed remained above 45 mph during the evening peak period) compared to 2 hours and 40 minutes of congestion in 2011. The average travel time from Tacoma to Federal Way decreased by 2 minutes as well. Although this is a favorable trend, it is unclear what contributed to the significant drop in the congestion duration.

On the other hand, the evening southbound commutes from Lakewood to Lacey and from Federal Way to Tacoma worsened in 2012 compared to 2011. The duration of congestion increased on both commutes, by 45 and 35 minutes, respectively. Travel times also increased by 2 minutes in 2012 compared to 2011 on both commutes.

Duration of congestion declines on northbound evening commutes

A congestion relief project funded by a federal grant is currently underway to provide operational efficiencies in the corridor, such as expanded Intelligent Transportation Systems (ITS) and a high occupancy vehicle (HOV) ramp bypass. For more details refer to the I-5 JBLM case study in the 2012 *Congestion Report*, pp. 63-65.

Both directions of the evening commutes from Olympia to Lacey and Lakewood to Tacoma experienced no congestion in 2012 or 2011. The average travel times were mostly steady for both years on these routes as well.

Reliability on 11 of 20 routes remained steady

The 95th percentile reliable travel times on 11 of the 20 routes remained steady (changed 2 minutes or less) from 2011 to 2012. The other nine routes experienced travel time changes of more than 2 minutes during that period: seven of those routes saw longer 95th percentile travel times, and two routes saw shorter 95th percentile travel times.

The 95th percentile reliability for the 10 morning commutes did not change significantly, except on the Federal Way to Tacoma trip, which increased by 3 minutes. The most notable changes were on the 10 evening commutes. Most of the northbound evening commutes saw improved

Changes in travel time performance for 20 south Puget Sound area high-demand commute trips on I-5
2011 and 2012; Morning (AM) peak (5-10 a.m.) and evening (PM) peak (2-8 p.m.) for an annualized average weekday; Five-minute peak of commuter rush (individual peak times vary); Length of route in miles; All travel times in minutes; Peak of commuter rush and duration of congestion expressed in hours and minutes

Route	Direction of travel	Length of route	Peak time of commuter rush	Travel time on the route at		Average travel time at peak of AM rush			Maximum throughput travel time		VMT during peak period	Duration of congestion (how long is average speed below 45 mph)		
				Posted speed	Maximum throughput speed	2011	2012	%Δ	MT^3 Index 2011	2012	%Δ in VMT	2011	2012	Δ
Northbound AM														
I-5 Olympia to Lacey	NB	6	8:10	6	7	6	6	0%	0.87	0.85	-3%	*	*	*
I-5 Lacey to Lakewood	NB	16	7:40	16	19	18	18	0%	0.92	0.94	0%	*	*	*
I-5 Lakewood to Tacoma	NB	5	7:50	5	6	6	7	17%	0.98	1.08	-4%	*	*	*
I-5 Tacoma to Federal Way	NB	11	7:20	11	13	14	15	7%	1.10	1.16	0%	*	1:05	1:05
I-5 Olympia to Tacoma	NB	27	7:25	27	33	30	31	3%	0.91	0.96	-2%	*	*	*
Southbound AM														
I-5 Lacey to Olympia	SB	6	7:45	6	7	6	6	0%	0.89	0.92	-4%	*	*	*
I-5 Lakewood to Lacey	SB	17	7:30	17	20	18	18	0%	0.88	0.87	-3%	*	*	*
I-5 Tacoma to Lakewood	SB	5	7:50	5	6	6	6	0%	0.94	0.89	-8%	*	*	*
I-5 Federal Way to Tacoma	SB	10	7:35	10	12	11	11	0%	0.86	0.91	-3%	*	*	*
I-5 Tacoma to Olympia	SB	28	7:25	28	34	30	29	-3%	0.88	0.88	-5%	*	*	*
Northbound PM														
I-5 Olympia to Lacey	NB	6	17:20	6	7	6	6	0%	0.92	0.92	-5%	*	*	*
I-5 Lacey to Lakewood	NB	16	16:45	16	19	31	30	-3%	1.61	1.54	-1%	2:50	2:35	-0:15
I-5 Lakewood to Tacoma	NB	5	17:20	5	6	7	7	0%	1.04	1.11	-7%	*	*	*
I-5 Tacoma to Federal Way	NB	11	17:30	11	13	16	14	-13%	1.26	1.08	0%	2:40	*	-2:40
I-5 Olympia to Tacoma	NB	27	16:40	27	33	45	44	-2%	1.37	1.33	-3%	2:25	2:10	-0:15
Southbound PM														
I-5 Lacey to Olympia	SB	6	17:20	6	7	7	8	14%	1.01	1.11	-2%	*	*	*
I-5 Lakewood to Lacey	SB	17	17:00	17	20	26	28	8%	1.29	1.38	-1%	1:45	2:30	0:45
I-5 Tacoma to Lakewood	SB	5	17:20	5	6	7	7	0%	1.11	1.06	-2%	*	*	*
I-5 Federal Way to Tacoma	SB	10	17:15	10	12	19	21	11%	1.57	1.72	3%	3:15	3:50	0:35
I-5 Tacoma to Olympia	SB	28	16:55	28	34	39	42	8%	1.17	1.26	-1%	1:10	1:50	0:40

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

Notes: The symbol "Δ" is used to denote change in a variable. Commute lengths and travel time values have been rounded to integer values for publication only. Length of routes may vary slightly for each direction of travel due to placement of monitoring equipment. MT^3 Index values cannot be reproduced as published using the integer values in the table. * Indicates that the average speed for the route did not fall below 45 mph (75% of posted speed).

Travel time reliability deteriorates for southbound afternoon trips

95th percentile reliable travel times, while the southbound trips deteriorated. This includes the largest deterioration in 95th percentile travel time of 9 minutes on the Lakewood to Lacey commute. The largest improvement in 95th percentile travel times of 4 minutes was on the evening commute northbound from Tacoma to Federal Way. These changes mean that travelers must plan an extra 9 minutes for their evening trip from Lakewood to Lacey in order to be on time 95% of the time. Travelers can leave 4 minutes later in 2012 than in 2011 for their evening Tacoma to Federal Way trip. In most cases, the changes in median, 80th percentile, and 90th percentile travel times aligned with the 95th percentile changes.

Duration and frequency in severe congestion vary by direction of trip

The southbound evening trips had more severe congestion in 2012 than in 2011, while the northbound evening trips improved. For example, travelers on I-5 northbound from Lacey to Lakewood experienced severe congestion 59% of the time at 4:50 p.m. in 2012, down from about 65% at 4:50 p.m. in 2011. A value of 0% on the graphs on the next page indicates that the average trip speed did not fall below 36 mph at that time of day.

Changes in reliable travel time percentiles for 20 south Puget Sound area high-demand commute trips on I-5

2011 and 2012; Morning (AM) peak (5-10 a.m.) and evening (PM) peak (2-8 p.m.) for an annualized average weekday; Five-minute peak of commuter rush (individual peak times vary); Length of route in miles; All travel times and differences in minutes; Peak of commuter rush expressed in hours and minutes

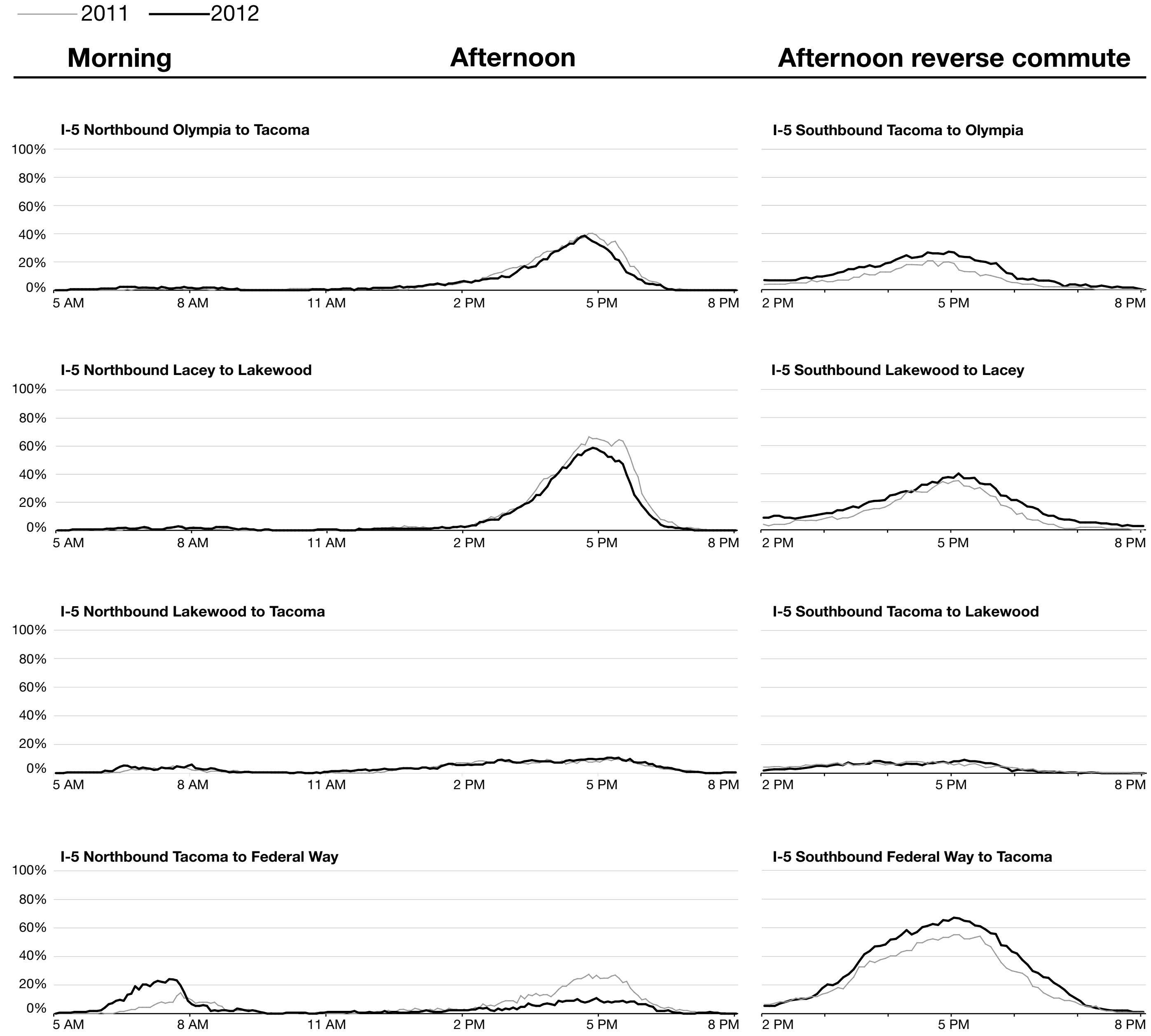
			Travel times on the route at		2011 percentiles				2012 percentiles				Difference 2011 vs. 2012			
Route	Length of route	Peak of commuter rush	Posted speed	Maximum throughput speed	Median 50th	80th	90th	95th	Median 50th	80th	90th	95th	Median 50th	80th	90th	95th
Northbound AM																
I-5 Olympia to Lacey	6	8:10	6	7	6	6	6	**6**	6	6	6	**6**	0	0	0	**0**
I-5 Lacey to Lakewood	16	7:40	16	19	17	18	19	**20**	18	18	19	**21**	1	0	0	**1**
I-5 Lakewood to Tacoma	5	7:50	5	6	6	7	7	**8**	7	8	8	**9**	1	1	1	**1**
I-5 Tacoma to Federal Way	11	7:20	11	13	14	16	19	**21**	13	19	22	**23**	-1	3	3	**2**
I-5 Olympia to Tacoma	27	7:25	27	33	29	31	32	**35**	31	32	35	**36**	2	1	3	**1**
Southbound AM																
I-5 Lacey to Olympia	6	7:45	6	7	6	6	6	**6**	6	7	7	**7**	0	1	1	**1**
I-5 Lakewood to Lacey	17	7:30	17	20	17	18	18	**19**	18	18	19	**19**	1	0	1	**0**
I-5 Tacoma to Lakewood	5	7:50	5	6	6	6	7	**7**	5	6	6	**6**	-1	0	-1	**-1**
I-5 Federal Way to Tacoma	10	7:35	10	12	10	11	11	**11**	11	12	12	**14**	1	1	1	**3**
I-5 Tacoma to Olympia	28	7:25	28	34	29	30	30	**31**	29	30	30	**31**	0	0	0	**0**
Northbound PM																
I-5 Olympia to Lacey	6	17:20	6	7	6	6	7	**8**	6	6	6	**9**	0	0	-1	**1**
I-5 Lacey to Lakewood	16	16:45	16	19	30	38	43	**50**	29	37	43	**48**	-1	-1	0	**-2**
I-5 Lakewood to Tacoma	5	17:20	5	6	6	7	8	**12**	6	7	9	**15**	0	0	1	**3**
I-5 Tacoma to Federal Way	11	17:30	11	13	16	19	22	**23**	13	16	18	**19**	-3	-3	-4	**-4**
I-5 Olympia to Tacoma	27	16:40	27	33	43	54	62	**68**	42	51	58	**65**	-1	-3	-4	**-3**
Southbound PM																
I-5 Lacey to Olympia	6	17:20	6	7	6	8	9	**10**	7	9	10	**13**	1	1	1	**3**
I-5 Lakewood to Lacey	17	17:00	17	20	23	32	37	**41**	24	36	43	**50**	1	4	6	**9**
I-5 Tacoma to Lakewood	5	17:20	5	6	7	7	8	**9**	6	7	8	**12**	-1	0	0	**3**
I-5 Federal Way to Tacoma	10	17:15	10	12	18	25	29	**31**	20	28	31	**34**	2	3	2	**3**
I-5 Tacoma to Olympia	28	16:55	28	34	36	45	52	**58**	39	51	60	**64**	3	6	8	**6**

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

Note: Commute lengths, travel times at posted and maximum throughput speeds along with reliable travel time percentile values have been rounded to integer values for publication purposes.

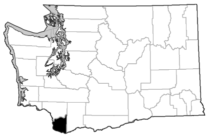
Results were mixed for the duration and frequency of severe congestion

Percent of days when speeds are less than 36 mph for selected south Puget Sound area commute trips
2011 and 2012; Weekdays only; 0% on graph indicates average trip speed did not fall below 36 mph (60% of posted speed)



Data source: WSDOT Strategic Assessment Office.

Commute Trip Analysis for Vancouver Area (Southwest Washington)

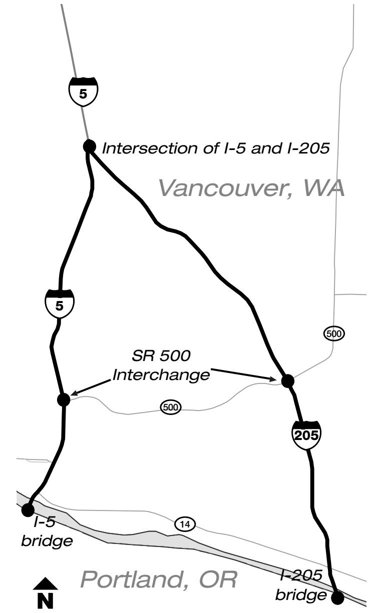


At a glance

- *The I-5 Columbia River bridge results in more than 1 hour and 30 minutes of morning commute congestion southbound*
- *I-205 operates at or near maximum throughput capacity during both the morning and evening commutes*

WSDOT introduces Vancouver area commute trip analysis

The two regional commute corridors in the Vancouver, Wash. area are I-5 and I-205. These corridors link Vancouver with the Portland, Ore. metropolitan area.



Vancouver, Washington area commute trips were defined along I-5 and I-205 to and from the Oregon border.

Vancouver to Portland commuters leave earlier to avoid I-5 congestion

Commuters traveling from Vancouver to Portland on I-5 during the morning (AM) peak period experience travel times more than twice that of the free flowing condition. At the peak of the morning commute (7:40 a.m.), it took an average of 7 minutes (at a speed of about 17 mph) in both 2010 and 2012 to drive the two-mile southbound trip on I-5 from SR 500 to the I-5 Columbia River Bridge. This congestion is caused by the narrow I-5 bridge and by the congestion created by the on-ramp near the approach to the bridge and the ingress points between SR 500 and the I-5 Columbia River Bridge.

Drivers attempting to avoid the overcrowded conditions between the I-5/SR 500 interchange and I-5 bridge have adjusted their commutes, resulting in a 7% decrease in vehicle miles traveled (VMT) on this section of I-5 during the morning peak period (7-10 a.m.), from 2010 to 2012. This reduction in VMT can be attributed to commuters making trips earlier, prior to congestion buildup (4%), and diverting to I-205 (3%). Despite the reduction in VMT, the duration of congestion held constant, lasting more than 1 hour and 30 minutes in 2010 and in 2012. The corridor experiences recurring backups that extend for 2.5 miles north of the I-5 bridge during the weekday morning peak period.

The average morning commute travel times in 2012 on southbound I-205 between the interchange with I-5 and the Glenn Jackson Bridge crossing the Columbia River were equal to the travel times at the maximum throughput speed. The average travel time during the morning peak period increased from 11 minutes in 2010 to 12 minutes in 2012 on this section of southbound I-205. Should the travel time trend continue to increase, throughput will decline. WSDOT is working to identify ways to efficiently operate the existing system and manage vehicular demand on I-205. Some of the more congested areas along I-205 during the morning peak period include the merge from SR 14 and SR 500, and the area near Padden Parkway. During the morning peak period, these ramps carry a near continuous flow of vehicles, adding to the congestion of the interstate.

Between 2010 and 2012, the flow of northbound traffic on I-5 between the I-5 bridge and the SR 500 interchange improved by 1 minute during the evening commute. The bottleneck south of the I-5 bridge delays northbound drivers and limits how quickly vehicles enter Washington state on the I-5 corridor. This allows I-5 to operate efficiently north of the I-5 bridge. There was no evening congestion there in 2012.

