

# The Impact of Truck Congestion on Washington State's Economy

## *Executive Summary*



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# Key Findings

## What Will Happen to the State and Regional Economies if Truck Freight Encounters More Congestion on our Highways?

To answer this question, The Washington State Department of Transportation (WSDOT), together with the Washington State University (WSU) Social & Economic Sciences Research Center and the WSU Freight Transportation Policy Institute, conducted an extensive survey of freight-dependent industries and companies in Washington State. Questions include information about their transportation and warehousing costs, as well as their response to a 20-percent increase in road congestion. Survey data was used in conjunction with an input-output analysis to quantify these congestion impacts on the local economy. Key findings from this effort include:

- **Congestion impacts freight-dependent businesses in real, measurable ways.** Many firms surveyed in this effort reported that a 20-percent increase in the level of congestion would translate into significant direct business cost increases – in the form of rising fuel and labor costs, new equipment, or increased inventory carrying costs. In fact, it is projected that 20 percent more truck congestion would result in over \$14 billion (in 2011 dollars)<sup>1</sup> of increased operating costs to Washington’s freight-dependent industries.

- **Industries respond to rising costs in different ways – but almost 60 percent pass on costs to consumers.** Of the 1,000 private-sector freight-dependent industries

that responded to the surveys during this research effort, 56 percent indicated that they would pass costs onto consumers. Six percent indicated that they would be forced to close, and three percent would relocate. Nineteen percent of industries would absorb the costs, and 16 percent would make internal operational changes to offset increasing transportation costs.

The study surveyed freight-dependent industries throughout Washington to determine how they would respond if congestion on the interstate and highway systems increased by 20 percent. The responses included:

- 56 percent would pass the costs onto consumers,
- 19 percent would absorb the costs,
- 16 percent would change their operations or routing,
- 6 percent would be forced to close their business, and
- 3 percent would relocate.

*The survey was conducted by the Washington State University Social & Economic Sciences Research Center (SESRC) in 2011.*

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<sup>1</sup> These impacts reflect a one-time economic shock to the economy. Aggregate impact of 20-percent increased congestion over multiple years was not analyzed in this study.

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- **Increasing business costs will have economic impacts that ripple through Washington State's economy, and result in losses of jobs and industrial output.** Rising business costs, if passed on to consumers<sup>2</sup>, will lower consumer spending in other categories. When all of the direct, indirect, and induced impacts are accounted for, this translates into net losses of more than 27,250 jobs and \$3.3 billion (in 2011 dollars) in economic output in Washington State<sup>3</sup>. Since IMPLAN estimates that Washington Statewide employment is estimated to be almost 3.9 million, and its output<sup>4</sup> is almost \$642 billion, this equates to 0.70 percent of total state employment, and 0.51 percent of total state output.
  - **Industries are impacted by congestion in different ways – not all of them negative.** Increased costs add to the prices paid for goods, leaving consumers with fewer resources to purchase services; and resulting in negative impacts to businesses of all types. However, other companies (such as transportation and trucking companies) will spend more on fuel and equipment, hiring more staff or paying more overtime to manage operations in a more congested environment. This will translate to positive economic gains in employment and local business revenue.
  - **Some freight industries will add jobs to offset congestion – but costs will be borne by consumers within Washington.** With 20-percent increased congestion over today's levels, many freight-dependent industries, such as transportation and warehousing, retail and wholesale trade, manufacturing, and mining, are all projected to have positive changes in employment. New employment will be generated as these industries attempt to retain productivity as congestion rises – either through changing their operations or holding additional inventory – and include jobs such as new truck drivers, administrative staff, and warehouse operators. Altogether, it is projected that these industries would add 17,831 new jobs (0.46 percent of statewide jobs) and \$3.03 billion (0.47 percent of statewide output) (in 2011 dollars) in industry output (Figure 1). However, these changes are not enough to offset the job losses incurred by some service industries, including health and social services, accommodation and real estate – where 45,088 jobs (1.16 percent of statewide jobs) are lost as well as \$6.34 billion (0.99 percent of statewide output) (in 2011 dollars) in industry output. These jobs will be lost due to lessening demand from consumers, who must devote more resources to purchasing goods, and are therefore required to cut back in other spending categories. Overall, one-time impacts to Washington's economy would be a loss of more than 27,250 jobs (0.70 percent of statewide

