Washington State
Department of Transportation

# The 2015
# Corridor Capacity Report

## The 14th edition of the annual *Congestion Report*

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Lynn Peterson, Secretary of Transportation

**WSDOT's comprehensive annual analysis of multimodal state highway system performance**

*Developed in partnership with*

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## Making multimodal connections work

Washington state traffic is growing. Higher employment rates translate into more drivers on the road, which in turn leads to longer commutes and everything that goes with congestion. WSDOT knows that addressing congestion takes a multi-faceted approach involving all partners, which is why the 2015 *Corridor Capacity Report* (CCR) is designed to help transportation policy makers, planners and engineers implement multimodal capacity opportunities for state highways.

This report apprises WSDOT, the Legislature, stakeholders, educational and research institutions, the media and the public about highway system conditions and how we can work together to reduce congestion. It also supports WSDOT's Practical Solutions and performance-based planning initiatives by reporting the multimodal capacity within 84 urban commute corridors.

The CCR provides multimodal system analysis, detailing usable capacity on state highways, mass transit, passenger rail and ferries. The report also considers congestion's impacts on air quality and people's wallets, providing a more complete picture of how traffic affects the state as a whole.

This report consists of three parts: this *Corridor Capacity Report*, a data Appendix and an addendum to the *Handbook for Corridor Capacity Evaluation*. See back cover for more details.

## *WSDOT expands multimodal analysis*

WSDOT's 2015 *Corridor Capacity Report* is the agency's 14th annual statewide analysis of multimodal system performance, and introduces Amtrak Cascades passenger rail performance as its newest addition. In addition, WSDOT is introducing a pilot arterial corridor performance analysis of US 395 in the Tri-Cities region. There is little guidance for detailed performance measurement of arterials.

Based on the positive feedback received on last year's report, WSDOT continues to fine tune the multimodal and environmental aspects of system performance evaluation from a corridor perspective. For this year's edition, multimodal capacity is evaluated along with travel time analyses for all major urban areas statewide where data is available. This helps planners take a comprehensive approach to finding solutions that are multimodal in nature.

## *New this year: Interactive maps help visualize data* NEW

Also new to this year's report, readers can explore each corridor's performance data within interactive online maps. For an overview of Washington state's transportation capacity, visit bit.ly/CCR15statewidemap. From there, readers can navigate to specific corridors to delve into areas of interest. Where you see the icon above in the report, click for interactive content.

### Connecting Washington

Gov. Jay Inslee and the Legislature have approved a $16 billion package to enhance the statewide multimodal transportation system while continuing to address critical infrastructure needs. WSDOT will use its Practical Solutions approach to work with communities and partners to improve the state's multimodal system. A few examples of congestion relief projects include: SR 167/SR 509 Gateway project ($1.9 billion), SR 520 "Rest of the West" ($1.6 billion), I-405 Lynnwood to Tukwila Corridor Improvements ($1.3 billion), US 395 North Spokane Corridor ($879 million), JBLM Congestion Relief Project ($494 million), I-90 Snoqualmie Pass ($426 million) and non-highway projects like bike paths, pedestrian walkways, rail and transit ($1.3 billion).

# Congestion on the rise since 2009

## Statewide and regional indicators

Although statewide traffic congestion (vehicle hours of delay) has been on an upward trajectory for the past five years, 2014 annual congestion (32.3 million hours) remained 8% below the 2007 pre-recession levels (35.1 million hours). The central Puget Sound region did not follow this 2014 trend and congestion there was 19% higher than pre-recession levels.

- Of the five monitored freeway corridors in the central Puget Sound region, three (I-5, I-405, I-90) saw congestion increases. Tolling and carpooling reduced congestion on SR 520 and SR 167 by 71% and 24%, respectively, in 2014 compared to 2007 pre-recession levels. (See table and charts on p. 4 of the appendix document).

Vehicle hours of delay increased 4.6% between 2012 and 2014, mirroring the growth in the state's economy. This delay on state highways cost drivers and businesses $808 million in 2014 compared to $773 million in 2012, about $116 per Washingtonian in 2014 compared to $113 in 2012.

- This amount of delay was influenced by Washington having more drivers on the road. Passenger vehicle registrations increased 6.9% while licensed drivers increased 7.6% between 2012 and 2014.
- More drivers in 2014 contributed to a 2.6% increase in the number of vehicle miles traveled (VMT) on all public roadways, up from 56.607 billion in 2012 to a new high of 58.060 billion miles.
- More drivers also had a hand in a 3.1% increase in the number of vehicle miles traveled (VMT) exclusively on state highways, which hit a new high of 32.177 billion in 2014, up from 31.214 billion in 2012.

Travel times are lower and person throughput is higher in HOV lanes as opposed to SOV (general purpose) lanes (refer to appendix pp. 27-29). A prime example of this is the HOV lane on I-5 at Northgate where travel times were up to 11 minutes more reliable and the movement of people was three times higher than in the adjacent SOV lanes in 2014.

WSDOT Incident Response teams responded to 8.1% more incidents (48,691 total) in 2014 than in 2012, which was accompanied by a 5.8% increase in incident-induced delay.

- Proactive work by Incident Response teams resulted in $74.1 million in economic benefit in 2014, a 4.9% increase from 2012.

The *Corridor Capacity Report* uses a two year comparison for multimodal system performance to identify trends over a longer time period. Between 2012 and 2014, there was significant percent change in some indicators such as corridor-specific delay. There are many variables that impact these trends – such as a stronger economy – that should be considered in the local context of each corridor. For example, from 2012 to 2014 the I-5 corridor in the south Puget Sound region saw an increase in vehicle hours of delay from 473,500 to 939,500 hours. Similarly, travel times from Federal Way to Tacoma increased by nine minutes while other south Puget Sound commute routes showed less variation.

### *Urban transit*

More people are taking buses than before. Transit ridership on urban commute corridors during daily peak periods increased 7.8%, from 104,970 in 2012 to 113,200 in 2014.

- The number of miles passengers traveled using transit during daily peak periods increased 10.4% statewide, from 1.3 million miles in 2012 to 1.5 million miles in 2014. Transit on I-5, between Federal Way and Everett, moved 56,331 people during peak periods on average weekdays. Without transit it would require five additional SOV lanes to meet the capacity demand on this stretch of I-5.
- Daily greenhouse gas emissions avoided during peak periods due to transit ridership improved by 17.9%, from 629,673 pounds in 2012 to 742,177 pounds in 2014.

### *Ferries*

The number of travelers using WSDOT Ferries continues its upward trend as annual ridership increased 4%, up from 22.2 million in 2012 to 23.2 million in 2014. Meanwhile, annual vehicle capacity utilization increased by two percentage points, from 59% in 2012 to 61% in 2014.

- Annual ferry trip reliability did not change significantly, at 99.5% in 2012 to 99.4% in 2014.
- Ferries on-time performance dropped one percentage point from 2012 to 94.8% in 2014.

### *Amtrak Cascades*

Amtrak Cascades riders took longer trips but less of them in 2014. While passenger miles traveled increased by 8.3% from 103.1 million miles in 2012 to 111.7 million miles in 2014, ridership declined 3.4% during the same period, from 725,000 to 700,000. Capacity utilization also decreased by four percentage points, from 64% in 2012 to 60% in 2014.

- Amtrak Cascades annual on-time performance fell by 2.1 percentage points, from 72.1% in 2012 to 70% in 2014.

# Dashboard of Indicators

| 2015 *Corridor Capacity Report* Dashboard of Indicators | 2010 | 2011 | 2012 | 2013 | 2014 | Difference '12 vs. '14[12] |
|---|---|---|---|---|---|---|
| **Demographic and economic indicators** | | | | | | |
| State population (thousands) | 6,725 | 6,768 | 6,818 | 6,882 | 6,968 | 2.2% |
| Gasoline price per gallon (annual average)[1] | $3.27 | $3.92 | $3.95 | $3.70 | $3.56 | -10.0% |
| Washington total employment (thousands of workers)[2] | 2,839 | 2,876 | 2,924 | 2,993 | 3,076 | 5.2% |
| Taxable retail sales (billions of dollars)[1] | $109.4 | $109.2 | $112.4 | $119.1 | $124.8 | 11.0% |
| **Multimodal performance measures** | | | | | | |
| Drive alone commuting rate[3] | 73.0% | 73.3% | 72.2% | 72.7% | 72.4% | 0.2% |
| Carpool commuting rate[3] | 10.5% | 10.2% | 10.7% | 10.1% | 10.1% | -0.6% |
| Bicycling and walking commuting rate[3] | 4.4% | 4.2% | 4.5% | 4.3% | 4.5% | 0.0% |
| Public transit commuting rate[3] | 5.5% | 5.6% | 5.8% | 6.3% | 6.3% | 0.5% |
| Transit ridership[4] (in millions) | 189.8 | 195.1 | 218.1 | 221.2 | N/A | N/A |
| WSDOT Ferries ridership[4] (in millions) | 22.6 | 22.3 | 22.2 | 22.5 | 23.2 | 4.5% |
| Amtrak Cascades ridership[5] (in thousands) | 737 | 742 | 725 | 694 | 700 | -3.4% |
| **Statewide congestion indicators** | | | | | | |
| **Greenhouse gas emissions** | | | | | | |
| Million metric tons of carbon dioxide equivalents ($CO_2e$)[6] | 96.4 | 92.1 | 92.0 | N/A | N/A | N/A |
| Transportation as percent of emissions from all sources statewide[6] | 43.8% | 45.5% | 46.2% | N/A | N/A | N/A |
| **Per person, total vehicle miles traveled on all public roads, state highways only** | | | | | | |
| All public roads vehicle miles traveled (VMT) (in billions) | 57.191 | 56.965 | 56.607 | 57.211 | 58.060 | 2.6% |
| All public roads per person VMT (miles) | 8,505 | 8,417 | 8,303 | 8,313 | 8,332 | 0.4% |
| State highways VMT (in billions) | 31.764 | 31.455 | 31.214 | 31.649 | 32.177 | 3.1% |
| State highways per person VMT (miles) | 4,724 | 4,648 | 4,578 | 4,599 | 4,618 | 0.9% |
| **Congestion on state highway system** | | | | | | |
| Total state highway lane miles | 18,630 | 18,642 | 18,659 | 18,662 | 18,680 | 0.1% |
| Percent of state highway system congested[7] | 5.5% | 5.4% | 5.5% | 5.5% | 5.8% | 0.3% |
| **Per person, total, and cost of delay on state highways** | | | | | | |
| Annual hours of per person delay on state highways[8] | 4.71 | 4.80 | 4.68 | 4.70 | 4.70 | 0.5% |
| Total vehicle hours of delay, in millions of hours[8] | 31.6 | 32.0 | 30.9 | 32.5 | 32.3 | 4.6% |
| Cost of delay on state highways (in millions)[8] | $791 | $799 | $773 | $811 | $808 | 4.6% |
| **Results Washington system performance measures** | | | | | | |
| Throughput productivity[9] | 96.1% | 96.0% | 95.7% | 95.2% | 94.6% | -1.1% |
| Reliability index[9] | 1.15 | 1.15 | 1.17 | 1.19 | 1.24 | 6.6% |
| **Corridor-specific congestion indicators (84 commutes statewide)** | | | | | | |
| Annual Maximum Throughput Travel Time Index ($MT^3I$)[10] | 1.39 | 1.38 | 1.29 | 1.43 | 1.37 | 6.4% |
| Number of commute routes with $MT^3I > 1$[11] | 47 | 60 | 59 | 56 | 62 | 5.1% |
| **WSDOT congestion relief projects (cumulative)** | | | | | | |
| Number of completed Nickel and Transportation Partnership Program mobility projects as of December 31 each year | 73 | 82 | 91 | 94 | 98 | 7 |
| Project value (dollars in millions) | $2,596 | $2,802 | $3,851 | $3,985 | $4,287 | $436 |

Data sources: Washington State Office of Financial Management, U.S. Energy Information Administration, Bureau of Labor Statistics – Consumer Price Index, Washington State Employment Security Department, Washington State Department of Revenue, WSDOT State Highway Log, U.S. Census Bureau - American Community Survey, National Transit Database, Washington Department of Ecology.

Notes: 1 These dollar values are inflation-adjusted using the Consumer Price Index, and are reported in 2014 dollars. 2 Employment only includes non-agricultural workers. 3 Based on 1-year estimates from the American Community Survey, commuting rates are of workers age 16 and older. 4 Ridership is the number of boardings, also called unlinked passenger trips. 5 These figures include riders on Washington segments only. 6 Values for 2013 and 2014 will be published by the Washington Department of Ecology in December 2016. See pp. 9, 13, 17, 21, 25, 31, 35, 37 and 39 for corridor-specific greenhouse gas emissions data. 7 Based on below 70% of posted speed. 8 Based on maximum throughput speed threshold (85% of posted speed). 9 See pp. 45-46 for descriptions of these measures. 10 Averaged for the 52 commute routes in the central Puget Sound region. 11 $MT^3I$ greater than one means the commute route experiences congestion. 12 Due to rounding, some percentages are not computable based on numbers in the table.

# WSDOT's Core Philosophy: Maximize System Capacity

## WSDOT aims to maximize throughput performance

Maximum throughput speed is the baseline speed WSDOT uses for congestion and capacity performance measurement. It is the speed at which the highest number of vehicles can move through a highway segment.

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 operate at peak efficiency because more vehicles are passing through the segment than at the posted speed limit. This happens because drivers at maximum throughput speeds can safely travel with a shorter distance between vehicles than they can at posted speeds. WSDOT aims to provide and maintain a system that maximizes capacity and yields the most productivity and efficiency.

WSDOT is building on this existing maximum throughput philosophy for vehicle travel to expand its application to multiple travel modes. This takes into account the capacity available on other modes along with that of the highway system with an aim to maximize person throughput.

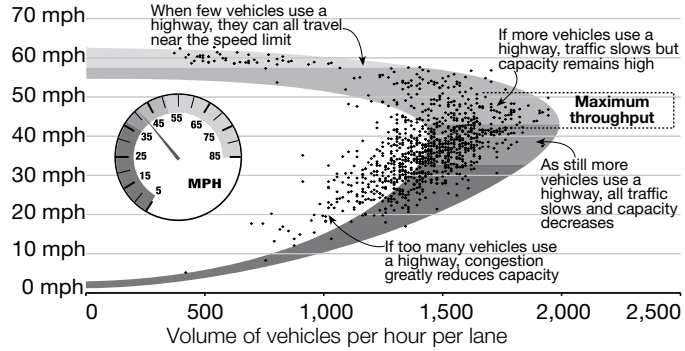
As part of this effort, beginning in the *2013 Corridor Capacity Report*, WSDOT incorporated multimodal performance measures to define system performance and available capacity across all modes. WSDOT introduced multimodal measures with an emphasis on person-based metrics to supplement the existing transportation system analysis. The multimodal measures include:

- Transit-oriented performance measures, such as total ridership, single occupant vehicle miles avoided, highway lane capacity augmented due to transit, and transit capacity used along the high-demand commute corridors.
- Greenhouse gas emissions per person during peak periods on commute corridors.
- Person-based measures, such as miles traveled per person and hours of delay per person in traffic along with the per person trip travel time on commute corridors.

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, etc.), weather 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 like US 395 in the Tri-Cities—see pp. 37-38), maximum throughput speeds are difficult to predict because they are influenced by conflicting traffic movements at intersections.

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

*Speed limit 60 mph; Maximum throughput speed ranges between 70%-85% of posted speed*




Data source: WSDOT Northwest Region Traffic Office.

WSDOT uses the maximum throughput speed 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, see pp. 6-7.

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

- Total vehicle delay and per person delay
- Percent of highway lane miles delayed and/or congested
- Lost throughput productivity
- Maximum Throughput Travel Time Index ($MT^3I$)
- Duration of the congested period
- Commute congestion cost

See *WSDOT's Handbook for Corridor Capacity Evaluation* for details on WSDOT's measurement and analysis approach for these and other system evaluation metrics.

# Statewide Congestion Indicators

*Visit bit.ly/CCR15statewidemap for this article's interactive map.*

## Per person vehicle miles traveled remains flat for past three years

Per person (per capita) vehicle miles traveled (VMT) on all Washington roads has remained around 8,300 for the past three years. In 2014, per capita VMT on all roads was measured at 8,332 miles – about 30 miles higher than 2012 (8,303 miles).

Looking at state highways alone, per person VMT remained around 4,600 for the past three years. In 2014, per capita VMT on state highways was 4,618 miles compared to 4,578 miles in 2012 – a 40 mile increase per Washingtonian.

## Statewide vehicle miles traveled on par with population growth

Statewide VMT on all Washington roads reached a new high of 58.060 billion miles in 2014, an increase of 2.6% from 2012 (56.607 billion). Similarly, state highway-only VMT reached a new high at 32.177 billion miles, an increase of 3.1% from 2012 (31.214 billion). Statewide VMT increases coupled with relatively steady per person VMT trend lines (0.4% increase on all roads and 0.9% on state highways) indicate that population growth is likely driving the increase in total vehicle miles traveled.

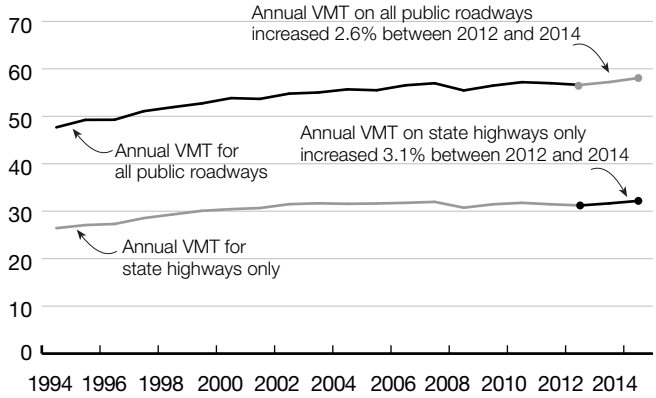
**Total vehicle miles traveled (VMT) in line with population growth, keeping person VMT flat**
*2010 through 2014; Population in thousands*

| | Total vehicle miles traveled (billions) | | Vehicle miles traveled per person | |
|---|---|---|---|---|
| **Year (population)** | **State highways** | **All public roads** | **State highways** | **All public roads** |
| **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 |
| **2013 (6,882)** | 31.649 | 57.211 | 4,599 | 8,313 |
| **2014 (6,968)** | 32.177 | 58.060 | 4,617 | 8,332 |
| **Δ 2014 vs. 2012** | 0.963 | 1.453 | 39 | 29 |
| **%Δ 2014 vs. 2012** | 3.1% | 2.6% | 0.9% | 0.4% |

Data sources: WSDOT Multimodal Planning Division and Washington State Office of Financial Management.

Per person measures for VMT have remained relatively unchanged over the past few years even though VMT saw system-wide increases. This shows statewide VMT increases are in line with Washington's population growth.

**Record high statewide vehicle miles traveled in 2014**
*1994 through 2014; Miles in billions*




Data sources: WSDOT Multimodal Planning Division and Washington State Office of Financial Management.

## *Central Sound accounts for 90% of delay*

Average statewide delay increased 4.6% between 2012 and 2014. When looking at specific urban areas, the Puget Sound region (King, Snohomish, Kitsap and Pierce counties) contributed to 96.8% of the statewide delay, which increased 3.7% between 2012 and 2014.

Based on the sub-area analysis at a county level, the central Puget Sound region (King and Snohomish counties) contributed 90.4% of statewide delay, while experiencing a 1% increase in delay compared to 2012.

Similar analysis in the south Puget Sound region (Pierce and Thurston counties) showed a 104.7% increase in delay, most of which occurred between Joint Base Lewis-McChord and the Fife area (see pp. 31-34), which contributed to 5% of the total statewide delay.

# Travel delay on state highways increases 4.6%

**Estimated annual travel delay and cost of delay on state highways by urban area**
*2010 through 2014; Delay in hours; Cost of delay in millions (2014 dollars)*

| Urban area | 2010 | 2011 | 2012 | 2013 | 2014 | %Δ 2012 vs. 2014 |
|---|---|---|---|---|---|---|
| Central Puget Sound (King and Snohomish counties) | 28,857,500 | 29,662,500 | 28,955,000 | 30,235,000 | 29,235,000 | 1.0% |
| South Puget Sound (Pierce and Thurston counties) | 1,470,000 | 1,080,000 | 795,000 | 1,145,000 | 1,627,500 | 104.7% |
| Spokane (Spokane County) | 97,500 | 82,500 | 77,500 | 105,000 | 142,500 | 83.9% |
| Tri-Cities (Benton and Franklin counties) | 155,000 | 155,000 | 140,000 | 150,000 | 172,500 | 23.2% |
| Vancouver (Clark County) | 157,500 | 167,500 | 160,000 | 130,000 | 200,000 | 25.0% |
| Other areas | 485,000 | 400,000 | 351,500 | 327,500 | 518,750 | 47.6% |
| **Statewide annual delay** | **31,645,000** | **31,970,000** | **30,900,000** | **32,450,000** | **32,332,500** | **4.6%** |
| **Annual cost of delay** | **$791** | **$799** | **$773** | **$811** | **$808** | **4.6%** |

Data source: WSDOT Multimodal Planning Division.
Note: Delay numbers might not match previous year's reports, as segmentation changes were made to better compare years.

Other parts of the state highways outside the Puget Sound region including urban areas such as Spokane (Spokane County), the Tri-Cities (Benton and Franklin counties) and Vancouver (Clark County) contributed 3.2% of statewide delay in 2014, while experiencing 20-80% increases in delay compared to 2012.

## *Travel delay costs Washington drivers and businesses $808 million in 2014*

Statewide travel delay cost drivers and businesses in Washington $808 million in 2014 compared to $773 million in 2012 (see table at top of next page). As the Puget Sound region contributes to 96.8% of total statewide delay, it is estimated that $783 million in delay costs occur in the Puget Sound region.

## *Emissions on high-demand urban commute corridors down by 2.5%*

In 2014, the weekday annual greenhouse gas emissions from vehicles on the high-demand commute corridors in the urban areas statewide were estimated to be 2.74 million metric tons (or 6.04 billion pounds) of carbon dioxide equivalents ($CO_2e$), 2.5% less than in 2012. Even while VMT and delay increased since 2012, emissions continue to decline due to increased efficiency of vehicles and the non-linear relationship between VMT, delay and emissions.

According to the Washington State Department of Ecology, transportation-related activities contributed 46.2% of all greenhouse gases released into the atmosphere in 2012 (the most recent year of data). Washington state generates more clean energy than the national average; as a result, transportation as a percent of statewide emissions is higher compared to the national average of 27%.

## *Urban commute corridors continue to experience increased delay*

All the urban corridors saw significant increases in delay, while changes in VMT were moderate. WSDOT tracks VMT and delay along with other multimodal performance measures on urban commute corridors statewide. Detailed evaluations of each corridor begin on p. 9.

# Non-farm employment up 5.2%

Non-farm employment in Washington reached 3.08 million workers in 2014, a 5.2% increase from 2012. This exceeds the 2007 employment level of 2.97 million workers (prior to the Great Recession that started in 2008). Washington's unemployment rate dropped to 6.2% in 2014, from 8.1% in 2012.

These trends indicate the economy is improving; however, several factors must also be considered. First, the decline in the unemployment rate can partially be attributed to workers leaving the labor force. Between 2012 and 2014, Washington's labor force participation rate (the percentage of the population currently working or actively seeking work) fell from 64.0% to 62.8%, because the labor force did not grow as quickly as the working age population. Second, average weekly hours worked by all Washington employees fell by nearly 1% between 2012 and 2014, likely due to an increase in part-time employment.

# Employment, licensed drivers continue upward trend

In the Seattle-Bellevue-Everett metropolitan area, employment grew 6.1%, the unemployment rate fell to a six-year low of 4.7%, and the labor force participation rate held steady at 69.8% between 2012 and 2014. Average hourly wages increased 1.4%, slightly more than at the statewide level. Even though average weekly hours worked fell by 12 minutes (a 0.6% decline) in the Seattle-Bellevue-Everett metropolitan area, this was less than the decline in statewide average weekly hours worked.

According to the 2014 American Community Survey, 72.4% of Washingtonians drove alone to work, a slight increase from 72.2% in 2012. Of the remaining Washington workers, 10.1% carpooled, 6.3% rode public transportation, 5.5% worked from home, 3.5% walked and 1% biked.

Traffic congestion, travel time and delay are influenced by a number of factors, including the availability of public transportation, the rate of drive-alone commuting, and the overall economy. Congestion tends to worsen as the economy strengthens and employment levels improve due to an increased number of commuters, especially when these workers are driving alone.

**Summary of Washington's economic indicators**
*2012 and 2014*

| Indicator | 2012 | 2014 | %Δ | Trend Actual | Trend Desired |
|---|---|---|---|---|---|
| Driving age population (ages 16 and over, in millions) | 5.42 | 5.55 | 2.5% | ↑ | N/A |
| Employment (millions of workers) | 2.92 | 3.08 | 5.2% | ↑ | ↑ |
| Unemployment rate | 8.1% | 6.2% | -23.5% | ↓ | ↓ |
| Taxable retail sales[1] (billions of dollars) | $112.4 | $124.8 | 11.0% | ↑ | ↑ |
| Gasoline price per gallon[1] | $3.95 | $3.56 | -10.5% | ↓ | N/A |
| Passenger vehicle registrations (millions) | 4.32 | 4.62 | 6.9% | ↑ | N/A |
| Licensed drivers (millions) | 5.09 | 5.47 | 7.6% | ↑ | N/A |

Data source: Washington State Office of Financial Management, U.S. Bureau of Labor Statistics, Washington State Department of Revenue, U.S. Energy Information Administration, Washington State Department of Licensing.
Note: 1 Adjusted for inflation and reported in 2014 dollars.

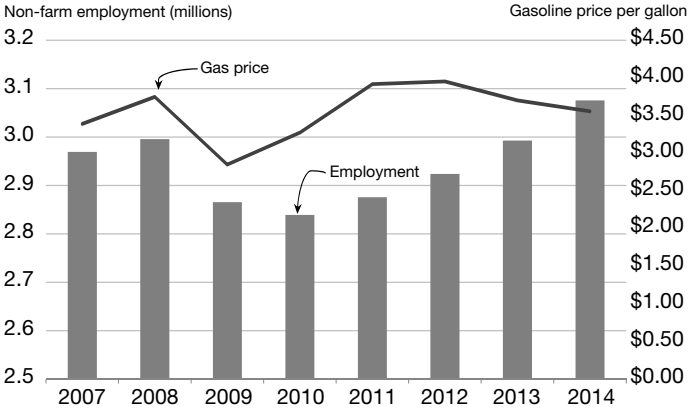
## Taxable retail sales hit six-year high

Washington state retail sales (adjusted for inflation and reported in 2014 dollars) increased 11% from 2012 to 2014. This improvement in consumer confidence and increased consumption is likely related to the growth in employment, and therefore linked to increased commute traffic that leads to congestion. Taxable retail sales can be an indicator of consumers' confidence in the economy and representative of truck traffic on Washington roadways, given that retail stores need to be supplied with goods.

## Gas prices decrease 10.5% since 2012

Gas prices in Washington fell 10.5% between 2012 and 2014, when accounting for inflation, from $3.95 per gallon in 2012 to $3.56 in 2014. The 2012 average gas price was the highest on record during the past 10 years. Washington's gas prices exceeded the national average by 20 cents in 2014. Falling gas prices have a tendency to worsen traffic congestion; when gas prices decline, driving becomes less expensive and people often drive alone (or drive more) rather than using alternative commute modes such as transit or carpools.

**Employment trends upward as gas prices fall**
*2007 through 2014; Gas prices in 2014 dollars*




Data sources: U.S. Bureau of Labor Statistics; U.S. Energy Information Administration.

## Licensed drivers increase along with registered passenger vehicles

There were 5.47 million licensed drivers in Washington in 2014, up 7.6% from 2012 (see chart at left). In addition, there were 4.62 million registered passenger vehicles, a 6.9% rise from two years ago. This translates to about 0.84 passenger vehicles per licensed driver in Washington.

Washington's driving age population (age 16 and older) increased 2.5% from 2012 to 2014, from 5.42 million to 5.55 million people. This exceeded the growth rate of total state population, which increased 2.2% from 2012 to 2014. In the Seattle-Bellevue-Everett metropolitan area, the driving age population increased by 3.1% between 2012 and 2014, from 2.16 million to 2.23 million people. This increase was likely a contributing factor to increased congestion.

**See Appendix pp. 2-3 for more statewide indicators data.**

Visit bit.ly/CCR15CentralSoundmap for this article's interactive map.