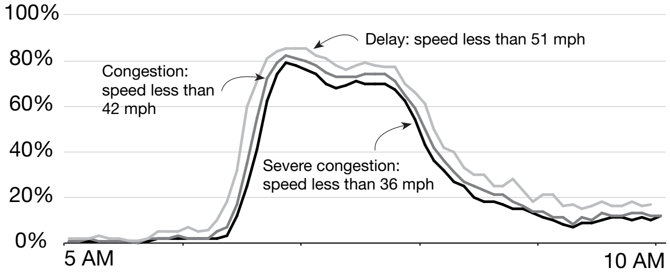
Evening commute on I-205 operates at capacity; WSDOT plans for growing demand

During the evening commute (3-6 p.m.), VMT increased 4% between 2010 and 2012 on the northbound section of I-205 between the Glenn Jackson Bridge and the interchange with I-5. This increase is due to typical growth and possible diversion of drivers to I-205 to avoid the congestion south of the I-5 bridge. Even with this increased demand, driver delays have decreased. Since 2010, WSDOT has constructed two projects that improved

I-205 operates at full capacity through Vancouver in 2012

the flow of traffic through the corridor. These projects are the I-205/Mill Plain Exit – 112th Connector project and a portion of the Salmon Creek Interchange Project, which improved the northbound off-ramp to 134th Street. These enhancements reduced ramp terminal queuing and alleviated weaving, thereby improving overall corridor efficiency. However, traffic demand for this corridor is growing, and may exceed corridor capacity in the near future. Congested segments, such as Mill Plain to SR 500 and between SR 500 and Padden Parkway, were operating near capacity in 2012. WSDOT is developing an I-205 Access and Operational Study to identify low-cost enhancements and strategically improve the corridor to prevent future traffic jams at these locations.

Morning commuters southbound on I-5 from SR 500 to the I-5 bridge are delayed on 85% of weekday trips at 7 a.m.
2012; Percent of weekdays delayed or congested



Data source: Private sector speed data provided through WSDOT Southwest Region Planning.

The graph above shows how often delay, congestion, and severe congestion affected commuters on I-5 in Vancouver in 2012. A value of 0% on the graph indicates that the average trip speed did not fall below the speed threshold at that time of day.

Changes in travel time performance for Vancouver area commute trips
2010 and 2012; Morning (AM) peak (7-10 a.m.) and evening (PM) peak (3-6 p.m.) for an annualized average weekday; Five-minute peak of commuter rush (individual peak times vary); Length of route in miles; All travel times in minutes; Peak of commuter rush and duration of congestion expressed in hours and minutes

				Travel time on the route at		Average (and reliable[2]) travel times at peak of commute rush			Maximum throughput travel time		Peak period VMT	Duration of congestion (how long is average speed below 45 mph)		
									MT^3 Index					
Route	Direction of travel	Length of route	Peak time of commuter rush	Posted speed[1]	Maximum throughput speed	2010	2012	%Δ	2010	2012	%Δ in VMT	2010	2012	Δ
Southbound AM: To Portland, Oregon (Washington state line)														
I-5 (I-205 interchange to I-5 bridge [Oregon])	SB	8	7:40	8	10	13 (23)	14 (26)	8% (13%)	1.36	1.41	-7%	0:45	1:00	0:15
I-5 (SR 500 interchange to I-5 bridge [Oregon])	SB	2	7:40	2	3	7 (15)	7 (16)	0% (7%)	2.42	2.54	-7%	1:35	1:35	0:00
I-205 (I-5 interchange to Glenn Jackson Bridge [Oregon])	SB	11	7:55	11	12	11 (15)	12 (16)	9% (7%)	0.90	0.94	2%	*	0:05	0:05
I-205 (SR 500 interchange to Glenn Jackson Bridge [Oregon])	SB	4	7:50	4	5	5 (5)	5 (7)	0% (40%)	0.88	0.95	2%	*	0:05	0:05
Northbound PM: From Portland, Oregon (Washington state line)														
I-5 (I-5 bridge [Oregon] to I-205 interchange)	NB	8	17:25	8	10	8 (9)	8 (9)	0% (0%)	0.87	0.84	0.3%	*	*	*
I-5 (I-5 bridge [Oregon] to SR 500 interchange)	NB	2	17:25	2	3	3 (3)	2 (3)	-33% (0%)	0.90	0.85	0.6%	0:05	*	-0:05
I-205 (Glenn Jackson Bridge [Oregon] to I-5 interchange)	NB	11	17:35	11	12	12 (17)	11 (14)	-8% (18%)	0.94	0.91	4%	0:10	0:05	-0:05
I-205 (Glenn Jackson Bridge [Oregon] to SR 500 interchange)	NB	4	17:35	4	5	5 (8)	5 (7)	0% (-13%)	1.00	0.96	4%	0:20	0:10	-0:10

Data source: WSDOT Strategic Assessment Office, WSDOT Southwest Region Planning, Private sector speed data, and Starlab at the University of Washington.

Notes: 1 For corridors with varying posted speed limits, a weighted average by distance was used as the posted speed. The symbol "Δ" is used to denote change in a variable. Commute lengths and travel time values have been rounded to integer values. MT^3 Index values cannot be reproduced as published using the integer values in the table. * Indicates that the average speed for the route did not fall below 45 mph (75% of posted speed) on a route.
2 Reliable travel times are the 95th percentile reliable travel times, indicating the time needed in order to arrive on time for 95% of trips, or 19 out of 20 weekday trips.

Commute Trip Analysis for the Spokane Area (Eastern Washington)

At a glance

- *Spokane area commute trip travel times increase 1% for the morning and 8% for the evening commutes from 2011 to 2012*
- *Trip reliability improves 18% for morning commuters westbound on I-90, saving them up to 3 minutes every day*

Trip times increase along with traffic volume and vehicle miles traveled through Spokane

Average daily traffic (ADT) volumes on I-90 near the Sprague Avenue interchange showed a slight increase from 108,000 to 110,000 vehicles per day from 2011 to 2012. Vehicle miles traveled (VMT) also increased on I-90: All day VMT was 13% higher in 2012 than in 2011 between Division Street and Argonne Road. During the peak periods, VMT increased 14% in the morning westbound peak direction (7-10 a.m.) and 12% in the evening eastbound peak direction (3-6 p.m.).

The average trip time westbound on I-90 in the morning peaked at 7:50 a.m. and increased 1% to almost 9 minutes, likely due to the higher traffic volume and vehicle miles traveled along the corridor. Likewise, the average trip time eastbound in the evening peaked at 5:30 p.m. and increased 8% to more than 9 minutes. Incidents remained the major cause of normal delay in the corridor.

Trip reliability varies eastbound and westbound

For the morning commute the 95th percentile reliable trip time improved 18% from almost 14 minutes down to about 11 minutes between 2011 and 2012. In other words, commuters could leave nearly 3 minutes later in 2012 than in 2011, while still ensuring they arrived at their destination early or on-time for 95% of their trips (19 out of every 20 weekday trips). The evening trip time reliability worsened 17% from 13 minutes to more than 15 minutes. Commuters needed to plan an extra 2 minutes to ensure they arrived on time.

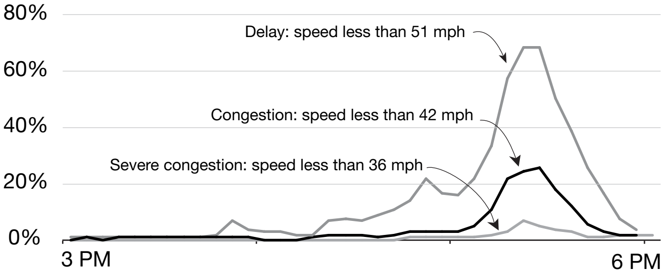
Delay and congestion peak in the evening

In 2012, travelers eastbound on I-90 through Spokane experienced delay at 5:20 p.m. on 68% of weekdays; they experienced congestion 25% of the time, and severe congestion 7% of the time. A value of 0% on the graph below indicates that the average trip speed did not fall below the speed threshold at that time of day.

I-90 eastbound from Division Street to Argonne Road showed the worst congestion and delay at 5:20 p.m.

or travel delay
August 13 - December 31, 2012, weekdays only

August 13 through December 31, 2012; Weekdays only



Data source: WSDOT Eastern Region Traffic Office.

Excluding the Division and Argonne interchanges, there are five off- and four on-ramps in the eastbound direction and six off- and five on-ramps in the westbound direction. The *Corridor Capacity Report* usually compares data two years apart (2010 compared to 2012); since the traffic counters were recalibrated in mid-2011, this year's travel time analysis compares data from August 13 through December 31, 2011, to the same timeframe in 2012.

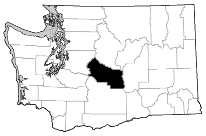
Morning/evening commutes: Changes in travel time performance for Spokane commute trips

2011 and 2012; Morning (AM) peak (7-10 a.m.) and evening (PM) peak (3-6 p.m.) for an annualized average weekday; Five-minute peak of commuter rush (individual peak times vary); Length of route in miles; All travel times in minutes; Peak of commuter rush and duration of congestion expressed in hours and minutes

				Travel time on the route at:		Average travel time at peak of commute rush			95th percentile reliable travel time			Commute vehicle miles traveled
Route	**Direction of travel**	**Length of route**	**Peak of commuter rush**	**Posted speed**	**Maximum throughput speed**	**2011**	**2012**	**%Δ**	**2011**	**2012**	**%Δ**	**%Δ**
I-90: Argonne Road to Division Street	WB	7.5	7:50	7.50	8.82	8.55	8.63	1%	13.87	11.35	-18%	14%
I-90: Division Street to Argonne Road	EB	7.5	17:30	7.50	8.82	8.63	9.32	8%	13.15	15.33	17%	12%

Data source: WSDOT Eastern Region Traffic Office.

Note: Weekday data for August 13 through December 31, 2011 and 2012.



Commute Trip Analysis for Snoqualmie Pass

At a glance

- ***The major causes of delay on Snoqualmie Pass include severe weather in the winter and tourist traffic during the summer***
- ***In 2012, Snoqualmie Pass experienced the most traffic delay in January, with delay occurring 17.4% of the time***

WSDOT introduces Snoqualmie Pass travel delay analysis

WSDOT is including Snoqualmie Pass (the Pass) in its expanded analysis of congestion and highway system performance statewide due to its importance in the state as a major east/west freight corridor. WSDOT classifies the Pass as a Tier 1 freight corridor meaning that more than 10 million tons of freight move through it annually. In 2012, the average annual daily traffic on the Pass was 27,232 vehicles with 23% of the traffic being semitrucks.

Majority of delay on Snoqualmie Pass occurs during winter months

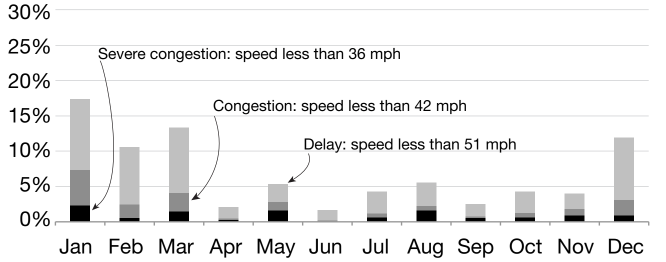
Traffic delay follows a somewhat predictable pattern based on several seasonal influences. These influences include severe weather in winter, summer tourist traffic starting after Memorial Day, and construction along the pass while weather permits.

January saw the most slowdowns with traffic experiencing delay (speeds below 85% of posted speed) 17.4% of the time. Severe congestion (speeds below 60% of the posted speed) occurred 2.3% of the time. Winter storms account for the majority of the delay that occurs between November and March. During these winter months the vehicle volumes remain fairly low; however heavy snow slows traffic and sometimes closes the Pass completely.

Summer delay tends to start in May before Memorial Day and run through Labor Day. Congestion is most concentrated during summer eastbound on Fridays, and westbound on Sundays. The month of August saw the worst congestion during the spring/summer months with traffic experiencing delay 5.5% of the time. The remainder of the congestion is mostly attributed to lane closures that happen while the weather allows for construction on the Pass.

Most delay on Snoqualmie Pass occurs in winter months

January 1 through December 31, 2012; Duration of delay, congestion, and severe congestion as a percentage of time during the month; Duration is shown for eastbound and westbound combined



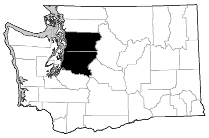
Data source: Private sector speed data provided through WSDOT Northcentral Region Traffic Office.

Notes: The remainder of time not shown above saw free flow traffic speeds. Delay is considered speeds 70% to 85% of posted speed, congestion is 60% to 70% of posted speed and severe congestion anything below 60% of posted speed.

Truck drivers put chains on their tires before heading over Snoqualmie Pass during winter. Snowy conditions slow traffic creating most of the delay that occurs on the Pass throughout the year.

In HOV Trip Analysis:

- *The High Occupancy Vehicle (HOV) lanes at 9 of 10 monitored locations accommodate more people per lane during peak periods than the adjacent single-occupancy vehicle lanes*
- *Only 5 of 14 monitored peak direction HOV commutes met the performance standard of 45 mph or greater during 90% of the peak hour*



High Occupancy Vehicle Trip Analysis

At a glance

- ***The HOV lanes at 9 of 10 monitored locations accommodate more people per lane during peak periods than the adjacent SOV lanes***
- ***Only 5 of 14 monitored peak direction HOV commutes met the performance standard of 45 mph or greater during 90% of the peak hour***

HOV lanes improve system performance

The central Puget Sound area freeway network includes a system of high occupancy vehicle (HOV) lanes serving travelers who carpool, vanpool, or use public transit. This system is designed to provide faster and more reliable travel options for travelers that choose to rideshare, and enhance the efficient operation of the freeway network by moving more people in fewer vehicles, compared to adjacent single occupancy vehicle (SOV) freeway lanes. About 310 lane-miles of the planned 320-mile Puget Sound area HOV network have been completed. See p. 10 or http://www.wsdot.wa.gov/hov/ for more information about the HOV lane network.

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

HOV trips improve system performance; increase person throughput

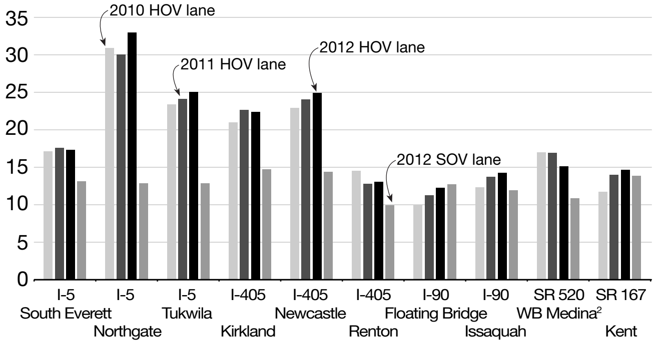
Person throughput across multiple modes could be a proxy for overall transportation system efficiency. Person throughput is a key metric for HOV lane performance; higher values indicate the system is efficiently moving people in fewer vehicles. The WSDOT HOV lane monitoring program estimates the number of people traveling in each vehicle at the same locations where vehicle volumes are monitored to determine person throughput in HOV lanes compared to adjacent SOV lanes.

Person throughput in the HOV lane varies by location; the most successful examples of HOV lane performance are at locations that combine the travel time benefits of the HOV lane with strong transit service. I-5 at Northgate is an example of such a location. In previous years, this location has shown significant HOV lane use and travel time benefits. It is located on a primary freeway commute corridor toward Seattle that includes significant transit service. In 2012, during the average morning peak period, the southbound HOV lane carried more than 15,100 persons on average, which is 45% of all southbound peak period travelers on this corridor, in only 20% of the vehicles. The HOV lane at this location carries an average of 3.8 persons per vehicle, or almost four times the number of persons per vehicle in the adjacent SOV lanes. Overall, the Puget Sound-area network attracts a significant number of ridesharing travelers; across all the monitoring locations, an average of about 35% of travelers use the HOV lanes during the peak periods. These values have been generally consistent from year to year.

The graph below shows HOV lane usage on a person volume basis, at selected monitoring locations on major Puget Sound area corridors during the peak periods. Since 2010, there has been an upswing in the number of HOV travelers carried by the HOV lane, following a period of lower volumes in 2009 amidst recessionary regional economic conditions (see the 2012 *Congestion Report*, p. 48). In 2010, 6 of the 10 locations showed higher HOV person volumes, compared to 2009. The trend continued in 2011 and 2012, as 7 of the 10 locations showed higher HOV person volumes compared to their respective prior years.

~~Person thro~~ughput[1] on HOV lanes outperform SOV lanes

2010 through 2012; Morning and evening peak period volumes, combined; Number of people in thousands



Data source: Washington State Transportation Center (TRAC).

Notes: Beginning in 2009, all person volume estimates are based on a more comprehensive transit ridership database that includes more information about private employer bus services. Person volume estimates are based on most recent 2011/2012 transit ridership and other data. 1 Person throughput is the sum of people using all HOV and SOV lanes from 6-9 a.m. and 3-7 p.m. in the peak direction of the commute at a point location. 2 SR 520 results based on modified location because of effects on data availability of nearby construction.

HOV lanes in high demand – only 5 of 14 commutes met performance

The graph also illustrates another way to track HOV lane efficiency, which is to compare HOV lane performance to SOV performance on a per-lane basis. In 2012, the HOV lane person volume was higher than that of the average adjacent SOV lane at 9 of the 10 monitored locations, up from 8 of 10 locations in 2011. The only monitored location where HOV person volume did not exceed adjacent SOV per-lane person volume in 2012 is at the I-90 midspan; on that roadway, the HOV lanes between Bellevue and Seattle consist of an HOV-only facility east of Mercer Island, and an express roadway between Seattle and Mercer Island that allows SOV traffic to access Mercer Island; the monitoring location is in the segment that allows SOVs.