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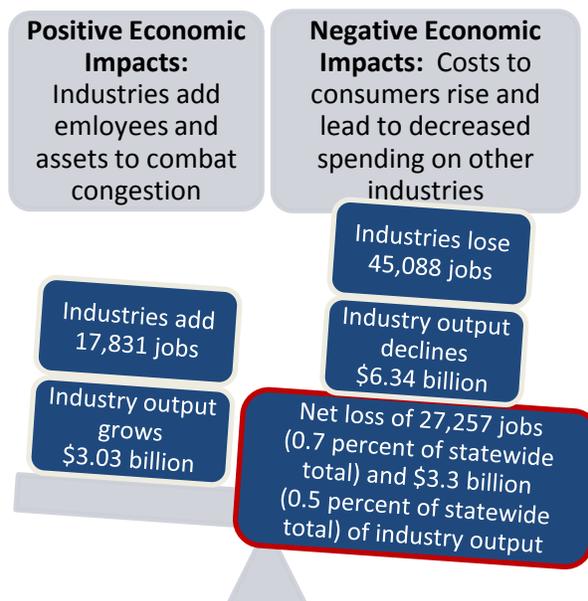
<sup>2</sup> It was assumed that 60 percent of the transportation costs are passed on to consumers, based on survey responses.

<sup>3</sup> This assumes that consumer purchases of goods will continue at today's levels, even if prices rise.

<sup>4</sup> This output was calculated for Washington State by IMPLAN v3 in 2008. More details are available at [www.IMPLAN.com](http://www.IMPLAN.com).

total) and \$3.3 billion (in 2011 dollars) (0.51 percent of statewide total) in economic output.

**Figure 1. Impacts of 20-Percent Increased Congestion in Washington**



- **The impacts on jobs and output may be higher when you look at the impacts as they accrue to six geographic regions within Washington. At this level, it is estimated that the central Puget Sound region would register the largest overall impacts from increasing congestion.** Slightly different results are produced if impacts are examined at the regional level (as opposed to aggregate statewide level). This is a result of several factors, including the fact that industries will have different multipliers at the regional level vs. the statewide level, as a result of impacts from the geographic clustering of certain industries, and because of small differences in the IMPLAN models used to calculate statewide vs. regional impacts<sup>5</sup>.

Therefore, it is recommended that the statewide, aggregate impacts (reported previously) are used to assess the overall impact of congestion on Washington's economy. However, regional totals are also provide in order to get a sense of how the impacts would be geographically distributed. As shown in Table 1 below, an increase of 20 percent over today's congestion

<sup>5</sup> IMPLAN models will be discussed more in section 2.1. However, it is important to note that six different regional models were used in order to capture differences in goods, services, and income levels in different regions of Washington State. A seventh IMPLAN model was created to model the aggregate, statewide view. All of the models used the 2008 IMPLAN database, and all results are reported in 2011 dollars.

levels is projected to cause over 21,700 job losses (0.90 percent of the Puget Sound regional total), as well as decreased regional output of over \$3.6 billion (0.82 percent of the Puget Sound region's total output). The other five regions in Washington would see decreased regional output of between \$31 million to \$290 million (between 0.21 percent and 0.80 percent of each region's total output); and would cause each region to lose between 345 and 2,200 jobs (between 0.31 percent and 0.77 percent of each region's total jobs).