# Interstate 5 Corridor Capacity Analysis

## Annual person miles traveled

| 2012 | vs. | 2014 |
|---|---|---|
| 2,441 | | 2,475 |

in millions of miles

1.4%

## Annual vehicle delay[1]

| 2012 | vs. | 2014 |
|---|---|---|
| 2,582 | | 3,756 |

in thousands of hours

45%

## Annual GHG emissions

| 2012 | vs. | 2014 |
|---|---|---|
| 2,031 | | 2,052 |

in millions of pounds of $CO_2$ equivalents

1.0%

## Annual passenger miles traveled on transit

| 2012 | vs. | 2014 |
|---|---|---|
| 204.6 | | 235.0 |

in millions of miles

13%

## Capacity savings due to transit

| 2012 | vs. | 2014 |
|---|---|---|
| 4.5 | | 4.9 |

in number of lanes

9.3%

## Percent transit seats occupied

| 2012 | vs. | 2014 |
|---|---|---|
| 75% | | 78% |

on average during peak periods

3%

## Percent park and ride spaces occupied

| 2012 | vs. | 2014 |
|---|---|---|
| 88% | | 92% |

on average during peak periods

4%

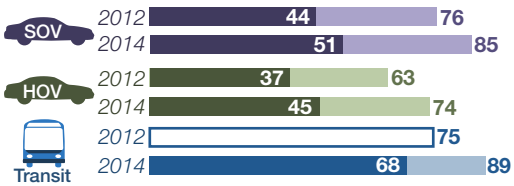
# Commute travel times

*2012 and 2014 during the morning (5-10 a.m) and evening (2-8 p.m.) peak periods; Weekday travel times in minutes at the 5-minute peak including average and reliable[2] travel times for single occupant vehicle (SOV), high occupancy vehicle (HOV) and transit[3] trips.*

Average SOV · Reliable SOV · Average HOV · Reliable HOV · Average transit · Reliable transit · Planned transit[4]

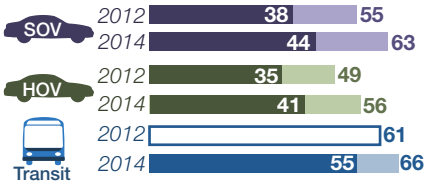
### *Everett to Seattle*

Morning; 7:25 a.m.; Trip length 24 miles



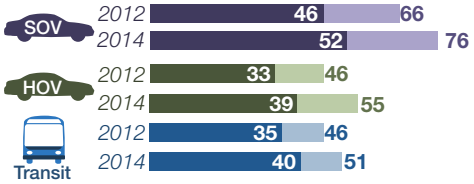

### *Seattle to Everett*

Evening; 4:45 p.m.; Trip length 23 miles



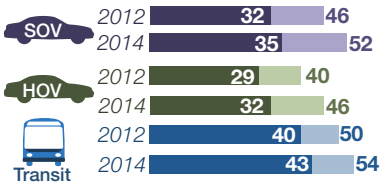

### *Federal Way to Seattle*

Morning; 7:15 a.m.; Trip length 22 miles

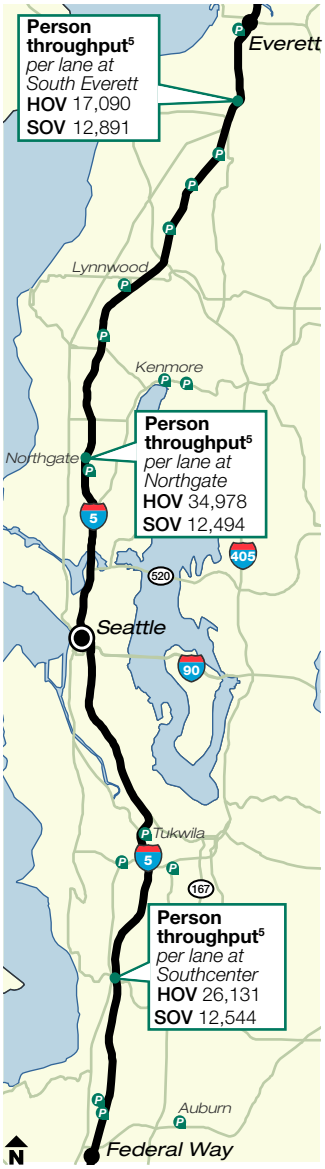



### *Seattle to Federal Way*

Evening; 4:10 p.m.; Trip length 22 miles




See Appendix pp. 5-21 for more commute routes




# Transit system use

*2012 and 2014; For typical weekday morning (6-9 a.m.) and evening (3-6 p.m.) transit[3] peak periods; Ridership and percent of available seats occupied on select commutes*

## *By commute*

| | Daily peak period riders | | Percent of seats occupied | |
|---|---|---|---|---|
| **Morning** (6-9 a.m.) | 2012 | 2014 | 2012 | 2014 |
| Everett to Seattle | 10,447 | 11,975 | 74% | 79% |
| Federal Way to Seattle *Includes Tacoma to Seattle bus routes | 8,004 | 8,096 | 73% | 70% |
| SeaTac to Seattle | 5,500 | 6,120 | 90% | 102% |
| **Evening** (3-6 p.m.) | | | | |
| Seattle to Everett | 10,367 | 12,282 | 70% | 75% |
| Seattle to Federal Way *Includes Seattle to Tacoma bus routes | 6,047 | 7,778 | 75% | 66% |
| Seattle to SeaTac | 7,934 | 7,161 | 100% | 112% |

# Park and ride capacity

*2012 and 2014; Average percent occupied for select park and rides (see map for locations); Rates over 100% denote vehicles parked in unmarked space*

## *Everett-Seattle commute*

| Park and ride (spaces) | 2012 percent occupied | 2014 percent occupied |
|---|---|---|
| Ash Way (1,022) | 100% | 106% |
| Lynnwood Transit Ctr. (1,370) | 100% | 100% |
| Northgate area (1,024) | 99% | 100% |
| S. Everett Freeway Station (397) | 97% | 100% |
| Mountlake Terrace (877) | 95% | 100% |
| Kenmore area (693) | 92% | 100% |
| Mariner (644) | 75% | 76% |
| Everett Station (1,107) | 47% | 67% |

## *Federal Way-Seattle commute*

| Park and ride (spaces) | 2012 percent occupied | 2014 percent occupied |
|---|---|---|
| Auburn area (633) | 99% | 100% |
| Tukwila area (855) | 98% | 100% |
| Kent area (996) | 98% | 98% |
| Puyallup area (583) | 93% | 97% |
| Tacoma Dome (2,273) | 95% | 96% |
| Sumner train station (302) | 100% | 94% |
| Lakewood area (1,093) | 69% | 87% |
| Federal Way area (2,067) | 75% | 73% |

Data sources and analysis: Washington State Transportation Center, WSDOT Multimodal Planning Division, WSDOT Northwest Region Traffic Office, Sound Transit, Pierce Transit, King County Metro, Community Transit and WSDOT Office of Strategic Assessment and Performance Analysis.

Notes: Measures at the top of the page are for the I-5 corridor between Everett and Federal Way for SOV trips only. 1 WSDOT defines delay as when average speeds are slower than 85% of the posted speed limit. 2 Reliable travel time will get commuters to their destination on time 19 out of 20 weekdays (95% of the time). 3 Transit travel times by bus, Link light rail and Sounder rail include some off-highway travel to stops and may not be directly comparable to SOV/HOV times which are highway only. 4 Planned transit travel time is used when average and reliable transit travel time data is not available. 5 Person throughput values include morning (6-9 a.m.) and evening (3-7 p.m.) traffic.

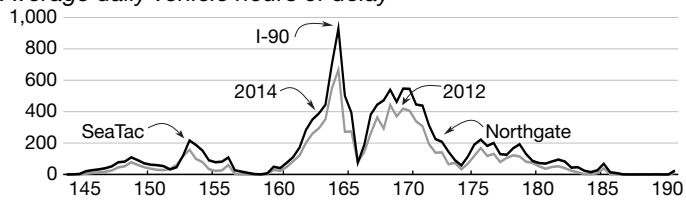
# HOV lanes, transit improve I-5 person throughput

Interstate 5 (I-5) is one of the key commute and economic corridors in the central Puget Sound region. Nearly 2.5 billion person miles were traveled between Federal Way and Everett in 2014, a 1.4% increase over 2012. The high occupancy vehicle (HOV) lane at Northgate on this corridor moved three times as many people as each adjacent single occupancy vehicle (SOV) lane. This speaks to the efficiencies of the HOV network and transit options on the corridor in moving more people.

Despite these efficiencies, traffic at specific locations on the corridor worsened from 2012 to 2014, with morning and evening weekday commutes experiencing heavy congestion on a daily basis. Delay increased 45% on I-5 between Federal Way and Everett. To learn why delay and miles traveled do not increase hand in hand, see the gray box on p. 12. Freeway segments near the I-90 interchange, downtown Seattle, Northgate and SeaTac contributed to the significant delay increases in 2014 compared to 2012. In addition to delaying commuters, this congestion directly impacted the movement of goods in Washington, as trucks accounted for 7% of the total daily traffic volume on the corridor in 2014.

***Corridor delay:*** The I-5 corridor in the central Puget Sound region between Federal Way and Everett experienced vehicle delay northbound around the I-90 interchange and between Northgate and downtown Seattle, as well as southbound at SeaTac. Vehicle delay along the I-5 corridor was consistently higher in 2014 compared to 2012 at varying magnitudes depending on the location and direction of travel (see graph above).

**Delay along the I-5 corridor by milepost**
*2012 and 2014; Northbound and southbound combined; Average daily vehicle hours of delay*

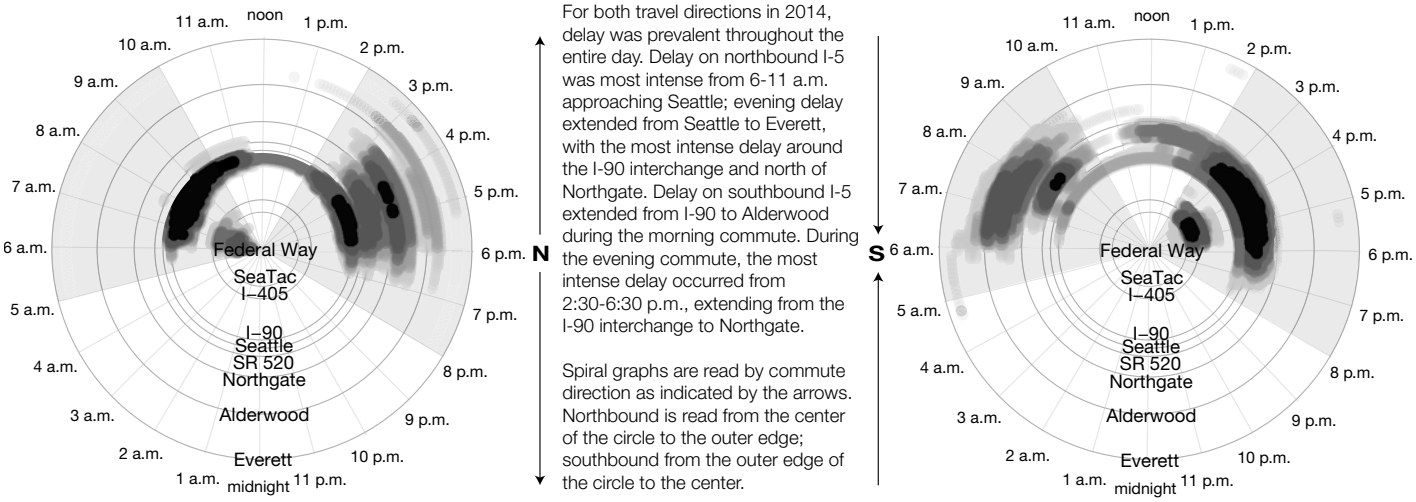



Data sources and analysis: WSDOT Multimodal Planning Division and WSDOT Office of Strategic Assessment and Performance Analysis.

The amount of delay significantly increased between 2012 and 2014 at specific locations on the I-5 corridor including: southbound at SeaTac (up 74%), northbound at the I-90 interchange (up 45%), and in both directions near Northgate (up 41%). It would have been even worse without transit. Data shows that even with conservative assumptions, transit ridership along the I-5 corridor translates to a capacity savings equivalent to five additional lanes of traffic during commute periods (See p. 12 for more information on transit ridership). Improvements at key congestion areas, such as the transit access ramps from I-90 to downtown Seattle that bypass the I-5 interchange, provide significant benefits in capacity and reducing travel delay. The spiral chart below shows the intensity of delay by time of the day and location in 2014.

***A focus on hot spots:*** The percent of days the Federal Way to Seattle commute operated in severely

**I-5 delay between Federal Way and Everett**
*2014; Weekdays only; Vehicle hours of delay; Shading represents intensity of delay*




For both travel directions in 2014, delay was prevalent throughout the entire day. Delay on northbound I-5 was most intense from 6-11 a.m. approaching Seattle; evening delay extended from Seattle to Everett, with the most intense delay around the I-90 interchange and north of Northgate. Delay on southbound I-5 extended from I-90 to Alderwood during the morning commute. During the evening commute, the most intense delay occurred from 2:30-6:30 p.m., extending from the I-90 interchange to Northgate.

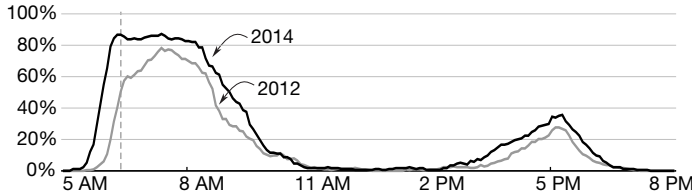
Spiral graphs are read by commute direction as indicated by the arrows. Northbound is read from the center of the circle to the outer edge; southbound from the outer edge of the circle to the center.

Data sources and analysis: Washington State Transportation Center and WSDOT Office of Strategic Assessment and Performance Analysis.

# Corridor capacity constraints plague peak period travelers

### Severe congestion on the Federal Way to Seattle commute

*2012 and 2014; Northbound; Percent of days the average speed was slower than 36 mph*

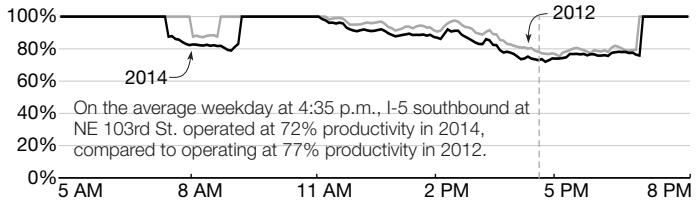



Data sources and analysis: WSDOT Northwest Region Traffic Office, Washington State Transportation Center and WSDOT Office of Strategic Assessment and Performance Analysis.

congested (36 mph or below) condition significantly worsened between 2012 and 2014 (see severe congestion chart above). For example, at around 6:30 a.m. during the morning commute from Federal Way to Seattle, the percent of days that speeds were below 36 mph increased from 57% in 2012 to 86% in 2014.

### Throughput on southbound I-5 at NE 103rd St.

*2012 and 2014; Based on the highest observed 5-minute flow rate; Southbound = 1,620 vehicles per hour per lane = 100%*



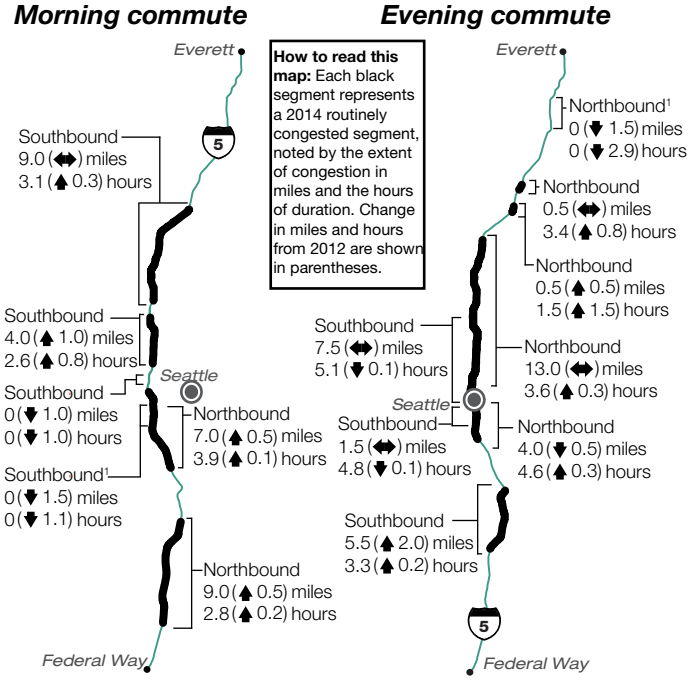

Data sources and analysis: WSDOT Multimodal Planning Division, Washington State Transportation Center and WSDOT Office of Strategic Assessment and Performance Analysis.

***Highway productivity:*** As traffic increases, congested roads carry fewer vehicles, resulting in a drop in throughput productivity at speeds slower than maximum throughput. In order to gauge the lost productivity on I-5 in the central Puget Sound region, WSDOT analyzed vehicle throughput at three locations: near South 188th Street, near Northeast 103rd Street and at the I-90 interchange. In 2012 and 2014, productivity at these locations at their most congested ranged from 72% to 84%. The graph above shows how productivity varies by direction of travel, location and time of day near Northeast 103rd Street in Northgate.

***Routinely congested segments:*** Of the 91-mile I-5 corridor between Federal Way and Everett (both directions), the segments leading to downtown Seattle experienced significant routine congestion. Overall, the locations where routine congestion occurred increased by nine miles between 2012 and 2014, while the amount of time of routine congestion increased by 22% (see map above right).

### Routinely congested segments of I-5

*2014; For weekday morning (5-10 a.m.) and evening (2-8 p.m.) peak periods; Length of backup in miles; Daily duration of congestion in hours (compared to 2012).*




Data sources and analysis: Washington State Transportation Center and WSDOT Office of Strategic Assessment and Performance Analysis.

Notes: See pp. 7-8 in the Appendix for all RCS data. 1 Routinely congested segments (RCS) that dropped below 50 minutes in duration in 2014 from 2012 are shown with just a bracket.

## *What does severe congestion mean for travel times on the corridor?*

***Single occupancy vehicle trips:*** Capacity constraints impacted both the Federal Way to Seattle northbound commute near the I-90 interchange and the Northgate area for the Everett to Seattle southbound commute. This resulted in increased average and reliable travel times during the morning peak period (5-10 a.m.). The average travel time for Federal Way to Seattle and Everett to Seattle commutes increased by up to seven minutes (up 16%) in 2014 compared to 2012 while reliable travel time increased by 10 minutes (up 15%).

Sixteen miles of the 22-mile commute route between Federal Way and Seattle and 14 miles of the 24-mile Everett to Seattle commute route experienced routine congestion. The greenhouse gas (GHG)emissions between the years remained similar on this corridor along with the duration of congestion.

The SeaTac to Seattle morning commute, a sub commute on the Federal Way to Seattle morning commute, takes more than two times longer than it should when compared to traveling at 50 mph (maximum throughput speed). The maximum throughput travel time index (MT3I), which allows WSDOT to

# Delay increases outpace VMT on I-5 in Seattle

compare severity of congestion across commutes, shows that SeaTac to Seattle has the highest MT3I—2.14—of the 12 I-5 commutes tracked in the central Puget Sound region.

***Transit trip travel times:*** Eight of the 12 commutes tracked on I-5 have transit travel time data. For example, in 2014 the average and reliable transit travel times for the I-5 commute from Federal Way to Seattle in the morning were 40 and 51 minutes, respectively. For the return trip in the evening, average transit travel time was 43 minutes, while reliable travel time was 54 minutes. See p. 9 for a comparison of transit trips to SOV and HOV trips.

***Transit ridership and GHG emissions avoided:*** Transit moved 56,331 people during the morning and evening peaks on an average weekday in 2014, a 9% increase over 2012. This corresponds with a 13% increase in transit passenger miles traveled. Transit ridership during peak periods means fewer cars on the road, which helps alleviate traffic congestion by making the most efficient use of available highway capacity. For example, transit ridership on I-5 from Everett to Seattle in the morning and the reverse evening trip saw ridership increase by 17% in 2014 (24,257 riders) compared to 2012 (20,814 riders).

Peak period transit ridership on the I-5 corridor in central Puget Sound was equal to nearly five extra lanes of capacity in 2014 (when compared to the peak efficiency of the roadway, which is a conservative approach to this measurement). Transit use during peak periods avoided 456,573 pounds of GHG emissions per day on the I-5 central Puget Sound corridor in 2014, a 27% improvement compared to 2012 (360,624 pounds). Transit routes on I-5 operated between 66% and 112% of their seating capacity during the morning and evening peak periods in 2014; 71% of them were more than 90% full.

***Park and ride:*** Along the I-5 corridor in the central Puget Sound region in 2014, park and ride (P&R) utilization rates ranged from 67% to 106% depending on the location, with 12 out of 16 having utilization rates above 90%. Any P&R lot that has 85% or more utilization is identified as operating at capacity. The availability of P&R spaces within the transit service network provides essential access points to transit riders. P&R locations need to have enough parking spaces and high utilization of those spaces to accommodate demand. A detailed review of P&R capacity and transit trip utilization rates by time of day could help ridership. Targeted outreach efforts from the transit agencies as well as employer initiatives to encourage participation in a Commute Trip Reduction program could also help address chronic highway capacity issues in the central Puget Sound region.

## *How much is congestion costing you?*

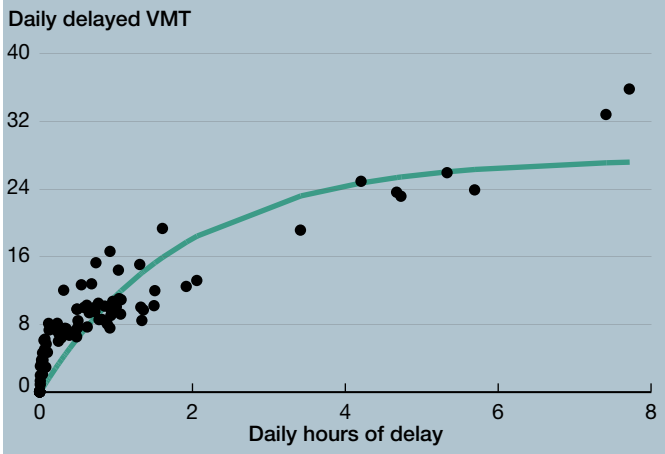
Commuters making roundtrips between Everett and Seattle, Federal Way and Seattle, and SeaTac and Seattle on I-5 took a hit to their wallets due to congestion in the central Puget Sound region. For example, the 48-mile roundtrip between Everett and Seattle claimed the highest cost due to congestion (measured in wasted time and gas), about $3,400 per commuter annually in 2014.

### Why was the delay increase significant while VMT only saw a slight increase?

Vehicle miles traveled (VMT) is an all day measure that fluctuates based on growth in driving population, job availability and other economic measures. Higher regional employment leads to more people commuting to work, which puts additional stress on the transportation system, lowering speeds and increasing delay.

**I-5 northbound delay increases, delayed VMT[1] levels off as threshold reached**

*2014; Daily hours of delay and daily delayed VMT in thousands*




Data sources and analysis: WSDOT Multimodal Planning Division and WSDOT Office of Strategic Assessment and Performance Analysis.

Note: 1 Delayed vehicle miles traveled (VMT) refers to VMT accrued when there is delay on the corridor.

Since delay is calculated when speeds are below 50 mph (threshold speed), WSDOT limited VMT to the same threshold, creating the measure of delayed VMT. Delayed VMT and vehicle hours of delay increase hand in hand until congestion becomes so severe that while delay continues to accumulate, delayed VMT begins to level off (see graph above). Vehicles record no additional VMT while delayed in traffic.

Visit bit.ly/CCR15CentralSoundmap for this article's interactive map.

# Interstate 405 Corridor Capacity Analysis

## Annual person miles traveled

| 2012 | vs. | 2014 |
|---|---|---|
| 1,146 | | 1,139 |

in millions of miles

0.5% ↓

## Annual vehicle delay[1]

| 2012 | vs. | 2014 |
|---|---|---|
| 1,681 | | 2,460 |

in thousands of hours

46% ↑

## Annual GHG emissions

| 2012 | vs. | 2014 |
|---|---|---|
| 974.1 | | 940.1 |

in millions of pounds of $CO_2$ equivalents

3.5% ↓

## Annual passenger miles traveled on transit

| 2012 | vs. | 2014 |
|---|---|---|
| 13.7 | | 14.5 |

in millions of miles

5.2% ↑

## Capacity savings due to transit

| 2012 | vs. | 2014 |
|---|---|---|
| 0.3 | | 0.3 |

in number of lanes

0% ↔

## Percent transit seats occupied

| 2012 | vs. | 2014 |
|---|---|---|
| 71% | | 71% |

on average during peak periods

0% ↔

## Percent park and ride spaces occupied

| 2012 | vs. | 2014 |
|---|---|---|
| 94% | | 96% |

on average during peak periods

2% ↑

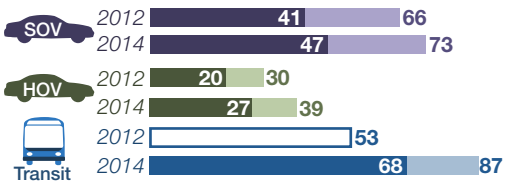
# Commute travel times

*2012 and 2014 during the morning (5-10 a.m) and evening (2-8 p.m.) peak periods; Weekday travel times in minutes at the 5-minute peak including average and reliable[2] travel times for single occupant vehicle (SOV), high occupancy vehicle (HOV) and transit[3] trips.*

Average SOV · Average HOV · Average transit · Reliable SOV · Reliable HOV · Reliable transit · Planned transit[4]

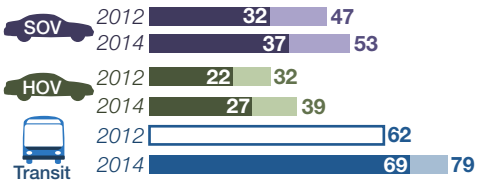
### *Lynnwood to Bellevue*

Morning; 7:25 a.m.; Trip length 16 miles



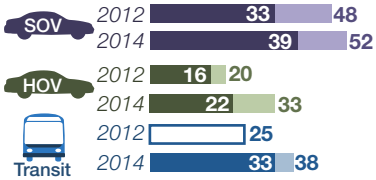

### *Bellevue to Lynnwood*

Evening; 4:50 p.m.; Trip length 16 miles



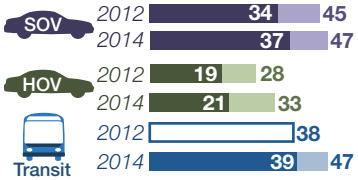

### *Tukwila to Bellevue*

Morning; 7:30 a.m.; Trip length 13 miles




### *Bellevue to Tukwila*

Evening; 4:45 p.m.; Trip length 13 miles




See Appendix pp.5-21 for more commute routes

# Transit system use

*2012 and 2014; For typical weekday morning (6-9 a.m.) and evening (3-6 p.m.) transit[3] peak periods; Ridership and percent of available seats occupied on select commutes*

## *By commute*

| | Daily peak period riders | | Percent of seats occupied | |
|---|---|---|---|---|
| **Morning** (6-9 a.m.) | 2012 | 2014 | 2012 | 2014 |
| Everett to Bellevue | 628 | 736 | 85% | 94% |
| Lynnwood to Bellevue | 330 | 418 | 69% | 88% |
| Tukwila to Bellevue | 397 | 206 | 69% | 46% |
| **Evening** (3-6 p.m.) | | | | |
| Bellevue to Everett | 607 | 802 | 76% | 84% |
| Bellevue to Lynnwood | 264 | 301 | 65% | 77% |
| Bellevue to Tukwila | 406 | 337 | 73% | 65% |

# Park and ride capacity

*2012 and 2014; Average percent occupied for select park and rides (see map for locations); Rates over 100% denote vehicles parked in unmarked space*

## *Lynnwood-Bellevue commute*

| Park and ride (spaces) | 2012 percent occupied | 2014 percent occupied |
|---|---|---|
| Ash Way (1,022) | 100% | 106% |
| Kenmore area (693) | 92% | 100% |
| Canyon Park (302) | 98% | 99% |
| Bothell (220) | 99% | 98% |
| South Kirkland (783) | 100% | 82% |
| Brickyard (443) | 80% | 82% |

## *Tukwila-Bellevue commute*

| Park and ride (spaces) | 2012 percent occupied | 2014 percent occupied |
|---|---|---|
| South Bellevue (519) | 100% | 107% |
| Wilburton (186) | 82% | 100% |
| Renton (150) | 96% | 98% |
| Renton Munipical (200) | 90% | 96% |
| Newport Hills (275) | 72% | 77% |

Data sources and analysis: Washington State Transportation Center, WSDOT Multimodal Planning Division, WSDOT Northwest Region Traffic Office, Sound Transit, Pierce Transit, King County Metro, Community Transit and WSDOT Office of Strategic Assessment and Performance Analysis.

Notes: Measures at the top of the page are for SOV trips only on the I-405 corridor between Lynnwood and Tukwila. 1 WSDOT defines delay as when average speeds are slower than 85% of the posted speed limit. 2 Reliable travel time will get commuters to their destination on time 19 out of 20 weekdays (95% of the time). 3 Transit travel times by bus include some off-highway travel to stops and may not be directly comparable to SOV/HOV times which are highway only. 4 Planned transit travel time is used when average and reliable transit travel time data is not available. 5 Person throughput values include morning (6-9 a.m.) and evening (3-7 p.m.) traffic.

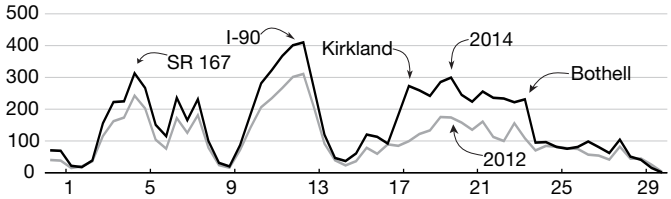
# I-405 delay increases near I-90, Kirkland-Bothell area

Interstate 405 (I-405) is one of the key commute and economic corridors in the central Puget Sound region and runs parallel to I-5 between Tukwila and Lynnwood. Over 1.1 billion person miles were traveled in 2014, a 0.5% decrease from 2012. The high occupancy vehicle (HOV) lane at Newcastle on this corridor moved approximately twice as many people as each adjacent single occupancy vehicle (SOV) lane.