Increases in transit ridership improve person throughput in HOV lanes

Transit ridership is a significant contributor to person volumes in the freeway HOV lane network. Three transit agencies operate service on the commute trip corridors in the central Puget Sound area. King County Metro ridership grew by 2.3% between 2011 and 2012; the agency attributed this growth to higher employment levels and additional bus service. Metro's 2012 annual ridership continues a recent upward trend and 2012 ridership is approaching the all-time high that was achieved in 2008, before the recession. Sound Transit ridership increased 13% on its regional buses between 2011 and 2012. Community Transit experienced a 7% drop in ridership between 2011 and 2012. Increases in ridership include boardings in downtown Seattle that were previously part of the ride-free zone prior to September 29, 2012.

Transit agencies in the region continue to face budget constraints and other issues that could affect ridership. WSDOT will continue to track bus ridership trends as part of its ongoing HOV performance monitoring activities. WSDOT analyzes the 2012 ridership on specific commute corridors in the central Puget Sound area on pp. 49-52.

WSDOT strives to achieve HOV performance goals of speed and reliability

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

Five of 14 HOV corridors met performance standards in 2012

Five of 14 monitored HOV peak-direction corridors met the state performance standard in 2012, compared to seven corridors meeting the standard in 2010 and 2011. For 12 of the 14 HOV peak-direction corridors the degree of compliance (to maintain an average HOV trip speed of 45 mph or greater, during 90% of the peak hour of travel) was lower in 2012, compared to the year before; the other two corridors showed no change. Overall, the 2012 results differ from those seen in 2009 through 2011, when HOV corridor compliance with the standard had generally improved from previous years. A review of the results since 2007 shows that 2012 performance is now similar to those experienced in 2007, prior to the start of recessionary economic conditions. Recently, there has been an upswing in economic conditions in the Seattle area, along with greater use of the HOV lane network during the past year.

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

2008 through 2012; Goal is to maintain 45 mph for 90% of peak hour

▨ = Goal not met

Commute routes	2008	2009	2010	2011	**2012**
Morning peak direction commutes					
I-5, Everett to Seattle SB	60%	69%	61%	64%	**54%**
I-5, Federal Way to Seattle NB	67%	92%	86%	72%	**51%**
I-405, Lynnwood to Bel SB	92%	94%	92%	94%	**76%**
I-405, Tukwila to Bellevue NB	49%	99%	99%	98%	**93%**
I-90, Issaquah to Seattle WB	100%	96%	100%	100%	**100%**
SR 520, Redmond to Bel WB	99%	94%	94%	97%	**51%**
SR 167, Auburn to Renton NB[1]	99%	99%	100%	99%	**96%**
Evening peak direction commutes					
I-5, Seattle to Everett NB	64%	49%	55%	76%	**68%**
I-5, Seattle to Federal Way SB	57%	67%	77%	82%	**63%**
I-405, Bel to Lynnwood NB	58%	71%	77%	74%	**56%**
I-405, Bellevue to Tukwila SB	35%	70%	74%	60%	**43%**
I-90, Seattle to Issaquah EB	100%	95%	99%	99%	**100%**
SR 520, Redmond to Bel WB	68%	71%	61%	70%	**54%**
SR 167, Renton to Auburn SB[1]	98%	99%	99%	99%	**98%**

Data source: Washington State Transportation Center (TRAC).

Notes: HOV reliability performance standards are based on the peak hour, the one-hour period during each peak period when average travel time is slowest. To meet the standard, a speed of 45 mph must be maintained for 90% of the peak hour. Numbers represent the percentage of the peak hour when speeds are above 45 mph. TRAC analyzes performance data for all complete segments of HOV lanes that have a loop detector. In some cases, data cannot be analyzed for the very beginning and ends of the lanes because there are no detectors at these locations. The year with worst congestion is 2007 prior to the economic recession. NB = Northbound; SB = Southbound; EB = Eastbound; WB = Westbound. "Bel" stands for Bellevue. 1 High occupancy toll (HOT) lanes replaced regular HOV lanes May 3, 2008.

High Occupancy Vehicle Trip Analysis

Ridesharers see improved trip travel time and reliability

The accompanying table summarizes the degree to which each Puget Sound-area HOV corridor met the state performance standards in recent years in the peak direction of travel (when HOV lane performance is most likely to be affected). During the evening peak hour five of the seven HOV corridors did not meet the state standard in 2012; this is a pattern that has persisted for at least the past eight years. During the morning peak hour, performance dropped over the past year, with three of the seven corridors meeting the standard in 2012, compared to five corridors meeting the standard in 2011. Factors that can influence peak-hour HOV corridor performance include high demand for HOV lanes that exceeds the available capacity; specific roadway geometry issues that constrain traffic flow, such as traffic merging from on-ramps or crossing lanes to use nearby off-ramps; and construction-related disruptions such as reduced shoulders, temporary lane re-striping, etc.

During the off-peak times of day, all HOV corridors generally meet the standard. Even during peak periods of congestion when HOV performance is reduced, HOV lanes generally continue to provide a speed and reliability benefit relative to the adjacent SOV lanes (see discussion of HOV travel times, later in this section).

Demand for HOV lanes increased in 2012

WSDOT analyzes the volume of vehicles and their person occupancy in HOV and SOV lanes at 10 monitoring locations in order to estimate person throughput. During the morning peak period, 9 of 10 monitoring locations experienced higher HOV lane volumes in 2012 compared to 2010, while evening peak period volumes increased at 8 of 10 locations. The SOV lanes showed the opposite pattern, with both morning and evening peak volumes decreasing at 8 of the 10 locations.

Combining all the monitoring locations for both morning and evening peak periods, HOV volumes were up by slightly more than 3%, while SOV volumes were down by less than 1%, from 2010 to 2012 (this does not include the HOV/HOT lane location on SR 167). When HOV and SOV volumes are combined for both peak periods, the total peak period volume was virtually unchanged over the two-year period.

HOV person occupancy compliance 98% in 2012

The central Puget Sound area HOV network consistently experiences high compliance with the minimum vehicle occupancy requirement. In 2012, across all 10 monitoring locations, the compliance rate was 98%.

Ridesharing has significant benefits in trip reliability compared to driving alone

HOV trips continue to offer benefits to ridesharing travelers by reducing day-to-day variability in travel times experienced on similar SOV trips.

WSDOT monitors the extent of travel performance benefits for HOV users by tracking the HOV performance on the 40 high-demand commute routes presented on pp. 69-70. These equivalent HOV routes are designed to include all the available HOV segments on each trip route (when HOV segments do not exist, SOV segments are used). For some SOV commute routes on I-5 and I-90, more than one alternate HOV route is analyzed due to the presence of express or reversible lanes.

Of the 42 HOV trips analyzed for 2012, 30 were faster by more than 2 minutes during times of peak congestion than the associated SOV trip, while the other 12 trips show no significant difference between the SOV and HOV route options (changed 2 minutes or less). The latter situation can occur if HOV lanes are not continuously available on the route (forcing HOVs to use the SOV lanes for part of the trip); if there is no congestion on the SOV lane of the route for that peak period and direction of travel (and therefore no comparative travel time benefit for the traveler in the HOV lane); or if HOV lane performance is affected by traffic that is using connected on- or off-ramps. Overall, the results are similar to those seen in previous years.

In addition, the 95th percentile reliable travel times are faster by more than 2 minutes on 30 of 42 HOV trips relative to their SOV counterparts, often by a significant degree. The 95th percentile reliable travel times changed 2 minutes or less on the other 12 trips. The lower 95th percentile values for HOV travelers over their SOV counterparts shows the benefit of using HOV lanes from a travel reliability perspective.

The 2012 *Congestion Report* analyzed 46 HOV commute trips, compared to 42 trips reported this year. This is due to the heavy construction activity on SR 520 for the Medina to SR 202: Eastside Transit and HOV Project. Once the construction is complete, WSDOT will resume reporting on the comparative analysis for HOV (2+, 3+) with corresponding SOV trips. The tables on pp. 69-70 provide the comparative details on the commute trip travel times for HOV and SOV trips.

Faster and more reliable travel times for HOV compared to SOV trips

Morning commutes: HOV lane travel time performance compared to single occupancy vehicle (SOV) lanes

2010 and 2012; Morning (AM) peak (5-10 a.m.) for an annualized average weekday; Five-minute peak of commuter rush (individual peak times vary); Length of route in miles; All travel times and differences in minutes; Peak of commuter rush expressed in hours and minutes

			Travel times on the route at		Average travel time at peak of AM rush					95% reliable travel times				
Route	Length of route	Peak of commuter AM rush	Posted speed	Maximum throughput speed	HOV lanes			SOV lanes	2012: Difference HOV vs. SOV	HOV lanes			SOV lanes	2012: Difference HOV vs. SOV
					2010	2012	Δ	2012		2010	2012	Δ	2012	
To Seattle														
I-5 Everett to Seattle														
Regular HOV lane	24	7:20	24	28	36	37	1	44	-7	55	63	8	76	-13
Reversible lanes	24	7:20	24	28	34	34	0	44	-10	49	49	0	76	-27
I-5 Federal Way to Seattle[1]	22	7:30	22	27	27	33	6	46	-13	36	46	10	66	-20
I-90/I-5 Issaquah to Seattle														
HOV & SOV lanes[1]	14	7:40	14	17	15	17	2	22	-5	18	22	4	35	-13
HOV & reversible lanes[1]	14	7:40	14	17	15	15	0	22	-7	17	18	1	35	-17
SR 520/I-5 Redmond to Seattle	13	7:40	13	16	17	19	2	18	1	20	23	3	22	1
I-5 SeaTac to Seattle	13	7:45	13	16	17	22	5	29	-7	25	29	4	38	-9
I-405/I-90/I-5 Bellevue to Seattle														
HOV & SOV lanes[1]	9	8:00	9	11	11	13	2	13	0	13	17	4	19	-2
HOV & reversible lanes[1]	9	8:00	9	11	10	10	0	13	-3	10	11	1	19	-8
I-405/SR 520/I-5 Bellevue to Seattle	10	7:40	10	12	15	15	0	15	0	17	18	1	19	-1
To Bellevue														
I-5/I-405 Everett to Bellevue	24	7:20	24	28	27	29	2	52	-23	32	40	8	81	-41
I-405 Lynnwood to Bellevue	16	7:30	16	19	18	20	2	41	-21	21	30	9	66	-36
I-405 Tukwila to Bellevue	13	7:35	13	16	14	15	1	33	-18	15	18	3	48	-30
I-5/I-90/I-405 Seattle to Bellevue[1]	8	8:35	8	10	12	11	-1	12	-1	18	17	-1	18	-1
I-90/I-405 Issaquah to Bellevue	9	7:45	9	11	11	11	0	14	-3	14	14	0	23	-9
SR 520/I-405 Redmond to Bellevue	6	8:50	6	7	9	9	0	8	1	11	11	0	10	1
To other locations – Morning (AM)														
I-405 Bellevue to Tukwila	13	7:40	13	16	13	13	0	18	-5	14	14	0	25	-11
SR 167 Auburn to Renton (HOT)	10	7:40	10	12	10	11	1	18	-7	12	15	3	28	-13
I-5/I-90 Seattle to Issaquah[1]	14	8:25	14	16	16	15	-1	16	-1	22	20	-2	21	-1
I-5/SR 520 Seattle to Redmond	13	8:45	13	16	25	18	-7	18	0	36	26	-10	25	1

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

Notes: Due to changes in the way WSDOT processed 2012 loop data, 2010 travel time data reported in the 2011 *Congestion Report* is not comparable with the current report. HOV trips with the same endpoints as SOV lane trips, but differing lengths, do not require any adjustment, since the difference in lengths is the result of HOVs using different roadways than SOVs (e.g., an HOV only interchange ramp). Commute lengths have been rounded to integer values for publication purposes only. Trip routes on I-5 and I-90 include reversible lane options for the weekday time periods (AM or PM) and directions of travel when the reversible lanes are in effect. The HOV trip on SR 520 eastbound from Seattle to Bellevue is no longer reported, because HOV lanes exist along only a very short portion of the route.

1 Some HOV trips have modified trip lengths compared to the corresponding standard SOV trips in the central Puget Sound area mentioned on pp. 42-56, due to the lack of data at the HOV trip's endpoints. Affected trips are on northbound I-5 from Federal Way to Seattle, and I-90 trips between Seattle and Issaquah, and between Bellevue and Seattle (both eastbound and westbound). In each case, to enable a direct comparison, the lengths of the corresponding SOV trips have been adjusted to match the HOV trip length as closely as possible; this means travel times and time stamps for the peak of the commuter rush for these modified SOV trips will not necessarily match those in the SOV trip tables on pp. 44-48, and the 2010 values in this table will not match 2010 values reported in the 2011 *Congestion Report*.

High Occupancy Vehicle Trip Analysis

HOV travel times and reliability exceed adjacent SOV lanes

Evening commutes: HOV lane travel time performance compared to single occupancy vehicle (SOV) lanes

2010 and 2012; Evening (PM) peak (2-8 p.m.) for an annualized average weekday; Five-minute peak of commuter rush (individual peak times vary); Length of route in miles; All travel times and differences in minutes; Peak of commuter rush expressed in hours and minutes

			Travel times on the route at		Average travel time at peak of PM rush					95% reliable travel times				
					HOV lanes			SOV lanes	2012: Difference HOV vs. SOV	HOV lanes			SOV lanes	2012: Difference HOV vs. SOV
Route	**Length of route**	**Peak of commuter PM rush**	**Posted speed**	**Maximum throughput speed**	**2010**	**2012**	**Δ**	**2012**		**2010**	**2012**	**Δ**	**2012**	
From Seattle														
I-5 Seattle to Everett														
Regular HOV lane	23	17:05	23	28	36	35	-1	38	-3	53	48	-5	55	-7
Reversible lanes	23	17:05	23	28	32	29	-3	38	-9	43	37	-6	55	-18
I-5 Seattle to Federal Way	22	16:35	22	27	27	29	2	32	-3	36	40	4	46	-6
I-5 Seattle to SeaTac	13	16:40	13	16	16	18	2	19	-1	21	25	4	30	-5
I-5/I-90/I-405 Seattle to Bellevue														
HOV & SOV lanes[1]	8	17:20	8	10	13	12	-1	13	-1	21	21	0	22	-1
HOV & reversible lanes[1]	8	17:20	8	10	10	9	-1	13	-4	10	10	0	22	-12
I-5/SR 520 Seattle to Redmond	13	17:30	13	16	23	16	-7	17	-1	37	21	-16	22	-1
I-5/I-90 Seattle to Issaquah														
HOV & SOV lanes[1]	14	17:20	14	16	18	17	-1	18	-1	26	26	0	28	-2
HOV & reversible lanes[1]	14	17:20	14	16	14	14	0	18	-4	15	14	-1	28	-14
From Bellevue														
I-405 Bellevue to Everett	23	17:15	23	28	28	30	2	40	-10	36	41	5	57	-16
I-405 Bellevue to Lynnwood	16	17:20	16	19	20	22	2	32	-10	26	32	6	47	-15
I-405 Bellevue to Tukwila	13	16:45	13	16	16	19	3	34	-15	22	28	6	45	-17
I-405/I-90/I-5 Bellevue to Seattle[1]	9	17:15	9	11	14	18	4	24	-6	23	29	6	36	-7
I-405/SR 520/I-5 Bellevue to Seattle	10	17:30	10	12	19	19	0	26	-7	27	25	-2	36	-11
I-405/I-90 Bellevue to Issaquah	9	17:35	9	11	14	15	1	18	-3	17	20	3	22	-2
I-405/SR 520 Bellevue to Redmond	5	17:40	5	7	8	8	0	8	0	11	11	0	12	-1
From other locations – Evening (PM)														
I-5 Everett to Seattle	24	16:25	24	28	35	46	11	49	-3	49	64	15	73	-9
I-90/I-5 Issaquah to Seattle[1]	14	16:45	14	17	18	19	1	26	-7	25	28	3	40	-12
SR 520/I-5 Redmond to Seattle	13	17:30	13	16	23	23	0	31	-8	39	36	-3	54	-18
I-5 SeaTac to Seattle	13	17:20	13	16	18	18	0	23	-5	29	25	-4	38	-13
SR 167 Renton to Auburn (HOT)	10	16:45	10	12	11	12	1	17	-5	15	15	0	29	-14
I-405 Tukwila to Bellevue	13	17:20	13	16	14	14	0	23	-9	15	15	0	38	-23

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

Notes: Due to changes in the way WSDOT processed 2012 loop data, 2010 travel time data reported in the 2011 *Congestion Report* is not comparable with the current report. HOV trips with the same endpoints as SOV lane trips, but differing lengths, do not require any adjustment, since the difference in lengths is the result of HOVs using different roadways than SOVs (e.g., an HOV-only interchange ramp). Commute lengths have been rounded to integer values for publication purposes only. Trip routes on I-5 and I-90 include reversible lane options for the weekday time periods (AM or PM) and directions of travel when the reversible lanes are in effect. The HOV trip on SR 520 eastbound from Seattle to Bellevue is no longer reported, because HOV lanes exist along only a very short portion of the route.

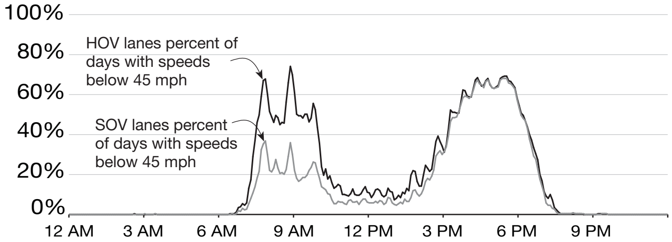
[1] Some HOV trips have modified trip lengths compared to the corresponding standard SOV trips in the central Puget Sound area mentioned on pp. 42-56, due to the lack of data at the HOV trip's endpoints. Affected trips are on northbound I-5 from Federal Way to Seattle, and I-90 trips between Seattle and Issaquah, and between Bellevue and Seattle (both eastbound and westbound). In each case, to enable a direct comparison, the lengths of the corresponding SOV trips have been adjusted to match the HOV trip length as closely as possible; this means travel times and time stamps for the peak of the commuter rush for these modified SOV trips will not necessarily match those in the SOV trip tables on pp. 44-48, and the 2010 values in this table will not match 2010 values reported in the 2011 *Congestion Report*.