**Table 1. Total Regional Impacts of 20-Percent Increased in Congestion**

Region	Employment	Output (Millions of Dollars)	Percentage of Regional Total	
			Employment	Output
<i>Northwest</i>	-1,786	-\$162	-0.48%	-0.29%
<i>Southwest</i>	-1,622	-\$266	-0.52%	-0.57%
<i>Central Basin</i>	-1,793	-\$244	-0.47%	-0.54%
<i>Northeast</i>	-2,213	-\$290	-0.77%	-0.80%
<i>Southeast</i>	-345	-\$31	-0.31%	-0.21%
<i>Puget Sound</i>	-21,741	-\$3,600	-0.90%	-0.82%
<b>Statewide Total</b>	<b>-29,500</b>	<b>-\$4,600</b>	<b>-0.76%</b>	<b>-0.72%</b>

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# 1.0 Project Overview

Congestion on the urban road network in the United States is estimated to cost the nation about \$85 billion annually<sup>6</sup>, a number that reflects the wasted fuel, lost productivity, and reduced mobility of each and every vehicle using the public roadway system. Though this number is impressive, it is not useful to inform public policy at the state level. Instead, additional knowledge is needed to understand *how* industries are impacted by congestion, *what* their likely response will be to increasing congestion, and the *net impact* of these industry responses to the Washington State economy.

To answer these questions, a study was designed and completed by the Washington State Department of Transportation's (WSDOT) Freight Systems Division, in coordination with the Washington State University's (WSU) Freight Policy Transportation Institute and the WSU Social and Economic Sciences Research Center (SESRC)<sup>7</sup>. The goal of this study was to increase WSDOT's knowledge about the impacts of congestion on goods movement-dependent businesses, and how these impacts trickle through the State's economy.

## 1.1 STUDY QUESTIONS

### Why Does Congestion Matter to the State's Economy?

Congestion causes freight-dependent businesses, such as manufacturing, retail and wholesale trade, agriculture, construction, and timber/wood products, to operate less efficiently by increasing the amount of wasted time that trucks (and drivers) spend in traffic. Congestion increases businesses' transportation costs, which are often passed on to consumers in the form of higher prices for goods. The study's survey of more than 1,000 freight-dependent businesses in Washington State indicated that about 60 percent of businesses would pass these increased costs onto consumers by raising the prices of their goods and services.



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<sup>6</sup> Assessing the Full Costs of Congestion on Surface Transportation Systems and Reducing Them through Pricing, U.S. Department of Transportation, 2009.

<sup>7</sup> The Economic Impact of Increased Congestion for Freight-Dependent Businesses in Washington State – Technical Report, WSDOT and WSU, 2012.

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## **What Causes Congestion?**

Traffic congestion is caused when traffic demand meets or exceeds transportation capacity.<sup>8</sup> This can occur as a result of a myriad of issues, such as ill-timed traffic control systems, geometric considerations (such as tight turns or narrow bridges), or because of vehicles with variable speeds using the same infrastructure. It also can be caused when there are simply too many vehicles vying for space on a highway. As such, congestion is a recurrent problem in many regions throughout the U.S. In Washington State and the rest of the nation, congestion is a significant problem near the metropolitan centers. Congestion also adds cost to goods made in rural areas, as most of these goods must be shipped to or through urban centers. Throughout this report, results will be reported for the State as a whole, and also broken into six regions: the central Puget Sound region, northwest region, southwest region central basin region, northeast region, and southeast Washington region<sup>9</sup>.

## **What will WSDOT do with This Study?**

The goal of this study is to add to WSDOT's knowledge about the impacts of highway congestion on the State's business sectors. The study findings will help WSDOT and the State understand how public investments in the State's truck freight economic corridors maximize economic growth and lower prices of consumer goods. Ultimately, this material will help the State to prioritize infrastructure investment decisions in a manner that maximizes the economic development potential of goods movement for the State, its businesses, and its consumers.

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<sup>8</sup> Congestion: A National Issue (<http://www.ops.fhwa.dot.gov/aboutus/opstory.htm>).

<sup>9</sup> These terms are general geographic descriptions used in the survey instrument to gather data.

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## 2.0 How was the Economic Assessment Performed?