Despite this efficiency, traffic at specific locations on the corridor worsened from 2012 to 2014, with morning and evening weekday commutes experiencing heavy congestion on a daily basis. Delay increased 46% on I-405 between Tukwila and Lynnwood. To learn why delay and miles traveled do not increase hand in hand, see the gray box on p. 16. Freeway segments near SR 169 in Renton, the I-90 interchange, and the Kirkland-Bothell area contributed to the significant delay increases in 2014 compared to 2012. In addition to delaying commuters, this congestion directly impacted the movement of goods in Washington, as trucks accounted for 5% of the total daily traffic volume on the corridor in 2014.

***Corridor delay:*** The I-405 corridor in the central Puget Sound region between Tukwila and Lynnwood experienced vehicle delay northbound near SR 169 (in Renton) and southbound at the I-90 interchange, while the Kirkland-Bothell area experienced congestion in both directions. Vehicle delay along the I-405 corridor was consistently higher in 2014 compared to 2012 at varying magnitudes depending on the location and direction of travel (see graph above). The amount of delay significantly increased between 2012 and 2014 at specific locations on the I-405 corridor including: northbound at the SR 167 interchange in Renton (up 38%), southbound at the I-90 interchange (up 33%), and in both directions in the Kirkland-Bothell area (up 80%). The spiral chart at the bottom of the page shows the intensity of delay by time of the day and location in 2014.

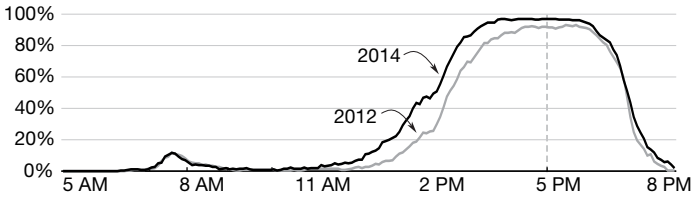
**Delay along the I-405 corridor by milepost**
*2012 and 2014; Northbound and southbound combined; Average daily vehicle hours of delay*




Data sources and analysis: WSDOT Multimodal Planning Division and WSDOT Office of Strategic Assessment and Performance Analysis.

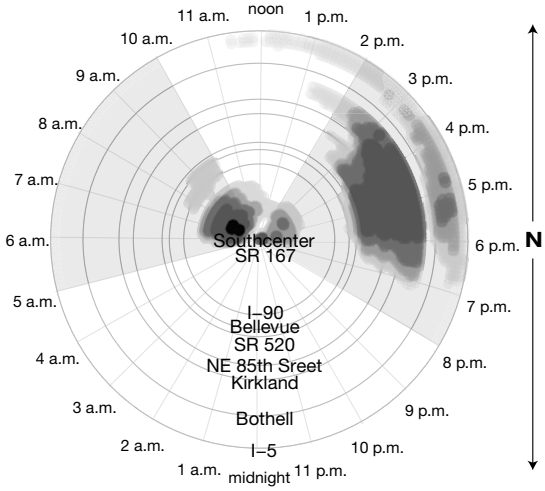
***A focus on hot spots:*** The percent of days that all I-405 corridor peak direction commutes operated in severely

**Severe congestion on the Bellevue to Tukwila commute**
*2012 and 2014; Southbound; Percent of days the average speed was slower than 36 mph*



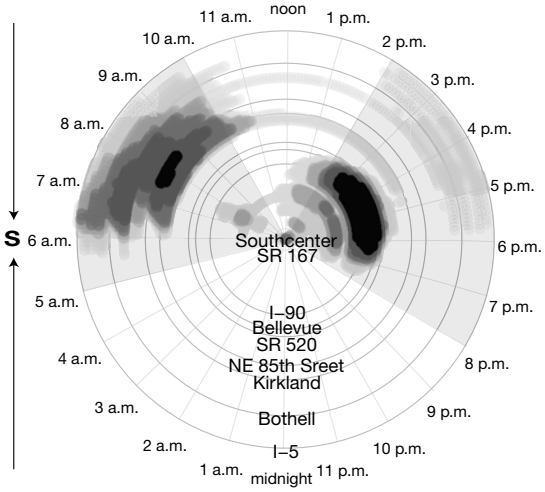

Data sources and analysis: WSDOT Northwest Region Traffic Office, Washington State Transportation Center and WSDOT Office of Strategic Assessment and Performance Analysis.

**I-405 delay between Tukwila and the Lynnwood I-5/I-405 interchange**
*2014; Weekdays only; Vehicle hours of delay; Shading represents intensity of delay*




In 2014, delay on northbound I-405 was most intense around SR 167 during the morning commute, but delay extended from SR 520 to I-5 during the majority of the evening commute. Delay on southbound I-405 was more widespread during the morning commute, but more intense during the evening commute. The most intense delay occured between SR 520 and I-90, and lasted from 2-7 p.m.

Spiral graphs are read by commute direction as indicated by the arrows. Northbound is read from the center of the circle to the outer edge; southbound from the outer edge of the circle to the center.

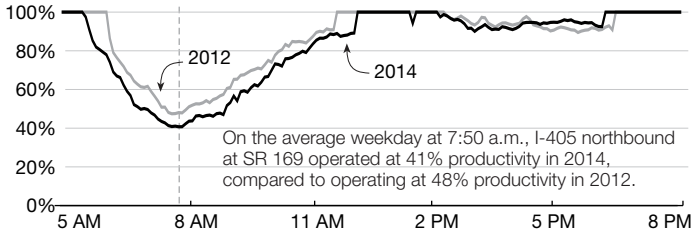



Data sources and analysis: Washington State Transportation Center and WSDOT Office of Strategic Assessment and Performance Analysis.

# Trip reliability on I-405 worsens by 11% since 2012

congested (36 mph) condition significantly worsened between 2012 and 2014, reaching up to 97% in 2014 (see congestion chart on p. 14). For example, at around 5 p.m. during the evening commute from Bellevue to Tukwila, the percent of days that speeds were below 36 mph increased from 92% in 2012 to 97% in 2014.

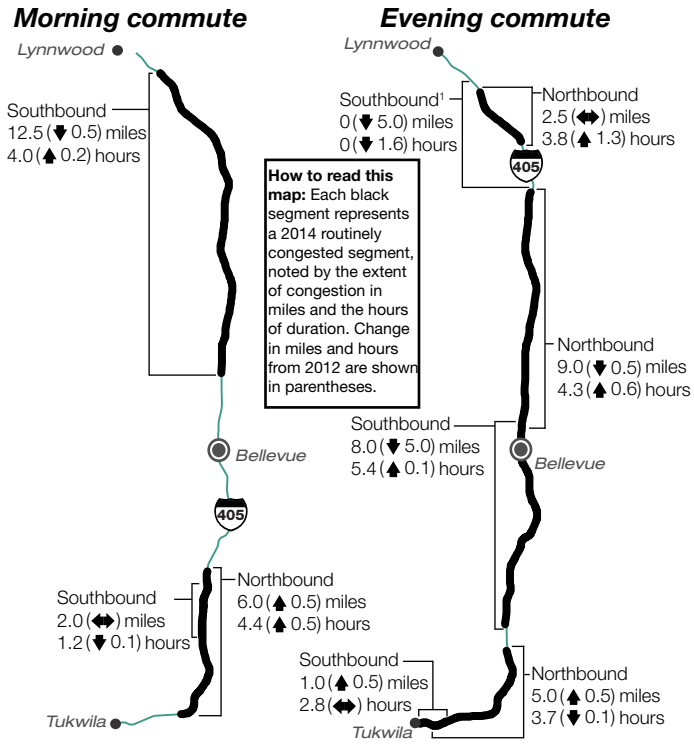
**Throughput on northbound I-405 at SR 169 near Renton**
*2012 and 2014; Based on the highest observed 5-minute flow rate; Northbound = 1,650 vehicles per hour per lane = 100%*




Data sources and analysis: WSDOT Multimodal Planning Division, Washington State Transportation Center and WSDOT Office of Strategic Assessment and Performance Analysis.

***Highway productivity:*** As traffic increases, congested roads carry fewer vehicles, resulting in a drop in throughput productivity at speeds slower than maximum throughput.

**Routinely congested segments of I-405**
*2014; For weekday morning (5-10 a.m.) and evening (2-8 p.m.) peak periods; Length of backup in miles; Daily duration of congestion in hours (compared to 2012).*




Data sources and analysis: Washington State Transportation Center and WSDOT Office of Strategic Assessment and Performance Analysis.
Notes: See pp. 7-8 in the Appendix for all RCS data. 1 Routinely congested segments (RCS) that dropped below 50 minutes in duration in 2014 from 2012 are shown with just a bracket.

In order to gauge the lost productivity on I-405 in the central Puget Sound region, WSDOT analyzed vehicle throughput at two locations: near SR 169 in Renton, and at NE 160th Street in Kirkland. In 2012 and 2014, productivity at these locations at their most congested ranged from 41% to 100%. The graph to the left shows how productivity varies by direction of travel, location and time of day in Renton.

***Routinely congested segments:*** Of the 58-mile I-405 corridor between Tukwila and Lynnwood (both directions), the segments leading to Bellevue experienced significant routine congestion. Overall, the locations where routine congestion occurred increased by 5.5 miles between 2012 and 2014, while the amount of time of routine congestion decreased by 3% (see map below left).

## *What does severe congestion mean for travel times on the corridor?*

***Single occupancy vehicle trips:*** Capacity constraints impacted the entire I-405 corridor between Tukwila and Lynnwood, but specifically near SR 169 in Renton, the I-90 interchange and the Kirkland-Bothell area. This resulted in increased average and reliable travel times during the morning and evening peak periods. The average travel time for I-405 commutes (Tukwila and Bellevue, Lynnwood and Bellevue) increased by up to six minutes (up 18%) in 2014 compared to 2012 while reliable travel time increased by up to seven minutes (up 11%).

Roughly 16 miles of the 29-mile commute route between Tukwila and Lynnwood experienced routine congestion. The greenhouse gas (GHG) emissions decreased by 3.5% in 2014 compared to 2012.

The Lynnwood to Bellevue and Tukwila to Bellevue morning commutes take about two-and-a-half times longer than they should when compared to traveling at 50 mph (maximum throughput speed). The maximum throughput travel time index (MT3I), which allows WSDOT to compare severity of congestion across commutes, shows that Lynnwood to Bellevue has the highest MT3I—2.41— of the eight commutes tracked on I-405 between Tukwila and Lynnwood.

***Transit trip travel times:*** Six of the eight commutes tracked on I-405 have transit travel time data. For example, in 2014 the average and reliable transit travel times for the I-405 commute from Tukwila to Bellevue in the morning were 51 and 57 minutes, respectively. For the return trip in the evening, average transit travel time was 57 minutes,

# I-405 transit use leads to 6% GHG emission reduction

while reliable travel time was 64 minutes. See p. 13 for a comparison of transit trips to SOV and HOV trips.

***Transit ridership and GHG emissions avoided:*** Transit moved approximately 2,930 people during the morning and evening peaks on an average weekday in 2014 and 2012. However, transit passenger miles traveled increased by 5% in the same time period. Transit ridership during peak periods means fewer cars on the road, which helps alleviate traffic congestion by making the most efficient use of available highway capacity. For example, transit ridership on I-405 from Lynnwood to Bellevue in the morning and the reverse trip, I-405 Bellevue to Lynnwood in the evening, saw ridership increase by 21% in 2014 (719 riders) compared to 2012 (594 riders).

Peak period transit ridership on the I-405 corridor in central Puget Sound was equal to approximately a quarter of an extra lane of capacity in 2014 (when compared to the peak efficiency of the roadway, which is a conservative approach to this measurement). Transit use during peak periods avoided 27,428 pounds of GHG emissions per day on the I-405 central Puget Sound corridor in 2014, a 6% improvement compared to 2012 (25,821 pounds). Transit routes on I-405 operated between 23% and 94% of their seating capacity during the morning and evening peak periods in 2014.

***Park and ride:*** Along the I-405 corridor in the central Puget Sound region in 2014, park and ride (P&R) utilization rates ranged from 77% to 107% depending on the location, with eight out of 11 having utilization rates above 95%. Any P&R lot that has 85% or more utilization is identified as operating at capacity. The availability of P&R spaces within the transit service network provides essential access points to transit riders. P&R locations need to have enough parking spaces and high utilization of those spaces to accommodate demand. A detailed review of P&R capacity and transit trip utilization rates by time of day could help ridership. Targeted outreach efforts from the transit agencies as well as employer initiatives to encourage participation in a Commute Trip Reduction program could also help address chronic highway capacity issues in the central Puget Sound region.

## *How much is congestion costing you?*

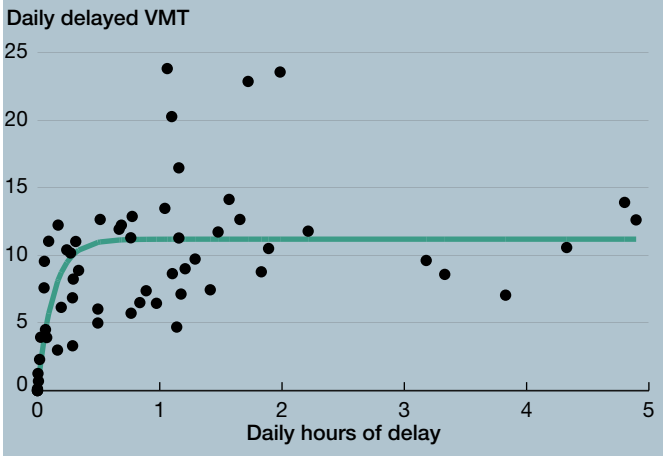
Commuters making roundtrips between Lynnwood and Bellevue, and Tukwila and Bellevue on I-405 took a hit to their wallets due to congestion in the central Puget Sound region. For example, the 32-mile roundtrip between Lynnwood and Bellevue claimed the highest cost due to congestion (measured in wasted time and gas), about $3,300 per commuter annually in 2014.

### Why was the delay increase significant while VMT only saw a slight increase?

Vehicle miles traveled (VMT) is an all day measure that fluctuates based on growth in driving population, job availability and other economic measures. Higher regional employment leads to more people commuting to work, which puts additional stress on the transportation system, lowering speeds and increasing delay.

**I-405 southbound delay increases, delayed VMT[1] fluctuates as threshold reached**

*2014; Daily hours of delay and daily delayed VMT in thousands*




Data sources and analysis: WSDOT Multimodal Planning Division and WSDOT Office of Strategic Assessment and Performance Analysis.

Note: 1 Delayed vehicle miles traveled (VMT) refers to VMT accrued when there is delay on the corridor.

Since delay is calculated when speeds are below 50 mph (threshold speed), WSDOT limited VMT to the same threshold, creating the measure of delayed VMT. Delayed VMT and vehicle hours of delay increase hand in hand until congestion becomes so severe that while delay continues to accumulate, delayed VMT begins to level off (see graph above). Vehicles record no additional VMT while delayed in traffic.

### New express tolling lanes to improve flow

WSDOT opened 17 miles of express toll lanes between Lynnwood and Bellevue in September 2015, which is expected to better manage demand and ease congestion.

Visit bit.ly/CCR15CentralSoundmap for this article's interactive map.

# State Route 520 Corridor Capacity Analysis

### Annual person miles traveled

| 2012 | vs. | 2014 | |
|---|---|---|---|
| 225.5 | | 227.7 | ▲ 1.0% |

in millions of miles

### Annual vehicle delay[1]

| 2012 | vs. | 2014 | |
|---|---|---|---|
| 94.7 | | 165.2 | ▲ 74% |

in thousands of hours

### Annual GHG emissions

| 2012 | vs. | 2014 | |
|---|---|---|---|
| 219.1 | | 222.7 | ▲ 1.7% |

in millions of pounds of $CO_2$ equivalents

### Annual passenger miles traveled on transit

| 2012 | vs. | 2014 | |
|---|---|---|---|
| 56.6 | | 60.4 | ▲ 6.7% |

in millions of miles

### Capacity savings due to transit

| 2012 | vs. | 2014 | |
|---|---|---|---|
| 2.1 | | 2.2 | ▲ 6.7% |

in number of lanes

### Percent transit seats occupied

| 2012 | vs. | 2014 | |
|---|---|---|---|
| 84% | | 94% | ▲ 10% |

on average during peak periods

### Percent park and ride spaces occupied

| 2012 | vs. | 2014 | |
|---|---|---|---|
| 92% | | 89% | ▼ 3% |

on average during peak periods

## Commute travel times

See Appendix pp. 5-21 for more commute routes

*2012 and 2014 during the morning (5-10 a.m) and evening (2-8 p.m.) peak periods; Weekday travel times in minutes at the 5-minute peak including average and reliable[2] travel times for single occupant vehicle (SOV), high occupancy vehicle (HOV) and transit[3] trips.*

Average SOV · Reliable SOV · Average HOV · Reliable HOV · Average transit · Reliable transit · Planned transit[4]

### *Bellevue to Seattle*

Morning; 8:35 a.m.; Trip length 10 miles

| | 2012 | 2014 |
|---|---|---|
| SOV | 15 / 19 | 17 / 25 |
| HOV | 15 / 18 | 17 / 23 |
| Transit | 26 | 27 / 28 |

### *Seattle to Bellevue*

Evening; 5:35 p.m.; Trip length 10 miles

| | 2012 | 2014 |
|---|---|---|
| SOV | 17 / 24 | 17 / 24 |
| HOV | N/A | |
| Transit | 28 | 26 / 26 |

### *Redmond to Seattle*

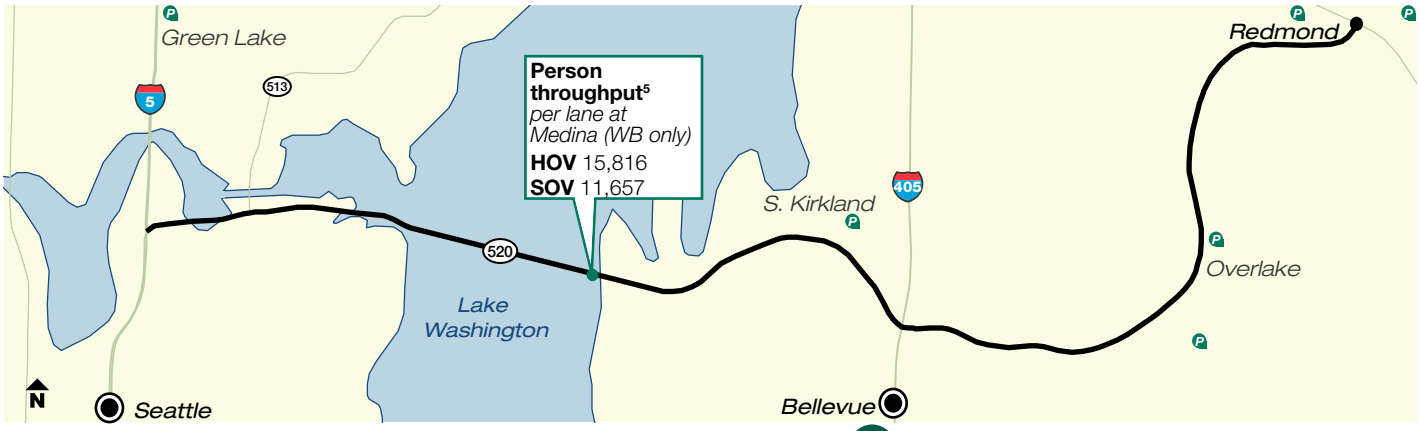
Morning; 8:35 a.m.; Trip length 13 miles

| | 2012 | 2014 |
|---|---|---|
| SOV | 18 / 22 | 20 / 26 |
| HOV | 19 / 23 | 23 / 30 |
| Transit | 29 | 29 / 30 |

### *Seattle to Redmond*

Evening; 5:35 p.m.; Trip length 13 miles

| | 2012 | 2014 |
|---|---|---|
| SOV | 17 / 22 | 18 / 24 |
| HOV | 16 / 21 | 18 / 22 |
| Transit | 31 | 29 / 30 |




## Transit system use

*2012 and 2014; For typical weekday morning (6-9 a.m.) and evening (3-6 p.m.) transit[3] peak periods; Ridership and percent of available seats occupied on select commutes*

### *By commute*

| | Daily peak period riders | | Percent of seats occupied | |
|---|---|---|---|---|
| **Morning** (6-9 a.m.) | 2012 | 2014 | 2012 | 2014 |
| Redmond to Seattle | 6,117 | 6,589 | 98% | 105% |
| Seattle to Redmond | 2,880 | 2,953 | 84% | 88% |
| Bellevue to Seattle | 1,330 | 1,363 | 81% | 88% |
| **Evening** (3-6 p.m.) | | | | |
| Seattle to Redmond | 6,084 | 6,558 | 95% | 109% |
| Redmond to Seattle | 3,056 | 3,131 | 86% | 95% |
| Seattle to Bellevue | 1,545 | 1,602 | 88% | 92% |

## Park and ride capacity

*2012 and 2014; Average percent occupied for select park and rides (see map for locations); Rates over 100% denote vehicles parked in unmarked space*

### *Seattle-Bellevue commute*

| Park and ride (spaces) | 2012 percent occupied | 2014 percent occupied |
|---|---|---|
| Greenlake (411) | 93% | 100% |
| South Kirkland (783) | 100% | 82% |

### *Redmond-Bellevue commute*

| Park and ride (spaces) | 2012 percent occupied | 2014 percent occupied |
|---|---|---|
| Bear Creek (283) | 100% | 106% |
| Overlake Transit Center (222) | 100% | 102% |
| Redmond (377) | 91% | 99% |
| Overlake (203) | 41% | 39% |

Data sources and analysis: Washington State Transportation Center, WSDOT Multimodal Planning Division, WSDOT Northwest Region Traffic Office, Sound Transit, Pierce Transit, King County Metro, Community Transit and WSDOT Office of Strategic Assessment and Performance Analysis.

Notes: Measures at the top of the page are for SOV trips only on the SR 520 corridor between Seattle and Redmond. 1 WSDOT defines delay as when average speeds are slower than 85% of the posted speed limit. 2 Reliable travel time will get commuters to their destination on time 19 out of 20 weekdays (95% of the time). 3 Transit travel times by bus include some off-highway travel to stops and may not be directly comparable to SOV/HOV times which are highway only. 4 Planned transit travel time is used when average and reliable transit travel time data is not available. 5 Person throughput values include morning (6-9 a.m.) and evening (3-7 p.m.) traffic.

# SR 520 evening severe congestion starts an hour earlier

State Route 520 (SR 520) is one of the key commute and economic corridors connecting I-5 and I-405 in the central Puget Sound region and runs parallel to I-90 across Lake Washington. Almost 228 million person miles were traveled on the corridor in 2014, a 1% increase over 2012. The Evergreen Point Floating Bridge portion of SR 520 is tolled in both directions. The westbound high occupancy vehicle (HOV) lane at Medina on this corridor moved 36% more people than each adjacent single occupancy vehicle (SOV) lane.

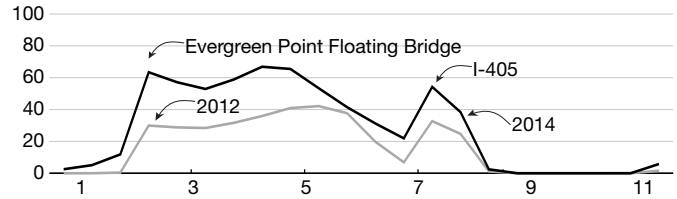
Despite this efficiency, traffic at specific locations on the corridor worsened from 2012 to 2014, with morning and evening weekday commutes experiencing moderate to heavy congestion on a daily basis. Delay increased by up to 74% on SR 520 between Seattle and Redmond. Freeway segments on the Evergreen Point Floating Bridge and near the SR 520 interchange with I-405 contributed to the significant delay increases in 2014 compared to 2012. In addition to delaying commuters, this congestion directly impacted the movement of goods in Washington as trucks accounted for 4% of the total daily traffic volume on the corridor in 2014.

***Corridor delay:*** The SR 520 corridor in the central Puget Sound region between Seattle and Redmond experienced vehicle delay in 2014 compared to 2012 at varying magnitudes depending on the location and direction of travel (see graph at top right). The amount of delay significantly increased between 2012 and 2014 at specific locations on the SR 520 corridor including: in both directions on the Evergreen Point Floating Bridge (up 72%) and westbound near the I-405 interchange (up 78%). The spiral chart at the bottom of the page shows westbound delay between Lake Washington and I-405 increased both in intensity and duration. For a detailed 2012 and 2014 comparison see Appendix p. 14.

***A focus on hot spots:*** Commuters driving between Bellevue and Seattle drove in severely congested conditions (36 mph or less) more often in 2014 than in 2012. Although westbound severe congestion ended around

**Delay along the SR 520 corridor by milepost**

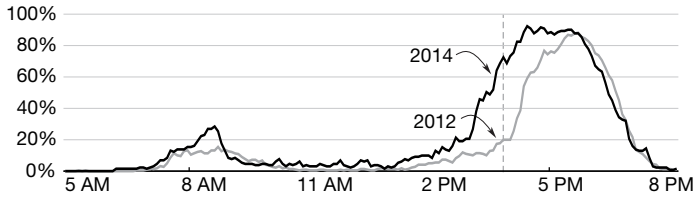
*2012 and 2014; Eastbound and westbound combined; Average daily vehicle hours of delay*




Data sources and analysis: WSDOT Multimodal Planning Division and WSDOT Office of Strategic Assessment and Performance Analysis.

**Severe congestion on the SR 520 Bellevue to Seattle commute**

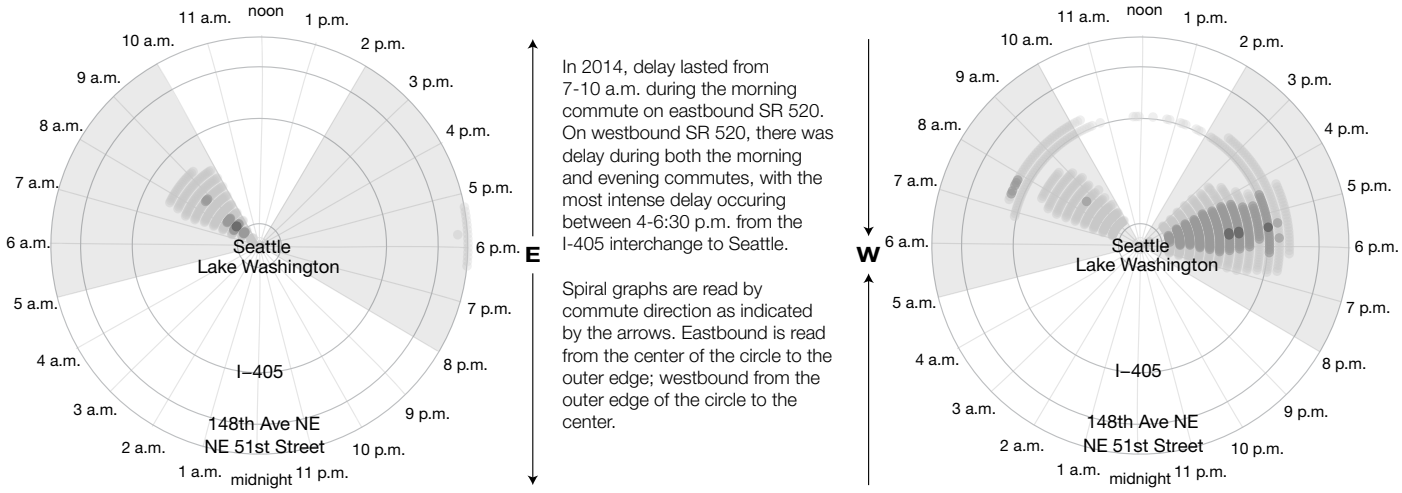
*2012 and 2014; Westbound; Percent of days the average speed was slower than 36 mph*




Data sources and analysis: WSDOT Northwest Region Traffic Office, Washington State Transportation Center and WSDOT Office of Strategic Assessment and Performance Analysis.

**SR 520 delay between Seattle and Redmond**

*2014; Weekdays only; Vehicle hours of delay; Shading represents intensity of delay*




In 2014, delay lasted from 7-10 a.m. during the morning commute on eastbound SR 520. On westbound SR 520, there was delay during both the morning and evening commutes, with the most intense delay occuring between 4-6:30 p.m. from the I-405 interchange to Seattle.

Spiral graphs are read by commute direction as indicated by the arrows. Eastbound is read from the center of the circle to the outer edge; westbound from the outer edge of the circle to the center.

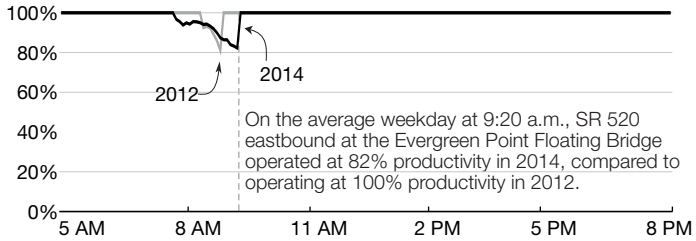
Data sources and analysis: Washington State Transportation Center and WSDOT Office of Strategic Assessment and Performance Analysis.