Congestion on SR 520 HOV lanes impacted by right-hand HOV lane

Comparing HOV and adjacent SOV lanes: Percent of weekdays when speeds fell below 45 mph

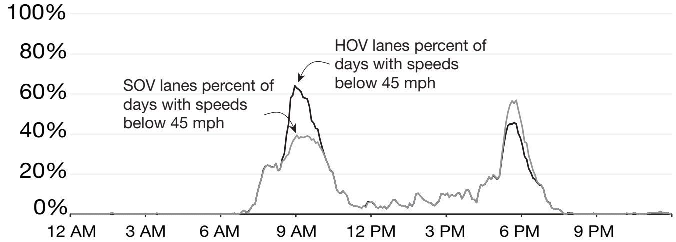
SR 520/I-405 Redmond to Bellevue

2012 weekday data only



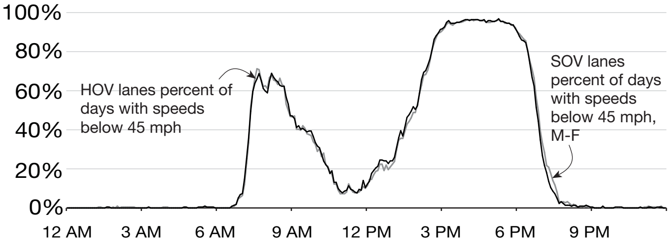
I-405/SR 520 Bellevue to Redmond

2012 weekday data only



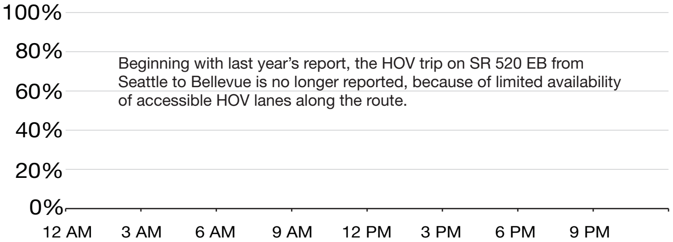
I-405/SR 520/I-5 Bellevue to Seattle

2012 weekday data only



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

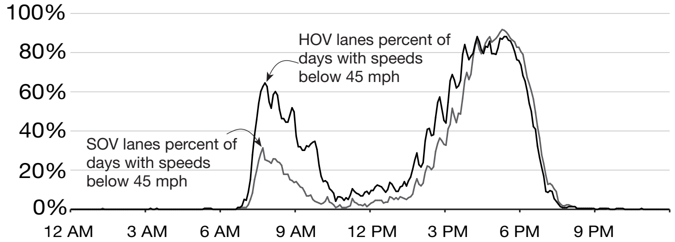
2012 weekday data only



Beginning with last year's report, the HOV trip on SR 520 EB from Seattle to Bellevue is no longer reported, because of limited availability of accessible HOV lanes along the route.

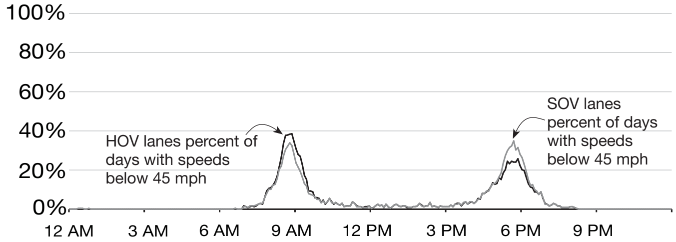
SR 520/I-5 Redmond to Seattle

2012 weekday data only



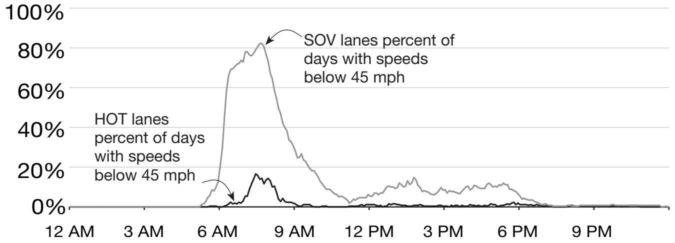
I-5/SR 520 Seattle to Redmond

2012 weekday data only



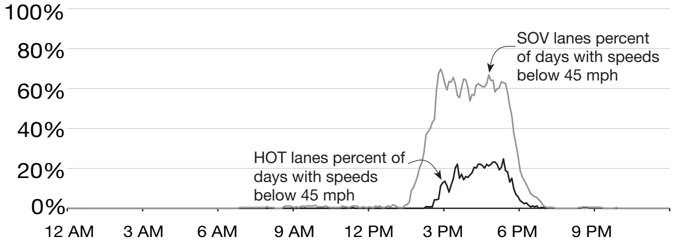
SR 167 Auburn to Renton

2012 weekday data only



SR 167 Renton to Auburn

2012 weekday data only



Data source: WSDOT Strategic Assessment Office.

When looking at the graphs above, it is important to remember that the SR 520 HOV lanes do not function in the same way as the other HOV lanes in the region. The SR 520 HOV lanes are located on the right side of the highway, and as such, short HOV-only segments are interspersed with segments where all vehicles are allowed, such as where vehicles are entering or exiting the highway. During peak periods, ramp-related congestion has a dramatic impact on SR 520 HOV lane performance.

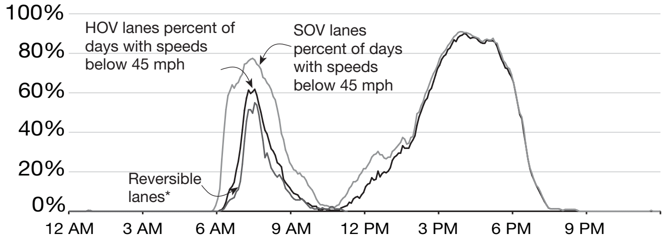
To avoid the ramp related congestion, many HOV drivers choose to move to the SOV lanes to bypass the congestion, returning to the HOV lane after the merge areas. The trip reliability for drivers exhibiting this behavior is greater than the reliability shown for the HOV lane. Another factor that can influence peak-hour HOV corridor performance includes construction-related disruptions such as reduced shoulders and temporary lane re-striping for the SR 520 Medina to SR 202: Eastside Transit and HOV project.

I-5 and I-90 reversible lanes less congested than SOV and HOV lanes

Comparing HOV and adjacent SOV lanes: Percent of weekdays when speeds fell below 45 mph

I-5 Everett to Seattle

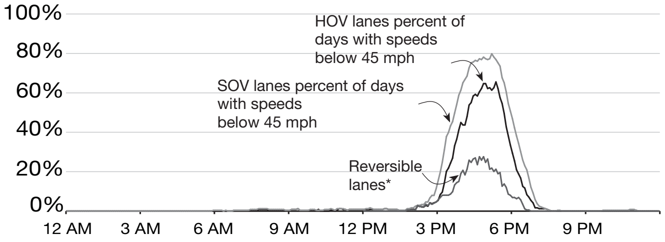
2012 weekday data only



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

I-5 Seattle to Everett

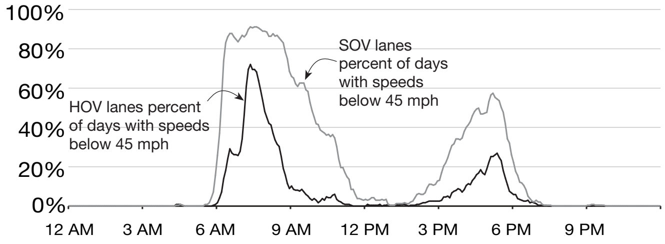
2012 weekday data only



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

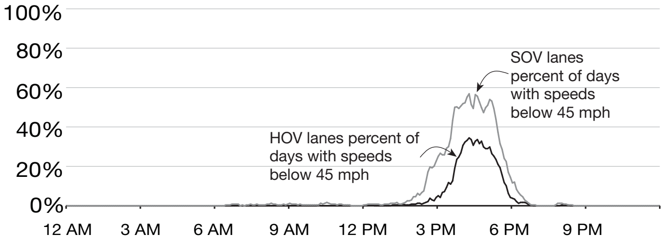
I-5 Federal Way to Seattle

2012 weekday data only



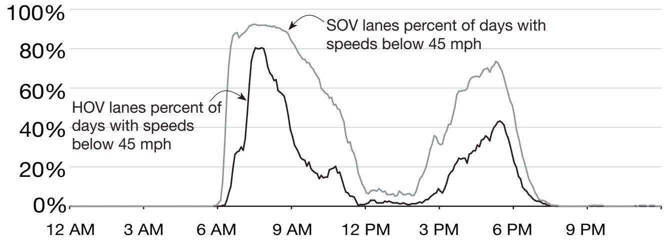
I-5 Seattle to Federal Way

2012 weekday data only



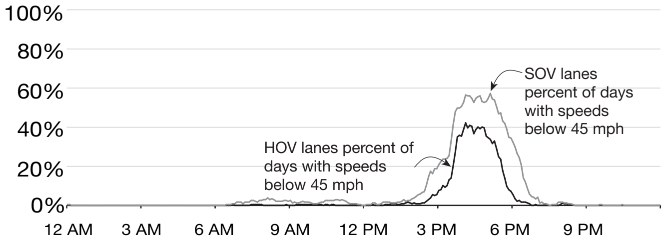
I-5 SeaTac to Seattle

2012 weekday data only



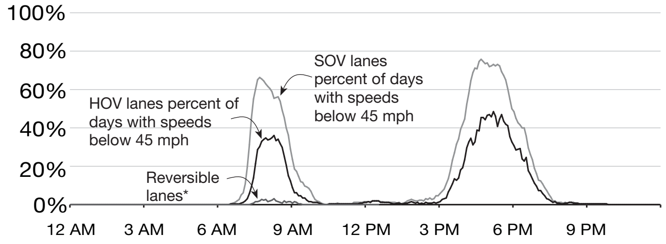
I-5 Seattle to SeaTac

2012 weekday data only



I-90/I-5 Issaquah to Seattle

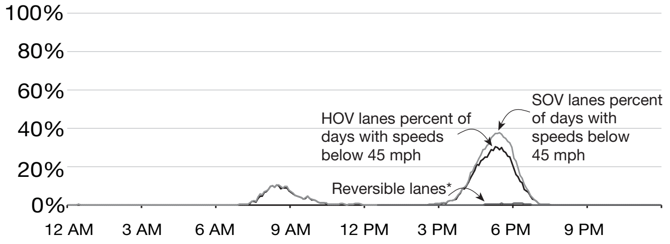
2012 weekday data only



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

I-90/I-5 Seattle to Issaquah

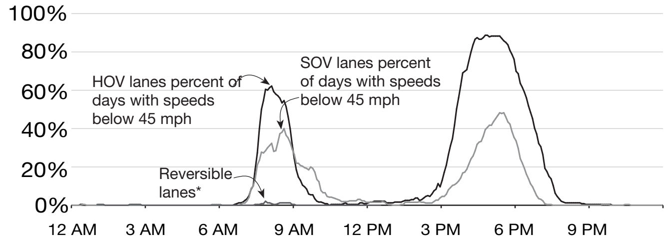
2012 weekday data only



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

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

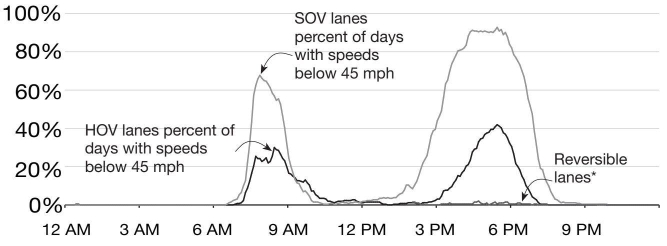
2012 weekday data only



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

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

2012 weekday data only



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

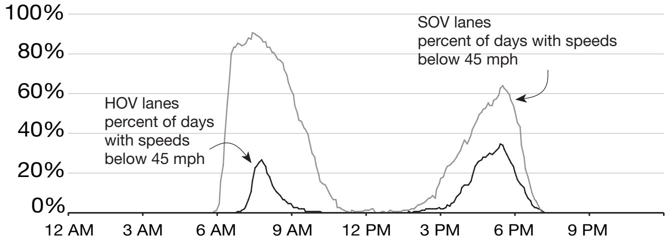
Data source: WSDOT Strategic Assessment Office.

I-405 HOV lanes offer significant benefits compared to SOV lanes

Comparing HOV and adjacent SOV lanes: Percent of weekdays when speeds fell below 45 mph