### 2.1 SELECTION OF THE ECONOMIC ASSESSMENT TOOL

It was determined that an Input-Output (I-O)-based economic assessment tool was the best tool to use for this effort. The strength of an I-O model comes from the vast amount of data that it contains to describe how all of the industries and institutions in an economy interact. These interactions allow the model to estimate the full impacts from a change in the economy in terms of direct impacts (changes to the primary industries), indirect impacts (changes to those industries that support primary industries), and induced impacts (changes to household incomes being altered by direct and indirect impacts).

The tool chosen for this assessment was IMPLAN<sup>10</sup> (IMpacts of PLANning). This static economic model estimates the direct, indirect, and induced impacts of dollars invested in industry sectors at defined geographical resolution. IMPLAN is a desirable tool because it is developed with national, publicly-available data sources,<sup>11</sup> and is a widely accepted tool for modeling impacts of transportation system changes. Six different regional models were used in order to capture differences in goods, services, and income levels in different regions of Washington State. A seventh IMPLAN model was created to model the aggregate, statewide view. All of the annual estimates throughout this report used the 2008 IMPLAN database, and are all reported in 2011 dollars.

#### Direct, Indirect, and Induced Impacts

**Direct impacts.** A measure of how the local economy is affected by changes to the primary industries.

**Indirect impacts.** Changes that would occur to the industries that support the primary industries.

**Induced impacts.** Quantify the economic changes that result from household incomes being altered in the direct and indirect phases.

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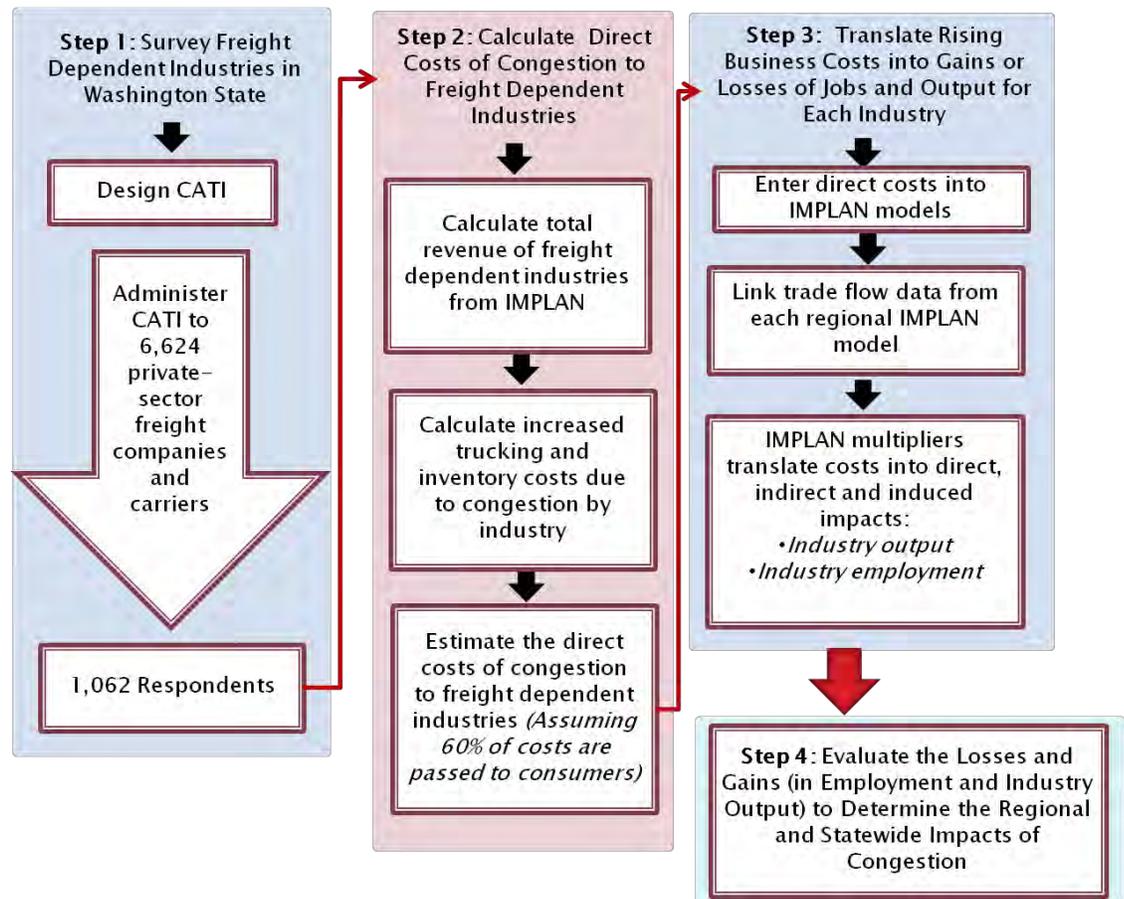
<sup>10</sup> IMPLAN uses a wide array of data sources, including U.S. Bureau of Economic Analysis Benchmark I/O Accounts, U.S. Bureau of Labor Statistics Covered Employment and Wages (ES202), U.S. Census Bureau County Business Patterns, and U.S. Census Bureau Economic Censuses and Surveys.