# SR 520 bridge efficiency dips during morning peak

the same time in both 2012 and 2014, it started an hour earlier during the evening peak period in 2014. Between 3 p.m. and 6 p.m., most weekday commuters experienced speeds well below 36 mph (see graph on previous page). For example, at 3 p.m. during the evening commute from Bellevue to Seattle, the percent of days that speeds were below 36 mph increased from 20% in 2012 to 69% in 2014.

**Throughput on eastbound SR 520 at the Evergreen Point Floating Bridge**

*2012 and 2014; Based on the highest observed 5-minute flow rate; Eastbound = 1,600 vehicles per hour per lane = 100%*




Data sources and analysis: WSDOT Multimodal Planning Division, Washington State Transportation Center and WSDOT Office of Strategic Assessment and Performance Analysis.

***Highway productivity:*** As traffic increases, congested roads carry fewer vehicles, resulting in a drop in throughput productivity at speeds slower than maximum throughput. In order to gauge the lost productivity on SR 520 in the central Puget Sound region, WSDOT analyzed vehicle throughput at the Evergreen Point Floating Bridge across Lake Washington. In 2012 and 2014, productivity at this location at its most congested ranged from 81% to 100% (see graph below left).

***Routinely congested segments:*** Of the approximately 26-mile SR 520 corridor between Seattle and Redmond (both directions), the segments on SR 520 between the I-5 and I-405 interchanges contributed to the most routine congestion. Overall, the locations where routine congestion occurred decreased by 2.5 miles between 2012 and 2014, while the amount of time of routine congestion decreased by 7%.

## *What does severe congestion mean for travel times on the corridor?*

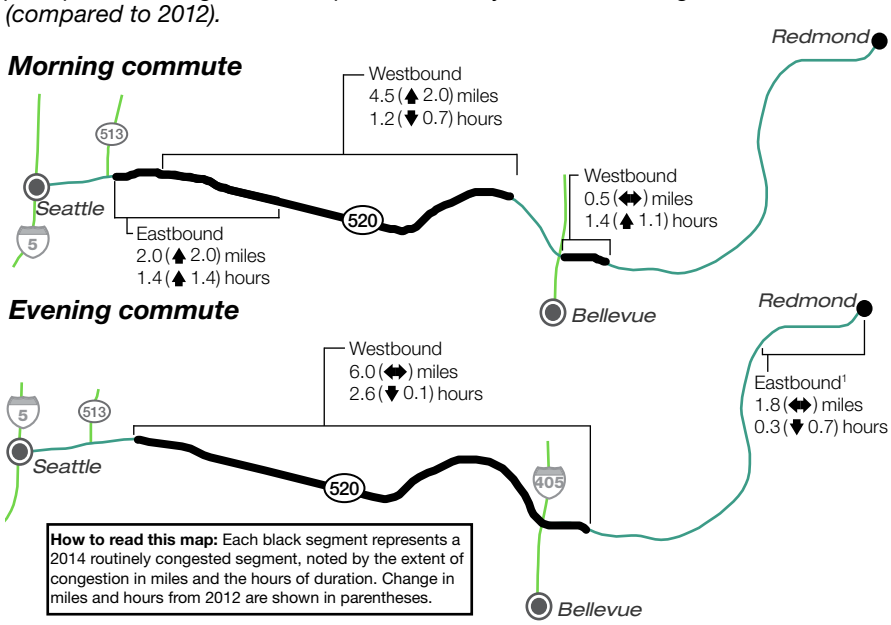
***Single occupancy vehicle trips:*** Capacity constraints impacted the SR 520 corridor between Seattle and Redmond specifically between the I-5 interchange in west Seattle and the I-405 interchange in Bellevue. This resulted in increased average and reliable travel times during the morning and evening peak periods. The average travel time for the morning SR 520 commute from Seattle to Bellevue increased by three minutes (up 20%) in 2014 compared to 2012 while reliable travel time increased by four minutes (up 18%).

Roughly 11 miles of the approximately 26-mile corridor (both directions) between Seattle and Redmond experienced routine congestion in 2014, a 19% decrease compared to 13.5 miles of routine congestion in 2012. The corridor-wide greenhouse gas (GHG) emissions increased by almost 2% in 2014 compared to 2012.

The Redmond to Seattle evening commute takes more than two times longer than it should when compared to traveling at 50 mph (maximum throughput speed). The maximum throughput travel time index (MT3I), which allows WSDOT to compare severity of congestion across commutes, shows that the Redmond to Bellevue evening commute has the highest MT3I—2.57— of the 12 commutes tracked on SR 520 between Seattle, Bellevue and Redmond.

**Routinely congested segments of SR 520**

*2014; For weekday morning (5-10 a.m.) and evening (2-8 p.m.) peak periods; Length of backup in miles; Daily duration of congestion in hours (compared to 2012).*




Data sources and analysis: Washington State Transportation Center and WSDOT Office of Strategic Assessment and Performance Analysis.

Notes: See pp. 7-8 in the Appendix for all RCS data. 1 Routinely congested segments (RCS) that dropped below 50 minutes in duration in 2014 from 2012 are shown with just a bracket.

# Transit makes efficient use of SR 520 capacity

***Transit trip travel times:*** All 12 commutes tracked on SR 520 have transit travel time data. For example, in 2014 the average and reliable transit travel times for the SR 520 commute from Seattle to Bellevue in the morning were 14 and 21 minutes, respectively. For the return trip in the evening, both the average and reliable transit travel time was 17 minutes. See p. 17 for a comparison of transit trips to SOV and HOV trips.

***Transit ridership and GHG emissions avoided:*** Transit moved 25,434 people during the morning and evening peaks on an average weekday in 2014, a 7% increase from 2012 (23,835 riders). On a similar note, daily transit passenger miles traveled increased by 7% in 2014 (231,493 miles) compared to 2012 (216,881 miles). Transit ridership during peak periods means fewer cars on the road, which helps alleviate traffic congestion by making the most efficient use of available highway capacity.

Peak period transit ridership on the SR 520 corridor in central Puget Sound was equal to more than two extra lanes of capacity in 2014 (when compared to the peak efficiency of the roadway, which is a conservative approach to this measurement). Transit use during peak periods avoided 119,708 pounds of GHG emissions per day on the SR 520 central Puget Sound corridor in 2014, a 9% improvement compared to 2012 (109,615 pounds). Transit routes on SR 520 operated between 18% and 109% of their seating capacity during the morning and evening peak periods in 2014.

***Park and ride:*** Along the SR 520 corridor in the central Puget Sound region in 2014, park and ride (P&R) utilization rates ranged between 39% and 106% depending on the location, with four out of six having utilization rates above 95%. Any P&R lot that has 85% or more utilization is identified as operating at capacity. The availability of P&R spaces within the transit service network provides essential access points to transit riders. P&R locations need to have enough parking spaces and high utilization of those spaces to accommodate demand. A detailed review of P&R capacity and transit trip utilization rates by time of day could help ridership. Targeted outreach efforts from the transit agencies as well as employer initiatives to encourage participation in a Commute Trip Reduction program could also help address chronic highway capacity issues in the central Puget Sound region.

## *How much is congestion costing you?*

Single occupant vehicle commuters making trips between Seattle and Redmond paid tolls to speed up the portion of the roundtrip across the Evergreen Point Floating Bridge compared to pre-tolling years. For the remaining 12 miles of the trip east of the bridge (between Bellevue and Redmond), the additional cost due to congestion (measured in wasted time and gas) was $650 or less per commuter annually in 2014, depending on the direction of travel.

Visit bit.ly/CCR15CentralSoundmap for this article's interactive map.

# Interstate 90 Corridor Capacity Analysis

### Annual person miles traveled

| 2012 | vs. | 2014 |
|---|---|---|
| 496.5 | | 501.1 |

in millions of miles — ▲ 0.9%

### Annual vehicle delay[1]

| 2012 | vs. | 2014 |
|---|---|---|
| 197.3 | | 277.7 |

in thousands of hours — ▲ 41%

### Annual GHG emissions

| 2012 | vs. | 2014 |
|---|---|---|
| 611.0 | | 609.8 |

in millions of pounds of $CO_2$ equivalents — ▼ 0.2%

### Annual passenger miles traveled on transit

| 2012 | vs. | 2014 |
|---|---|---|
| 51.5 | | 52.7 |

in millions of miles — ▲ 2.2%

### Capacity savings due to transit

| 2012 | vs. | 2014 |
|---|---|---|
| 1.7 | | 1.8 |

in number of lanes — ▲ 7.6%

### Percent transit seats occupied

| 2012 | vs. | 2014 |
|---|---|---|
| 109% | | 118% |

on average during peak periods — ▲ 9%

### Percent park and ride spaces occupied

| 2012 | vs. | 2014 |
|---|---|---|
| 93% | | 96% |

on average during peak periods — ▲ 3%

## Commute travel times

See Appendix pp. 5-21 for more commute routes

*2012 and 2014 during the morning (5-10 a.m) and evening (2-8 p.m.) peak periods; Weekday travel times in minutes at the 5-minute peak including average and reliable[2] travel times for single occupant vehicle (SOV), high occupancy vehicle (HOV) and transit[3] trips.*

Average SOV · Reliable SOV · Average HOV · Reliable HOV · Average transit · Reliable transit · Planned transit[4]

### *Bellevue to Seattle*

Morning; 8:25 a.m.; Trip length 10 miles

| | 2012 | 2014 |
|---|---|---|
| SOV | 17 / 24 | 19 / 26 |
| HOV | 13 / 17 | 14 / 18 |
| Transit | 26 | 27 / 28 |

### *Seattle to Bellevue*

Evening; 5:25 p.m.; Trip length 11 miles

| | 2012 | 2014 |
|---|---|---|
| SOV | 18 / 29 | 17 / 29 |
| HOV | 12 / 21 | 12 / 18 |
| Transit | 25 | 26 / 26 |

### *Issaquah to Seattle*

Morning; 7:40 a.m.; Trip length 15 miles

| | 2012 | 2014 |
|---|---|---|
| SOV | 26 / 40 | 29 / 42 |
| HOV | 17 / 22 | 19 / 23 |
| Transit | 26 | 28 / 31 |

### *Seattle to Issaquah*

Evening; 5:25 p.m.; Trip length 16 miles

| | 2012 | 2014 |
|---|---|---|
| SOV | 23 / 34 | 22 / 33 |
| HOV | 17 / 26 | 16 / 22 |
| Transit | 29 | 22 / 24 |

## Transit system use

*2012 and 2014; For typical weekday morning (6-9 a.m.) and evening (3-6 p.m.) transit[3] peak periods; Ridership and percent of available seats occupied on select commutes*

### *By commute*

| | Daily peak period riders | | Percent of seats occupied | |
|---|---|---|---|---|
| **Morning** (6-9 a.m.) | 2012 | 2014 | 2012 | 2014 |
| Issaquah to Seattle | 4,303 | 4,580 | 99% | 116% |
| Bellevue to Seattle | 3,176 | 3,232 | 120% | 115% |
| Issaquah to Bellevue | 370 | 447 | 106% | 110% |
| **Evening** (3-6 p.m.) | | | | |
| Seattle to Issaquah | 4,248 | 4,838 | 108% | 129% |
| Seattle to Bellevue | 3,376 | 3,620 | 130% | 121% |
| Bellevue to Seattle | 1,376 | 1,439 | 132% | 131% |

## Park and ride capacity

*2012 and 2014; Average percent occupied for select park and rides (see map for locations); Rates over 100% denote vehicles parked in unmarked space*

### *Seattle-Bellevue commute*

| Park and ride (spaces) | 2012 percent occupied | 2014 percent occupied |
|---|---|---|
| South Bellevue (519) | 100% | 107% |
| Mercer Island (447) | 100% | 100% |

### *Issaquah-Bellevue commute*

| Park and ride (spaces) | 2012 percent occupied | 2014 percent occupied |
|---|---|---|
| Eastgate (1,614) | 93% | 99% |
| Issaquah Transit Center (819) | 96% | 93% |
| Issaquah Highlands (1,010) | 86% | 87% |

Data sources and analysis: Washington State Transportation Center, WSDOT Multimodal Planning Division, WSDOT Northwest Region Traffic Office, Sound Transit, King County Metro, Community Transit and WSDOT Office of Strategic Assessment and Performance Analysis.

Notes: Measures at the top of the page are for the I-90 corridor between Seattle and Issaquah for SOV trips only. 1 WSDOT defines delay as when average speeds are slower than 85% of the posted speed limit. 2 Reliable travel time will get commuters to their destination on time 19 out of 20 weekdays (95% of the time). 3 Transit travel times by bus include some off-highway travel to stops and may not be directly comparable to SOV/HOV times which are highway only. 4 Planned transit travel time is used when average and reliable transit travel time data is not available. 5 Person throughput values include morning (6-9 a.m.) and evening (3-7 p.m.) traffic.

# Westbound delay near Eastgate increases 96%

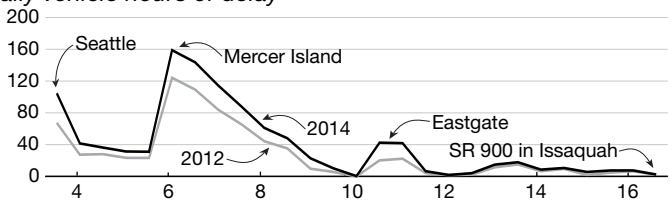
Interstate 90 (I-90) is one of the key commute and economic corridors connecting I-5 and I-405 in the central Puget Sound region and runs parallel to SR 520 across Lake Washington. More than 501 million person miles were traveled on the corridor in 2014, nearly a 1% increase over 2012. The I-90 floating bridge is the non-tolled alternative to SR 520 across Lake Washington. The high occupancy vehicle (HOV) lane on the floating bridge west of Mercer Island moves 3% more people and the HOV lane in Issaquah carries 34% more people than each adjacent single occupancy vehicle (SOV) lane.

Despite this efficiency, traffic at specific locations on the corridor worsened from 2012 to 2014, with morning and evening weekday commutes experiencing moderate to heavy congestion on a daily basis. Delay increased by up to 41% on I-90 between Seattle and Issaquah. Westbound freeway segments on Mercer Island contributed to the significant delay increases in 2014 compared to 2012. In addition to delaying commuters, this congestion directly impacted the movement of goods in Washington as trucks accounted for 6% of the total daily traffic volume on the corridor in 2014.

***Corridor delay:*** The I-90 corridor in the central Puget Sound region between Seattle and Issaquah experienced vehicle delay in 2014 compared to 2012 at varying magnitudes depending on the location and direction of travel (see graph above right). The amount of delay significantly increased between 2012 and 2014 at specific locations on the westbound I-90 corridor including: Eastgate (up 96%), Mercer Island (up 34%) and the floating bridge (up 33%). The spiral chart at the bottom of the page shows significant delay on the I-90 corridor, especially in the westbound direction.

**Delay along the I-90 corridor by milepost**

*2012 and 2014; Eastbound and westbound combined; Average daily vehicle hours of delay*

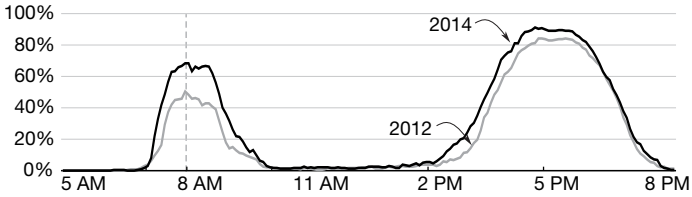



Data sources and analysis: WSDOT Multimodal Planning Division and WSDOT Office of Strategic Assessment and Performance Analysis.

***A focus on hot spots:*** Commuters driving between Bellevue and Seattle via I-90 drove in severely congested conditions (36 mph or less) more often in 2014 than in 2012, with up to a 90% likelihood at certain times of the day in 2014. Between 3-6 p.m., most weekday commuters experienced speeds well below 36 mph (see graph below). For example, at around 8 a.m.

**Severe congestion on the I-90 Bellevue to Seattle commute**

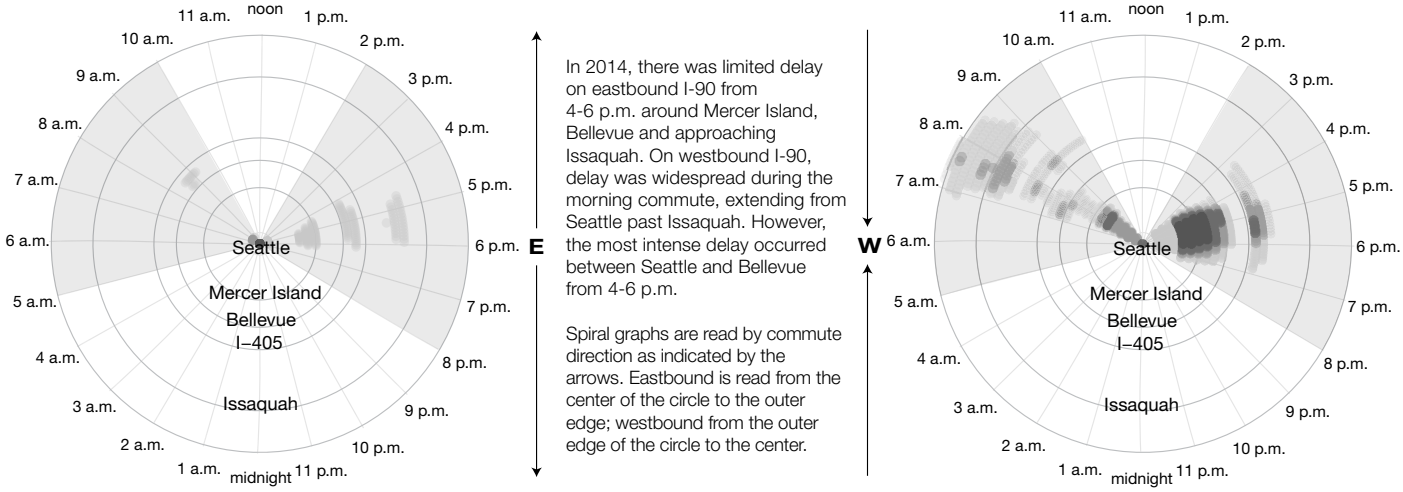
*2012 and 2014; Westbound; Percent of days the average speed was slower than 36 mph*




Data sources and analysis: WSDOT Northwest Region Traffic Office, Washington State Transportation Center and WSDOT Office of Strategic Assessment and Performance Analysis.

**I-90 delay between Seattle and Issaquah**

*2014; Weekdays only; Vehicle hours of delay; Shading represents intensity of delay*




In 2014, there was limited delay on eastbound I-90 from 4-6 p.m. around Mercer Island, Bellevue and approaching Issaquah. On westbound I-90, delay was widespread during the morning commute, extending from Seattle past Issaquah. However, the most intense delay occurred between Seattle and Bellevue from 4-6 p.m.

Spiral graphs are read by commute direction as indicated by the arrows. Eastbound is read from the center of the circle to the outer edge; westbound from the outer edge of the circle to the center.

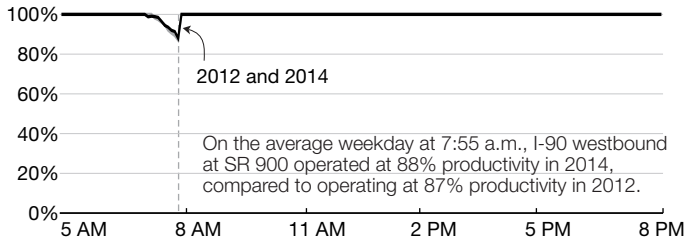
Data sources and analysis: Washington State Transportation Center and WSDOT Office of Strategic Assessment and Performance Analysis.

# I-90 capacity constrained near Mercer Island, Eastgate

during the morning commute from Bellevue to Seattle, the percent of days that speeds were below 36 mph increased from 50% in 2012 to 68% in 2014.

***Highway productivity:*** As traffic increases, congested roads carry fewer vehicles, resulting in a drop in throughput productivity at speeds slower than maximum throughput. In order to gauge the lost productivity on I-90 in the central Puget Sound region, WSDOT analyzed vehicle throughput at the I-90 floating bridge across Lake Washington. In 2012 and 2014, productivity at this location at its most congested ranged from 87% to 100% (see graph below).

**Throughput on westbound I-90 at SR 900**
*2012 and 2014; Based on the highest observed 5-minute flow rate; Westbound = 1,580 vehicles per hour per lane = 100%*



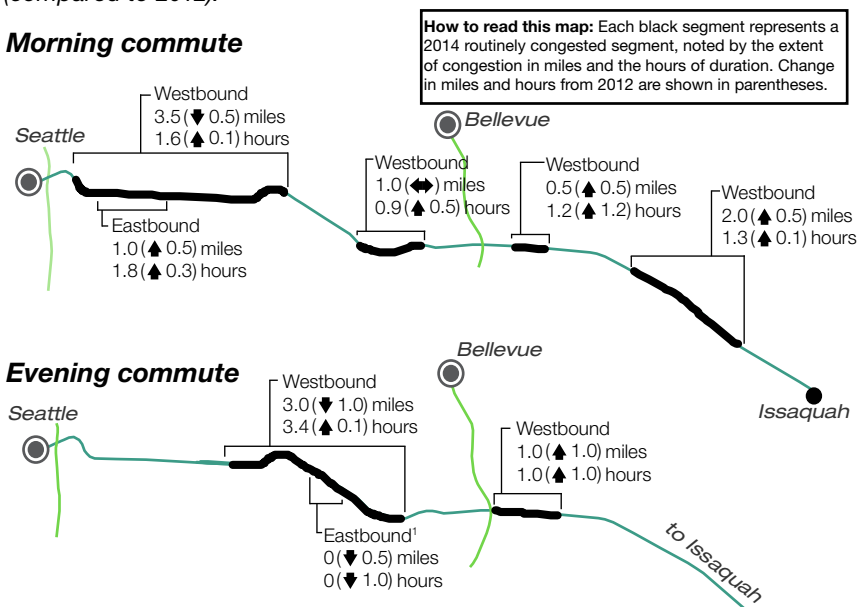

Data sources and analysis: WSDOT Multimodal Planning Division, Washington State Transportation Center and WSDOT Office of Strategic Assessment and Performance Analysis.

***Routinely congested segments:*** Of the approximately 30-mile I-90 corridor between Seattle and Issaquah (both directions), the segments on the I-90 floating bridge, Mercer Island and in the Eastgate area contribute to the most routine congestion. Overall, the locations where routine congestion occurred remained the same at 13 miles for 2012 and 2014, while the amount of time of routine congestion decreased by 18%.

## *What does severe congestion mean for travel times on the corridor?*

***Single occupancy vehicle trips:*** Capacity constraints impacted the I-90 corridor between Seattle and Issaquah specifically in the westbound direction near Mercer Island and the Eastgate area. This resulted in increased average and reliable travel times during the morning and evening peak periods. The average travel time for the morning I-90 commute from Bellevue to Seattle increased by two minutes (up 12%) in 2014 compared to 2012 while reliable travel time increased by two minutes (up 8%). On the other hand, the average travel time for the evening commute from Seattle to Bellevue improved by one minute in 2014 compared to 2012 while reliable travel time remained at 29 minutes.

**Routinely congested segments of I-90**
*2014; For weekday morning (5-10 a.m.) and evening (2-8 p.m.) peak periods; Length of backup in miles; Daily duration of congestion in hours (compared to 2012).*




Data sources and analysis: Washington State Transportation Center and WSDOT Office of Strategic Assessment and Performance Analysis.
Notes: See pp. 7-8 in the Appendix for all RCS data. 1 Routinely congested segments (RCS) that dropped below 50 minutes in duration in 2014 from 2012 are shown with just a bracket.

Roughly 13 miles of the approximately 30-mile corridor (both directions) between Seattle and Issaquah experienced routine congestion, which remained unchanged from 2012. The corridor-wide greenhouse gas (GHG) emissions decreased by approximately 0.2% in 2014 compared to 2012.

The Issaquah to Seattle morning commute takes 54% longer and the reverse evening commute takes 17% longer than they should when compared to traveling at 50 mph (maximum throughput speed). The maximum throughput travel time index (MT3I), which allows WSDOT to compare severity of congestion across commutes, shows that the Bellevue to Seattle evening commute has the highest MT3I—2.37—of the 12 commutes tracked on I-90 between Seattle, Bellevue and Issaquah.

***Transit trip travel times:*** Ten of the 12 commutes tracked on I-90 have

# All five I-90 park and rides operating at capacity

transit travel time data. For example, in 2014 the average and reliable transit travel times for the I-90 commute from Seattle to Bellevue in the morning were 27 and 28 minutes, respectively. For the return trip in the evening, both the average and reliable transit travel time was 26 minutes. See p. 21 for a comparison of transit trips to SOV and HOV trips.

***Transit ridership and GHG emissions avoided:*** Transit moved 21,241 people during the morning and evening peaks on an average weekday in 2014, an 8% increase from 2012 (19,745 riders). On a similar note, daily transit passenger miles traveled increased by 2% in 2014 (201,854 miles) compared to 2012 (197,477 miles). Transit ridership during peak periods means fewer cars on the road, which helps alleviate traffic congestion by making the most efficient use of available highway capacity.

Peak period transit ridership on the I-90 corridor in central Puget Sound was equal to nearly two extra lanes of capacity in 2014 (when compared to the peak efficiency of the roadway, which is a conservative approach to this measurement). Transit use during peak periods avoided 107,101 pounds of GHG emissions per day on the I-90 central Puget Sound corridor in 2014, a 4% improvement compared to 2012 (102,802 pounds). Transit routes on I-90 operated between 99% and 132% of their seating capacity during the morning and evening peak periods in 2014.

***Park and ride:*** Along the I-90 corridor in the central Puget Sound region in 2014, park and ride (P&R) utilization rates ranged between 87% and 107% depending on the location. Any P&R lot that has 85% or more utilization is identified as operating at capacity. The availability of P&R spaces within the transit service network provides essential access points to transit riders. P&R locations need to have enough parking spaces and high utilization of those spaces to accommodate demand. A detailed review of P&R capacity and transit trip utilization rates by time of day could help ridership. Targeted outreach efforts from the transit agencies as well as employer initiatives to encourage participation in a Commute Trip Reduction program could also help address chronic highway capacity issues in the central Puget Sound region.

## *How much is congestion costing you?*

Commuters making roundtrips between Seattle and Bellevue, and Seattle and Issaquah on I-90 took a hit to their wallets due to congestion in the central Puget Sound region. For example, each commuter making roundtrips between Seattle and Bellevue using I-90, the non-tolled, cross-lake alternative to SR 520, paid approximately $1,525 annually in 2014 due to congestion (measured in wasted time and gas).

Visit bit.ly/CCR15CentralSoundmap for this article's interactive map.

# State Route 167 Corridor Capacity Analysis

## Annual person miles traveled

| 2012 | vs. | 2014 |
|---|---|---|
| 305.6 | | 304.3 |

in millions of miles

0.5%

## Annual vehicle delay[1]

| 2012 | vs. | 2014 |
|---|---|---|
| 174.6 | | 225.2 |

in thousands of hours

29%

## Annual GHG emissions

| 2012 | vs. | 2014 |
|---|---|---|
| 265.4 | | 261.3 |

in millions of pounds of $CO_2$ equivalents

1.6%

### Annual passenger miles traveled on transit

| 2012 | vs. | 2014 |
|---|---|---|
| 6.0 | | 5.6 |

in millions of miles

6.5%

### Capacity savings due to transit

| 2012 | vs. | 2014 |
|---|---|---|
| 0.2 | | 0.2 |

in number of lanes

0%

### Percent transit seats occupied

| 2012 | vs. | 2014 |
|---|---|---|
| 51% | | 52% |

on average during peak periods

1%

### Percent park and ride spaces occupied

| 2012 | vs. | 2014 |
|---|---|---|
| 77% | | 81% |

on average during peak periods

4%

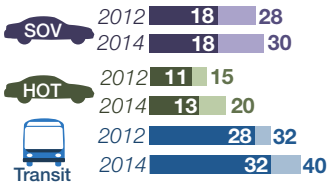
## Commute travel times

*2012 and 2014 during the morning (5-10 a.m) and evening (2-8 p.m.) peak periods; Weekday travel times in minutes at the 5-minute peak including average and reliable[2] travel times for single occupant vehicle (SOV), high occupancy vehicle (HOT) and transit[3] trips.*

Average SOV · Average HOT · Average transit
Reliable SOV · Reliable HOT · Reliable transit

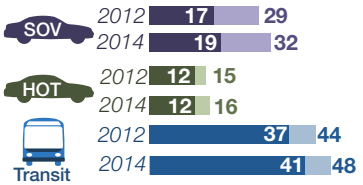
### *Auburn to Renton*

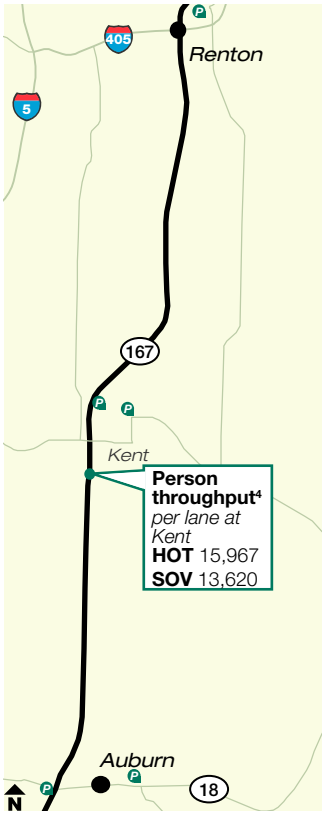
Morning; 7:45 a.m.; Trip length 10 miles




### *Renton to Auburn*

Evening; 3:45 p.m.; Trip length 10 miles




## Transit system use

*2012 and 2014; For typical weekday morning (6-9 a.m.) and evening (3-6 p.m.) transit[3] peak periods; Ridership and percent of available seats occupied on select commutes*

### *By commute*

| | Daily peak period riders | | Percent of seats occupied | |
|---|---|---|---|---|
| **Morning** (6-9 a.m.) | **2012** | **2014** | **2012** | **2014** |
| Auburn to Renton | 1,108 | 984 | 49% | 51% |
| **Evening** (3-6 p.m.) | | | | |
| Renton to Auburn | 1,306 | 1,205 | 53% | 53% |

## Park and ride capacity

*2012 and 2014; Average percent occupied for select park and rides (see map for locations)*

### *Auburn-Renton commute*

| Park and ride (spaces) | 2012 percent occupied | 2014 percent occupied |
|---|---|---|
| Auburn Station (633) | 99% | 100% |
| South Renton (373) | 98% | 100% |
| Kent area (996) | 97% | 98% |
| Renton (150) | 96% | 98% |
| Renton Municipal (200) | 90% | 96% |
| Peasley Canyon (54) | 89% | 84% |
| Auburn (244) | 48% | 65% |
| Kent/James Street (713) | 21% | 29% |

Data sources and analysis: Washington State Transportation Center, WSDOT Multimodal Planning Division, WSDOT Northwest Region Traffic Office, Sound Transit, Pierce Transit, King County Metro, Community Transit and WSDOT Office of Strategic Assessment and Performance Analysis.