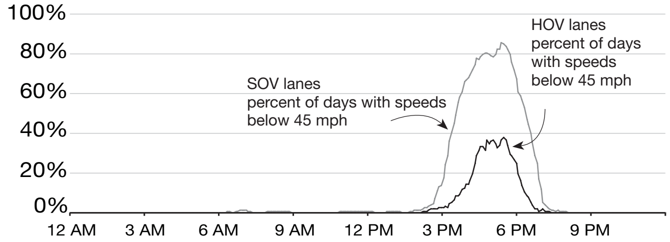
I-5/I-405 Everett to Bellevue

2012 weekday data only



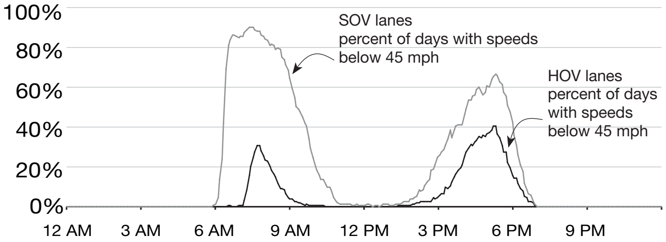
I-405/I-5 Bellevue to Everett

2012 weekday data only



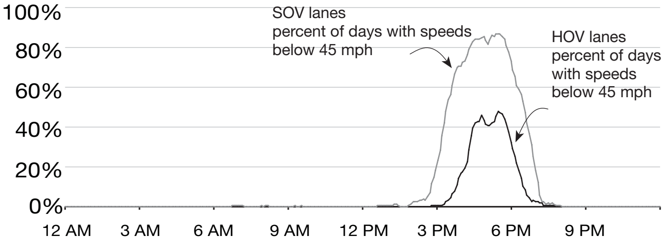
I-405 Lynnwood to Bellevue

2012 weekday data only



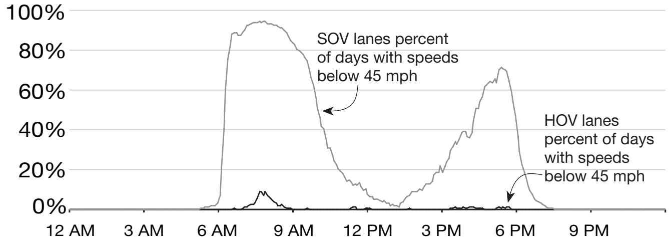
I-405 Bellevue to Lynnwood

2012 weekday data only



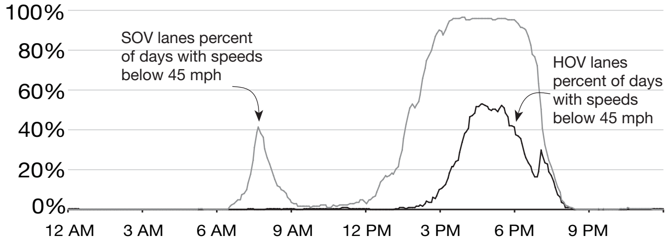
I-405 Tukwila to Bellevue

2012 weekday data only



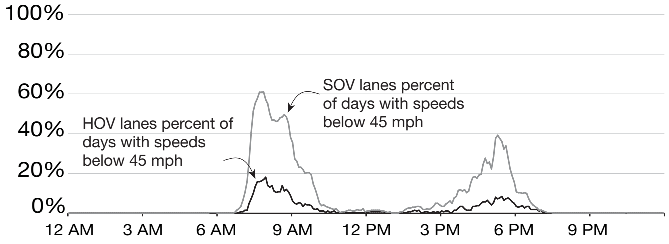
I-405 Bellevue to Tukwila

2012 weekday data only



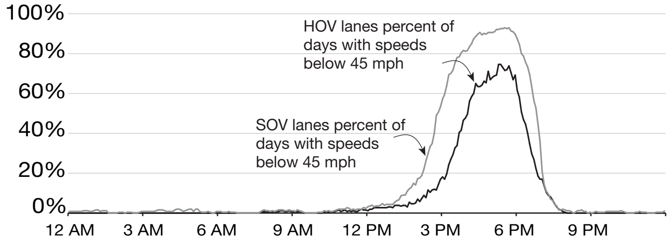
I-90/I-405 Issaquah to Bellevue

2012 weekday data only



I-405/I-90 Bellevue to Issaquah

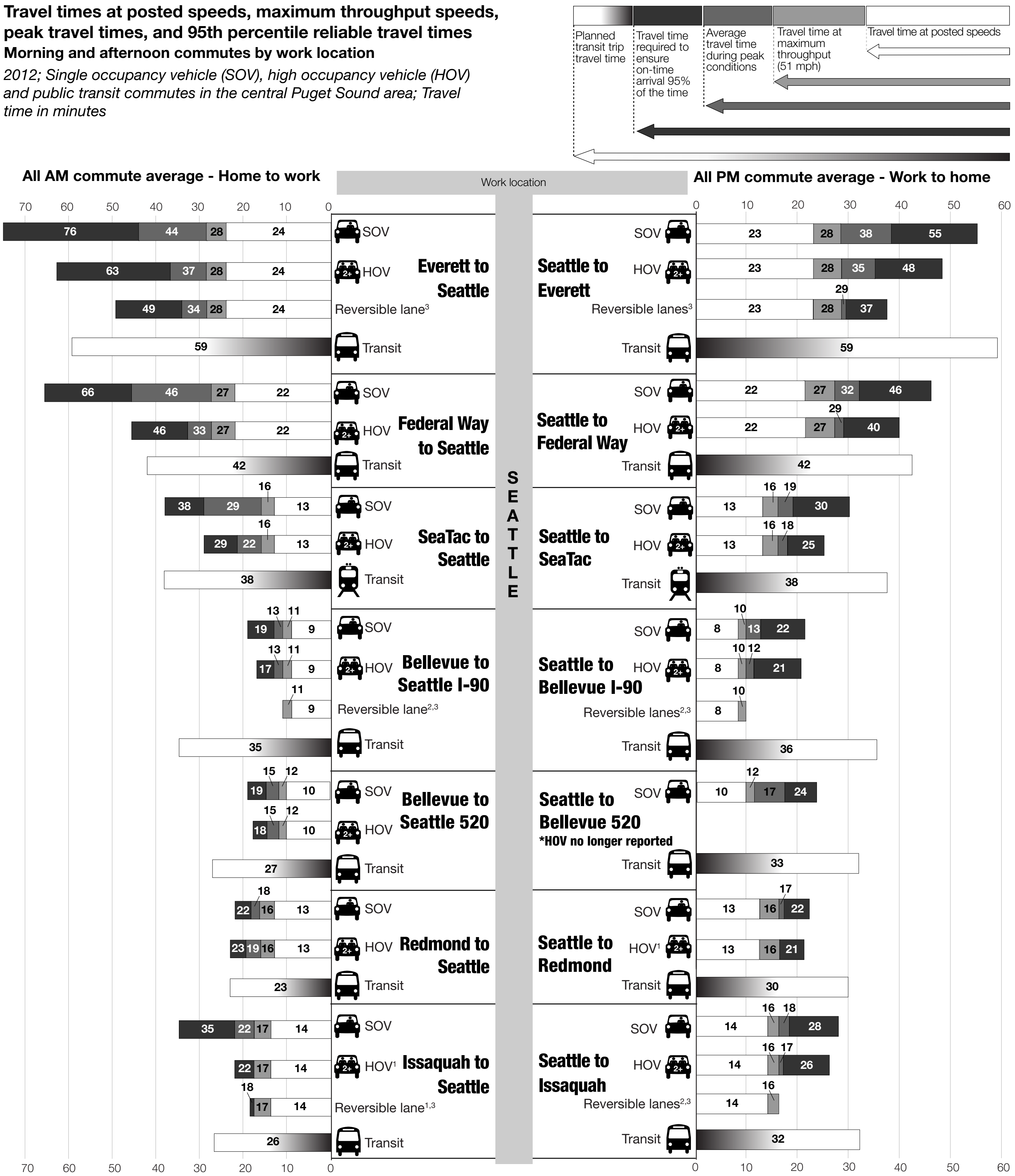
2012 weekday data only



Data source: WSDOT Strategic Assessment Office.

Travel time comparison for SOV, HOV, transit trips to work in Seattle

Travel times at posted speeds, maximum throughput speeds, peak travel times, and 95th percentile reliable travel times
Morning and afternoon commutes by work location
2012; Single occupancy vehicle (SOV), high occupancy vehicle (HOV) and public transit commutes in the central Puget Sound area; Travel time in minutes



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

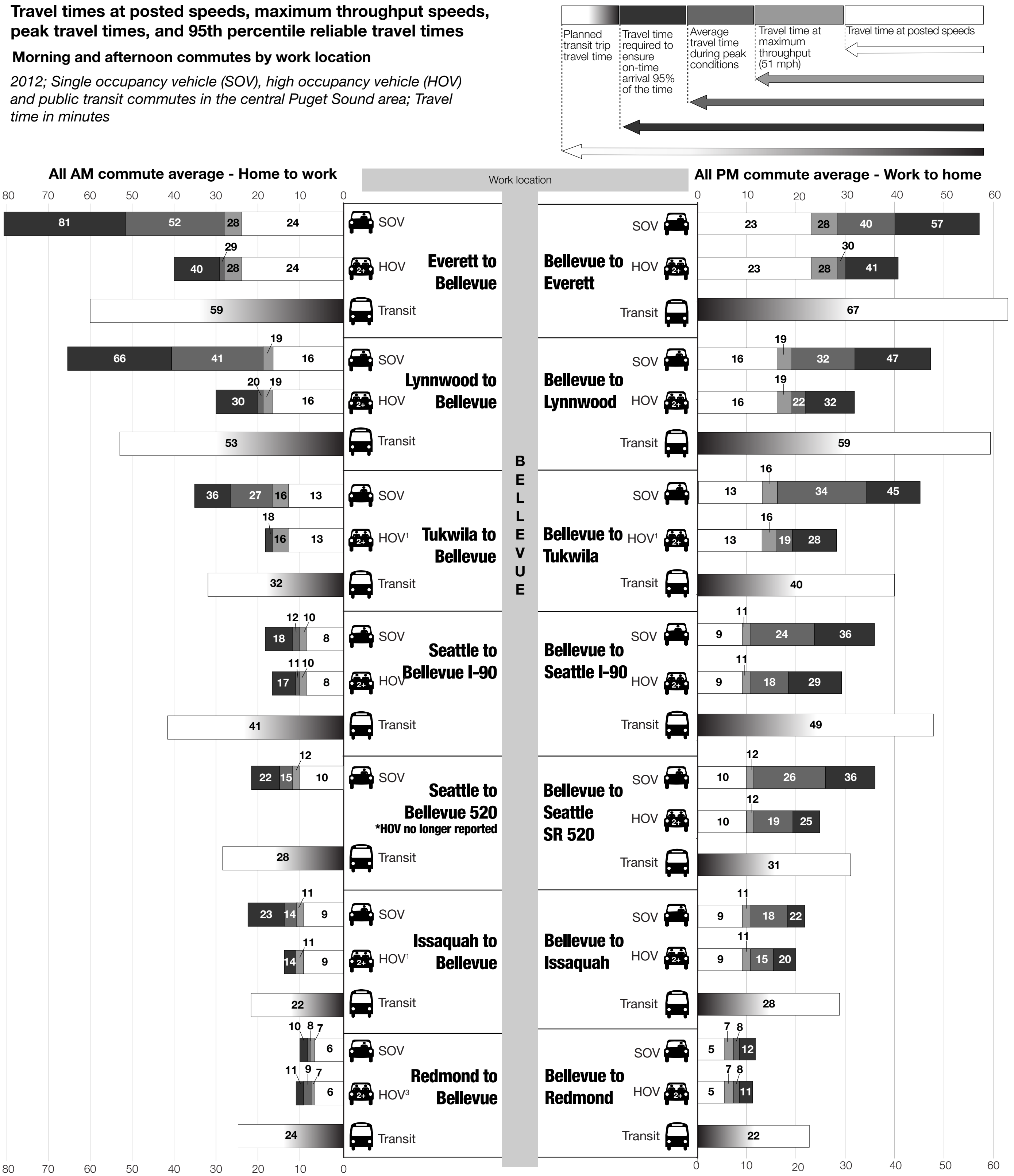
Notes: 1 Average travel times were equal to or faster than maximum throughput travel times on this route.
2 Average travel times and 95th percentile reliable travel times were equal to or faster than maximum throughput travel times on this route.
3 Monday through Friday reversible lane hours of operation: I-5 Southbound - 5 to 11:15 a.m.; Northbound - noon to 11 p.m.; I-90 Westbound - 1 a.m. to 12:30 p.m.; Eastbound - 2 p.m. to midnight.

Travel time comparison for SOV, HOV, transit trips to work in Bellevue

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

Morning and afternoon commutes by work location

2012; Single occupancy vehicle (SOV), high occupancy vehicle (HOV) and public transit commutes in the central Puget Sound area; Travel time in minutes



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

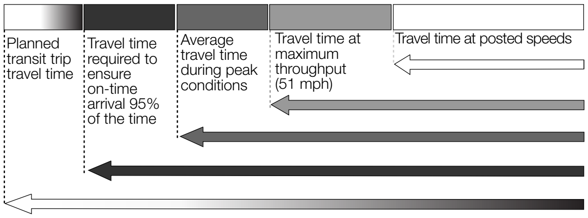
Notes: 1 Average travel times were equal to or faster than maximum throughput travel times on this route.
2 Average travel times and 95th percentile reliable travel times were equal to or faster than maximum throughput travel times on this route.

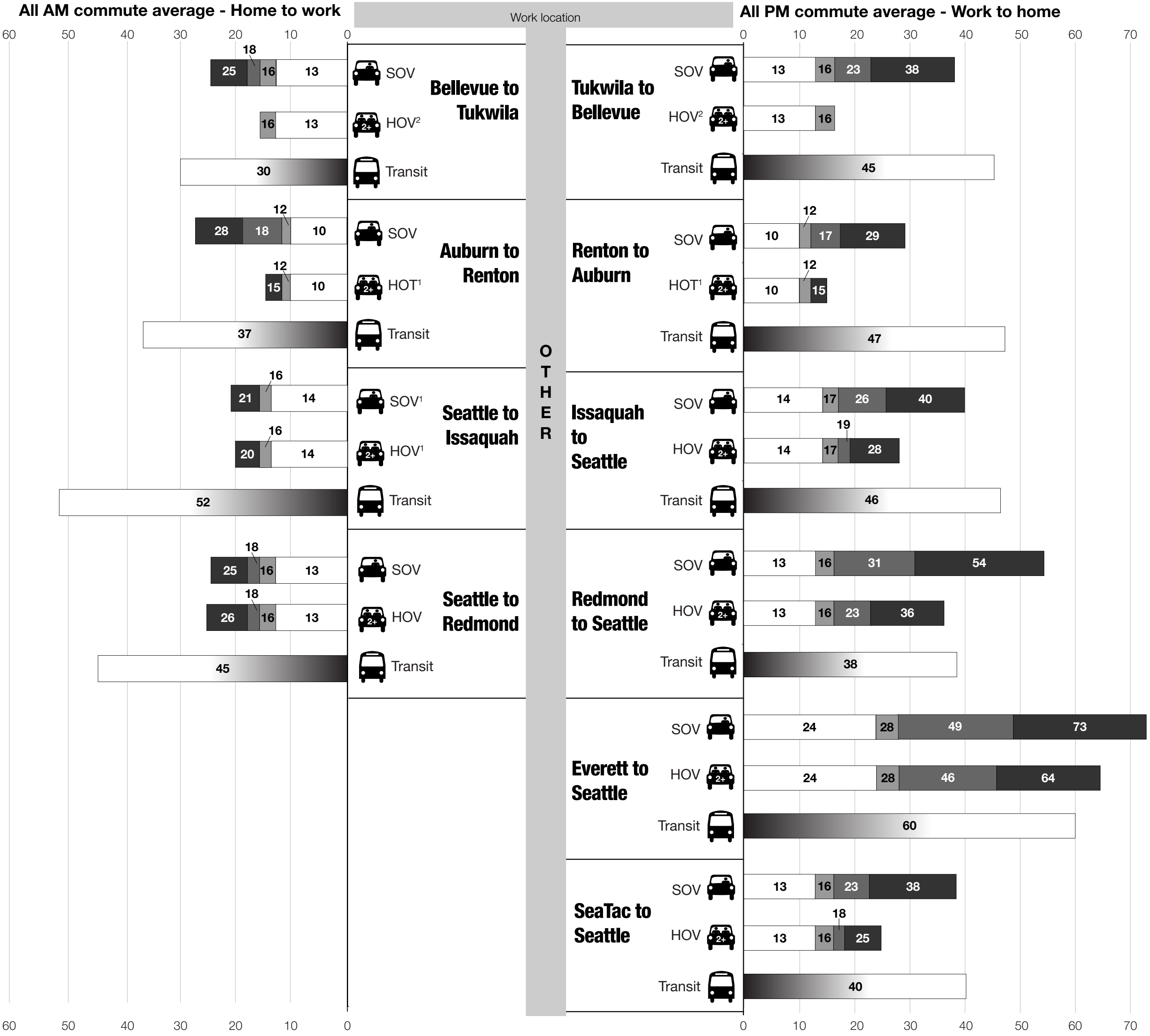
Travel time comparison for SOV, HOV, transit trips to other work locations

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

Morning and afternoon commutes by work location

2012; Single occupancy vehicle (SOV), high occupancy vehicle (HOV), high occupancy toll (HOT), and public transit commutes in the central Puget Sound area; Travel time in minutes





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

Notes: 1 Average travel times were equal to or faster than maximum throughput travel times on this route.

2 Average travel times and 95th percentile reliable travel times were equal to or faster than maximum throughput travel times on this route.

In Project Results:

Tolling Operations **78**

- *In 2012, the 20 million tolled trips on SR 520 generated about $55 million*
- *The volume of transit passengers crossing Lake Washington increased 20% to 25% since 2010*
- *Tolled trips in the SR 167 high occupancy toll (HOT) lanes increases 10% in the past year*
- Good To Go! *passes can be used on all of the tolled facilities statewide*

Active Traffic Management on Washington's Smarter Highways **80**

- *Active Traffic Management corridors have reduced weekend collisions on I-5 by 25% since their activation in 2010*
- *WSDOT is currently operating three Active Traffic Management corridors on I-5, SR 520 and I-90 in the central Puget Sound area*

Incident Response Annual Report **81**

- *WSDOT's Incident Response teams provided assistance at 45,037 incidents in 2012, clearing them in an average of 12.7 minutes*
- *Incident Response saved motorists about $70.7 million by preventing 8,610 secondary collisions and reducing delay and wasted fuel*

Before and After Analyses of Capacity Expansion Projects **85**

- *Travel time for SR 432 eastbound to I-5 ramps improved 13% during the evening commute*
- *Mainline I-5 through Federal Way traffic returned to free-flowing following ramp redesign*
- *Average speeds eastbound on SR 410 through Bonney Lake during the evening commute improved from 41 mph to the speed limit of 45 mph*

I-405 Corridor Improvement Program Before and After Analysis **89**

- *WSDOT has delivered 11 projects totaling $1 billion in investments on the I-405 corridor and generating an estimated 13,700 jobs*
- *Average daily vehicle delay on I-405 dropped 35% between its peak in 2006 and 2011, after WSDOT completed mobility projects on I-405*

Tolling Operations Annual Report

At a glance

- *In 2012, the 20 million tolled trips on SR 520 generated about $55 million*
- *The volume of transit passengers crossing Lake Washington increased 20% to 25% since 2010*
- *Tolled trips in the SR 167 high occupancy toll (HOT) lanes increased 10% in the past year*
- Good To Go! *passes can be used on all of the tolled facilities statewide*

SR 520 tolling funds bridge replacement and improves traffic flow; Transit ridership up

Tolling on the SR 520 bridge began December 29, 2011 with two central goals: raise funding for the replacement bridge and reduce congestion on SR 520. Tolling is expected to raise $1 billion overall toward the $4.13 billion SR 520 Bridge Replacement and HOV Program, which builds 12.8 miles of safety and mobility improvements along SR 520 from I-5 in Seattle to SR 202 in Redmond.

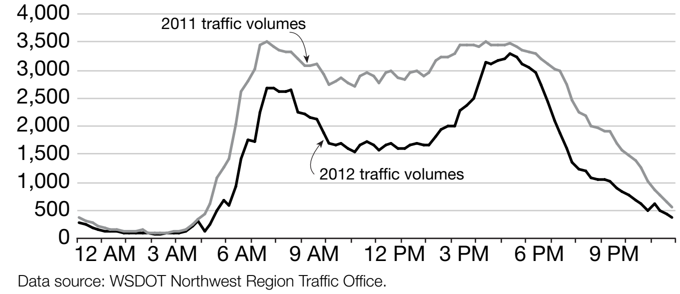
SR 520 tolling was one of several federally-funded projects implemented to help reduce congestion and improve safety on SR 520 and I-90 in the central Puget Sound area. The projects were a cooperative effort between WSDOT, the Puget Sound Regional Council, King County and the Federal Highway Administration. This collaboration, known as the Lake Washington Urban Partnership, aimed to improve traffic flow and safety across the lake by implementing variable tolling on SR 520 and Smarter Highways on SR 520 and I-90, enhancing transit service and supporting regional programs.

Changes in traffic volumes less than projected

An average of 68,000 vehicles crossed the SR 520 bridge each weekday in 2012, down from 103,000 in 2011. This 34% decrease in traffic is less than the 48% drop in SR 520 traffic volumes that was forecast for the first year of tolling.

Traffic volumes down on SR 520 after WSDOT implements tolling at the end of 2011

January 1, 2011 through December 31, 2012; Average traffic volume in vehicles per hour



Data source: WSDOT Northwest Region Traffic Office.

Peak-hour, peak-direction diversion rates on nearby SR 522 and I-90 met, or were less than projected. The majority of diversion occurred during off-peak times when the existing demand on SR 522 and I-90 was below the available capacity, allowing them to accommodate additional traffic volume. However, when looking at both the cross-lake corridors and SR 522 there is a 6% decrease in the number of trips all day (the SR 520 tolling report refers to all three routes as "cross-lake corridors". It can be accessed at http://www.wsdot.wa.gov/Tolling/publications.htm).

Travel times for drivers using the SR 520 bridge remained faster in 2012 than before tolling. Westbound SR 522 drivers are experiencing longer travel times in the afternoon, and westbound I-90 travel times have increased compared to pre-tolling travel times. Eastbound I-90 and SR 522 travel times are less affected. WSDOT continues to monitor travel times on all three corridors.