<sup>11</sup> IMPLAN is a proprietary model available from MIG, Inc., at: [www.IMPLAN.com](http://www.IMPLAN.com).

## 2.2 FOUR-STEP METHODOLOGY OVERVIEW

To answer the questions posed at the outset of the study, it was determined that new data were needed regarding the relationship between congestion, associated costs to industries, and the ripple effects to the State's economy. A four-step methodology was developed, which focused on an extensive survey of freight-dependent businesses, and a series of I-O models. This four-step evaluation process is summarized in Figure 2 below.

**Figure 2. Economic Impact Assessment Methodology**



- Step 1 – Survey freight-dependent industries.** In order to gather the types of data necessary to support the economic impact assessment, a Computer-Assisted Telephone Interview (CATI) was developed and administered between 2009 and 2011<sup>12</sup>. A total of 6,624 private-sector freight companies and carriers were invited to take the CATI, representing industries such as agribusiness, construction, global gateways (ports, etc.), food manufacturing, manufacturing, retail, trucking warehousing, wholesale, and lumber

<sup>12</sup> This survey was a joint effort between WSDOT and WSU SESRC.

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companies. The survey dataset recorded sufficient responses from 1,062 businesses (29.6 percent). Questions focused on gathering data necessary to input into the economic assessment tool in Step 2, including questions about geographic location (out of six regions), industry classification, main freight activity, average hourly trucking costs, trucking cost components, inventory carrying costs, and strategies to combat congestion.

- **Step 2 – Calculate the direct costs of congestion to freight-dependent industries.** The increased costs to freight-dependent businesses from rising congestion were calculated from data gathered during the survey effort. These sample level statistics were used with IMPLAN data to estimate population-level trucking and inventory costs.
- **Step 3 – Translate rising business costs into gains or losses of jobs and output for each industry.** IMPLAN economic models were used to transform the direct costs of congestion to freight industries into statewide economic impacts in Washington State. This step relied on survey data that revealed that 60 percent of freight industries would pass on rising costs to consumers, thereby, reducing the amount of income available for consumers to spend in other categories. The reduced consumer<sup>13</sup> spending was the key variable that was inputted into IMPLAN to calculate the direct, indirect, and induced regional and statewide impacts. Seven IMPLAN models were used in total: one statewide model and six region-specific models. Impacts were recorded in terms of lost or gained jobs, as well as the accompanying increasing or decreasing industry output.
- **Step 4 – Evaluate the losses and gains (in employment and industry output) to determine regional and statewide impact of congestion.** Finally, the industry-specific gains and losses were aggregated to determine the net impact of congestion on the economy of Washington State. The IMPLAN assessment results were translated into easily-understood impacts (net jobs and net reduced output) for Washington State industry groups and for the six geographic regions within the State (as well as aggregated for the State as a whole). Results varied slightly whether grouped by industry or geography; a reflection of the different trade flow and industries present in the seven different IMPLAN models.

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<sup>13</sup> This assumes that consumer purchases of goods will continue at today's levels, even if prices rise.

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# 3.0 How will Increased Congestion Affect the Economy?