Notes: Measures at the top of the page are for SOV trips only on the SR 167 corridor between Auburn and Renton. 1 WSDOT defines delay as when average speeds are slower than 85% of the posted speed limit. 2 Reliable travel time will get commuters to their destination on time 19 out of 20 weekdays (95% of the time). 3 Transit travel times by bus and Sounder rail include some off-highway travel to stops and may not be directly comparable to SOV/HOV times which are highway only. 4 Person throughput values include morning (6-9 a.m.) and evening (3-7 p.m.) traffic.

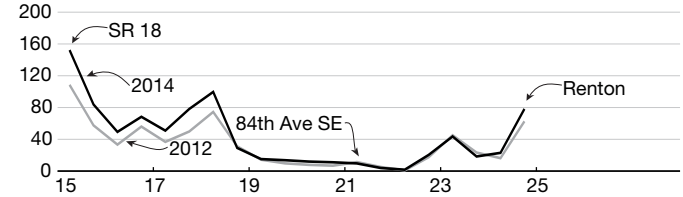
State Route 167 (SR 167) is one of the key commute and economic corridors in the central Puget Sound region and a virtual extension to I-405 south of the Tukwila/Renton area. More than 304 million person miles were traveled between Renton and Auburn in 2014, a 0.5% decrease over 2012. The high occupancy toll lane (an HOV lane open to solo drivers who choose to pay a toll) at Kent on this corridor moves nearly 20% more people than each adjacent single occupancy vehicle (SOV) lane. Carpools of two or more, vanpools and buses use the HOT lanes toll-free. Toll rates adjust to ensure traffic in the HOT lane is free flowing even when the regular lanes are congested.

Despite these efficiencies, traffic at specific locations on the corridor worsened from 2012 to 2014, with morning and evening weekday commutes experiencing heavy congestion on a daily basis. Delay increased 29% on SR 167 between Auburn and Renton. Freeway segments near the corridor

# High throughput indicates HOT lanes relieve congestion

endpoints in the two cities contributed to the significant delay increases in 2014 compared to 2012. In addition to delaying commuters, this congestion directly impacted the movement of goods in Washington as trucks accounted for 11% of the total daily traffic volume on the corridor in 2014.

**Delay along the SR 167 corridor by milepost**
*2012 and 2014; Northbound and southbound combined; Average daily vehicle hours of delay*

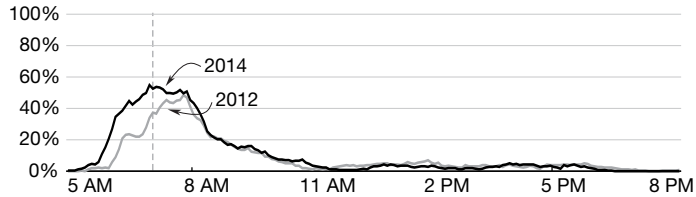



Data sources and analysis: WSDOT Multimodal Planning Division and WSDOT Office of Strategic Assessment and Performance Analysis.

***Corridor delay:*** The SR 167 corridor in the central Puget Sound region between Auburn and Renton experienced vehicle delay in Auburn near SR 18 in both directions of travel and northbound in Renton. Vehicle delay on the SR 167 corridor was higher in 2014 compared to 2012 at varying magnitudes depending on the location and direction of travel (see graph above). The amount of delay increased between 2012 and 2014 at specific locations on the SR 167 corridor including: northbound in Renton (up 23%), and in both directions near the SR 18 interchange (up 40%). The spiral chart below shows the intensity of delay by time of the day and location in 2014.

***A focus on hot spots:*** Commuters driving on SR 167 drove in severely congested conditions (36 mph or less) more often in 2014 than in 2012. For example, at around 7 a.m. during the morning commute from Auburn to Renton, the percent of days that speeds were below 36 mph increased from 34% in 2012 to 55% in 2014. The chart below also shows that severe congestion started earlier in the day in 2014 compared to 2012.

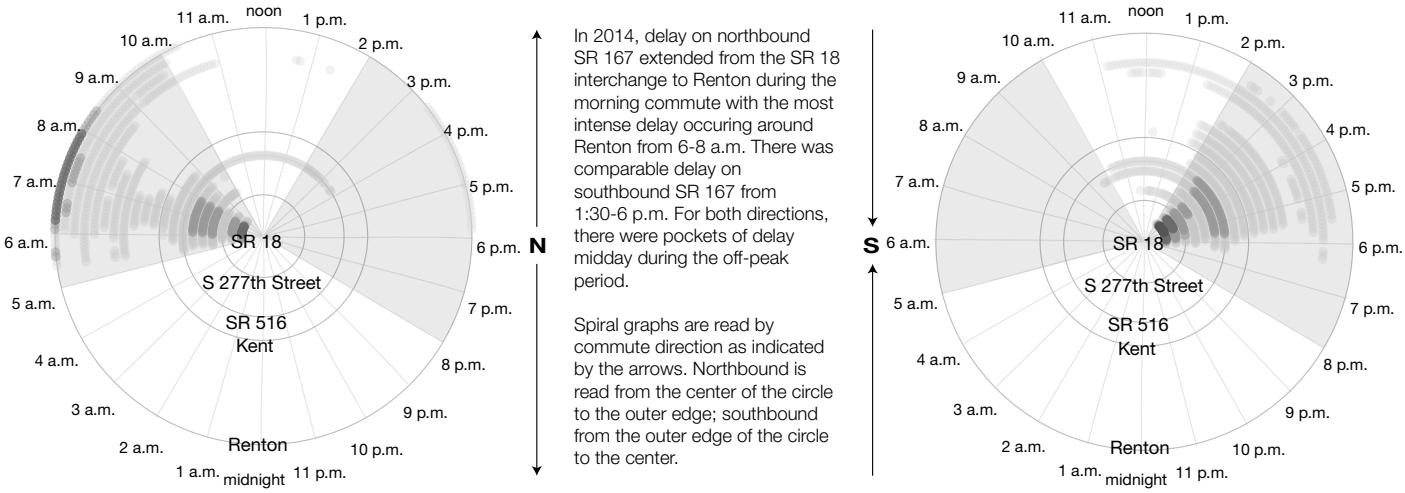
**Severe congestion on the Auburn to Renton commute**
*2012 and 2014; Northbound; Percent of days the average speed was slower than 36 mph*




Data sources and analysis: WSDOT Northwest Region Traffic Office, Washington State Transportation Center and WSDOT Office of Strategic Assessment and Performance Analysis.

***Highway productivity:*** As traffic increases, congested roads carry fewer vehicles, resulting in a drop in throughput productivity at speeds slower than maximum throughput. In order to gauge the lost productivity on SR 167 in the central Puget Sound region, WSDOT analyzed vehicle throughput at 84th Avenue SE in Kent. In 2012 and 2014, productivity at this location at its most congested is around 91% and 84% in the northbound and southbound directions, respectively (see graph at top of next page).

**SR 167 delay between Auburn and Renton**
*2014; Weekdays only; Vehicle hours of delay; Shading represents intensity of delay*



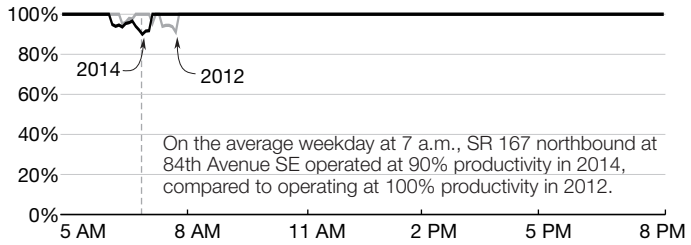

In 2014, delay on northbound SR 167 extended from the SR 18 interchange to Renton during the morning commute with the most intense delay occuring around Renton from 6-8 a.m. There was comparable delay on southbound SR 167 from 1:30-6 p.m. For both directions, there were pockets of delay midday during the off-peak period.

Spiral graphs are read by commute direction as indicated by the arrows. Northbound is read from the center of the circle to the outer edge; southbound from the outer edge of the circle to the center.

Data sources and analysis: Washington State Transportation Center and WSDOT Office of Strategic Assessment and Performance Analysis.

# Transit ridership decreases 9% on SR 167 corridor

**Throughput on northbound SR 167 at 84th Avenue SE**
*2012 and 2014; Based on the highest observed 5-minute flow rate; Northbound = 1,520 vehicles per hour per lane = 100%*

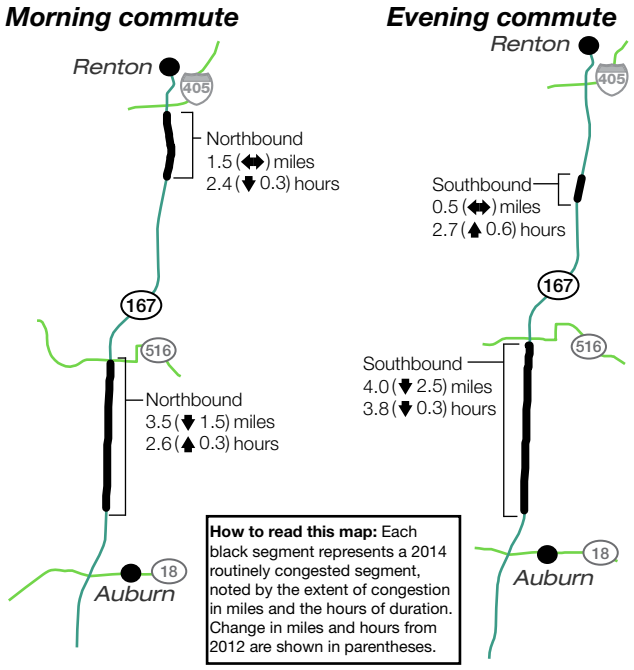



Data sources and analysis: WSDOT Multimodal Planning Division, Washington State Transportation Center and WSDOT Office of Strategic Assessment and Performance Analysis.

This high yield in throughput on SR 167 indicates that HOT lanes as an operational strategy relieve congestion and make traffic flow better for all users on the corridor.

***Routinely congested segments:*** Of the 20-mile SR 167 corridor between Auburn and Renton (both directions), the segment between SR 516 and SR 18 in both directions and the northbound segment near the SR 167/I-405 interchange experienced significant routine congestion. Overall, the locations where routine congestion occurred decreased by four miles between 2012 and 2014, and the amount of time of routine congestion decreased by 4%.

**Routinely congested segments of SR 167**
*2014; For weekday morning (5-10 a.m.) and evening (2-8 p.m.) peak periods; Length of backup in miles; Daily duration of congestion in hours (compared to 2012).*




Data sources and analysis: Washington State Transportation Center and WSDOT Office of Strategic Assessment and Performance Analysis.

## *What does severe congestion mean for travel times on the corridor?*

***Single occupancy vehicle trips:*** Capacity constraints impacted the SR 167 corridor between Auburn and Renton is impacted by capacity constraints along the corridor and specifically near SR 18 interchange in Auburn and on the northbound segment leading up to the SR 167/I-405 interchange. This resulted in increased average and reliable travel times during the morning and evening peak periods. The average travel time for the Auburn to Renton morning commute remained the same in 2014 and 2012 while average travel time increased by up to two minutes (up 12%) on the Renton to Auburn evening commute. The reliable travel times increased by two and three minutes, respectively.

Roughly 9.5 miles of the 20-mile corridor (both directions) experienced routine congestion between Auburn and Renton, a 30% decrease compared to the 13.5 miles of routine congestion in 2012. The greenhouse gas (GHG) emissions decreased by approximately 2% in 2014 compared to 2012.

The Auburn to Renton morning commute and Renton to Auburn evening commute take more than one-and-a-half times longer than they should when compared to traveling at 50 mph (maximum throughput speed). The maximum throughput travel time index (MT3I), which allows WSDOT to compare severity of congestion across commutes, shows that Renton to Auburn has the highest MT3I—1.6—of the four commutes tracked on SR 167 between Auburn and Renton.

***Transit trip travel times:*** Two of the four commutes tracked on SR 167 have transit travel time data. For example, in 2014 the average and reliable transit travel times for the SR 167 commute from Auburn to Renton in the morning were 32 and 40 minutes, respectively. For the return trip in the evening, the average transit travel time was 41 minutes, while the reliable transit travel time was 48 minutes. See p. 25 for a comparison of transit trips to SOV and HOV trips.

***Transit ridership and GHG emissions avoided:*** Transit moved 2,189 people during the morning and evening peaks on an average weekday in 2014, a 9% decrease from 2012 (2,414 riders). On a similar note, daily transit passenger miles traveled decreased by 7% in 2014

# Unused capacity available on SR 167 transit routes

(21,366 miles) compared to 2012 (22,852 miles). Transit ridership during peak periods means fewer cars on the road, which helps alleviate traffic congestion by making the most efficient use of available highway capacity.

Peak period transit ridership on the SR 167 corridor in central Puget Sound was equal to approximately a fifth of an extra lane of capacity in 2014 (when compared to the peak efficiency of the roadway, which is a conservative approach to this measurement). Transit use during peak periods avoided 10,265 pounds of GHG emissions per day on the SR 167 central Puget Sound corridor in 2014, a 5% decline compared to 2012 (10,758 pounds). Transit routes on SR 167 operated between 51% and 53% of their seating capacity during the morning and evening peak periods in 2014.

***Park and ride:*** Along the SR 167 corridor in the central Puget Sound region in 2014, park and ride (P&R) utilization rates ranged from 29% to 100% depending on the location, with five out of eight having utilization rates above 95%. Any P&R lot that has 85% or more utilization is identified as operating at capacity. The availability of P&R spaces within the transit service network provides essential access points to transit riders. P&R locations need to have enough parking spaces and high utilization of those spaces to accommodate demand. A detailed review of P&R capacity and transit trip utilization rates by time of day could help ridership. Targeted outreach efforts from the transit agencies as well as employer initiatives to encourage participation in a Commute Trip Reduction program could also help address chronic highway capacity issues in the central Puget Sound region.

## *How much is congestion costing you?*

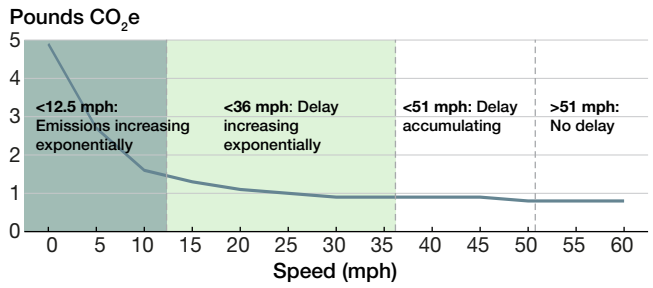
Commuters making roundtrips between Auburn and Renton on SR 167 took a hit to their wallets due to congestion (measured in wasted time and gas), about $1,200 per commuter annually in 2014.

### Why do greenhouse gas emissions not always increase with delay?

Between 2012 and 2014, corridor greenhouse gas (GHG) emissions did not change hand in hand with increases in delay. Delay begins to accumulate at higher speeds where GHG emission rates hold steady despite changes in speed. Vehicles are also becoming more efficient. Ideally, vehicle efficiency improvements result in decreasing GHG emissions, but increases in delay sometimes offset efficiency gains, especially at slower speeds.

**Delay accumulates at higher speeds, well before greenhouse gas emission rates begin to increase**

*Greenhouse gas emission rates in pounds of $CO_2e$ per vehicle mile traveled for passenger vehicles; Speed in miles per hour*

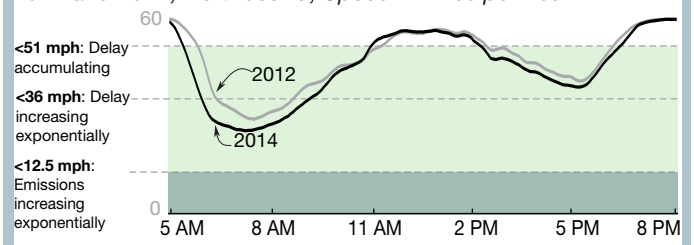



Data sources and analysis: Puget Sound Regional Council and WSDOT Office of Strategic Assessment and Performance Analysis.

For example, on I-5 in the central Puget Sound region GHG emissions increased between 2012 and 2014 along with delay (see p. 9). I-5 had some of the slowest speeds in the state, contributing to the increased emissions along the corridor. The graph below shows the drop in speeds on the commute from Federal Way to Seattle. Speeds were low enough to trigger increases in emissions, but not so slow that emissions rose as fast as delay. For more information on how vehicle speeds interact with GHG emissions, see WSDOT's *Handbook for Corridor Capacity Evaluation*, p. 16.

**Speeds on I-5 from Federal Way to Seattle drop low enough in 2014 to trigger increases in emissions[1]**

*2012 and 2014; Northbound; Speed in miles per hour*




Data sources and analysis: Washington State Transportation Center and WSDOT Office of Strategic Assessment and Performance Analysis.

Note: 1 Although average speeds did not drop below 12.5 mph, the speed at which greenhouse gas emissions rise exponentially, emissions begin to rise around 25 mph. At 7:15 a.m. (the 5-minute peak), the average speed in 2014 was 25.5 mph, down from 29.7 mph in 2012.

# High Occupancy Vehicle Trip Analysis

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

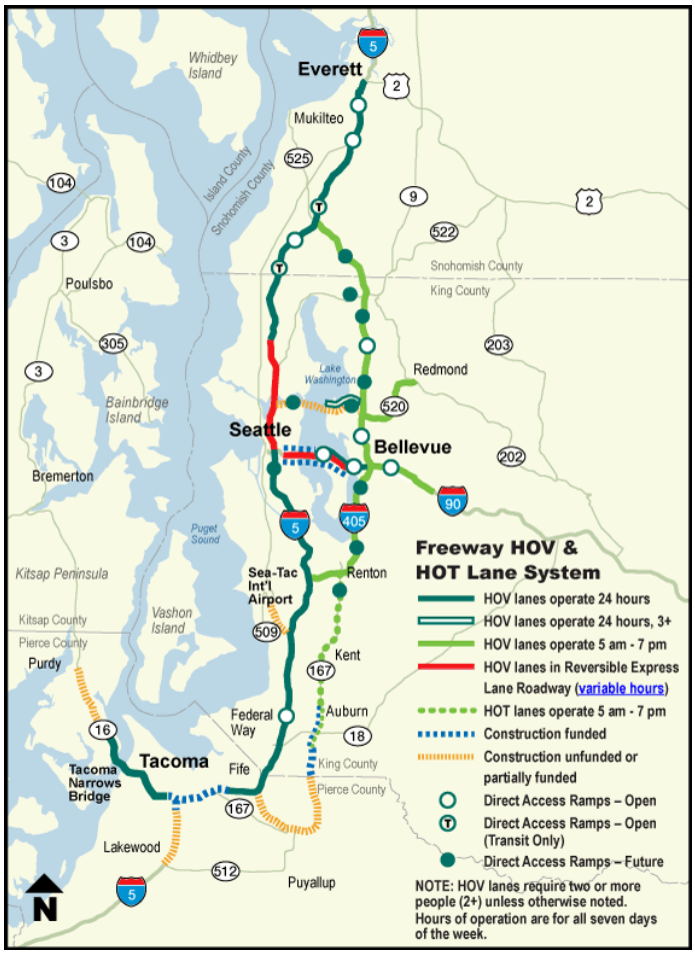
WSDOT monitors three aspects of Puget Sound region HOV lane performance: 1) the person-carrying performance of HOV lanes as compared to the adjacent general purpose lanes, 2) travel time performance for HOV lane users, and 3) overall travel performance and reliability on freeway HOV corridors.

## HOV lanes outperform SOV lanes for person throughput

One of the key metrics of HOV lane performance is the ability of the HOV network to efficiently move more travelers. WSDOT estimates the number of vehicles and travelers at 10 locations on the major freeway corridors in the central Puget Sound region to evaluate how the HOV network is performing.

Since 2010, there has been an upswing in the number of travelers using the HOV lanes, following a period of lower volumes during the recession. This trend continued in 2014, with seven of the 10 monitored locations experiencing increased person throughput compared to 2012. Overall HOV person throughput was about 2% lower compared to 2013. The graph at right shows peak period SOV lane person throughput for 2014. In all 10 monitored locations, HOV lane person throughput was higher than the average for adjacent SOV lanes in 2014.

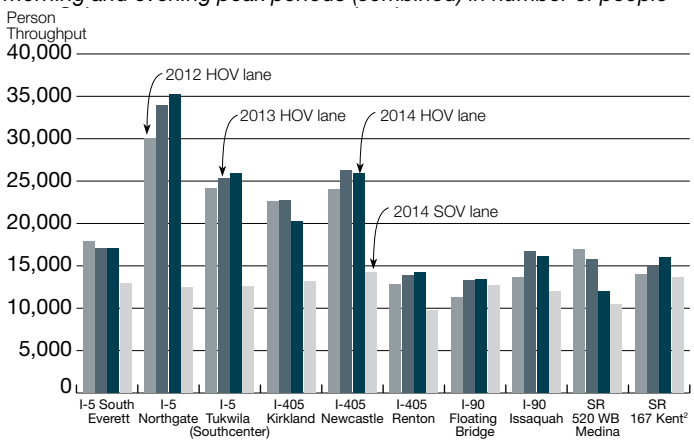
The number of people using the HOV lane varies by location and time of day; the most successful examples of HOV lane usage occur when the HOV lane offers a clear travel time benefit, combined with strong transit service.




*Approximately 310 lane-miles of a planned 320-mile freeway system of high occupancy vehicle (HOV) lanes have been built in the Puget Sound region since 1970.*

**Person throughput[1] on HOV lanes higher than SOV lanes**

*2012 through 2014; Average daily person throughput volumes for morning and evening peak periods (combined) in number of people*




Data source: Washington State Transportation Center.

Notes: 1 Person volume estimates are based on most recent 2012-2014 transit ridership and other data. The SOV lane volumes are the estimated person volumes for the average SOV lane at each location. 2 Single occupant vehicles may pay a toll to use the high occupancy lane on SR 167.

# HOV and transit carry nearly half of travelers at Northgate

The Northgate area on Interstate 5 (I-5) north of downtown Seattle is a good example of a roadway with high person throughput, as it is in a heavily traveled freeway corridor served by a number of transit routes. In previous years, this location has consistently shown HOV lane travel time benefits and significant usage. In 2014, during the average morning peak period, the southbound I-5 HOV lane at Northgate carried more than 48% (16,300) of all travelers toward downtown Seattle in only 22% of the vehicles. The HOV lane at this location carried an average of 3.9 persons per vehicle, or nearly three times the number of persons per vehicle as the adjacent SOV lanes. High levels of transit service and ridership are major contributing factors to the person throughput along I-5, along with a significant number of ridesharing travelers attracted by the HOV network. Across all the monitoring locations, an average of 36% of the people using the freeway during the peak periods at these locations use the HOV lanes. These values have been generally consistent from year to year.

## Transit ridership contributes to higher person throughput in HOV lanes

Bus ridership is a significant component of person volumes on the HOV network. In the central Puget Sound region, King County Metro, Sound Transit and Community Transit all showed noticeable annual ridership growth, continuing the trend from recent years. Metro's transit boardings were up by 2% in 2014, resulting in a new annual ridership record of 121 million. This surpassed the previous record set six years prior, just before the recession. Metro attributed the ridership increase to continuing regional employment growth as well as service improvements. Sound Transit boardings increased 6% in 2014, including 13% growth in Central Link light rail ridership, and Community Transit ridership grew by 8%.

Transit service is also expanding in 2015 in the region. Metro is adding service using cost savings and additional revenue from the voter-approved Seattle Proposition 1, and Community Transit is continuing to expand service. Even with these improvements, transit agencies will continue to face budget and capacity constraints that could affect future ridership.

## HOV lanes continue to provide speed and reliability benefits for travelers

WSDOT monitors the benefits for HOV lane users by tracking the travel times and reliability of HOV trips that parallel each of WSDOT's 40 high-demand commute corridors. For some SOV commutes there are two HOV routes, such as those along I-5 and I-90, where there are reversible express lanes.

Of the 42 HOV trips analyzed for 2014, 29 were more than two minutes faster during times of peak congestion compared to the associated SOV trip, while the other 13 trips showed no significant travel time difference between the SOV and HOV route options. Overall, the 2014 HOV travel time results are similar to those seen in previous years.

The 95th percentile reliable travel times are faster by more than two minutes on 34 of the 42 HOV trips relative to their SOV counterparts in 2014 (up from 30 routes in 2012). The other eight trips showed little or no difference in 95th percentile travel times. These shorter reliable travel times illustrate another benefit of using HOV lanes.

See Appendix pp. 22-29 for the travel time and reliability performance of each monitored HOV and SOV lane.

## Three of 14 HOV corridors met reliability standards in 2014

The performance and reliability standard for freeway HOV lanes that was adopted by WSDOT and the Puget Sound Regional Council in 1991 states that travelers in the HOV lane should be able to maintain an average speed of at least 45 mph, 90% of the time during the peak hour of travel.

Three of the 14 monitored HOV peak-direction corridors met the state performance standard in 2014 (one in the morning and two in the evening), compared to five corridors that met the standard in 2012. The degree of compliance with the performance standard held steady or worsened for all of the monitored locations in 2014 compared to the year before. The past three years have seen an overall drop in compliance with the HOV standard; this followed a three-year period when HOV corridor compliance with the standard had generally improved.

Even during congested periods when HOV performance is reduced, HOV lanes still generally provide speed and reliability benefits compared to adjacent SOV lanes. During the off-peak times of day, all HOV corridors generally meet the standard.

See Appendix p. 26 for a table that summarizes the degree to which each HOV corridor met the state performance standards in recent years in the peak direction of travel.

Visit bit.ly/CCR15SouthSoundmap for this article's interactive map.