Transit, vanpools continue strong ridership growth

Transit passenger volumes, including vanpools and Microsoft's Connector service for employees, across Lake Washington increased 20% to 25% since 2010. As part of the Urban Partnership, King County Metro and Sound Transit added 140 daily bus trips across the SR 520 bridge, increasing weekday service to 740 trips on 19 routes serving the corridor.

Between 2011 and 2012, the total number of cross-lake transit and vanpool riders grew during the peak period. The number of vanpools crossing SR 520 also increased (34%) during this timeframe. The increased use of HOV trips means that while the peak-period vehicle trips decreased by 6%, only 2% fewer people crossed the lake on SR 520.

Revenue is on track to meet SR 520 funding needs

SR 520 traffic and revenue continue to meet projections and are on track to provide more than $1 billion in funding to help pay for the construction of a new bridge. Approximately 20 million trips were taken during tolling hours (5 a.m. to 11 p.m.), generating $55 million in gross toll revenue in 2012.

Use of SR 167 HOT lanes increase; Speeds still better than SOV lanes

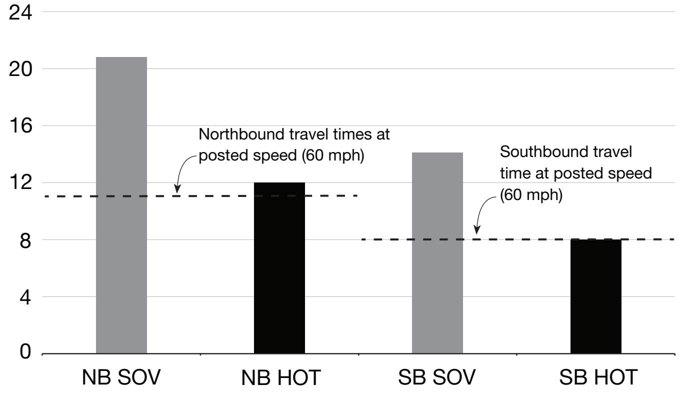
SR 167 high occupancy toll (HOT) lanes

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

HOT lanes result in faster travel times

Between July 2012 and June 2013 (Fiscal Year 2013), the northbound HOT lane saved weekday drivers an average of 9 minutes of travel time in the peak hour (7-8 a.m.). Average travel time in the HOT lane was 12 minutes compared to 21 minutes in the SOV lanes. The average toll for single occupant vehicles to use the northbound HOT lane during the peak hour was $2.20. The weekday southbound HOT lane saved drivers 6 minutes during the peak afternoon hour (4-5 p.m.), with average travel times of 8 minutes in the HOT lane and 14 minutes in the SOV lane; the average toll was $1.45.

Average travel time for HOT lanes is better than for adjacent lanes during peak hours of travel
July 2012 through June 2013; Tuesday through Thursday only; Travel time in minutes



Data source: WSDOT Northwest Region Traffic Office.

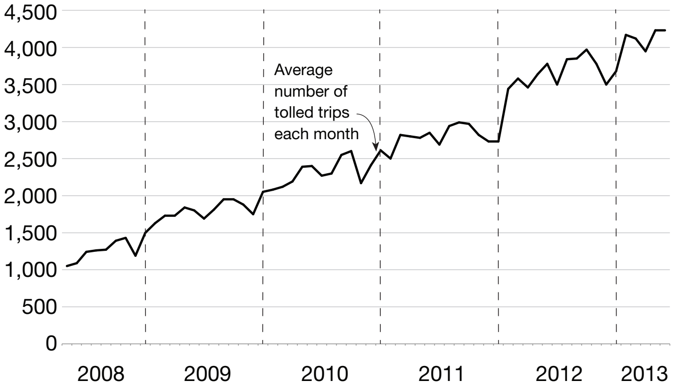
Daily volumes consistent with regional trends

During FY2013, the average combined (SOV+HOT) daily traffic volume on SR 167 increased 2% compared to volumes recorded in FY2008, prior to the start of HOT lane operations.

HOT lane usage increases 10% in the past year

The FY2013 data demonstrates the public's understanding of the benefits of HOT lanes: the average daily number of tolled trips continues to rise. Tolled trips increased more than 10% from 3,800 trips in June 2012, to 4,200 trips a year later in June 2013. Both gross and net revenues continue to climb.

Number of tolled trips continues to increase in HOT lanes
May 2008 through June 2013; Tuesday through Thursday only



Data source: WSDOT Northwest Region Traffic Office.

Good To Go! passes good on all Washington state tolled facilities

There are three facilities in Washington state currently tolled: the SR 520 bridge and SR 167 HOT lanes already mentioned, plus the SR 16 Tacoma Narrows Bridge. A *Good To Go!* pass can be used on any of these tolled facilities. For more information on the *Good To Go!* pass options visit: www.wsdot.wa.gov/goodtogo/PassesAvailable2011.htm. Toll rates are available online at: http://www.wsdot.wa.gov/Tolling/TollRates.htm.

The Good To Go! *Switchable Pass mounts on the windshield using Velcro backing. The Swtichable Pass can be turned on or off by sliding the tab to the on or off position. It is well-suited for those who carpool in the SR 167 HOT lanes (no toll), and cross the SR 16 or SR 520 bridges at other times (all vehicles are tolled, regardless of occupancy). The Switchable Pass is about the size of a candy bar.*

Active Traffic Management on Washington's Smarter Highways

At a glance

- *Active Traffic Management corridors have reduced weekend collisions on I-5 by 25% since their activation in 2010*
- *WSDOT is currently operating three Active Traffic Management corridors on I-5, SR 520 and I-90 in the central Puget Sound area*

Data shows Active Traffic Management is reducing collisions

WSDOT is seeing a 25% reduction in the frequency of weekend collisions due to the presence of Active Traffic Management (ATM) signs on I-5, two years following implementation. Weekend drivers tend to be less familiar with the area and what traffic conditions to expect. The positive weekend results show that these drivers benefit significantly from the implementation of ATM. Weekday traffic saw a 7% reduction in collisions, showing that even for drivers accustomed to the corridor, advance warning of slow-downs or incidents helps them avoid collisions.

On August 10, 2010, WSDOT activated the state's first Smarter Highways infrastructure along the I-5 corridor northbound approaching Seattle. Infrastructure on the SR 520 and I-90 corridors between Bellevue and Seattle were activated the following year. The systems in place on the I-90 and SR 520 corridors have been used to assist with construction traffic control and the impacts of travel changes due to tolling. The I-5 corridor provides the best insight into the performance of the ATM system because it had fewer construction impacts than the other two corridors.

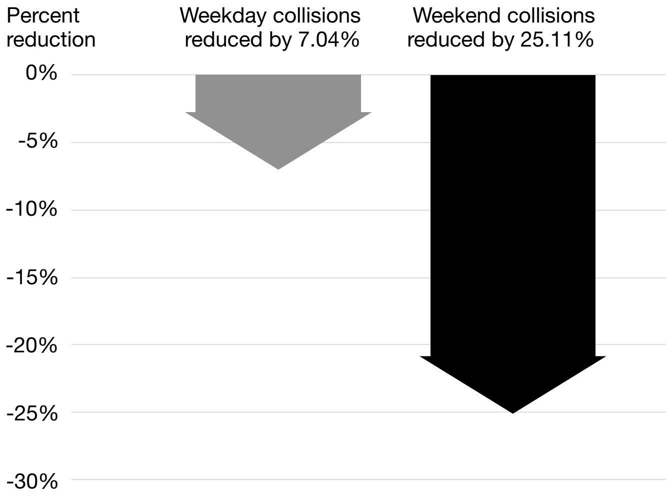
Tracking collision performance is a challenge because a large data set is needed before the results can be considered statistically significant. WSDOT is continuing to collect and process collision data along the ATM corridors, and plans to provide an update on the performance of the I-5 corridor in next year's *Corridor Capacity Report*.

The table at right lists WSDOT's inventory of owned, active, and operational Intelligent Transportation System (ITS) devices.

Seattle after activating Smarter Highways technology
reduces collisions

August 10, 2010 through December 31, 2012; Percent reduction in collisions for weekday and weekend traffic

August 10, 2010 through December 31, 2012; Percent reduction in collisions for weekday and weekend traffic



Data source: WSDOT Northwest Region Traffic Office.

Note: This data compares two-year periods before and after the installation of Active Traffic Management gantries on I-5 northbound for weekdays and weekends between 5 a.m. and 8 p.m.

WSDOT's Intelligent Transportation System (ITS) inventory continues to grow

2008 through 2013; Statewide inventory of WSDOT owned, active and operational ITS devices as of August 21, 2013

Device Type	2008	2009	2010	2011	2012	2013	Approximate cost per device
Closed circuit television camera[1]	542	555	699	746	850	933	\$15,000 - \$30,000
Variable message signs[1]	181	188	201	258	232	279	\$100,000 - \$250,000
Highway advisory radio transmitters[2]	68	70	82	88	83	86	\$50,000
Road/weather information system	97	100	105	106	106	109	\$25,000 - \$50,000
Metered ramps	137	143	154	155	149	150	\$10,000 - \$20,000[3]
Traffic data stations[4]	554	565	639	660	742	767	\$10,000 - \$20,000
Smarter Highway gantries[5]	0	25	53	56	56	56	\$650,000 - \$900,000

Data source: WSDOT Traffic Operations Office.

Notes: 1 Figures include devices that are owned, operated and maintained by WSDOT. 2 2010 HART count also includes nine portable devices, 2013 does not. 3 This represents the cost of one ramp meter device; there may be multiple ramp meters on one ramp. 4 The number of data stations includes those operated by the Traffic Data Office (for 2013 there are 196). 5 The majority increase in the numbers of CCTV, VMS, Traffic Data Stations are a direct result of the installation of the Automated Traffic Management System structures. While each structure is separate, the data collection as well as the data informational signing cannot be attributed to a specific structure unless actually installed upon it as they work together to form the system. The individual devices installed upon each gantry are not delineated here.

Incident Response Annual Report

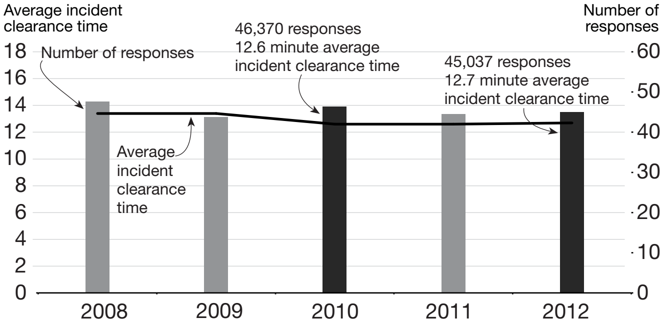
At a glance

- *WSDOT's Incident Response teams provided assistance at 45,037 incidents in 2012, clearing them in an average of 12.7 minutes*
- *Incident Response saved motorists about $70.7 million by preventing 8,610 secondary collisions and reducing delay and wasted fuel*

Incident Response teams provide assistance at 45,037 incidents

WSDOT's Incident Response (IR) program responded to 45,037 incidents in 2012, clearing scenes to get traffic moving in an average of 12.7 minutes. The IR team's assistance provided motorists in Washington approximately $70.7 million in estimated economic benefits by proactively preventing 8,610 secondary collisions and reducing the time and fuel wasted by drivers in delay through quickly clearing incidents. The IR program's annual budget was $4.5 million making the program's estimated annual benefit to cost ratio 16:1 for 2012.

Number of incident responses down from 2010
2008 through 2012; Clearance time in minutes; Number of responses in thousands



Data source: Washington State Patrol, Washington Incident Tracking System (WITS).
Note: Data provided is only for incidents to which a WSDOT Incident Response team responded.

Incident clearance times trending down since 2008

The IR program's average incident clearance time statewide was 12.7 minutes in 2012 which is not significantly different than the 12.6-minute average clearance time from 2010 and 2011 (about 6 seconds difference). However, the 2012 clearance time is 42 seconds faster than the 2008 average clearance time of 13.4 minutes. In general, faster clearance times mean less incident-induced congestion and fewer secondary crashes on Washington's highways.

WSDOT's Incident Response program reduces non-recurring congestion on state highways

The Incident Response (IR) program's mission is to clear traffic incidents safely and quickly, to minimize congestion, restore traffic flow, and reduce the risk of secondary collisions. Incidents account for nearly half of non-recurring traffic congestion (caused by one-time events like severe weather or collisions). IR teams are trained and equipped to assist motorists and the Washington State Patrol (WSP) during traffic-related emergencies. In addition to responding to emergencies, IR teams provide a variety of services to motorists such as jump-starts or changing flat tires. These services keep traffic moving and reduce the risk of collisions from distracted driving.

The IR program is active in all six WSDOT regions with about 47 full-time equivalent positions and 62 dedicated IR-related vehicles. IR teams patrol 493 centerline miles statewide on major traffic corridors during peak commute hours.

Incident Response performance measure definitions
As defined in the Federal Highway Administration's Incident Management Handbook

Performance measure	Definition	Measuring unit
Roadway clearance time	The time between the first recordable awareness of an incident (detection, notification, or verification) by a responding agency and first confirmation that all lanes are available for traffic flow.	Time in minutes
Incident clearance time	The time between the first recordable awareness of the incident and the time the last responder has left the scene.	Time in minutes
Secondary incidents[1]	The number of unplanned incidents beginning with the time of detection of the primary incident where a collision occurs either within the incident scene or within the queue in either direction, resulting from the original incident.	Number of incidents

Data source: Federal Highway Administration's Traffic Incident Management Handbook
Note: 1 Secondary incidents avoided as a result of the Incident Response team's presence is a nationally-recommended performance measure. WSDOT estimates incidents prevented and associated benefits - see *Gray Notebook* 47, p. 19, and *Gray Notebook* 46, p. 26, for more on calculation methods.

Incident-related delay cost travelers an estimated $157 million

Incident Response prevents $70.7 million in delay and secondary collisions

WSDOT estimates that IR crews' proactive management of incident scenes provided an economic benefit of $70.7 million to Washington travelers. These benefits are provided in two ways. First, by clearing incidents quickly, WSDOT crews reduce time and fuel motorists would have wasted in incident-induced congestion. In 2012, WSDOT estimates that IR crews prevented about $39.3 million in incident-related congestion costs. Second, by proactively managing traffic at incident scenes, IR crews reduce the risk of secondary incidents caused by distracted driving. WSDOT crews prevented an estimated 8,610 secondary collisions, resulting in a $31.4 million economic benefit (see the 2012 *Congestion Report*, p. 72, for calculation methods of secondary crashes and *Gray Notebook* 43, p. 21, for calculation of delay reduction benefits).

Incident-related delay costs travelers $157 million

Traffic delay that occurred at the 45,037 incidents WSDOT crews responded to in 2012, cost travelers in Washington an estimated $157 million. This is a 2.7% decrease from the $161 million in costs from 2011. Without the work of WSDOT's IR crews, this cost would have been $200.3 million ($39.3 million in prevented delay costs plus $161 million in actual delay costs). WSDOT estimates these costs at $244 per minute of incident duration for non-blocking incidents and $345 per minute of blocking incidents based on research from the University of Washington's Transportation Center (TRAC).

Blocking incidents cause more than half of delay costs

About 21.3% (9,599) of incidents in 2012 were blocking, meaning they closed down at least one lane of travel. The other 78.7% (35,438) were non-blocking incidents. However, blocking incidents caused 51%, or roughly $80.2 million, of incident-induced delay costs. Crews cleared blocking incidents in an average of 26.2 minutes and non-blocking incidents in an average of 9.2 minutes.

WSDOT teams deployed to fewer fatality incidents

Washington State Patrol (WSP) deployed WSDOT IR crews to manage traffic at the scenes of 66 fatal collisions in 2012. This is 11 fewer than the 77 fatal collisions IR crews were deployed to in 2010.

The average clearance time for fatality incidents increased by 9.7 minutes from 206.1 minutes in 2010 to 215.8 minutes in 2012. Fatality incidents are often complex, involving multiple responding agencies and IR teams do not generally have control over when incidents are cleared. WSDOT tracks and reports on fatality incidents to see how they affect IR performance and statewide congestion. Overall,

WSDOT teams' performance at incidents prevented $70.7 million in incident-related costs

January 1 through December 31, 2012; Performance by incident duration; Time in minutes; Cost and economic benefits in dollars

Incident type	Number of incidents	Average IR response time[3]	Average *roadway* clearance time	Average *incident* clearance time	Incident-induced delay costs	Estimated economic benefits from IR program[4]
Incident duration less than 15 minutes						
Blocking[2]	5,076	2.0	4.9	6.8	$10,590,120	$4,403,341
Non-blocking	29,343	0.4	-	5.1	$35,300,944	$17,100,703
Total[1]	**34,419**	**0.6**	**4.9**	**5.3**	**$45,891,064**	**$21,504,044**
Incident duration 15 to 90 minutes						
Blocking[2]	4,139	8.8	25.5	33.0	$45,166,365	$18,780,044
Non-blocking	5,980	6.7	-	27.1	$37,128,748	$17,986,139
Total[1]	**10,119**	**7.6**	**25.5**	**29.6**	**$82,295,113**	**$36,766,183**
Incident duration over 90 minutes						
Blocking[2]	384	20.8	167.3	184.4	$24,430,485	$10,158,125
Non-Blocking	115	21.7	-	164.7	$4,622,824	$2,239,417
Total[1]	**499**	**21.0**	**167.3**	**179.9**	**$29,053,309**	**$12,397,542**
Grand Total[1]	**45,037**	**2.4**	**21.1**	**12.7**	**$157,239,486**	**$70,667,769**

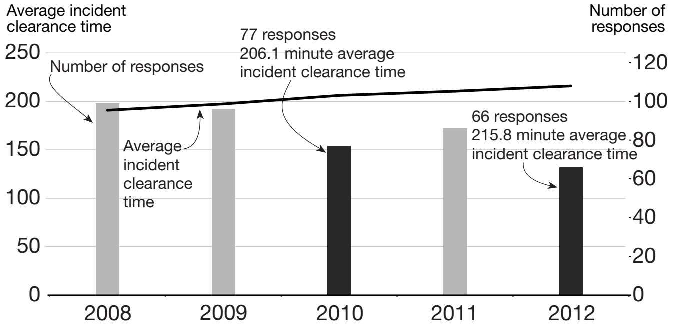
Data source: Washington Incident Tracking System (WITS), Washington State Patrol, WSDOT Traffic Office, and University of Washington Transportation Center (TRAC).