## 3.1 IMPACTS TO INDUSTRIES

Impacts do not accrue to all industries equally. Certainly, business costs rise as congestion increases – a result of necessary investments into additional trucks, drivers, fuel, and time to ship the same amount of goods as before. However, some freight-dependent industries will show positive benefits from additional expenditures, as they spend more money on employees and inputs when transportation and storing goods to counteract increased congestion. In turn, employees have more to spend in the local economy. Since survey results reveal that between 60 to 80 percent of these increased costs will be passed through to consumers, this means that increased congestion will result in two types of economic effects – as the negative shock to consumers (increased prices of goods and services resulting in decreased consumer expenditures in certain other categories) is contrasted by the positive effect to certain industries from the increased assets and labor. Industries can be grouped into those that will yield some positive benefits vs. those that will feel negative economic impacts (Table 2). Though, in general, freight-dependent industries will feel positive impacts and service industries will feel negative impacts, there are some outliers. For example, construction and agriculture (ag), forestry and fishing are both projected to feel net negative impacts. For construction, these negative impacts may be due to the industries interdependence with real estate and rental. Ag, forestry and fishing may suffer since those industries (agriculture in particular) may find it more difficult to pass costs onto consumers.

**Table 2. Economic Impacts to Industries from Congestion**

<b>These industries will incur additional expenditures (positive impacts) in order to combat congestion:</b>	<b>These industries will suffer from reduced expenditures (negative impacts):</b>
<ul style="list-style-type: none"><li>• Transportation &amp; information</li><li>• Administrative services</li><li>• Retail trade</li><li>• Wholesale trade</li><li>• Government</li><li>• Manufacturing</li><li>• Management of companies</li><li>• Mining</li></ul>	<ul style="list-style-type: none"><li>• Health &amp; social services</li><li>• Real estate &amp; rental</li><li>• Finance &amp; insurance</li><li>• Accommodation &amp; food</li><li>• Arts &amp; entertainment</li><li>• Construction &amp; utilities</li><li>• Professional &amp; scientific</li><li>• Educational services</li><li>• Ag, forestry, and fishing</li></ul>

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If 60 percent of all increased business costs are passed on to consumers (which the survey results suggest is a conservative estimate), the net economic impact will be negative. As shown in Figure 1 earlier in this Executive Summary, a 20-percent increased congestion will result in the addition of 17,831 jobs (0.5 percent of statewide jobs) and \$3.03 billion in output<sup>14</sup> (0.51 percent of statewide output) – as industries add employees and assets (e.g., new trucks) to combat congestion. However, these gains will be far outweighed by the negative impacts to Washington State – as consumers are forced to spend more on freight-dependent industry goods’ higher prices and cut back on other spending categories. Overall, it is estimated that 20-percent increased congestion would result in a one-time net loss of 27,257 jobs (0.7 percent of statewide jobs) and \$3.3 billion in industry output (0.47 percent of statewide output)<sup>15</sup>, when all direct, indirect, and induced impacts are considered.

## 3.2 IMPACTS TO REGIONS

The magnitude of economic impacts varies significantly between regions. As noted in the key findings section of this report, slightly different results are produced if impacts are examined at the regional level (as opposed to aggregate statewide level). This is a result of several factors, including the fact that industries will have different multipliers at the regional level vs. the statewide level, as a result of impacts from the geographic clustering of certain industries, and because of small differences in the IMPLAN models used to calculate statewide vs. regional impacts<sup>16</sup>. Therefore, it is recommended that the statewide, aggregate impacts (reported previously) are used to assess the overall impact of congestion on Washington’s economy. However, regional totals are also provide in order to get a sense of how the impacts would be geographically distributed.