# South Puget Sound I-5 Corridor Capacity Analysis

### Annual person miles traveled

| 2012 | vs. | 2014 |
|---|---|---|
| 1,565 | | 1,609 |

in millions of miles

2.9%

### Annual vehicle delay[1]

| 2012 | vs. | 2014 |
|---|---|---|
| 473.5 | | 939.9 |

in thousands of hours

99%

### Annual GHG emissions

| 2012 | vs. | 2014 |
|---|---|---|
| 1,399 | | 1,396 |

in millions of pounds of $CO_2$ equivalents

0.2%

### Annual passenger miles traveled on transit

| 2012 | vs. | 2014 |
|---|---|---|
| 29.6 | | 34.5 |

in millions of miles

17%

### Capacity savings due to transit

| 2012 | vs. | 2014 |
|---|---|---|
| 0.9 | | 1.1 |

in number of lanes

18%

### Percent transit seats occupied

| 2012 | vs. | 2014 |
|---|---|---|
| 44% | | 46% |

on average during peak periods

2%

### Percent park and ride spaces occupied

| 2012 | vs. | 2014 |
|---|---|---|
| 78% | | 84% |

on average during peak periods

6%

## Commute travel times

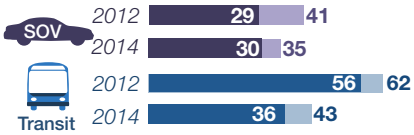
*2012 and 2014 during the morning (5-10 a.m) and evening (2-8 p.m.) peak periods; Weekday travel times in minutes at the 5-minute peak including average and reliable[2] travel times for single occupant vehicle (SOV) and transit[3] trips.*

Average SOV · Average transit · Reliable SOV · Reliable transit

See Appendix pp. 30-36 for more commute routes

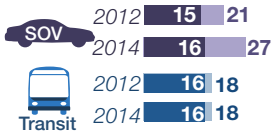
### *Olympia to Tacoma*

Morning; 7:25 a.m.; Trip length 26 miles



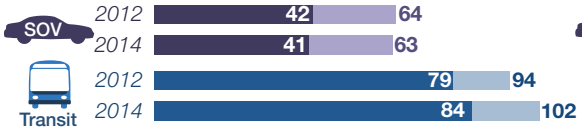

### *Tacoma to Federal Way*

Morning; 7:25 a.m.; Trip length 12 miles



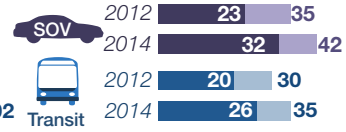

### *Tacoma to Olympia*

Evening; 4:50 p.m.; Trip length 28 miles




### *Federal Way to Tacoma*

Evening; 5:15 p.m.; Trip length 10 miles



## Transit system use

*2012 and 2014; For typical weekday morning (6-9 a.m.) and evening (3-6 p.m.) transit[3] peak periods; Ridership and percent of available seats occupied on select commutes*

### *By commute*

| | Daily peak period riders | | Percent of seats occupied | |
|---|---|---|---|---|
| **Morning** (6-9 a.m.) | 2012 | 2014 | 2012 | 2014 |
| Olympia to Tacoma | 301 | 282 | 36% | 29% |
| Tacoma to Federal Way[4] | 3,946 | 4,635 | 55% | 59% |
| **Evening** (3-6 p.m.) | | | | |
| Tacoma to Olympia | 339 | 434 | 35% | 35% |
| Federal Way to Tacoma[4] | 3,760 | 4,866 | 56% | 57% |

## Park and ride capacity

*2012 and 2014; Average percent occupied for select park and rides (see map for locations)*

### *Olympia-Federal Way commute*

| Park and ride (spaces) | 2012 percent occupied | 2014 percent occupied |
|---|---|---|
| Tacoma Dome Station (2,273) | 96% | 96% |
| SR 512 Lakewood (493) | 93% | 95% |
| Lakewood Station (600) | 48% | 79% |
| DuPont (126) | 60% | 77% |
| Martin Way (318) | 50% | 42% |
| Hawks Prairie (332) | 15% | 34% |

Data sources and analysis: Washington State Transportation Center, Sound Transit, Pierce Transit, Intercity Transit, WSDOT Olympic Region and WSDOT Office of Strategic Assessment and Performance Analysis.

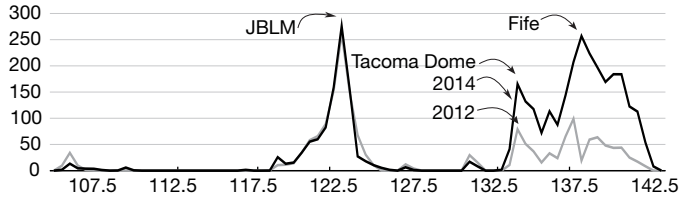
Notes: Measures at the top of the page are for SOV trips only on the I-5 corridor between Olympia and Federal Way. 1 WSDOT defines delay as when average speeds are slower than 85% of the posted speed limit. 2 Reliable travel time will get commuters to their destination on time 19 out of 20 weekdays (95% of the time). 3 Transit travel times by bus and Sounder rail include some off-highway travel to stops and may not be directly comparable to SOV times which are highway only. 4 Includes transit trips between Olympia/Tacoma and Seattle.

# South Puget Sound congestion sees significant increases

Interstate 5 (I-5) is the key commute and economic corridor connecting the south and central Puget Sound regions. More than 1.6 billion person miles were traveled between Olympia and Federal Way in 2014, a 2.9% increase over 2012.

Traffic at specific locations on the corridor worsened from 2012 to 2014, with morning and evening weekday commutes experiencing moderate to heavy congestion on a daily basis. Delay increased 99% on the corridor with the Fife area contributing to the significant increase in 2014 compared to 2012 (see chart below). To learn why delay and miles traveled do not increase hand in hand, see the gray box on p. 34. In addition to delaying commuters, this congestion directly impacts the movement of goods in Washington as trucks accounted for 7% of the total daily traffic volume on the corridor in 2014.

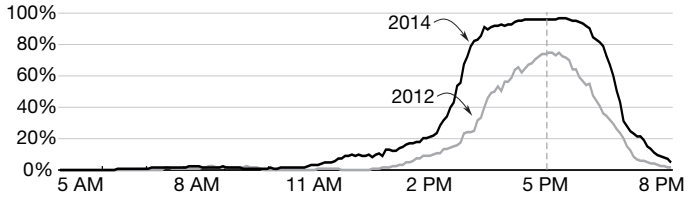
**Delay along the I-5 corridor by milepost**
*2012 and 2014; Northbound and southbound combined; Average daily vehicle hours of delay*




Data sources and analysis: WSDOT Olympic Region Traffic Office and WSDOT Office of Strategic Assessment and Performance Analysis.

***Corridor delay:*** The I-5 corridor in the south Puget Sound region between Olympia and Federal Way experiences a significant amount of vehicle delay (shown in the spiral chart at the bottom of the page) at Joint Base Lewis McChord (JBLM) and the Fife area along with increases in vehicle miles traveled by up to 6%. While the graphs below and on the next page show the I-5 JBLM area experienced significant delay, the amount remained unchanged between 2012 and 2014. On the other hand, the Fife area has experienced a nearly 160% increase in delay in 2014 compared to 2012, the majority of which was in the southbound direction. This increase is likely due to the relocation of a bottleneck, along with the end of HOV lane restrictions near Fife.

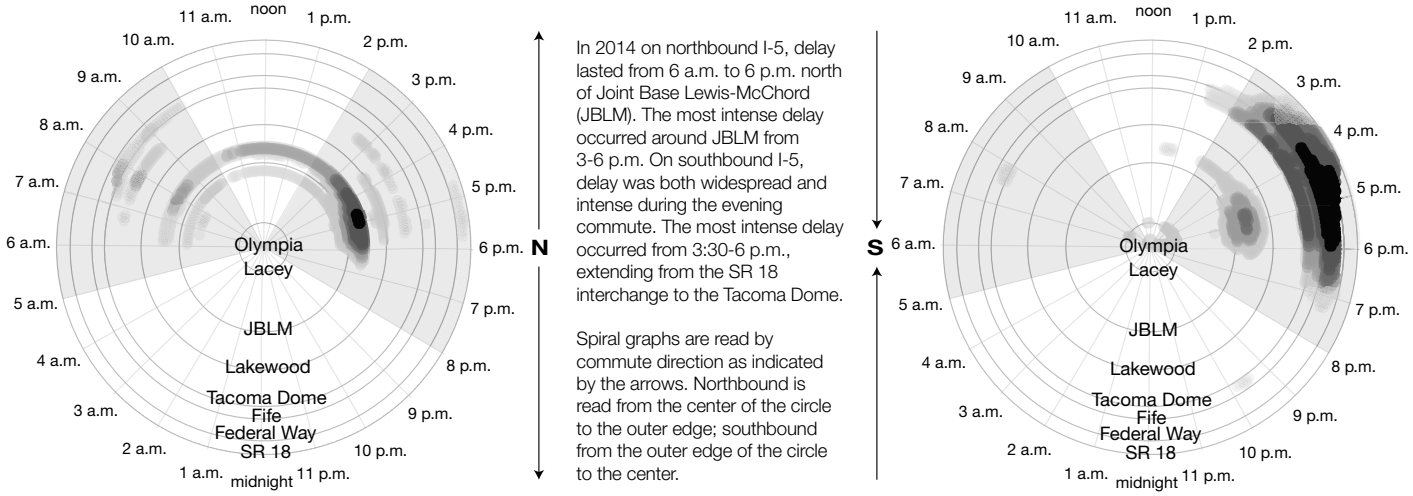
**Severe congestion on the Federal Way to Tacoma commute**
*2012 and 2014; Southbound; Percent of days the average speed was slower than 36 mph*




Data sources and analysis: WSDOT Olympic Region Traffic Office and WSDOT Office of Strategic Assessment and Performance Analysis.

***A focus on hot spots:*** The percent of days the Federal Way to Tacoma commute operated in severely congested (36 mph or below) condition significantly worsened between 2012 and 2014. The graph above shows that generally between 3-6 p.m., most weekday commutes experience speeds well below 36 mph. For example, at 5 p.m., the percent of days experiencing severe congestion increased from 75% in 2012 to 97% in 2014.

**I-5 delay between Olympia and Federal Way**
*2014; Weekdays only; Vehicle hours of delay; Shading represents intensity of delay*



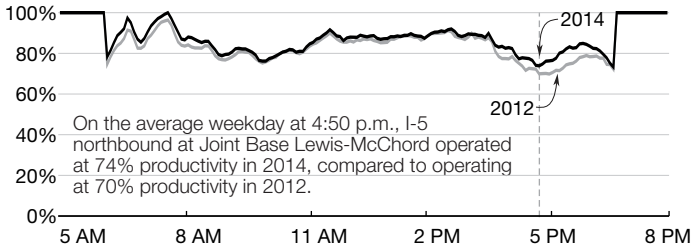

In 2014 on northbound I-5, delay lasted from 6 a.m. to 6 p.m. north of Joint Base Lewis-McChord (JBLM). The most intense delay occurred around JBLM from 3-6 p.m. On southbound I-5, delay was both widespread and intense during the evening commute. The most intense delay occurred from 3:30-6 p.m., extending from the SR 18 interchange to the Tacoma Dome.

Spiral graphs are read by commute direction as indicated by the arrows. Northbound is read from the center of the circle to the outer edge; southbound from the outer edge of the circle to the center.

Data sources and analysis: Washington State Transportation Center and WSDOT Office of Strategic Assessment and Performance Analysis.

# Capacity constraints evident at JBLM and Tacoma Dome

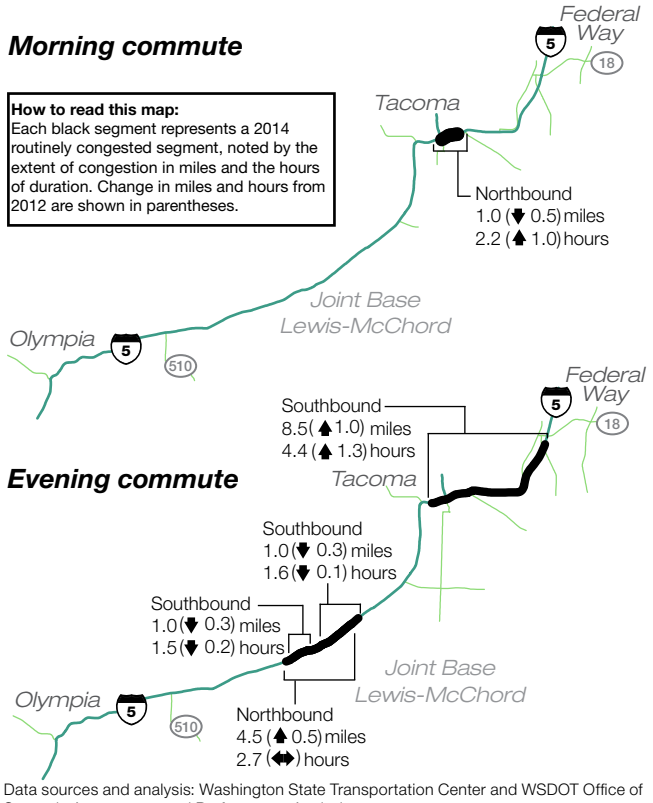
**Throughput on northbound I-5 at JBLM**
*2012 and 2014; Based on the highest observed 5-minute flow rate; Northbound = 1,580 vehicles per hour per lane = 100%*




Data sources and analysis: WSDOT Olympic Region Traffic Office, Washington State Transportation Center and WSDOT Office of Strategic Assessment and Performance Analysis.

***Highway productivity:*** As traffic increases, congested roads carry fewer vehicles, resulting in a drop in throughput productivity at speeds slower than maximum throughput. In order to gauge the lost productivity on I-5 in the south Puget Sound region, vehicle throughput was analyzed at four locations: near 14th Avenue in Olympia, near JBLM, near the Tacoma Dome, and near SR 18. In 2012 and 2014, productivity at these locations at their most congested ranged from 70% to 100%. The graph at left shows how productivity varies by direction of travel, location and time of day near JBLM.

**Routinely congested segments of I-5**
*2014; For weekday morning (5-10 a.m.) and evening (2-8 p.m.) peak periods; Length of backup in miles; Daily duration of congestion in hours (compared to 2012).*




Data sources and analysis: Washington State Transportation Center and WSDOT Office of Strategic Assessment and Performance Analysis.
Notes: 2012 times were rounded to half hour periods in the 2013 Corridor Capacity Report. See table on p. 34 of the Appendix for corrected routinely congested segment data for 2012. The 2012 routinely congested segment reported in 2013 Corridor Capacity Report from mileposts 133.5 to 134.5 was no longer congested in the 2014 data.

***Routinely congested segments:*** Of the 38-mile I-5 corridor between Olympia and Federal Way (both directions), the segment between JBLM and SR 18 experienced routine congestion. While the locations were similar between 2012 and 2014, the amount of time of routine congestion increased by 21%.

## *What does severe congestion mean for travel times on the corridor?*

***Single occupancy vehicle trips:*** The Federal Way to Tacoma southbound commute is impacted by capacity constraints near the Tacoma Dome. This results in increased average and reliable travel times during the evening peak period (2-8 p.m.). The average travel time for this route increased by nine minutes (up 39%) in 2014 compared to 2012, while reliable travel time increased by seven minutes (up 20%). This 10-mile commute is routinely congested, with a significant increase in the duration of congestion along this route. The amount of time speeds on this 10-mile segment of the corridor were below 45 mph was four hours and 10 minutes in 2012 and five hours and 35 minutes in 2014 – an increase of one hour and 25 minutes.

The Federal Way to Tacoma southbound commute takes more than two and a half times longer than it should when compared to traveling at 50 mph (maximum throughput speed). This delayed traffic movement contributed to an increase of 5% in greenhouse gas (GHG) emissions between 2012 and 2014. The maximum throughput travel time index (MT3I) WSDOT uses to compare severity of congestion across commutes shows that Federal Way to Tacoma has the highest MT3I—2.62—of the 20 commute routes tracked in the south Puget Sound region.

***Transit trip travel times:*** The transit route with the most improved travel time is the Olympia to Tacoma morning trip — it improved by 20 minutes in 2014 (36 minutes) compared to 2012 (56 minutes). This is mostly due to express buses run by Intercity Transit and Sound Transit thanks to a Regional Mobility Grant funded by WSDOT under RCW 47.66.030. One other route near the Tacoma Dome that saw severe congestion is the Federal Way to Tacoma southbound

# Transit ridership saves a full lane of capacity along I-5

transit trip, which took six minutes longer in the evening while its morning trip remained the same.

**Changes in south Puget Sound transit times**
*I-5 transit routes during peak hours from 2012 to 2014*

***Transit ridership and GHG emissions avoided:*** Transit moved 11,852 people during the morning and evening peaks on an average weekday in 2014. Transit ridership during peak periods means fewer cars on the road, which helps alleviate traffic congestion by making the most efficient use of available highway capacity. Peak period transit ridership on the south Puget Sound I-5 corridor was equal to one extra lane of capacity in 2014 (when compared to the peak efficiency of the roadway, which is a conservative approach to this measurement).

The Federal Way to Tacoma transit route in the evening saw ridership increase by 29% from 2012 to 2014. This corresponds to an increase in transit passenger miles traveled of 29%. The GHG emissions avoided by these transit trips during peak periods in 2014 compared to 2012 increased 20% for the morning Tacoma to Federal Way commute and 29% for the evening Federal Way to Tacoma commute. These two popular transit routes are operating at 59% and 57% of their seating capacity during the morning and evening peak periods, respectively.

***Park and ride:*** Along the I-5 corridor in the south Puget Sound region in 2014, park and ride (P&R) utilization rates ranged from 34% to 96% depending on location. The SR 512 Lakewood P&R along with the Tacoma Dome Station saw a utilization rate of 95% or more. Any P&R lot that has 85% or more utilization is identified as operating at capacity.

The availability of P&R spaces within the transit service network provides essential access points to transit riders. P&R locations need to have enough parking spaces and high utilization of those spaces to accommodate demand. A detailed review of P&R capacity and transit trip utilization rates by time of day could help ridership. Targeted outreach efforts from the transit agencies as well as employer initiatives to encourage participation in a Commute Trip Reduction program could also help address chronic highway capacity issues in the south Puget Sound region.

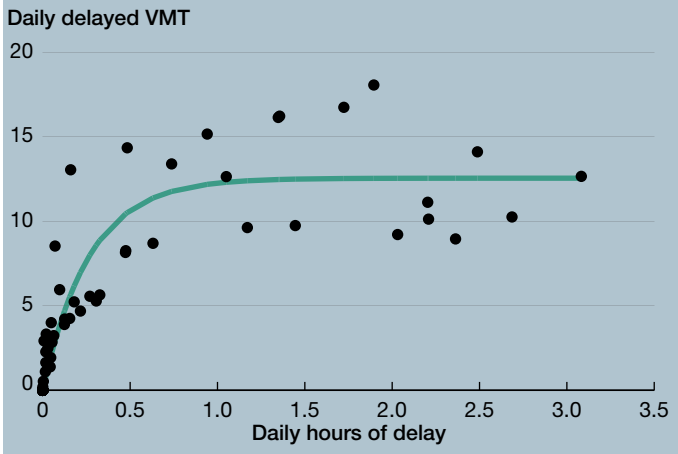
## *How much is congestion costing you?*

The southbound evening commute along I-5 from Federal Way to Tacoma experienced the most congestion of all south Puget Sound area commutes. This 10-mile trip claimed the highest cost due to congestion (measured in wasted time and gas), about $1,100 per commuter annually in 2014.

### Why was the delay increase significant while VMT only saw a slight increase?

Vehicle miles traveled (VMT) is an all day measure that fluctuates based on growth in driving population, job availability and other economic measures. Higher regional employment leads to more people commuting to work, which puts additional stress on the transportation system, lowering speeds and increasing delay.

**Delayed VMT[1] on I-5 southbound from Federal Way to Olympia reaches limit as delay continues to grow**
*2014; Daily hours of delay and daily delayed VMT in thousands*




Data sources and analysis: WSDOT Olympic Region Traffic Office and WSDOT Office of Strategic Assessment and Performance Analysis.
Note: 1 Delayed vehicle miles traveled (VMT) refers to VMT accrued when there is delay on the corridor.

Since delay is calculated when speeds are below 50 mph (threshold speed), WSDOT limited VMT to the same threshold, creating the measure of delayed VMT. Delayed VMT and vehicle hours of delay increase hand in hand until congestion becomes so severe that while delay continues to accumulate, delayed VMT begins to level off (see graph above). Vehicles record no additional VMT while delayed in traffic.

Visit bit.ly/CCR15Spokanemap for this article's interactive map.

# Spokane Region I-90 Corridor Capacity Analysis

### Annual person miles traveled

| 2012 | vs. | 2014 |
|---|---|---|
| 217.2 | | 221.8 |

in millions of miles

2.1%

### Annual vehicle delay[1]

| 2012 | vs. | 2014 |
|---|---|---|
| 28.2 | | 59.9 |

in thousands of hours

112%

### Annual GHG emissions

| 2012 | vs. | 2014 |
|---|---|---|
| 197.8 | | 176.2 |

in millions of pounds of $CO_2$ equivalents

11%

### Annual passenger miles traveled on transit

| 2012 | vs. | 2014 |
|---|---|---|
| 1.9 | | 1.9 |

in millions of miles

0%

### Capacity savings due to transit

| 2012 | vs. | 2014 |
|---|---|---|
| 0.1 | | 0.1 |

in number of lanes

0%

### Percent transit seats occupied

| 2012 | vs. | 2014 |
|---|---|---|
| 62% | | 57% |

on average during peak periods

5%

### Percent park and ride spaces occupied

| 2012 | vs. | 2014 |
|---|---|---|
| 76% | | 81% |

on average during peak periods

5%

## Commute travel times

*2012 and 2014 during the morning (7-10 a.m.) and evening (3-6 p.m.) peak periods; Weekday travel times in minutes at the peak 5-minute interval including average and reliable[2] travel times for single occupant vehicle (SOV) and planned transit[3] travel times.*

Average SOV
Reliable SOV
Planned transit time

### *Argonne Rd. to Division St.*

Morning; 7:50 a.m.; Trip length 7.5 miles

| | 2012 | 2014 |
|---|---|---|
| SOV | 9 / 10 | 9 / 12 |
| Transit | 15 | 15 |

### *Division St. to Argonne Rd.*

Evening; 4:15 p.m.; Trip length 7.5 miles

| | 2012 | 2014 |
|---|---|---|
| SOV | 7 / 9 | 9 / 11 |
| Transit | 24 | 24 |

## Transit system use

*2012 and 2014; For typical weekday morning (6-9 a.m.) and evening (3-6 p.m.) transit[3] peak periods; Ridership and percent of available seats occupied on select commutes*

### *By commute*

| | Daily peak period riders | | Percent of seats occupied | |
|---|---|---|---|---|
| | 2012 | 2014 | 2012 | 2014 |
| **Morning** (6-9 a.m.) | | | | |
| Argonne to Division | 598 | 614 | 57% | 58% |
| **Evening** (3-6 p.m.) | | | | |
| Division to Argonne | 468 | 458 | 71% | 57% |

## Park and ride capacity

*2012 and 2014; Average percent occupied for select park and rides[4] (see map for locations)*

### *Argonne-Division commute*

| Park and ride (spaces) | 2012 percent occupied | 2014 percent occupied |
|---|---|---|
| Liberty Lake[6] (165) | 100% | 97% |
| Mirabeau Point (198) | 86% | 83% |
| Valley Transit Center (236) | 50% | 68% |

See Appendix pp. 37-39 for more commute routes

Data sources and analysis: WSDOT Eastern Region Planning Office, Spokane Transit Authority and WSDOT Office of Strategic Assessment and Performance Analysis.
Notes: Measures at the top of the page are for SOV trips only on the I-90 corridor in the Spokane area. 1 WSDOT defines delay as when average speeds are slower than 85% of the posted speed limit. 2 Reliable travel time will get a commuter to their destination on time or early 19 out of 20 weekdays (95% of the time). 3 Transit travel times by bus include some off-highway travel to stops and may not be directly comparable to SOV times which are highway only. 4 Liberty Lake park and ride not shown in map extent.

Interstate 90 (I-90) in the Spokane region is one of the region's key commute and economic corridors. Approximately 222 million person miles were traveled on I-90 between Division Street and Argonne Road in 2014, a 2.1% increase over 2012.

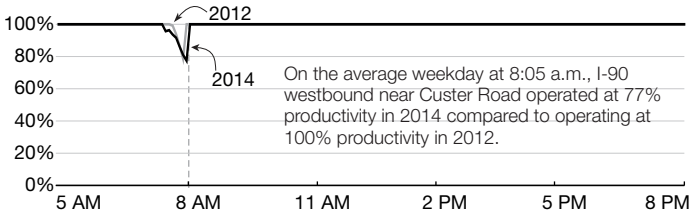
Traffic at specific locations on the corridor worsened from 2012 to 2014, with morning and evening weekday commutes experiencing light to moderate congestion on a daily basis. Delay increased 112% on the corridor between 2012 and 2014, in part due to an increase in crashes. In addition to delaying commuters, this congestion directly impacts the movement of goods in Washington as trucks accounted for 6% of the total daily traffic volume on the corridor in 2014.

***Highway productivity:*** As traffic increases, congested roads carry fewer vehicles, resulting in a drop in throughput productivity at speeds slower than maximum throughput speed. In order to gauge the lost productivity on I-90 in the

# Spokane region experiences mild congestion along I-90

Spokane region, WSDOT analyzed vehicle throughput at three locations near Freya Street, Custer Road and Broadway Avenue. In 2012 and 2014, productivity at these locations at their most congested ranged from 77% to 100%, meaning that up to a quarter of the freeway's capacity was unavailable due to congestion for a short time in the morning peak period. The graph below shows how productivity varies by direction of travel, location and time of day near Custer Road.

**Throughput on westbound I-90 near Custer Road**
*2012 and 2014; Based on the highest observed 5-minute flow rate; Westbound = 1,960 vehicles per hour per lane = 100%*

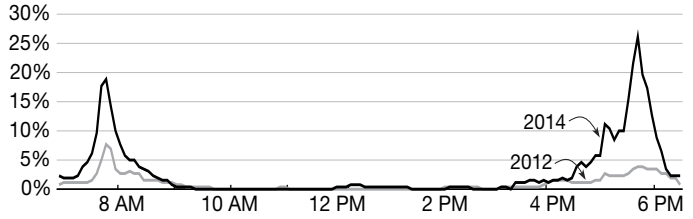



Data sources and analysis: WSDOT Eastern Region Planning Office and WSDOT Office of Strategic Assessment and Performance Analysis.

***Routinely congested segments:*** Both directions of the 7.5-mile I-90 corridor between Division Street and Argonne Road experience about a mile of routine congestion, lasting for 20 minutes in the morning, and 50 minutes during the evening peak period.

***A focus on hot spots:*** The commute routes on I-90 through the Spokane region do not experience significant delay, and travel conditions rarely reach average speeds slower than 45 mph, the threshold for congestion. However, these routes did experience congestion occasionally. On the westbound commute in 2014 there was up to a 26% chance of experiencing congestion during peak commute periods on an average weekday. For eastbound commutes, travelers were less likely to experience congestion in 2014 than in 2012. Unlike some urban centers of the state, the Spokane region does not experience any regular severe congestion (average speeds slower than 36 mph).

**Congestion on the Spokane I-90 commute**
*2012 and 2014; Westbound; Percent of days the average speed was slower than 45 mph*




Data sources and analysis: WSDOT Eastern Region Planning Office and WSDOT Office of Strategic Assessment and Performance Analysis.

## *What does congestion mean for travel times on the corridor?*

Between 2012 and 2014, average travel times changed by two minutes or less, and remained less than or equal to maximum throughput during the peak periods. While average and reliable transit travel time data is not yet available in the Spokane region, planned travel times for transit remained the same in 2014 as in 2012, 15 minutes for the morning westbound commute and 24 minutes for the evening eastbound commute.

***Transit ridership and GHG emissions avoided:*** Transit moved 1,072 people on the corridor during the morning and evening peaks on an average weekday in 2014. Transit ridership during peak periods means fewer cars on the road, which helps alleviate traffic congestion by making the most efficient use of available highway capacity. Peak period transit ridership on the Spokane region I-90 corridor was equal to a tenth of an extra lane of capacity in 2014 (when compared to the peak efficiency of the roadway, which is a conservative approach to this measurement).

Transit routes on the I-90 corridor are operating at 58% and 57% of their seating capacity during the morning and evening peak periods, respectively. While combined morning and evening ridership remained relatively steady since 2012, the amount of greenhouse gas emissions avoided improved by 1% in 2014. Overall emissions on the I-90 Spokane region corridor decreased by 11% between 2012 and 2014.

Spokane Transit Authority is anticipating grant funding to coordinate with WSDOT and regional partners to improve connections with routes outside of the corridor, upgrade passenger amenities, enhance operations and expand park and ride (P&R) facilities. These improvements will encourage additional ridership and accommodate growth in demand for P&R spaces.

***Park and ride:*** Along the I-90 corridor in the Spokane region in 2014, P&R utilization rates ranged from 68% to 97% depending on location. The Liberty Lake P&R, east of Argonne Road, saw an average utilization rate of 97%. Any P&R lot that has 85% or more utilization is identified as operating at capacity. The availability of P&R spaces within the transit service network provides essential access points to transit riders. P&R locations need to have enough parking spaces and high utilization of those spaces to accommodate demand.

# Tri-Cities US 395 Corridor Capacity Analysis

**Annual person miles traveled**

| 2012 | vs. | 2014 |
|---|---|---|
| N/A | | 79.7 |

in millions of miles

N/A[4]

**Annual vehicle delay[1,2]**

| 2012 | vs. | 2014 |
|---|---|---|
| N/A | | 1.1 |

in thousands of hours

N/A[4]

**Annual GHG emissions**

| 2012 | vs. | 2014 |
|---|---|---|
| N/A | | N/A |

in millions of pounds of $CO_2$ equivalents

N/A[4]

## Commute travel times

*2012 and 2014 during the morning (6-8 a.m) and evening (3-6 p.m.) peak periods; Weekday travel times in minutes during peak periods including average and reliable[3] travel times for single occupant vehicle (SOV) trips.*

- Average SOV
- Reliable SOV

### *Kennewick to Pasco*

Morning; 6-8 a.m.; Trip length 6 miles

SOV *2014* **12** **17**

### *Pasco to Kennewick*

Evening; 3-6 p.m.; Trip length 6 miles

SOV *2014* **14** **23**

## Park and ride capacity

*2014; Average percent occupied for select park and rides (see map for locations)*

### *Kennewick-Pasco commute*

| Park and ride (spaces) | 2014 percent occupied |
|---|---|
| Union Street & 27th Avenue (50) | 80% |
| Huntington Transit (96) | 61% |
| U.S. 395 & Yelm Street (39) | 50% |
| Pasco - North 22nd Avenue Transit (50) | 42% |

Data sources and analysis: WSDOT South Central Region Planning Office, National Performance Management Research Data Set, WSDOT Multimodal Planning Division and WSDOT Office of Strategic Assessment and Performance Analysis.