Notes: 1 Of the 45,037 incidents IR teams responded to 1,979 of were "unable to locate" (UTL) incidents; IR personnel were en route to respond, but the incident cleared before the team reached the reported location. UTL incidents are included in the total number of incidents but not figured into average times. 2 An incident is defined as blocking when it closes down at least one lane of travel on the road. 3 A majority of incidents that WSDOT teams respond to are "roved" upon, meaning the team spots the incident while on patrol and thus is present at the scene when the first recordable awareness occurs. This makes average response times, especially for shorter lasting incidents, very small. 4 "Economic benefits" include the sum of economic benefits from saved time, gas and secondary incidents avoided due to the proactive work of the IR teams.

Incident Response resources vary to meet WSDOT's regional needs

Fewer fatalities on state highways leads to reduced WSDOT IR crew responses

2008 through 2012; Clearance time in minutes; Number of responses



Data source: Washington State Patrol, Washington Incident Tracking System (WITS).

Note: Data provided is only for incidents to which a WSDOT Incident Response team responded.

How are IR teams notified of an incident?

Incident Response teams are notified of an incident in three ways: "roving," "dispatched," and "called out". Roving refers an IR vehicle that locates an incident while patrolling a commute corridor. Dispatched refers to when IR units are deployed to an incident by the Washington State Patrol or a WSDOT traffic management center. Finally, some IR teams are available on call when they are not on their official shift. When an on-call IR team is activated it is referred to as called out.

fatality incidents made up 0.15% of incidents IR teams responded to in 2012, but caused 3% of incident-induced delay. IR teams have historically responded to between 31% and 42% of all fatality incidents on state highways. As the total number of fatalities declines, IR team responses are also likely to decline (see *Gray Notebook* 50, p. 2).

Incident Response teams help travelers in each WSDOT region

WSDOT maintains Incident Response crews in each of the six WSDOT regions. The size and function of each team is determined largely by local needs. For example, WSDOT maintains the largest IR team of 31 drivers in its Northwest Region which contains most of the Seattle metropolitan area. The Northwest Region team responded to 28,856 incidents (64.1% of all incidents statewide) and had an average incident clearance time of 12.2 minutes. Northwest Region has more of a focus on roving IR units as minor incidents are more frequent and can have a significant impact on congestion due to local traffic volumes.

In contrast, the IR team in the North Central Region, (which includes Snoqualmie Pass on I-90) responded to 178 incidents in 2012, with an average incident clearance time of 53.5 minutes. IR crews in this region focus on responding to incidents when dispatched by WSP due to low traffic volumes in the region.

However the team also patrols Snoqualmie Pass due to the high proportion of commercial vehicle volume. This results in the North Central Region having the highest rate of WSDOT teams being dispatched to incidents by WSP or a traffic management center and the highest rate of blocking incidents, which increases response and clearance times. See the table below for a summary of region performance.

Regional Incident Response teams provide services based on local need

January 1 through December 31, 2012; Performance by WSDOT region; Time in minutes

	Region program facts		**Region incident statistics**				**Region notification method split[3]**		
WSDOT Region	**Full-time equivalent positions[1]**	**Dedicated IR vehicles**	**Number of incidents**	**Percent of incidents statewide**	**Percent blocking[2]**	**Average *incident* clearance time**	**Percent roved upon**	**Percent dispatched**	**Percent called out**
Eastern	2.0	3	4,374	9.7	19.4	11.7	69.0%	31.0%	0.0%
North Central	0.8	1	178	0.4	78.1	53.5	66.3%	33.7%	0.0%
Northwest	31.0	43	28,856	64.1	24.0	12.2	71.9%	28.0%	0.1%
Olympic[4]	8.2	10	6.359	14.1	10.2	15.9	82.4%	17.4%	0.2%
South Central	0.5	1	1,327	2.9	25.0	12.8	85.5%	14.5%	0.0%
Southwest	4.4	4	3,943	8.8	17.7	10.7	78.1%	21.0%	0.9%
Statewide	**46.9**	**62**	**45,037**	**100**	**21.3**	**12.7**	**74.0%**	**25.8**%	**0.2**%

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

Notes: 1,979 of the 45,037 incidents are "unable to locate" (UTL) incidents; IR personnel were en route to respond, but the incident cleared before the team reached the reported location. UTL incidents are included in the total number of incidents but not figured into other performance measures.

1 A partial FTE means one or more team members in a region work part-time. 2 An incident is defined as blocking when at least one lane of travel is closed to traffic. 3 WSDOT Incident Response teams are notified of an incident through three methods including roving upon an incident while patrolling, being dispatched to an incident by a WSDOT traffic center or the Washington State Patrol, and being called out to an incident after regular service hours. 4 Olympic region's FTE and vehicle figures include one FTE and vehicle located at WSDOT headquarters which serve a largely administrative role.

Incident Response

Fewer over-90-minute incidents occurring on key highway segments

Over-90-minute incidents decline on key Washington highway segments

There were 293 incidents that lasted more than 90 minutes along the nine key highway segments in western Washington in 2012. There was one less over-90-minute incident in 2012 than in 2011, which had 294 incidents, and 34 fewer than 2010, which had 259 incidents. The nine key corridors include I-5, I-205, I-405, I-90 between North Bend and Seattle, SR 18, SR 167, SR 520, SR 512 and SR 16 from Tacoma to Purdy. WSDOT monitors over-90-minute incidents on these corridors due to their disproportionate impact on congestion and the economy in Washington state.

IR crews cleared these incidents in an average of 160 minutes. This is 5 minutes slower than the 155-minute performance goal set in a joint operations agreement between WSDOT and WSP. The average clearance time in 2010 was 162 minutes, or about 2 minutes slower than 2012.

Included in the 293 over-90-minute incidents in 2012 are 14 “extraordinary” incidents that each took more than six hours to clear. These 14 incidents took an average of 491 minutes (8 hours and 11 minutes) to clear and were generally caused by major collisions involving semitrucks. Without these, the average clearance time for over-90-minute incidents would have been 143 minutes.

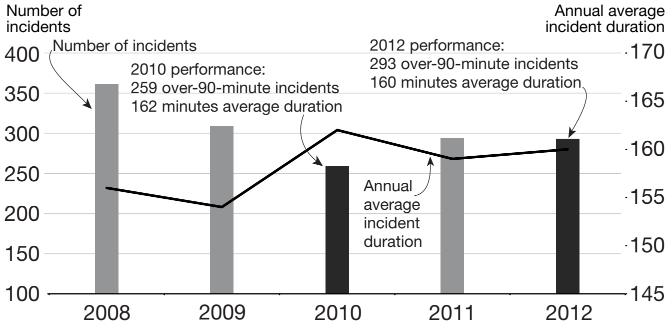
Major incident towing program clears 13 of 14 incidents in less than 90 minutes

WSDOT activated the Major Incident Towing (MIT) program 14 times in 2012, costing a total of $36,075. This brings the total number of activations to 101 since the program’s start in June 2007, with $222,673 spent as of December 31, 2012. Thirteen of the 14 activations in 2012 were “successful,” meaning each incident was cleared in less than 90 minutes. The fourteenth activation in 2012 was canceled.

The Major Incident Towing program was created to improve clearance times of incidents involving an overturned heavy vehicle that is blocking the road. Heavy vehicles, generally semitrucks, are involved in about 5% of all incidents but account for 25%-30% of incidents that take more than 90 minutes to clear due to their large size and the time needed to clean up spilled cargo. WSDOT and WSP contract with specialized heavy-tow companies to be on call for these incidents to return the highway to its full operating capacity as soon as possible.

Over-90-minute incidents decline from 2010 to 2012 on key western Washington highways

2008 through 2012; Number of incidents; Average incident duration in minutes



Data source: Washington State Patrol, Washington Incident Tracking System (WITS).

Olympic Region Incident Response team member Willie Ramsey talks to Transportation Secretary Lynn Peterson about the program on her first day at WSDOT.

Incident Response program makes a difference for travelers on a personal level

While IR teams provide benefits to all travelers using Washington highways, they also offer help and reassurance to individual motorists who may be stuck in unsafe situations. Traffic or road conditions can make even changing a flat tire hazardous. The IR team’s primary concern in these situations is the safety of everyone involved. Below are a few samples of comment cards left by travelers after receiving help from IR crew members.

- “Can’t imagine any improvements. Very happy to have you there for us. Thanks!”
- “Just keep up the great service! Rick was most professional and at the same time very compassionate - he was/is a life saver! Thank you for this service.”
- “Jeff was very comforting and kept myself and my children safe who were in the car. Thanks so much!”

Before and After Analyses of Capacity Expansion Projects

At a glance

- *Travel time for SR 432 eastbound to I-5 ramps improved 13% during the evening commute*
- *Mainline I-5 through Federal Way traffic returned to free-flowing after ramp redesign*
- *Average speeds eastbound on SR 410 through Bonney Lake during the evening commute improved from 41 mph to the speed limit of 45 mph*

WSDOT's approach to capacity expansions: when and where it is needed most

Maintaining an efficient transportation system is critical to Washington's economy, quality of life, and environment. WSDOT's highest priority is preserving the safe and long-lasting performance of the existing infrastructure, facilities, and services. However, there are times when WSDOT uses targeted investments in new capacity where it is needed most to relieve chronic congestion or safety issues. With WSDOT's other two strategies of using operational efficiencies and managing travel demand, adding capacity strategically helps address congestion head-on and improve the performance of our state's integrated transportation system.

Redesigned I-5/SR 432 interchange improves access to Talley Way industrial area

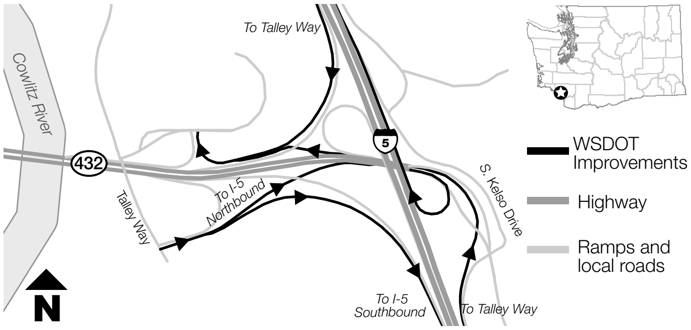
During 2010 and 2011, WSDOT reconstructed a pair of interchanges to alleviate weaving conditions between the ramps near Longview and Kelso in southwestern Washington. The interchanges provide connections between I-5, SR 432, and local roads including Talley Way, which serves a nearby industrial area. Traffic is a mix of cars and commercial trucks.

Originally, traffic from I-5 to Talley Way merged with mainline SR 432 traffic less than half a mile before taking the Talley Way off-ramp; similar conditions occurred on the return trip toward I-5. While the interchanges did not experience significant congestion, by constructing ramps that separate individual traffic movements, WSDOT and local agencies are improving safety and mobility for the growing industrial development and enhancing access to the port of Longview.

Traffic from I-5 to Talley Way can now proceed along its own ramp directly to Talley Way, without merging onto SR 432, while I-5 traffic bound for SR 432 takes a separate ramp. These changes eliminate weaving movements and associated safety concerns, while improving peak capacity and connectivity with local roads.

WSDOT analyzed the safety and mobility effects of this interchange improvement project, and assessed the number of direct, indirect, and induced jobs it generated. Based on fiscal year (FY) annual expenditures for this $35.3 million project, there were about 72 jobs supported each year from FY2007 through FY2013. The peak expenditure year (FY2011) supported approximately 166 direct, indirect and induced jobs.

Traffic counts show mainline SR 432 peak hour volumes at about 1,350 vehicles; ramp volumes were as high as 900 vehicle per hour northbound from I-5. Based on midweek (Tuesday through Thursday) traffic patterns, there were no significant changes in traffic volume following the project, aside from anticipated changes due to separate traffic movements on the new ramps.



The redesigned interchange and new ramps improve connectivity between I-5, SR 432 and Talley Way by separating traffic.

Interchange redesign improves travel time 13% for traffic on SR 432 eastbound to I-5 ramps

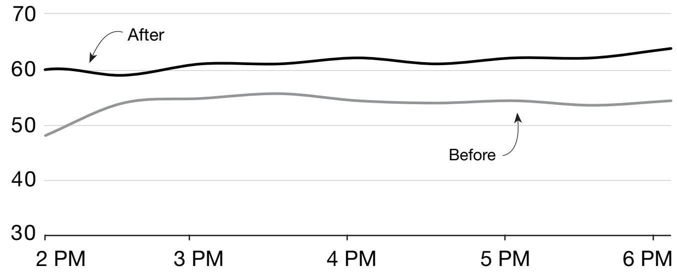
WSDOT collected average travel time data before (2009) and after (2012) reconstruction of the I-5/SR 432 interchange. The interchange improvement project provided a separate ramp for industrial traffic from Talley Way so that it does not merge with mainline SR 432. Drivers merging from SR 432 to southbound I-5 originally contended with traffic merging

I-5/SR 432 interchange redesign reduces collisions 23%

onto mainline SR 432 prior to diverging to the I-5 on-ramps (northbound and southbound) or Old Pacific Highway.

The graph below shows a difference in travel time of 0.2 minute (13%) for eastbound travelers going to southbound I-5 during the evening commute (2-6 p.m.). The speed limit was reduced from 55 mph before construction to 45 mph during the analysis timeframe following construction. Travelers typically drove 54 mph before the speed limit changed; the average speed actually increased to 62 mph even though the speed limit dropped to 45 mph.

Average speed increased 8 mph eastbound on SR 432
2009 and 2012; Weekdays only; Evening peak period (2-6 p.m.)
mainline SR 432 traffic heading to I-5 southbound



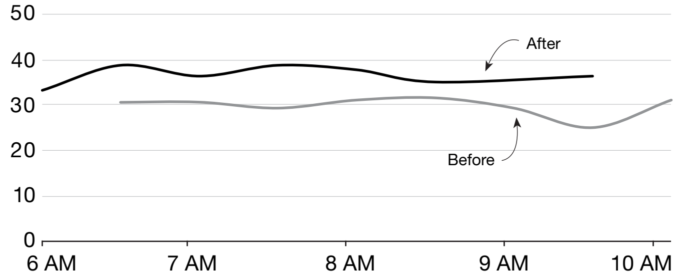
Data source: WSDOT Traffic Office.
Note: Speed limit decreased from 55 mph to 45 mph

The ramp that separated Talley Way traffic from SR 432 mainline allowed SR 432 to flow smoothly on to I-5. Following the analysis of traffic volumes, travel speeds, and traffic safety, WSDOT returned the speed limit to 55 mph on mainline SR 432.

Traffic from I-5 southbound to Talley Way travels faster on the reconfigured off-ramp

Similarly, traffic from southbound I-5 to Talley Way originally merged with mainline SR 432 prior to taking the off-ramp to Talley Way. The reconfigured I-5 southbound off-ramp now splits traffic bound for Talley Way from that continuing onto mainline SR 432. Traffic from northbound I-5 merges with this new ramp prior to joining with Talley Way. The new ramp adds 0.25 miles to the trip length, which adds less than 23 seconds to the travel time from I-5 southbound to Talley Way. However, the average speed on the ramp increased by almost 7 mph in the morning peak period (6-10 a.m.), from 30 mph to 37 mph following project completion.

Traffic from I-5 southbound heading for Talley Way travels at 37 mph after reconstruction, up from 30 mph
2009 and 2012; Weekdays only; Morning peak period (6-10 a.m.)



Data source: WSDOT Traffic Office.

New ramps separate drivers and eliminate merges to help vehicles transfer smoothly and safely between I-5, SR 432 and Talley Way.

Safety improves in the interchange vicinity: 23% fewer collisions per year

Collision data were evaluated for safety trends within the combined interchange areas (SR 432 milepost 8.50 to 10.33 and I-5 milepost 36.10 to 37.50, excluding collisions on the mainline between the ramps to/from SR 432). There were 104 reported collisions in the three years before construction (35 collisions per year), and 27 collisions in the one year of data available to date after construction. This represents a 23% decline in the number of collisions per year. There were no fatalities before, during, or after construction.

Talley Way traffic benefits from new ramps

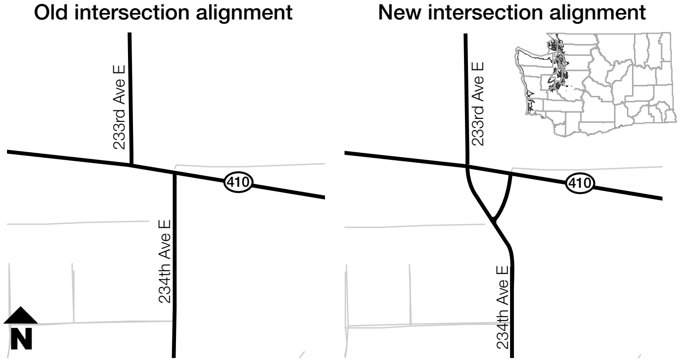
Traffic heading between Talley Way and I-5 benefitted from dedicated ramps that eliminated the need to merge with mainline SR 432 traffic. Although the improvement in travel time and average speed from the realignment of closely spaced interchanges was measurable on only two sections of the corridor, the overall commute experience and safety improved at the interchanges. The restoration of the speed limit back to 55 mph one year after project completion is a result of smoother traffic flows and relatively improved safety due to the reconfigured interchanges.