The central Puget Sound region would register the largest overall impacts from 20-percent increased congestion: over 21,700 job losses (0.90 percent of the Puget Sound regional total), as well as decreased regional output of over \$3.6 billion (0.82 percent of the Puget Sound region’s total output). The other five regions in Washington would see decreased regional output of between \$31 million to \$290 million (between 0.21 percent and 0.80 percent of each region’s total output), and would cause each region to lose between 345 and

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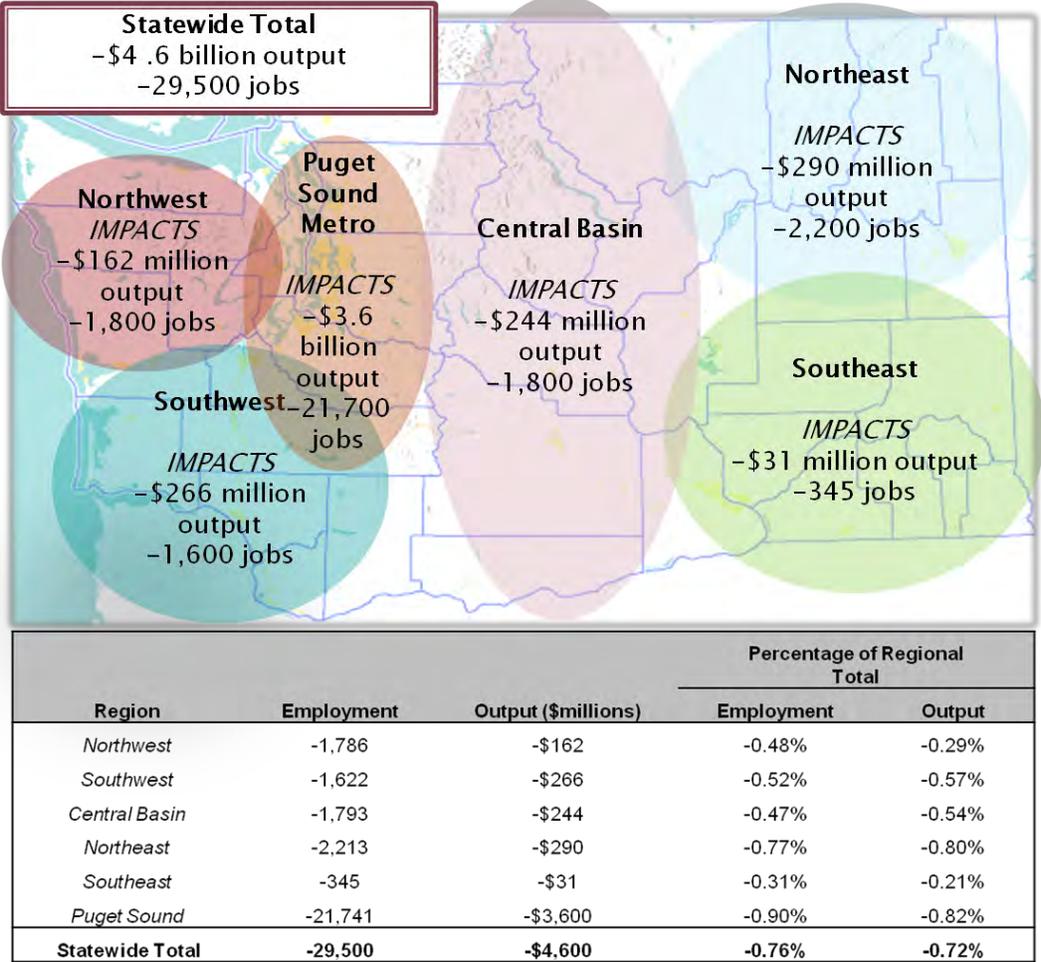
<sup>14</sup> These numbers include direct, indirect, and induced impacts.

<sup>15</sup> These impacts reflect a one-time economic shock to the economy. Aggregate impact of 20-percent increased congestion over multiple years was not analyzed in this study.

<sup>16</sup> Six different regional IMPLAN models were used in order to capture differences in goods, services, and income levels in different regions of Washington State. A seventh IMPLAN model was created to model the aggregate, statewide view. All of the models used the 2008 IMPLAN database, and all results are reported in 2011 dollars.

2,200 jobs (between 0.31 percent and 0.77 percent of each region's total jobs). Regional estimates of lost output and jobs, as well as the percent of regional total in each category, are shown in Figure 3 below.