Notes: Measures at the top of the page are for the US 395 corridor in the Tri-Cities area for SOV trips only. 1 WSDOT defines delay as when average speeds are slower than 85% of the posted speed limit. 2 Annual vehicle delay for US 395 arterial corridor is calculated for peak periods only. 3 Reliable travel time will get commuters to their destination on time 19 out of 20 weekdays (95% of the time). 4 Data unavailable at this time.

US 395 is a key commute and freight route in the Tri-Cities region, which includes the cities of Pasco, Kennewick and Richland. More than 79.7 million person miles were traveled between Kennewick and Pasco in 2014. US 395 serves commuters traveling to business areas throughout the Tri-Cities, and as one of two major river crossings in the region, is one of the most critical links in the region's transportation system. Segments of the corridor experience moderate congestion during weekday morning (6-8 a.m.) and evening (3-6 p.m.) peak periods, in part due to traffic signals on the corridor.

Unlike freeway corridor analysis, there is little guidance on detailed performance measurement for arterial corridors. As a step forward in the evolving field of arterial corridor analysis, the 2015 *Corridor Capacity Report* is introducing a pilot analysis of US 395 in the Tri-Cities region that will serve as a baseline for identifying corridor capacity trends in future years. This corridor has eight signals regulating traffic flow, which inevitably adds to corridor delay in addition to any delay due to capacity issues. During the morning and evening peak hours in 2014, US 395 experienced approximately 1,100 vehicle hours of delay. In addition to delaying commuters, this congestion directly impacted the movement of goods in Washington as trucks accounted for approximately 11% of the total daily traffic volume on the corridor in 2014.

# Pilot capacity analysis to serve as baseline in Tri-Cities

## *What does congestion mean for travel times on the corridor?*

In 2014, northbound commuters on US 395 traveling the six miles from Kennewick to Pasco in the morning peak period experienced travel times of 12 minutes on average, three minutes longer than the maximum throughput travel time of nine minutes. Commuters could reach their destination 19 out of 20 times within 17 minutes. In addition to traffic signals, two lanes merging into one also contributed to the northbound capacity constraints. The US 395 Columbia River Bridge connects Kennewick and Pasco, and is a major chokepoint in the corridor in both directions. During the evening peak period, it took southbound commuters 14 minutes on average to travel on US 395 from the Lewis Street Interchange in Pasco to I-82 in Kennewick, five minutes longer than it would at maximum throughput. Nineteen out of 20 times, commuters could reach Kennewick within 23 minutes.

***Park and ride:*** Along the US 395 corridor in the Tri-Cities region in 2014, park and ride (P&R) utilization rates ranged from 42% to 80% depending on location. The Union Street and 27th Avenue P&R saw a utilization rate of 80%. Any P&R lot that has 85% or more utilization is identified as operating at capacity. Depending on data availability, transit measures will be discussed in future Tri-Cities region analyses. The availability of P&R spaces within the transit service network provides essential access points to transit riders, vanpools and carpools. P&R locations need to have enough parking spaces and high utilization of those spaces to accommodate demand.

## Future corridor analysis in the works for SR 240 and I-182

WSDOT conducted further preliminary congestion analysis on other key commute corridors in the Tri-Cities region. The analysis determined that I-82 and US 12 do not need to be tracked for corridor capacity concerns at this time, data is needed to determine if SR 397 should be tracked, and SR 240 and I-182 both have known congested segments in the Tri-Cities region that should be tracked when more detailed data becomes available.

SR 240 is an important commute and freight corridor in Richland, connecting the Tri-Cities to the U.S. Department of Energy Hanford Site north of the Tri-Cities and facilitating 61.4 million person miles traveled in 2014. This corridor has six traffic signals and experiences frequent and persistent delay during the commute peak periods on the portion of SR 240 known as the Bypass Highway from the I-182 interchange to Jadwin Avenue. When detailed traffic data becomes available, WSDOT will conduct a more complete congestion analysis. Specific to P&R lots along SR 240, utilization ranges from 4% (at a new lot) up to 55%. Many Hanford commuters arrive from outside the SR 240 corridor, so P&R lots across the region are crucial to maximizing capacity.

I-182 has two known congested segments—where the highway is concurrent with SR 240 and US 395. When data becomes available, WSDOT expects to analyze congestion on I-182 in Richland from the SR 240 Bypass Highway to George Washington Way, as well as in Pasco from US 395/20th Avenue to SR 397.

Visit bit.ly/CCR15Vancouvermap for this article's interactive map.

# Vancouver Region I-5 and I-205 Corridor Capacity Analysis

### Annual person miles traveled[1]

| 2012 | vs. | 2014 |
|---|---|---|
| 464.6 | | 481.1 |

in millions of miles — ▲ 3.6%

### Annual vehicle delay[2]

| 2012 | vs. | 2014 |
|---|---|---|
| 40.5 | | 51.9 |

in thousands of hours — ▲ 28%

### Annual GHG emissions

| 2012 | vs. | 2014 |
|---|---|---|
| 380.2 | | 377.5 |

in millions of pounds of $CO_2$ equivalents — ▼ 0.7%

### Annual passenger miles traveled on transit

| 2012 | vs. | 2014 |
|---|---|---|
| 2.0 | | 2.1 |

in millions of miles — ▲ 5.3%

### Capacity savings due to transit

| 2012 | vs. | 2014 |
|---|---|---|
| 0.2 | | 0.2 |

in number of lanes — ↔ 0%

### Percent transit seats occupied

| 2012 | vs. | 2014 |
|---|---|---|
| 51% | | 55% |

on average during peak periods — ▲ 4%

### Percent park and ride spaces occupied

| 2012 | vs. | 2014 |
|---|---|---|
| 53% | | 55% |

on average during peak periods — ▲ 2%

## Commute travel times

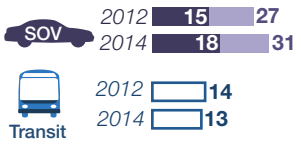
*2012 and 2014 during the morning (6-9 a.m) and evening (3-6 p.m.) peak periods; Weekday travel times in minutes at the 5-minute peak including average and reliable[3] travel times for single occupant vehicle (SOV) and planned transit[4] travel times.*

Average SOV
Reliable SOV
Planned transit time

### Interstate 5 commutes

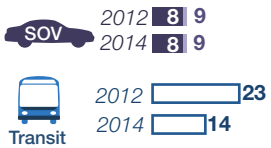
#### *I-205 to I-5 bridge*

Morning; 6:45 a.m.; Trip length 8 miles




#### *I-5 bridge to I-205*

Evening; 5:15 p.m.; Trip length 8 miles




### Interstate 205 commutes

#### *I-5 to I-205 bridge*

Morning; 7:40 a.m.; Trip length 10 miles

#### *I-205 bridge to I-5*

Evening; 5:30 p.m.; Trip length 10 miles

See Appendix pp. 40-42 for more commute routes

## Transit system use

*2012 and 2014; For typical weekday morning (6-9 a.m.) and evening (3-6 p.m.) transit[4] peak periods; Ridership and percent of available seats occupied on select commutes*

### *By commute*

| | Daily peak period riders | | Percent of seats occupied | |
|---|---|---|---|---|
| **Morning** (6-9 a.m.) | 2012 | 2014 | 2012 | 2014 |
| I-5: I-205 to I-5 bridge | 650 | 633 | 51% | 53% |
| I-205: SR 500 to I-205 bridge | 469 | 496 | 61% | 64% |
| **Evening** (3-6 p.m.) | | | | |
| I-5: I-5 bridge to I-205 | 547 | 608 | 45% | 52% |
| I-5: I-5 bridge to SR 500 | 479 | 553 | 52% | 57% |

## Park and ride capacity

*2012 and 2014; Average percent occupied for select park and rides[5] (see map for locations)*

### *Interstate 5 commute route*

| Park and ride (spaces) | 2012 percent occupied | 2014 percent occupied |
|---|---|---|
| 99th Street Transit Ctr. (609) | 61% | 65% |
| Salmon Creek (472) | 55% | 55% |
| Andresen (100) | 51% | 51% |
| BPA (390) | 16% | 19% |

### *Interstate 205 commute route*

| Park and ride (spaces) | 2012 percent occupied | 2014 percent occupied |
|---|---|---|
| Fisher's Landing Transit Ctr. (563) | 89% | 89% |
| Evergreen Transit Ctr. (267) | 12% | 12% |

Data sources and analysis: WSDOT Southwest Region Planning Office, Southwest Washington Regional Transportation Council, C-TRAN, National Performance Management Research Data Set and WSDOT Office of Strategic Assessment and Performance Analysis.

Notes: Measures at the top of the page are for SOV trips only on the I-5 and I-205 corridors in the Vancouver area. 1 Due to limited data availability, measurements for annual person miles traveled are not comparable to previous editions of the *Corridor Capacity Report*. WSDOT recommends that the percent change be used as an indicator of a general trend for the region. 2 WSDOT defines delay as when average speeds are slower than 85% of the posted speed limit. 3 Reliable travel time will get a commuter to their destination on time or early 19 out of 20 weekdays (95% of the time). 4 Transit travel times by bus include some off-highway travel to stops and may not be directly comparable to SOV times which are highway only. 5 The number of spaces and occupancy data has been updated for 2012 and 2014 based on the most current information.

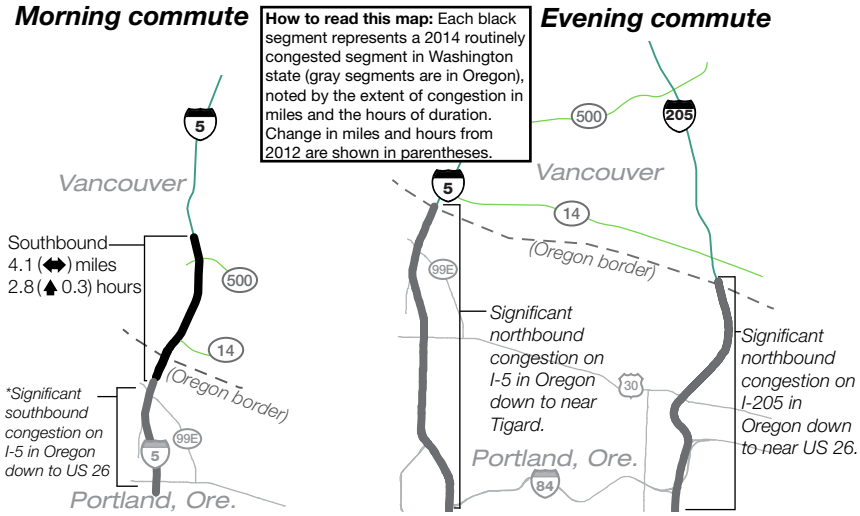
# I-5 bridge a bottleneck between Portland and Vancouver

Interstate 5 (I-5) and I-205 in the Vancouver region are two of the region's key commute and economic corridors. General trends for the corridors indicate a 3.6% increase between 2012 and 2014 in annual person miles traveled. The corridors analyzed are I-5 and I-205 from the I-5/I-205 split near the Clark County fairgrounds to the respective bridges that cross the Washington state line.

Traffic at specific locations on the corridor worsened from 2012 to 2014, with morning and evening weekday commutes experiencing moderate to heavy congestion on a daily basis. Delay increased 28% on the corridor between 2012 and 2014. In addition to delaying commuters, this congestion directly impacts the movement of goods in Washington as trucks accounted for almost 7% of the total daily traffic volume on the corridors in 2014.

**Routinely congested segments of I-5, I-205 in the Vancouver area**

*2014; For weekday morning (6-9 a.m.) and evening (3-6 p.m.) peak periods; Length of backup in miles; Daily duration of congestion in hours (compared to 2012)*

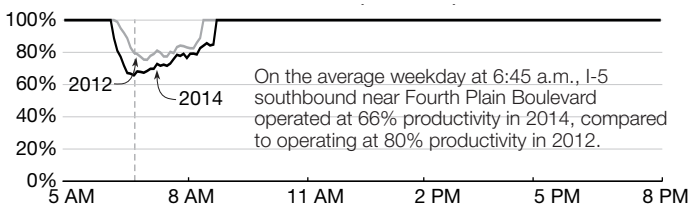



Data sources and analysis: National Performance Measurement Research Data Set, WSDOT Southwest Region Planning Office and WSDOT Office of Strategic Assessment and Performance Analysis.

***Highway productivity:*** As traffic increases, congested roads carry fewer vehicles, resulting in a drop in throughput productivity at speeds slower than maximum throughput. In order to gauge the lost productivity on I-5 and I-205 in the Vancouver region, WSDOT analyzed vehicle throughput at two locations: near Fourth Plain Blvd. on I-5 and near 10th Street on I-205. In 2012 and 2014, productivity at these locations at their most congested ranged from 66% to 100%, meaning that up to one-third of the freeway's capacity was unavailable due to congestion for a short time during the morning peak period. The graph below shows how productivity varies by direction of travel, location and time of day near Fourth Plain Blvd.

**Throughput on southbound I-5 near Fourth Plain Boulevard**

*2012 and 2014; Based on the highest observed 5-minute flow rate; Southbound = 1,430 vehicles per hour per lane = 100%*




Data sources and analysis: WSDOT Southwest Region Planning Office and WSDOT Office of Strategic Assessment and Performance Analysis.

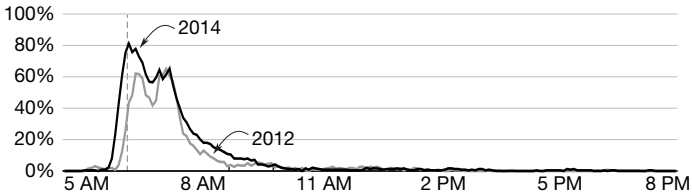
Note: This graph is for a specific location and not representative of operations along the entire corridor. There are areas of congestion that are not displayed on this graph due to the limited data available.

***Routinely congested segments:*** Of the 36 miles on the I-5 and I-205 corridors from where they split near the Clark County fairgrounds to the respective bridges that cross the Washington state line (both directions), the segments between SR 500 and the I-5 bridge in the southbound direction experienced routine congestion in the morning. The amount of time of routine congestion increased by 12%. As shown in the maps above, significant congestion also occurred in the Portland area on the I-5 and I-205 corridors heading into Washington during the evening commute.

***A focus on hot spots:*** Morning commuters driving on I-5 between the I-205 interchange and the I-5 bridge at the state line drove in severely congested conditions (36 mph or less) more often in 2014 than in 2012. During the morning peak period up to 80% of the weekday

**Severe congestion on the I-5 Vancouver to Portland commute (I-205 interchange to I-5 bridge)**

*2012 and 2014; Southbound; Percent of days the average speed was slower than 36 mph*

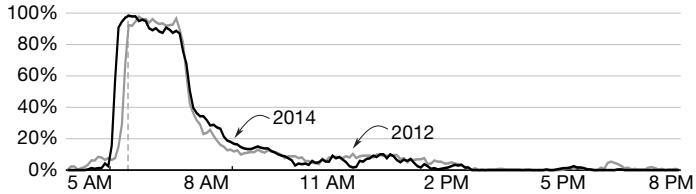



Data sources and analysis: National Performance Management Research Data Set and WSDOT Office of Strategic Assessment and Performance Analysis.

# Transit moved 7% more people during peaks in 2014

commutes on this segment of I-5 experienced speeds below 36 mph (see graph at bottom of last page). Similarly, the sub commute on I-5 from SR 500 to the I-5 bridge experienced severe congestion close to 100% of all weekdays. For example, at around 6:30 a.m. the percent of days speeds were below 36 mph increased from 92% in 2012 to 98% in 2014 (see graph below).

**Severe congestion on the I-5 Vancouver to Portland commute (SR 500 to I-5 bridge)**
*2012 and 2014; Southbound; Percent of days the average speed was slower than 36 mph*




Data sources and analysis: National Performance Management Research Data Set and WSDOT Office of Strategic Assessment and Performance Analysis.

## *What does severe congestion mean for travel times on the corridor?*

***Single occupancy vehicle trips:*** Between 2012 and 2014, average travel times for I-5 commutes in the Vancouver region increased by three minutes or less, while the reliable travel times increased by no more than four minutes. On I-205 commutes average travel times increased by no more than two minutes. However, the reliable travel time on the morning I-205 commute from the I-5 interchange to the Glenn Jackson Bridge increased by 11 minutes (up 73%), from 15 minutes in 2012 to 26 minutes in 2014.

***Transit trip travel times:*** Six of the eight commutes tracked on I-5 and I-205 have transit travel time data. For example, in 2014 the planned transit travel time for the I-5 commute from the I-5/I-205 interchange to the I-5 bridge in the morning was 33 minutes. For the return trip in the evening, the planned transit travel time was 43 minutes. See p. 39 for a comparison of transit trips to SOV and HOV trips.

***Transit ridership and GHG emissions avoided:*** Transit moved 2,468 people on both the corridors combined during the morning and evening peaks on an average weekday in 2014, a 7% increase over 2012. Transit ridership during peak periods translates to fewer cars on the road, which helps alleviate traffic congestion by making the most efficient use of available highway capacity. Peak period transit ridership on the I-5 and I-205 Vancouver region corridors was equal to a fifth of an extra lane of capacity in 2014 (when compared to the peak efficiency of the roadway, which is a conservative approach to this measurement).

Transit routes on the I-5 and I-205 corridors combined operated on average at 54% of their seating capacity during peak periods, a 3% improvement from 2012. Transit use during peak periods avoided 3,438 pounds of greenhouse gas emissions per day on the I-5 and I-205 corridors in 2014, a 10% improvement compared to 2012 (3,117 pounds).

***Park and ride:*** Along the I-5 corridor in the Vancouver region in 2014, park and ride (P&R) utilization rates ranged between 19% and 65% depending on the location, with the 99th Street Transit Center showcasing the highest average utilization rate of 65%. Similarly, in 2014, P&R utilization rates on I-205 at the two monitored locations were 12% at Evergreen Transit Center and 89% at Fisher's Landing Transit Center. Any P&R lot that has 85% or more utilization is identified as operating at capacity. The availability of P&R spaces within the transit service network provides essential access points to transit riders. P&R locations need to have enough parking spaces and high utilization of those spaces to accommodate demand.

Amtrak CASCADES

# Corridor Capacity Analysis

**Passenger miles traveled**

| 2012 | vs. | 2014 | |
|---|---|---|---|
| 103.1 | | 111.7 | ▲ 8.3% |

in millions of miles

**Annual on-time performance[1]**

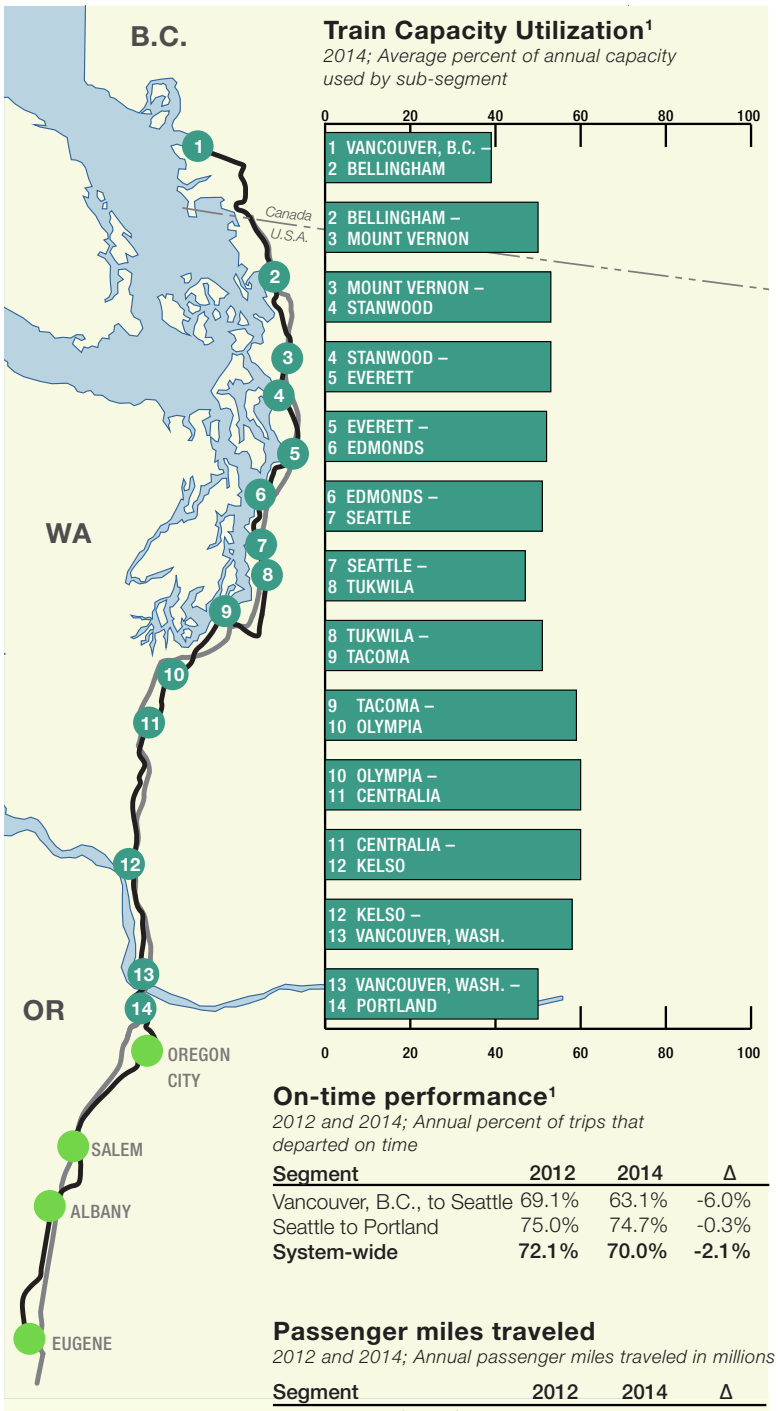
| 2012 | vs. | 2014 | |
|---|---|---|---|
| 72.1% | | 70.0% | ▼ 2.1% |

of scheduled trips

**Annual capacity utilization + annual ridership**

| 2012 | vs. | 2014 | | 2012 | vs. | 2014 | |
|---|---|---|---|---|---|---|---|
| 64% | | 60% | ▼ 4% | 725 | | 700 | ▼ 3.4% |

for the peak sub-segment — in thousands of passengers




**Train Capacity Utilization[1]**

*2014; Average percent of annual capacity used by sub-segment*

**On-time performance[1]**

*2012 and 2014; Annual percent of trips that departed on time*

| Segment | 2012 | 2014 | Δ |
|---|---|---|---|
| Vancouver, B.C., to Seattle | 69.1% | 63.1% | -6.0% |
| Seattle to Portland | 75.0% | 74.7% | -0.3% |
| **System-wide** | **72.1%** | **70.0%** | **-2.1%** |

**Passenger miles traveled**

*2012 and 2014; Annual passenger miles traveled in millions*

| Segment | 2012 | 2014 | Δ |
|---|---|---|---|
| Vancouver, B.C., to Seattle | 23.4 | 27.6 | 17.9% |
| Seattle to Portland | 79.8 | 84.1 | 5.4% |
| **System-wide** | **103.1** | **111.7** | **8.3%** |

As population and economic activity grow and congestion worsens along the I-5 corridor, the importance of providing travel options that reduce reliance on single-occupancy vehicles to leisure and business travelers increases. As part of the state's long-term strategy to provide a sustainable multimodal transportation system and increase person throughput, Amtrak Cascades provides five daily intercity rail round trips for various segments of the Vancouver, British Columbia, to Eugene, Oregon, corridor.

***Passenger miles traveled:*** In 2014, Amtrak Cascades passengers rode 111.7 million passenger miles in Washington, an increase of 8.3% from 2012. This increase indicates that riders on average traveled longer distances per trip since ridership simultaneously decreased by 3.4%. Washington trains carried each passenger an average of 120 passenger miles per gallon of fuel in 2014, based on a locomotive fuel use estimate of 1.2 gallons per mile.

***Capacity utilization:*** Riders utilized 60% of Amtrak Cascades train capacity on average in Washington in 2014 for the peak sub-segments (Olympia – Centralia and Centralia – Kelso), four percentage points lower than in 2012. Average train capacity fluctuates throughout the year, with trains selling out during weekends, holidays and summer months. Utilization rates for the peak sub-segment can limit available capacity for the entire corridor. WSDOT measures capacity utilization for each sub-segment using a ratio of seats used to seats available.

***On-time performance:*** Trains in Washington achieved 70% on-time performance in 2014, down approximately two percentage points from 2012, due in part to a 20-project construction program to improve trip reliability. The Seattle to Portland evening trip had the highest on-time performance, at 82.3%. The on-time performance goal is 80%, but inter-train congestion consistently cause corridor delays. The corridor improvement projects, complete in 2017, will reduce congestion and add capacity.

Data source and analysis: WSDOT Rail Division.

Notes: All "Washington" data is for trains between Portland, Oregon, and Vancouver, B.C. regardless of funding entity. See bit.ly/RailPerformance for more information. 1 A train is considered on time if it is within 10 minutes of scheduled arrival times for trains operating the Vancouver, B.C. to Seattle and Seattle to Portland segments; or 15 minutes of scheduled arrival times for trains operating the Vancouver, B.C. to Portland segment.

# Washington's Ferry Corridor Capacity Analysis

**Annual ridership[1]**

| 2012 | vs. | 2014 | |
|---|---|---|---|
| 22.20 | | 23.19 | ▲ 4% |

in millions of passengers

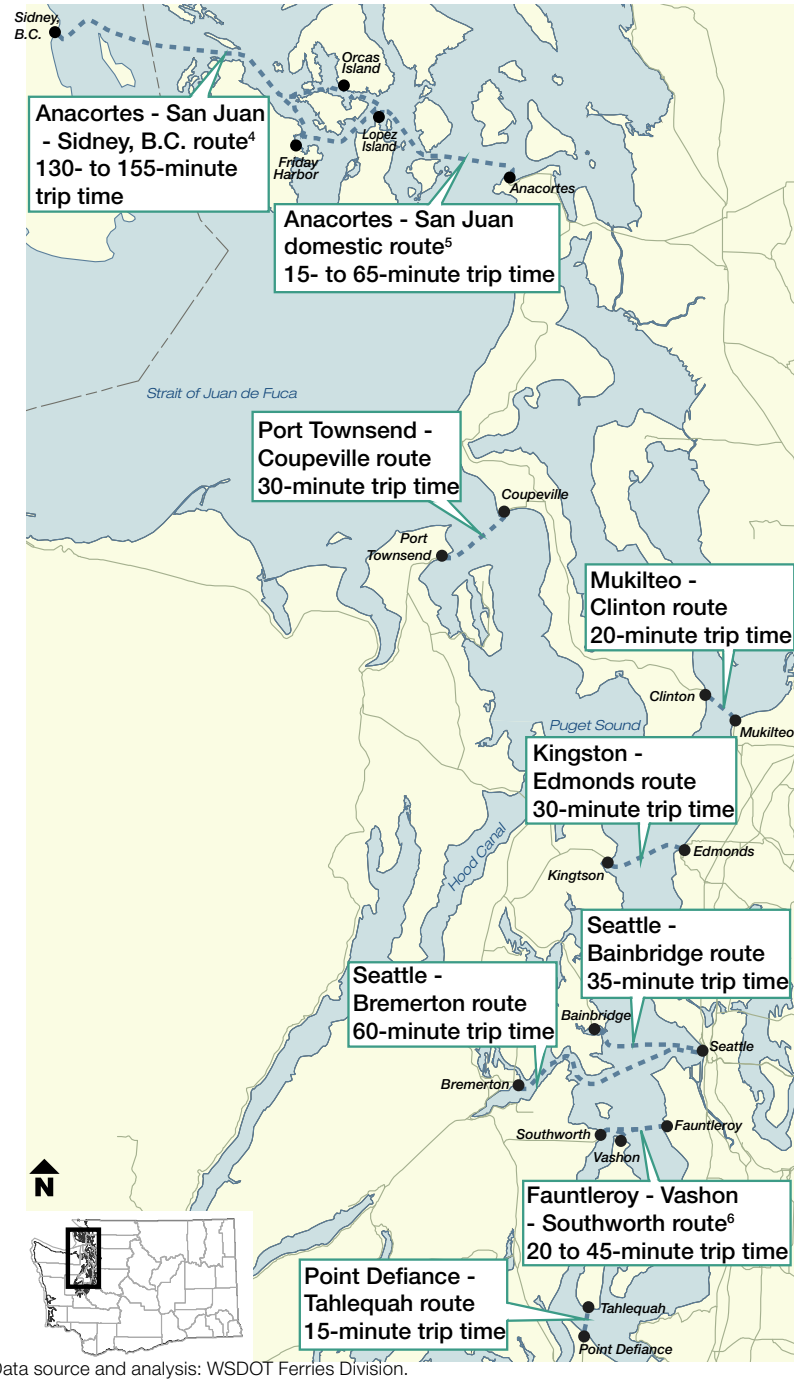
**Annual trip reliability[2]**

| 2012 | vs. | 2014 | |
|---|---|---|---|
| 99.5% | | 99.4% | ▼ 0.1% |

of scheduled trips sailed

**Annual fuel usage + use per service mile**

| 2012 | vs. | 2014 | | 2012 | vs. | 2014 | |
|---|---|---|---|---|---|---|---|
| 17.47 | | 17.26 | ▼ 1% | 19.12[3] | | 19.00 | ▼ 1% |
| in millions of gallons | | | | in gallons per mile | | | |




## Ferry capacity utilization

*2012 and 2014; Vehicle utilization (driver + passenger utilization)*

| Ferry Route | 2012 | 2014 | Δ |
|---|---|---|---|
| Anacortes - San Juan domestic | 53% (9%) | 56% (12%) | 3% (3%) |
| Anacortes - San Juan - Sidney, B.C. | 55% (17%) | 55% (18%) | 0% (1%) |
| Edmonds - Kingston | 65% (10%) | 66% (11%) | 1% (1%) |
| Fauntleroy - Vashon - Southworth | 60% (9%) | 60% (9%) | 0% (0%) |
| Mukilteo - Clinton | 66% (12%) | 66% (12%) | 0% (0%) |
| Point Defiance - Tahlequah | 45% (6%) | 50% (7%) | 5% (1%) |
| Port Townsend - Coupeville | 64% (11%) | 66% (11%) | 2% (0%) |
| Seattle - Bainbridge | 60% (15%) | 61% (15%) | 1% (0%) |
| Seattle - Bremerton | 44% (13%) | 45% (15%) | 1% (2%) |
| **System-wide** | **59% (11%)** | **61% (12%)** | **2% (1%)** |

Notes: Utilization data is based on the cumulative capacity (in terms of the number of vehicle spaces and room for passengers) on all vessels serving that route, and is measured for all sailings in a calendar year. Utilization for the San Juan domestic route is measured at Anacortes, and for the Fauntleroy - Vashon - Southworth "triangle route" at Fauntleroy. 2012 utilization data for the triangle route has been updated to show a change in allotment assumptions. See Appendix p. 43 for number of trips data.