SR 410 Bonney Lake commute trip more reliable

Added lanes and signalized intersection on SR 410 in Bonney Lake improve traffic flow

SR 410 runs from SR 167 (Puyallup/Sumner), through the city of Bonney Lake to SR 165 (Buckley). The area around Bonney Lake and east Pierce County has developed tremendously in the last decade and SR 410 is showing the impact of this development. In 2008, the peak period traffic volumes on SR 410 were 620 vehicles per hour (vph) (westbound morning) and 950 vph (eastbound evening) approaching the directional capacity of the two-lane, suburban highway.

WSDOT completed a 1.49 mile project on SR 410 between the intersections of 214th Avenue East and 234th Avenue East (MP 15.61 to 17.10), adding one lane to SR 410 in each direction with a raised median separating the eastbound and westbound traffic. The project also realigns the intersection at 234th Avenue East to create a four-way, signalized intersection at 233rd Avenue East. The travel on mainline SR 410 improved after one lane was added in each direction and left turns were restricted to signalized intersections with designated turn lanes.


Old intersection alignment
New intersection alignment

The project along SR 410 realigned 234th Avenue East with 233rd Avenue East and creating a four-way, signalized intersection. The project also added a lane in each direction on SR 410, left-turn lanes at the traffic signal, and a median barrier.

Based on annual expenditures for this $20.5 million project, there were about 29 jobs supported each year from FY2007 through FY2013. The peak expenditure year (FY2011) supported approximately 94 direct, indirect and induced jobs

Access to and from SR 410 improves and traffic flows more smoothly after traffic signal installation

Construction began in March 2010; the new lanes and reconfigured intersection were open to traffic in September 2011. Peak hour traffic volume during the eastbound evening commute was about 1,000 vehicles on mainline SR 410 before construction; the peak hour volume decreased by about 100 vehicles (10%) after construction. The volume on 234th Avenue East did not change significantly during the analysis period.

There are two primary commute trips in this area: the SR 410 trip carrying travelers through Bonney Lake and the local commute trip taking Bonney Lake residents to and from work. Peak morning traffic is primarily westbound from and through Bonney Lake, and the evening is eastbound.

Morning trip speeds are slower, but more reliable

Before construction, the average speed for westbound morning (6-9 a.m.) commuters through Bonney Lake was 50 mph, above the posted speed limit of 45 mph. After construction, the average speed decreased 14% to 43 mph. The decrease in speed (and increase in travel time) was expected due to the new four-way traffic signal. Before construction, both average travel times and speeds were unreliable during the peak period, compared to after construction. This means the average travel time and speed are now more reliable throughout the morning peak period.

Local commuters northbound on 234th Avenue East turning left onto westbound SR 410 before construction were controlled by a stop sign, while SR 410 was free-flowing. The local movement was further complicated by competing southbound traffic from nearby 233rd Avenue East, resulting in long queues and traffic conflicts. The new signal at the realigned intersection with 233rd Avenue East improved the ease of traffic movements onto SR 410 westbound. The average travel time remained constant at 1.9 minutes during the morning peak period (6-9 a.m.),

Average speeds decline for three of four Bonney Lake commute trips on SR 410 following intersection project
July 2008 and 2012; Weekdays only; Morning commute trips westbound (6-9 a.m.) and evening commute trips eastbound (3-6 p.m.)

Morning commutes		Travel time (minutes)	Average speed (mph)
SR 410 through Bonney Lake westbound toward Sumner	Before	1.5	50
	After	1.7	43
	Change	13%	-14%
Local Bonney Lake (234th Avenue) westbound toward Sumner	Before	1.9	36
	After	1.9	34
	Change	0%	-6%
Evening commutes			
SR 410 through Bonney Lake eastbound toward Buckley	Before	1.8	41
	After	1.7	45
	Change	-11%	10%
Local Bonney Lake (234th Avenue) eastbound from Sumner	Before	1.6	41
	After	1.6	39
	Change	0%	-5%

Data source: WSDOT Traffic Office.

I-5/South 320th Street off-ramp improves travel flow

while the average speed decreased slightly from 36 mph to 34 mph. The installation of a traffic signal did not add significant travel time, and improved the ease and safety with which traffic can turn left onto SR 410 during the peak morning commute. The signal also eliminated excessive queuing on northbound 234th Avenue East.

Evening trip travel times improve or hold steady
Before construction, it took slightly less than 2 minutes to complete the evening trip (2-6 p.m.) through Bonney Lake eastbound on SR 410 at an average speed of 41 mph, which was below the 45 mph speed limit. After construction, the average speed increased to 45 mph, and travel times decreased 11%, even with a new traffic signal.

The local evening commute eastbound on SR 410 to 234th Avenue East can use a right-turn lane at the new traffic signal. Drivers may also turn right at the old alignment of 234th Avenue East. As expected, travel times were unchanged. The average speed decreased slightly from 41 mph to 39 mph during the evening peak period (3-6 p.m.).

Travel times show mixed results, while traffic capacity benefits from new signal and lanes

The traffic signal and additional lanes on SR 410 increased capacity and travel time reliability, and reduced potential conflict points by channeling turning movements to the controlled intersection. Average speeds were slower by up to 14% on three of the four commute trips; the eastbound evening trip on SR 410 saw speeds increase by 10% to the speed limit of 45 mph. Travel times were longer in the mornings by up to 13%; evening travel times were shorter by up to 11%.

A flagger directs traffic during construction in 2010 to widen SR 410 and install a traffic signal at the intersection with 233rd Avenue East.

WSDOT and the city of Federal Way widened the I-5 southbound off-ramp at South 320th Street and made other improvements.

Redesigned I-5 ramp in Federal Way reduces congested conditions by 55%

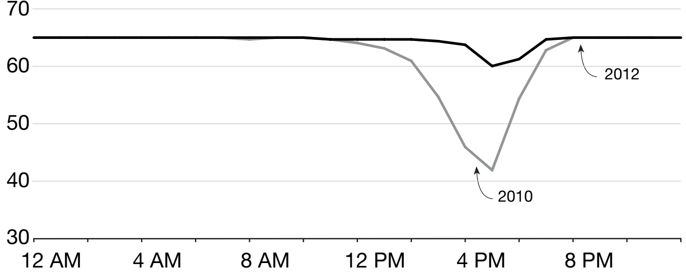
From June through October 2011 WSDOT and the city of Federal Way worked to improve the southbound I-5 off-ramp to South 320th Street in Federal Way. Crews widened the ramp from three to five lanes, upgraded lighting, modified signal timing and built a retaining wall.

Widening the ramp was expected to improve safety by preventing traffic from backing up onto southbound I-5, which can lead to mainline congestion and unsafe driving conditions. New lighting, signing, guardrail and a crosswalk also were installed to improve safety in the area.

The posted speed on this section of mainline I-5 is 60 mph. The minimum average speed of 42 mph occurred at 5 p.m. on mainline I-5 near the off-ramp to South 320th Street. After the project completion, this minimum average speed increased by 18 mph to the posted speed on mainline I-5, showing that congestion on the ramp was no longer impacting mainline traffic flow.

The average daily volume for the I-5 ramp to South 320th Street decreased 3% after construction, from approximately 14,100 vehicles per day (vpd) in 2010 to 13,700 vpd in 2012. However, the volume during the peak hour increased 3%, from approximately 1,160 to 1,190 vehicles.

The average speed near the I-5 off-ramp improved by up to 18 mph during the evening peak period
2010 and 2012; Weekdays only; I-5 southbound at South 320th Street



Data source: WSDOT Northwest Region Traffic Office.

I-405 Corridor Improvement Program Before and After Analysis

At a glance

- ***WSDOT has delivered 11 projects totaling $1 billion in investments on the I-405 corridor and generating an estimated 13,700 jobs***
- ***Average daily vehicle delay on I-405 dropped 35% between its peak in 2006 and 2011, after WSDOT completed mobility projects on I-405***

WSDOT delivers $1 billion in projects

WSDOT delivered 11 projects on I-405 on-time and on budget between 2003 and 2012. The projects are part of the I-405 Master Plan, adopted in 2002, and represent a nearly $1 billion investment in mobility and safety on the I-405 corridor. An additional project, the Bellevue to Lynnwood Express Toll Lanes, is currently under construction and brings the total investment up to $1.4 billion. Based on annual expenditures, WSDOT estimates that these projects generated about 13,700 direct, indirect, and induced jobs between fiscal year 2003 and 2012 with the peak occurring in 2008 with 2,670 jobs.

Improvements ranged from targeted expansions of roadway capacity to reconfiguring congested interchanges to improve traffic flow (see the map at right for project locations and expenditures as of December 31, 2012). Projects were funded by the 2003 Nickel and 2005 Transportation Partnership Account (TPA) gas tax initiatives. Two projects also received federal funding through the American Recovery and Reinvestment Act (ARRA).

Congestion indicators improving throughout I-405

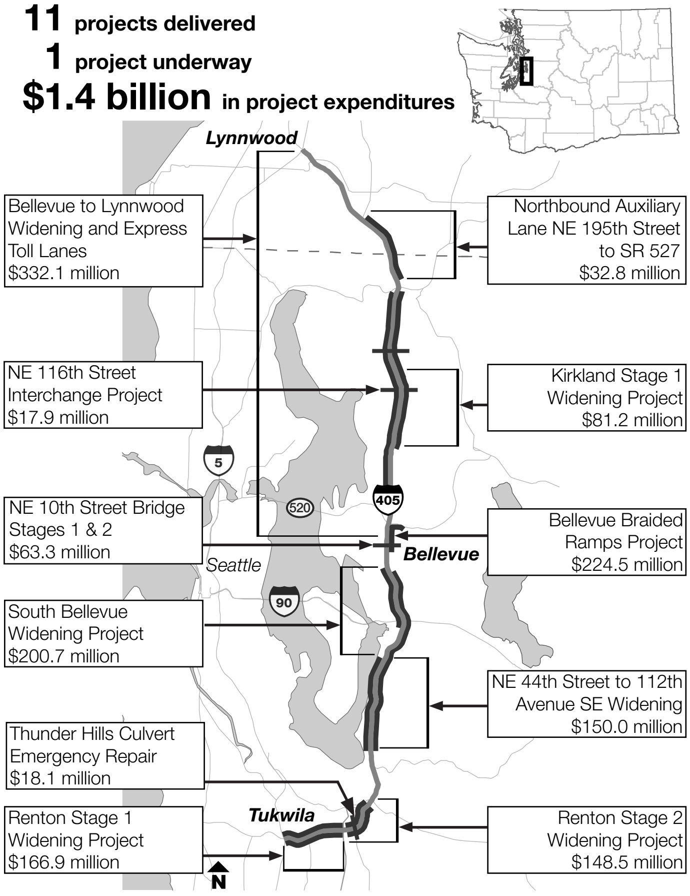
The morning commutes from Lynnwood and Tukwila to Bellevue and their corresponding evening commutes cover the northern and southern halves of I-405, respectively. Bellevue is a regional job center on the I-405 corridor and a major commuter destination during the work week.

WSDOT delivers projects as per the I-405 master plan

2003 through 2012; Project locations and project descriptions; Expenditures in millions of dollars

WSDOT delivered throughout the I-405 corridor

2003 through 2012; Project locations and project expenditures



Data source: WSDOT Eastside Corridor Program Office.

Commuters on these routes saw a direct benefit from WSDOT's projects as travel times during peak hour commutes improved. Average travel times for the morning commutes on I-405 from Lynnwood and Tukwila to Bellevue were faster

I-405 commute trip performance metrics improve on all major commutes

2006 and 2011; Average and reliable travel times in minutes; Duration of congestion expressed in hours and minutes

	Average travel time			Reliable travel time[1]			Duration of congestion		
Morning commutes	**2006**	**2011**	**Δ**	**2006**	**2011**	**Δ**	**2006**	**2011**	**Δ**
Lynnwood to Bellevue	41	37	-4	67	57	-10	3:35	2:55	-0:40
Tukwila to Bellevue	42	25	-17	63	31	-32	4:35	3:30	-1:05
Evening commutes									
Bellevue to Lynnwood	31	31	0	43	44	+1	3:45	3:00	-0:45
Bellevue to Tukwila	33	33	0	45	44	-1	6:25	4:45	-1:40

Data source: WSDOT Strategic Assessment Office.

Notes: The symbol "Δ" is used to denote change in a variable. 1 The 95th percentile reliable travel time is the time needed in order to arrive at your destination 19 out of 20 weekday trips, or 95% of the time.

Collisions on I-405 decline after completion of WSDOT projects

by 4 and 17 minutes, respectively. Average travel times for the corresponding evening commutes from Bellevue back to Lynnwood and Tukwila remained the same as 2006 levels.

Travel time reliability on these commute routes also showed improvement. The 95th percentile reliable travel time (the amount of time that will get a driver to their destination on time for 19 out of 20 trips) for the two morning commutes improved. The morning commute from Tukwila to Bellevue improved the most with a 32 minute drop in the 95th percentile reliable travel time. This reduced the gap between the reliable travel time and the average travel time to 6 minutes (down from 21 minutes) further illustrating how this section of the I-405 corridor became more reliable.

Even though the reliable travel times on the evening commutes were relatively unchanged, the duration of congestion (the amount of time traffic speeds are below 45 mph) improved by at least 40 minutes on each route. The biggest improvement was on the Bellevue to Tukwila evening commute, when the duration of congestion shrank by 1 hour and 40 minutes. The other three commutes improved by up to 1 hour and 5 minutes.

Corridor-wide, average daily vehicle delay (relative to the maximum throughput speed of 51 mph) on I-405 dropped by 35% from 8,334 hours in 2006 to 5,413 hours in 2011 after all 11 projects were complete. During the same period average daily vehicle miles traveled (VMT) on I-405 increased by less than 1%. These results strongly suggest that WSDOT's projects had a positive effect on reducing congested conditions along the corridor.

I-405 projects also improve safety

The number of collisions occurring on I-405 dropped 17.6% between 2006 and 2011 from averaging 7.5 collisions per day to 6.2 collisions per day, respectively. VMT was nearly unchanged during this timeframe, so the rate of collisions dropped roughly 18.1%: from 2.1 collisions per million VMT in 2006 to 1.7 in 2011.

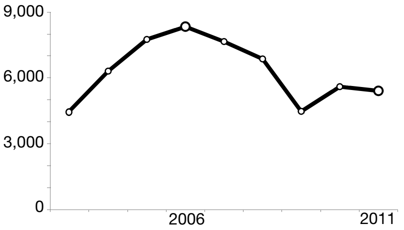
In addition to the safety benefits, these reductions in collisions help avoid congestion. According to research from the University of Washington, each extra minute it takes to clear a traffic incident causes about 286 minutes of vehicle delay. In 2011, WSDOT's Incident Response program cleared each incident in about 10.7 minutes. Using these figures, reductions in collisions on I-405 after completion of WSDOT's projects saved drivers approximately 24,400 hours of vehicle delay in 2011 compared to 2006.

Key I-405 congestion indicators show improvement

2003 through 2011; Average hours of daily vehicle delay; Average daily vehicle miles traveled in thousands

35% drop in average daily vehicle delay between 2006 (peak year) and 2011

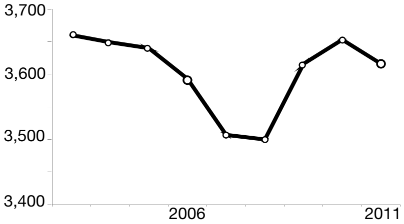
Hours of vehicle delay



Less than 1% increase in vehicle miles traveled (VMT) between 2006 and 2011

Vehicle miles traveled (VMT)

in thousands



Data source: WSDOT Strategic Assessment Office.

Public transit on I-405 takes cars off the road

Sound Transit provides the majority of transit services along I-405 between Tukwila and Lynnwood. In the I-405 Master Plan, it was proposed that additional transit services would be provided in order to alleviate some of the recurrent congestion in the peak periods (6-9 a.m. and 3-6 p.m.).

Between 2006 and 2012, the number of bus trips on I-405 increased 62% in the morning, and 50% in the evening. In this timeframe, the ridership more than doubled in the morning, and increased by 61% in the evening, outpacing the increase in number of trips in both cases.

WSDOT provided nearly $4 million in funds for three regional mobility grants to expand park and ride (P&R) lot capacity, and promote use of transit services. King County Metro added 100 parking stalls to the Bothell P&R lot, for a total of 220. The Kirkland P&R lot capacity was increased by 250 stalls, to a total of 325. The utilization of these P&R lots was 99% to 100% in 2012. The projects also improved passenger facilities, bicycle access and storage, incorporated Transit Oriented Development (TOD) projects into the surrounding areas, and installed signal prioritization for transit. Metro expects transit ridership to reduce an additional 548,000 vehicle trips by 2016.

Bus service on I-405 increased 50% or more since 2006

2006 and 2012; Morning (AM) (6-9 a.m.) and evening (PM) (3-6 p.m.) peak periods

	2006		2012		% change	
	AM	PM	AM	PM	AM	PM
Number of trips	34	32	55	48	62%	50%
Ridership	1,159	1,118	2,534	1,801	119%	61%

Data source: Sound Transit.

Table of Tables and Graphs

Publication Information

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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 511 from most phones. The automated telephone system provides information on Puget Sound traffic conditions and travel times, statewide construction impacts, statewide incident information, mountain pass conditions, weather information, the state ferry system information, and phone numbers for transit, passenger rail, airlines and travel information systems in adjacent states and for British Columbia.

Get WSDOT's mobile application

WSDOT's Android and iPhone applications include statewide traffic cameras, travel alerts, mountain pass reports, ferry schedules and alerts, northbound Canadian border wait times, and more. Use these images to download the application:

Scan the image on the left to download WSDOT's Android application. Scan the image on the right to download the iPhone application.

Android **iPhone**

For additional information about WSDOT programs and projects, visit http://www.wsdot.wa.gov.

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