**Figure 3. Regional Impacts<sup>a</sup> of 20-Percent Increased Congestion in Washington<sup>b</sup>**



<sup>a</sup> These numbers include direct, indirect, and induced impacts.

<sup>b</sup> These geographic regions are estimates only and were self-reported by survey respondents. Actual geographic boundaries may vary from those depicted here.

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## 4.0 Lessons Learned and Recommendations

### What Do These Findings Suggest for WSDOT's Policies towards Addressing Congestion on Corridors Used by Trucks?

Washington's economic vitality and renowned livability depend on reliable, responsible, and sustainable transportation. Maintaining the transportation system at a level that allows for the safe, efficient movement of freight is an important component of this sustainable system. To this end, the findings of this study suggest several "lessons learned" and recommendations for WSDOT.

**Congestion causes increased direct transportation costs to freight-dependent industries – which translate to increased costs of goods and services to consumers in Washington State.** Congestion causes freight-dependent businesses, such as manufacturing, retail and wholesale trade, agriculture, construction, and timber/wood products, to operate less efficiently by increasing the amount of time for each truck trip and increasing the time that trucks (and drivers) spend in traffic, wasting time in an unproductive manner. In fact, it is projected that 20 percent more truck congestion would result in over \$14 billion of increased operating costs to Washington's freight-dependent industries. Since many freight industries have the ability to pass on their rising transportation costs in the form of higher cost goods, consumers and service industries may feel the biggest impacts from increasing congestion. When multiplied into economic impacts, this translates into losses of over 27,250 jobs (0.70 percent of statewide total) and \$3.3 billion<sup>17</sup> (0.51 percent of statewide total) (in 2011 dollars) in economic output.

**These demonstrated economic impacts suggest that WSDOT should prioritize investments that enhance mobility for trucks and freight industries as a way to support the State's goals of a strong economy.** Washington State law directs public investments in transportation to support economic vitality, preservation, safety, mobility, the environment, and system stewardship. A demonstrated economic link between truck congestion and increased costs to consumers and industry means that WSDOT could prioritize investments that enhance the mobility of trucks. This could include several of the investment principles imbedded in WSDOT's *Moving Washington* approach:



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<sup>17</sup> These numbers include direct, indirect, and induced impacts.

- **Operate efficiently.** Strategies include utilizing traffic technologies, such as ramp meters and other control strategies to improve traffic flow and reduce collisions, deploying Incident Response to quickly clear collisions, optimizing traffic signal timing to reduce delay, and implementing low-cost/high-value enhancements to address immediate needs.
- **Manage demand.** Strategies include using variable-rate tolling in ways that reduce traffic during the most congested times and balance capacity between express and regular lanes, improving the viability of alternate modes, and providing traveler information to allow users to move efficiently through the system.
- **Add capacity strategically.** Targeting the worst traffic hotspots or filling critical system gaps to best serve an entire corridor, community, or region means fixing bottlenecks that constrain the flow.

The study suggests that economic impacts<sup>18</sup> of rising congestion will be felt in every region of the State. However, they will be the most acute in the central Puget Sound Metropolitan region. The investment prioritization process should take this into account when selecting the most efficient projects to alleviate congestion. An increase of 20 percent over today's congestion levels is projected to cause over 21,700 job losses (0.90 percent of the Puget Sound regional total), as well as decreased regional output of over \$3.6 billion (0.82 percent of the Puget Sound region's total output). The other five regions in Washington would see decreased regional output of between \$31 million \$290 million (between 0.21 percent and 0.80 percent of each region's total output), and would cause each region to lose between 345 and 2,200 jobs (between 0.31 percent and 0.77 percent of each region's total jobs).

In Washington State and the rest of the nation, congestion is a significant problem near the metropolitan centers. Congestion also adds cost to goods made in rural areas, as most of these goods must be shipped to or through urban centers. Therefore, investment into the metropolitan region's freight system may have corresponding positive benefits to more rural regions within Washington.



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<sup>18</sup> Including direct, indirect, and induced impacts.