## On-time performance by route

*2012 and 2014; Annual percent of trips that departed on time*

| Ferry Route | 2012 | 2014 | Δ |
|---|---|---|---|
| Anacortes - San Juan domestic | 88.0% | 90.3% | 2.3% |
| Anacortes - San Juan - Sidney, B.C. | 88.8% | 90.1% | 1.3% |
| Edmonds - Kingston | 99.3% | 98.6% | -0.7% |
| Fauntleroy - Vashon - Southworth | 95.6% | 92.3% | -3.3% |
| Mukilteo - Clinton | 98.7% | 97.5% | -1.2% |
| Point Defiance - Tahlequah | 99.4% | 99.6% | 0.2% |
| Port Townsend - Coupeville | 93.3% | 95.3% | 2.0% |
| Seattle - Bainbridge | 97.3% | 94.2% | -3.1% |
| Seattle - Bremerton | 97.9% | 98.1% | 0.2% |
| **System-wide** | **95.8%** | **94.8%** | **-1.0%** |

Notes: A vessel is considered on time if it departs within 10 minutes of its scheduled departure. WSDOT's annual goal is for 95% of trips to depart on time.

## Ridership by route

*2012 and 2014; Annual ridership in thousands*

| Ferry Route | 2012 | 2014 | %Δ |
|---|---|---|---|
| Anacortes - San Juan domestic | 1,755 | 1,911 | 9% |
| Anacortes - San Juan - Sidney, B.C. | 135 | 140 | 3% |
| Edmonds - Kingston | 3,808 | 4,003 | 5% |
| Fauntleroy - Vashon - Southworth | 2,886 | 2,919 | 1% |
| Mukilteo - Clinton | 3,835 | 3,950 | 3% |
| Point Defiance - Tahlequah | 650 | 705 | 8% |
| Port Townsend - Coupeville | 684 | 723 | 6% |
| Seattle - Bainbridge | 6,119 | 6,321 | 3% |
| Seattle - Bremerton | 2,329 | 2,523 | 8% |
| **System-wide** | **22,201** | **23,194** | **4%** |

Data source and analysis: WSDOT Ferries Division.

Notes: 1 Passenger ridership includes vehicle drivers and passengers, as well as walk-on passengers and bicyclists. 2 Trip reliability is the ratio of actual sailings compared to the number of scheduled sailings. 3 This figure has been updated since the 2013 *Corridor Capacity Report* to reflect more accurate rounding. 4 The international route takes 130 minutes non-stop between Anacortes and Sidney, B.C., and 155 minutes if the trip stops at Friday Harbor. 5 Data for the San Juan inter-island route is combined with the San Juan domestic route. The 65-minute trip time is specifically for Anacortes to Friday Harbor with no stops, and the inter-island trips have shorter trip times. 6 Some trips are direct between two locations (with shorter trip times) and others serve all three locations.

# On average, 61% of vehicle capacity on ferries is used

Annual ridership on WSDOT ferries increased 4%, with about 740,000 more passengers and 252,000 more vehicles in 2014 than in 2012. Annual trip reliability changed less than 1% in that timeframe. Both years met the system-wide goal of completing at least 99% of scheduled sailings. Fuel use is related to the number of sailings, the type and size of vessel, and route characteristics. Between 2012 and 2014, ferry vessel fuel use decreased 1%.

WSDOT's ferry service routes function as marine corridors in Washington state. They are integral links across the Puget Sound, connecting island and peninsula communities with the major employment centers.

## Ferry route analysis:

***Ridership by route:*** Ridership increases ranged between 1% and 9% on all nine reported-on routes from 2012 to 2014. The largest ridership increase (9%) was on the Anacortes – San Juan Domestic route, even with 35 fewer trips. The Point Defiance – Tahlequah and Seattle – Bremerton routes showed ridership increases over 8% in the two-year period. These increases are likely due to an economic upswing, indicated by an increase in leisure trips measured by higher single ticket sales.

***Ferry route capacity:*** WSDOT owns and operates 23 ferry vessels — the newest in the fleet Motor/Vessel (M/V) *Samish* was launched in June 2015. These vessels serve nine routes with stops at 19 ferry terminals in Washington and one in Sidney, British Columbia (B.C.). Seven of the nine ferry routes are served by at least two vessels, operating simultaneously in order to keep terminal wait times low. The route capacity is defined as the cumulative passenger and vehicle capacities for all sailings of each vessel serving a particular route, and may fluctuate depending on vessel size or crew for each trip. Read more in the 2014 *Corridor Capacity Report* (p. 42).

***Capacity utilization:*** In 2014, the utilization of vehicle spaces on all ferry trips averaged 61%, two percentage points higher than in 2012. Vehicle space utilization on individual ferry routes ranged between 45% (Seattle – Bremerton) and 66% (Mukilteo – Clinton; Edmonds – Kingston; and Port Townsend – Coupeville) in 2014. Ferry route utilization based on ridership and vessel capacity reflects utilization for all sailings over the entire day, not for peak periods as used by most other transportation modes.

Because ferry vessels are capable of carrying many more passengers than vehicles, the passenger utilization rates are lower, ranging from 7% (Point Defiance – Tahlequah) to 18% (between Canada and the U.S.) of the available capacity in 2014.

Passenger capacity utilization on ferries, which includes drivers of the onboard vehicles, increased one percentage point statewide in 2014 as compared to 2012. The highest increase of three percentage points was observed on the Anacortes – San Juan Domestic route. Similarly, vehicle capacity utilization remained fairly steady, changing two percentage points or less for all ferry routes except two. The Anacortes – San Juan Domestic route vehicle capacity utilization increased three percentage points and the Point Defiance – Tahlequah route increased five percentage points.

***On-time performance:*** There were more than 162,000 sailings in 2014, an average of 444 sailings every day of the year. In 2014, 94.8% of sailings departed within 10 minutes of their scheduled departure, which is just shy of WSDOT's annual system wide goal of 95%. On six of nine routes, on-time performance held steady or improved from 2012 to 2014. The largest improvement, 2.3 percentage points, was on the Anacortes – San Juan Domestic route, with an on-time performance of 90.3% in 2014. On-time performance declined on the Fauntleroy – Vashon – Southworth route by 3.3 percentage points to 92.3%, due in part to vessel mechanical issues and heavy traffic during the busy summer months. Four routes did not meet WSDOT's system wide goal for on-time performance, partly due to slow replacement boats and longer loading times related to increased system ridership.

***Trip reliability:*** Two routes in 2014 did not meet the annual system-wide reliability goal of completing at least 99% of scheduled sailings. On the remaining seven routes that were above the goal, reliability changed less than one percentage point. On the Port Townsend – Coupeville route, trip reliability dropped from 96.9% to 95.6% between 2014 and 2012, meaning that 117 fewer scheduled trips were completed on this route in 2014 than in 2012. Reliabilty for the Anacortes – San Juan – Sidney, B.C. route also dropped from 100% to 98.2% in this time frame. Fourteen fewer scheduled trips were completed in 2014 compared to 2012, with 10 of those cancellations resulting from the vessel being shuffled to cover service needs created by mechanical issues on the M/V *Tacoma*.
**See Appendix p. 43 for more ferry performance data.**

## Federal law emphasizes system performance

The Moving Ahead for Progress in the 21st Century (MAP-21) federal legislation is intended to increase the transparency and accountability of states in their investment of taxpayer dollars in transportation infrastructure and services nationwide, and ensure states invest money in transportation projects that collectively make progress toward achieving national transportation goals.

The MAP-21 law sets performance measure requirements for states in various areas, including air quality and system performance. The national MAP-21 goals include reducing congestion, improving system reliability, supporting freight movement and economic vitality, and ensuring environmental sustainability.

WSDOT has proactively worked 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 is still in progress and 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 current status for MAP-21, see *Gray Notebook* 58, p. 6.

## Results Washington focuses on performance and accountability

Results Washington, the state's performance management system that outlines Gov. Jay Inslee's priorities for the state, focuses on key goals that strive to strengthen the economy, protect the environment, and make Washington an ideal place to live and do business.

WSDOT manages performance measures related to sustainable, efficient infrastructure, which falls within the prosperous economy goal area. The Results Washington transportation performance measures related to system performance and commute methods include the following:

- **Alternative commute methods:** Increase the percentage of Washingtonian's using alternative commute methods to 29% by 2020.
- **Travel and freight reliability:** Ensure travel and freight reliability (impacted by economic growth) on strategic corridors does not deteriorate beyond 5% from 2012 levels through 2017.
- **System efficiency:** Operate strategic corridors at 90% efficiency or higher through 2017.

**Alternative Commute Methods:** A transportation system that integrates and supports travel by many different modes can work more efficiently, improve mobility and accessibility and reduce greenhouse gas emissions. Increasing the use of alternative modes of transportation improves reliability and helps maximize capacity on the entire transportation system.

In 2014, 27.6% of Washington workers age 16 years and older used an alternative commute method (which includes carpool, vanpool, public transportation, walk, bike, taxicab, motorcycle, or telecommute) to travel to work. This is a 0.3 percentage point increase from 27.3% of Washington workers using alternative commute methods in 2013, but a 0.2 percentage point decrease from 27.8% in 2012.

WSDOT uses a variety of strategies to manage demand on the transportation system, which include incorporating demand management strategies into project design and corridor planning studies, Commute Trip Reduction, and improving bicyclist and pedestrian safety. The Results Washington report for alternative commute methods can be accessed at http://1.usa.gov/1itYe8j.

**Travel and Freight Reliability:** Washington state depends on its roadways to reliably move people and goods. Reliability is an important metric for highway users because it provides information that allows travelers to plan for on-time arrival with a higher degree of certainty. Commuters can plan their daily trips to work during peak hours, and shippers and freight carriers require predictable travel times to remain competitive. Maintaining reliable travel times for people and freight movement is important to the region's economic vitality.

# Travel reliability worsens as economy grows

WSDOT uses a reliability index for the daytime travel period (5 a.m. to 8 p.m.) for 26 central Puget Sound key commute routes to assess travel and freight reliability. The reliability index is the 80th percentile reliable travel time (the travel time at which the traveler is on time four out of five weekday trips) divided by the maximum throughput travel time (the amount of time it takes to travel the length of a corridor at maximum throughput speed). A reliability index greater than 1 indicates that the system is congested; an increase in the index over time indicates worsening congestion and less reliable travel times.

In 2014, travel and freight reliability increased by about 6.6% from 2012 levels; therefore, WSDOT did not meet the goal of maintaining travel and freight reliability to no more than 5% above the 2012 baseline. Travel time reliability has been worsening since 2009, which follows the overall trend of economic growth. Reliable travel times are impacted by economic activity because more people and freight movement often means more traffic on the roads.

WSDOT's strategies for improving travel and freight reliability include implementing Practical Solutions to enable more flexible and sustainable transportation investment decisions, promoting multimodal transportation options, and integrating tolling and High Occupancy Toll (HOT) lanes. The Results Washington report for travel and freight reliability can be accessed at https://data.results.wa.gov/reports/G2-3-2-a-Travel-and-Freight-Reliability.

**System Efficiency:** Commuters value efficiency across all transportation modes because it allows them to make better use of their own time, while shippers and freight carriers require an efficient system to remain competitive.

By tracking throughput productivity, WSDOT can monitor and prioritize efficiency needs. WSDOT averages the throughput productivity percentages (the percentage of maximum throughput recorded) for 20 locations on central Puget Sound corridors during the daytime travel period (5 a.m. to 8 p.m.). An increase in throughput productivity indicates that system efficiency has improved, meaning more people and/or goods are being moved per corridor mile.

For 2014, WSDOT met the goal of operating strategic corridors at 90% efficiency or higher. However, system efficiency has been worsening overall since 2009, which follows the overall trend of economic growth since the Great Recession. The most recent data shows throughput productivity in 2014 at approximately 94.6%.

WSDOT's strategies for improving system efficiency are the same as the strategies for travel and freight reliability. The Results Washington report for system efficiency can be accessed at https://data.results.wa.gov/reports/G2-3-2-b-Capacity-on-Strategic-Corridors.

## WSDOT prioritizes clean transportation

WSDOT also has an interest in the clean transportation measures that fall under the sustainable energy and a clean environment goal area. These performance measures include reducing transportation-related greenhouse gas (GHG) emissions, reducing average GHG emissions for each vehicle mile traveled in Washington, improving the fuel efficiency of Washington's passenger vehicle and light duty truck fleet, and increasing the number of plug-in electric vehicles registered in the state. Reports for these measures can be accessed at https://data.results.wa.gov/stat/goals/jwmx-2eqx/6rbf-43qk/m9ep-tu5s.

## Results WSDOT sets the agency's direction and priorities

Results WSDOT, the agency's strategic plan for 2014-2017, aligns with Results Washington. This plan focuses on maximizing capacity for the entire multimodal system, emphasizes working across all modes, and strives to provide and support safe, reliable and cost-effective transportation options to improve livable communities and economic vitality for people and businesses. The 2015 *Corridor Capacity Report* was created to help inform WSDOT policy makers, planners and engineers as they examine opportunities for maximizing multimodal capacity, supporting Results WSDOT's emphasis on innovation through Practical Solutions and performance based planning initiatives.

RESULTS WSDOT
MOVING WASHINGTON FORWARD

For more information on Results WSDOT, see http://www.wsdot.wa.gov/Secretary/ResultsWSDOT.htm.

# WSDOT teams keep traffic moving at 48,691 incidents

Incident Response (IR), WSDOT's traffic incident management program, responded to 48,691 incidents in 2014, clearing scenes to keep traffic moving in an average of 12 minutes and 12 seconds from incident notification. WSDOT's assistance provided approximately $74.1 million in estimated economic benefit to travelers and businesses in Washington by reducing congestion caused by traffic incidents and helping prevent secondary incidents. WSDOT's annual IR budget was $4.5 million in 2014, meaning WSDOT provided an estimated $16.46 benefit for every dollar spent on traffic incident management.

## Incident clearance times improve by half a minute from 2012

WSDOT's IR teams cleared incidents in an average of 12 minutes and 12 seconds in 2014, half a minute faster than the clearance time teams achieved in 2012. The IR program's average incident clearance time has hovered around 12 minutes and 40 seconds from 2010 through 2013. In general, faster clearance times mean less incident-induced congestion and fewer secondary incidents.

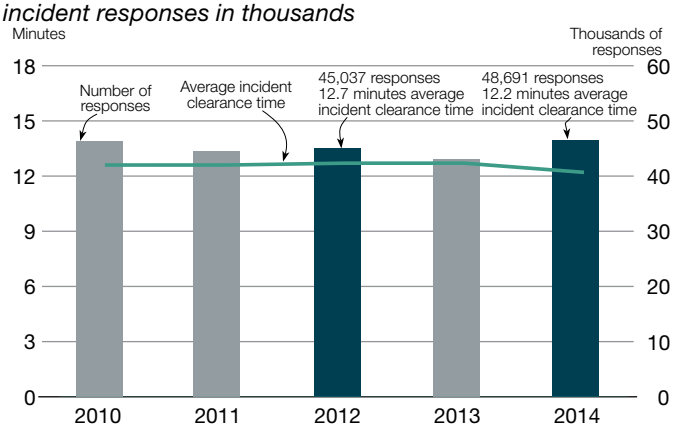
**Traffic incident management is a key strategy for maximizing highway system performance**

Traffic incidents such as collisions are responsible for nearly half of non-recurrent congestion (traffic congestion caused by one-time events). Non-recurrent congestion can also be caused by severe weather or large events. These events temporarily reduce the transportation system's ability to move people and goods. Traffic incident management is nationally recognized as a best practice for reducing or preventing non-recurrent congestion.

The mission of WSDOT's Incident Response program is to clear traffic incidents safely and quickly, minimizing congestion and the risk of secondary collisions. The program is active in all six WSDOT regions with about 80 trained IR drivers and 62 dedicated vehicles. Teams patrol 493 centerline miles of state highway on major corridors during peak traffic hours and assist the Washington State Patrol in traffic emergencies at all hours.

**Incident clearance times remain below 13 minutes during past four years, total incidents down slightly**

*2010 through 2014; Clearance time in minutes; Number of incident responses in thousands*




Data source: Washington Incident Tracking System (WITS)

Notes: Data is only for incidents to which a WSDOT Incident Response team responded

## WSDOT prevents $74.1 million in delay and secondary collisions

WSDOT estimates that IR crews' proactive management of incident scenes provided an economic benefit of $74.1 million to travelers and businesses using Washington highways in 2014. These benefits are provided in two ways. First, by clearing incidents as quickly as possible, WSDOT crews reduce the time and fuel motorists would have wasted in incident-induced congestion. In 2014, WSDOT estimates that IR crews prevented about $41.6 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 or sudden changes in traffic conditions. WSDOT crews prevented an estimated 9,738 secondary

*An Incident Response unit at the scene of a major incident on I-5 in 2014. WSDOT crews work to keep emergency responders and commuters safe at incident scenes while also helping to keep traffic moving.*

# WSDOT responds to 48,691 incidents in 2014

**WSDOT teams' performance at incidents in 2014 prevents $74.1 million in incident-related costs**
*2014; Incidents by duration; Time in minutes; Cost and economic benefit in dollars*

| | | Blocking[1] incidents | | All incidents | | Economic impacts | |
|---|---|---|---|---|---|---|---|
| **Incident duration** | **Number of incidents[2]** | **Percent blocking** | **Average roadway clearance time** | **Average incident clearance time** | **Average roadway clearance time** | **Cost of incident-induced delay** | **Economic benefits[3] from IR program** |
| Less than 15 min. | 36,285 | 15.1% | 4.6 | 5.0 | 4.4 | $48,092,534 | $22,465,794 |
| Between 15 and 90 min. | 9,621 | 49.0% | 25.3 | 29.8 | 25.1 | $85,347,053 | $37,732,914 |
| Over 90 min. | 540 | 84.4% | 169.3 | 183.9 | 168 | $32,898,110 | $13,907,348 |
| **Total** | **48,691** | **22.9%** | **20.8** | **12.2** | **20.1** | **$166,337,697** | **$74,106,056** |
| **Percent change from 2012** | ↑ **8.1%** | ↑ **1.6%** | ↓ **1.5%** | ↓ **3.6%** | ↓ **4.8%** | ↑ **5.8%** | ↑ **4.9%** |

Data sources: Washington Incident Tracking System, Washington State Patrol, WSDOT Traffic Office, and Washington State Transportation Center.
Notes: 1 An incident is defined as blocking when it closes down at least one lane of travel on the road. 2 WSDOT teams were unable to locate (UTL) 2,245 of the 48,691 incidents. UTL incidents are included in the total number of incidents but not figured into other performance measures. 3 Economic benefits include the sum of benefits from saved time, gas and secondary incidents avoided due to IR teams' proactive work. Numbers may not add due to rounding.

incidents in 2014, resulting in $32.5 million of economic benefit. See WSDOT's *Handbook for Corridor Capacity Evaluation* pp. 40-42 for delay reduction benefit calculations as well as all other IR related metrics.

## Incidents led to $166 million in congestion-related costs

Traffic delay at the 48,691 incidents that WSDOT teams responded to in 2014 cost travelers on Washington highways an estimated $166.3 million. This is 5.8% more than the $157.2 million in costs that occurred in 2012. Without the work of WSDOT's IR crews, this cost would have been $240.4 million ($74.1 million in prevented delay and secondary collisions costs plus $166.3 million in actual delay costs).

## Blocking incidents make up less than a quarter of all incidents, half of delay

About 22.9% of the incidents that WSDOT's IR teams responded to in 2014 blocked at least one lane of traffic (10,652 out of the 48,691 total incidents for the year). These blocking incidents caused 56.7% of the incident-related congestion costs for the year.

Blocking incidents have been found to cause more congestion per minute of incident than non-blocking incidents. Also, blocking incidents tend to last longer (see the incident duration column in the table above) as they are more complicated to clear.

## Commercial vehicles involved in 7.4% of all incidents

Commercial vehicles, such as semitrucks, were involved in 3,440 incidents or about 7.4% of all incidents IR teams responded to in 2014 (not including unable to locate or UTL incidents, see notes in table above). On average these incidents took 14 minutes and 36 seconds to clear, about 2 minutes and 24 seconds longer than the overall average clearance time.

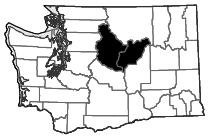
However, commercial vehicles were involved in a larger proportion of incidents lasting over 90 minutes, accounting for 16.7% of these incidents. Furthermore, over-90-minute incidents involving a commercial vehicle took an average of 3 hours and 28 minutes to clear. This is roughly 24 minutes longer than all over-90-minute incidents.

Incidents involving commercial vehicles can be more complex to clear due to factors such as the size of the vehicle or any freight spilled due to the incident. These incidents can also require special towing equipment. Just like with other incidents, WSDOT's goal is quicker clearance times and less impact to the overall system.

### Customer feedback: Incident Response program keeps traffic safe and moving

WSDOT drivers give comment cards to motorists who receive assistance. Below are comments the program received in 2013.

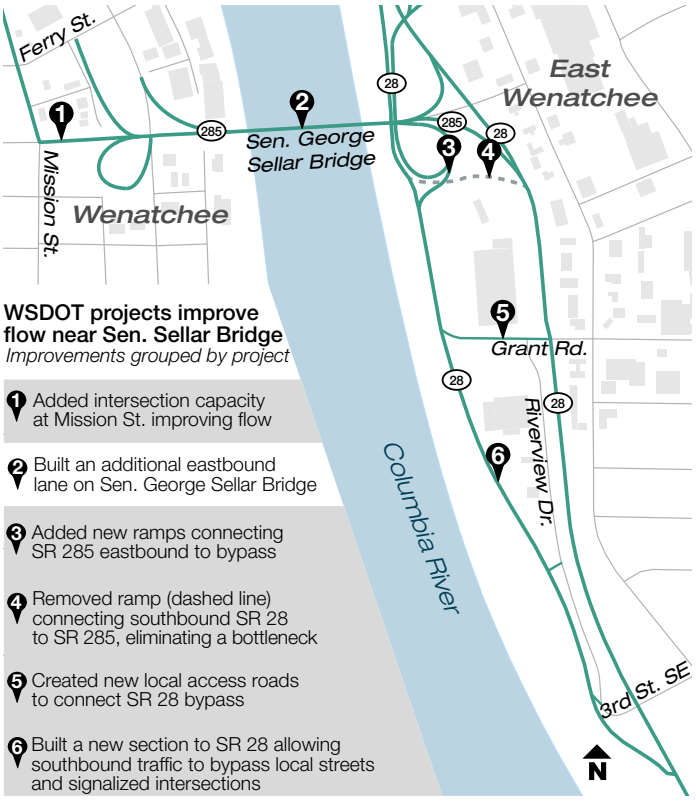
- *My car ran out of gas in the middle of a traffic jam...Within 30 seconds [IR] was helping me...Thanks!*
- *This was a fantastic service and made a very bad situation much safer for the people involved in the disabled van.*
- *Randy was kind and worked very fast! I am so thankful! He even helped me merge back into traffic when finished.*



# New capacity expedites travel in Wenatchee

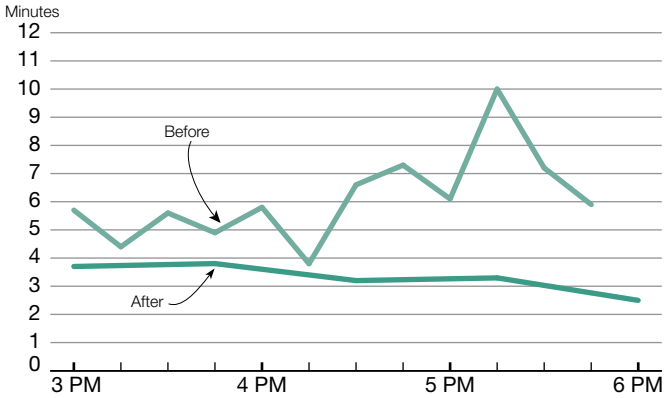
WSDOT completed a series of three projects between May 2009 and December 2013 to relieve congestion on State Route (SR) 285 and SR 28 near the Sen. George Sellar Bridge in Wenatchee. WSDOT's evaluation shows the new capacity and redesigned interchanges improved the average travel time from Ferry Street to Grant Road (see map below) by 2 minutes and 24 seconds during the evening commute (3-6 p.m.) which was the primary concern on this stretch of highway.

The three projects cost a total of $63.4 million and were funded in part by the 2005 Transportation Partnership Account. WSDOT increased capacity at the intersection of SR 285 and Mission Street at the west end of the bridge, added an extra lane to eastbound SR 285 across the bridge and built a new bypass on SR 28 at the east end. These improvements removed a bottleneck at the old SR 285/SR28 interchange, improving traffic flow throughout the area.




Notes: Projects include (from top to bottom) SR 285 - West End George Sellar Bridge - Intersection Improvement; SR 285 - George Sellar Bridge - Additional Eastbound lane; and, SR 28 East End George Sellar Bridge.

**State Route 285/State Route 28 eastbound evening travel times stabilize after WSDOT improvements**
*July 2008 (before) and July 2014 (after); Eastbound travel times on SR 285 and SR 28 from Ferry St. to Grant Rd.*[1]




Data source and analysis: WSDOT Multimodal Planning Division.
Notes: 1 Total length was 1.04 miles before and 1.08 miles after.

WSDOT also added Intelligent Transportation System (ITS) features throughout the project area and a pedestrian path across the bridge. ITS improvements included an automatic congestion detection system and overhead electronic signs to alert drivers about traffic conditions as they approach the bridge.

## Evening commute times across bridge improve by as much as seven minutes

Before construction, SR 285 had four lanes going across the Sen. George Sellar Bridge. Eastbound traffic from the bridge and SR 28 had to merge just north of the signalized intersection with Grant Road. The new bypass allows eastbound traffic to avoid the Grant Road intersection, eliminating a chokepoint created by vehicles weaving to get to their desired lane before the intersection. Vehicles from eastbound SR 28 now take a separate exit to get to Grant Road or 3rd Street. After construction, roughly 50% of SR 28 traffic bypasses local roads completely.

Before WSDOT completed the improvements, eastbound travel times from Ferry Street to Grant Road (about one mile) averaged 5 minutes and 42 seconds and would spike as high as 10 minutes during the evening commute. After, travel times remained steady at around 3 minutes and 18 seconds for the duration of the evening peak (see chart above). Traffic volume was unchanged after construction so it is reasonable to conclude that the travel time improvements were due to WSDOT's projects.

# *Corridor Capacity Report* Credits

The Corridor Capacity Report is developed and produced by a small team of data scientists at the WSDOT Office of Strategic Assessment and Performance Analysis each year, with the help of dozens of individuals both at WSDOT and across the state's transportation community. WSDOT gratefully acknowledges their contributions.

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## Behind the scenes of the *Corridor Capacity Report*

Beginning with the 2014 *Corridor Capacity Report* WSDOT published detailed performance measure information as part of a data appendix along with a *Handbook for Corridor Capacity Evaluation*, which serves as a one-stop shop to help readers navigate the annual *Corridor Capacity Report*'s multimodal analysis of transportation system performance. The handbook is a tool for technical professionals working to implement system performance measurement and reporting as part of their agency's accountability initiatives and/or the federal Moving Ahead for Progress in the 21st Century (MAP-21) requirements.

Updates to the document this year include additions to the transit trip analysis chapter, and a new chapter on Amtrak Cascades performance measures.

## Americans with Disabilities Act information

This material can be made available in an alternative format (large print, Braille, cassette tape, or on computer disc) by emailing the Washington State Department of Transportation Diversity/ADA Affairs Team at wsdotada@wsdot.wa.gov or by calling toll free (855) 362-4ADA (4232). Persons who are deaf or hard of hearing may make a request by calling the Washington State Relay at 711.

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WSDOT's 2015 *Corridor Capacity Report* is prepared by the
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