

Transportation Infrastructure Investment Prioritization: Responding to Regional and National Trends and Demands

Jeremy L. Sage, PhD
Freight Policy Transportation Institute
School of Economic Sciences
Washington State University

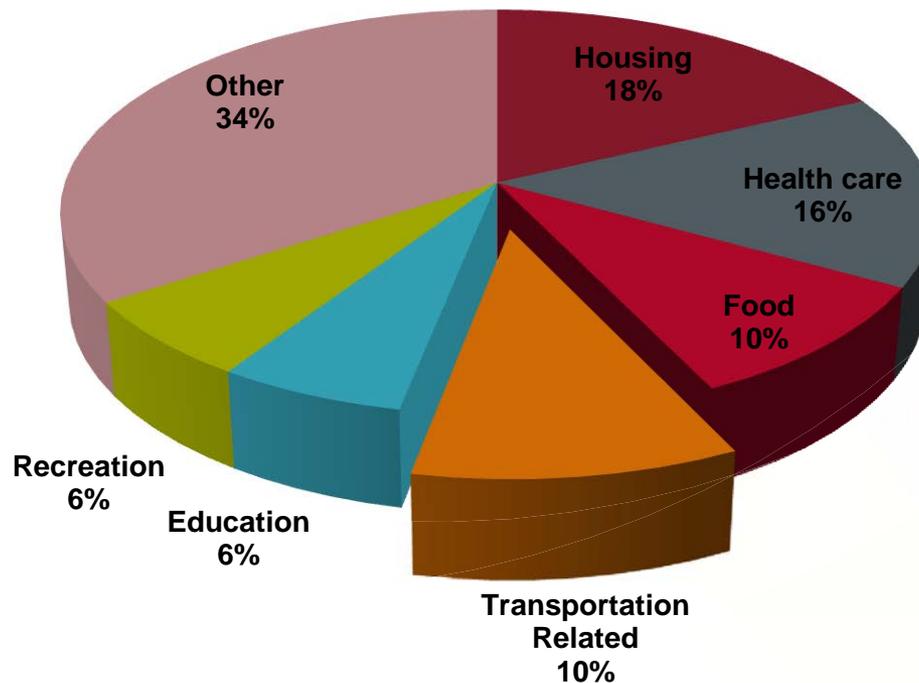


Presentation Overview:

- **Motivation**
 - Why do we (and should we) care about the productivity of Freight Transportation?
- **The Cost of Congestion in Washington State**
- **Future FPTI work**

Economic Competitiveness

U.S. GDP by Major Spending Category (1)



In 2011, transportation-related goods and services contributed \$1.6 trillion to the \$15.6 trillion GDP

Freight Movement and International Trade

Weight of Shipments by Transportation Mode: 2007, 2011, and 2040 (millions of tons) (2)

	2007				2011				2040			
	Total	Domestic	Exports	Imports	Total	Domestic	Exports	Imports	Total	Domestic	Exports	Imports
Total	18,878	16,851	655	1,372	17,621	15,336	895	1,390	28,521	23,095	2,632	2,794
Truck	12,779	12,587	95	97	11,302	11,065	107	130	18,786	18,083	368	335
Rail	1,899	1,745	61	93	1,895	1,695	108	92	2,771	2,182	388	201
Water	950	504	65	381	824	501	75	248	1,070	559	164	347
Air, air & truck	13	3	4	6	18	3	5	10	53	6	20	27
Multiple modes & mail	1,414	419	389	606	1,618	409	547	662	3,574	645	1,546	1,383
Pipeline	1,507	1,328	4	175	1,653	1,412	6	235	1,741	1,257	17	467
Other & unknown	316	266	36	14	313	251	48	14	526	362	130	34

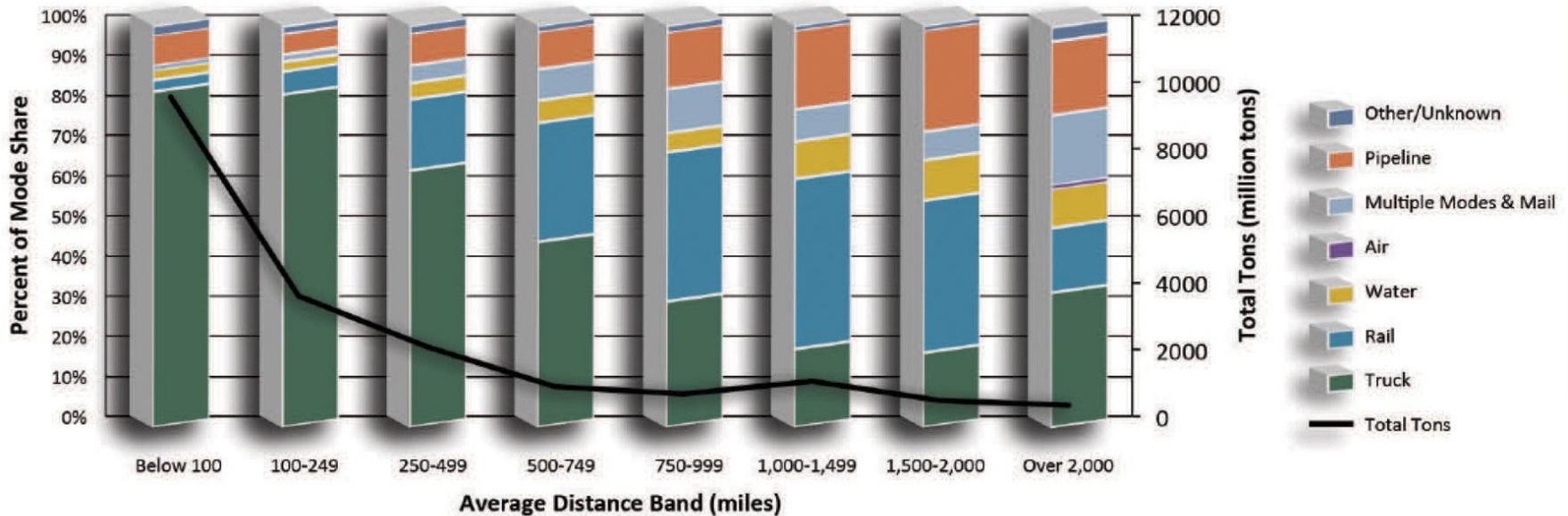
Freight Movement and International Trade

Value of Shipments by Transportation Mode: 2007, 2011, and 2040
(billions of 2007 dollars) (2)

	2007				2011				2040			
	Total Domestic	Exports	Imports		Total Domestic	Exports	Imports		Total Domestic	Exports	Imports	
Total	16,651	13,457	1,196	1,997	16,804	13,200	1,285	2,319	39,265	27,131	5,303	6,831
Truck	10,780	10,225	267	287	10,573	9,921	266	386	21,465	19,315	985	1,166
Rail	512	374	45	93	515	380	47	88	898	555	148	195
Water	340	158	15	167	279	151	19	108	337	138	46	153
Air, air & truck	1,077	151	422	505	1,219	158	420	641	5,043	834	1,997	2,212
Multiple modes & mail	2,877	1,639	394	844	3,099	1,658	473	968	9,925	5,203	1,911	2,811
Pipeline	723	658	4	61	779	693	5	81	776	605	17	154
Other & unknown	341	252	48	41	341	239	55	47	821	482	199	139

Freight Movement and International Trade

Mode Share of Tonnage and Total Tonnage by Distance Band: 2007 (2)



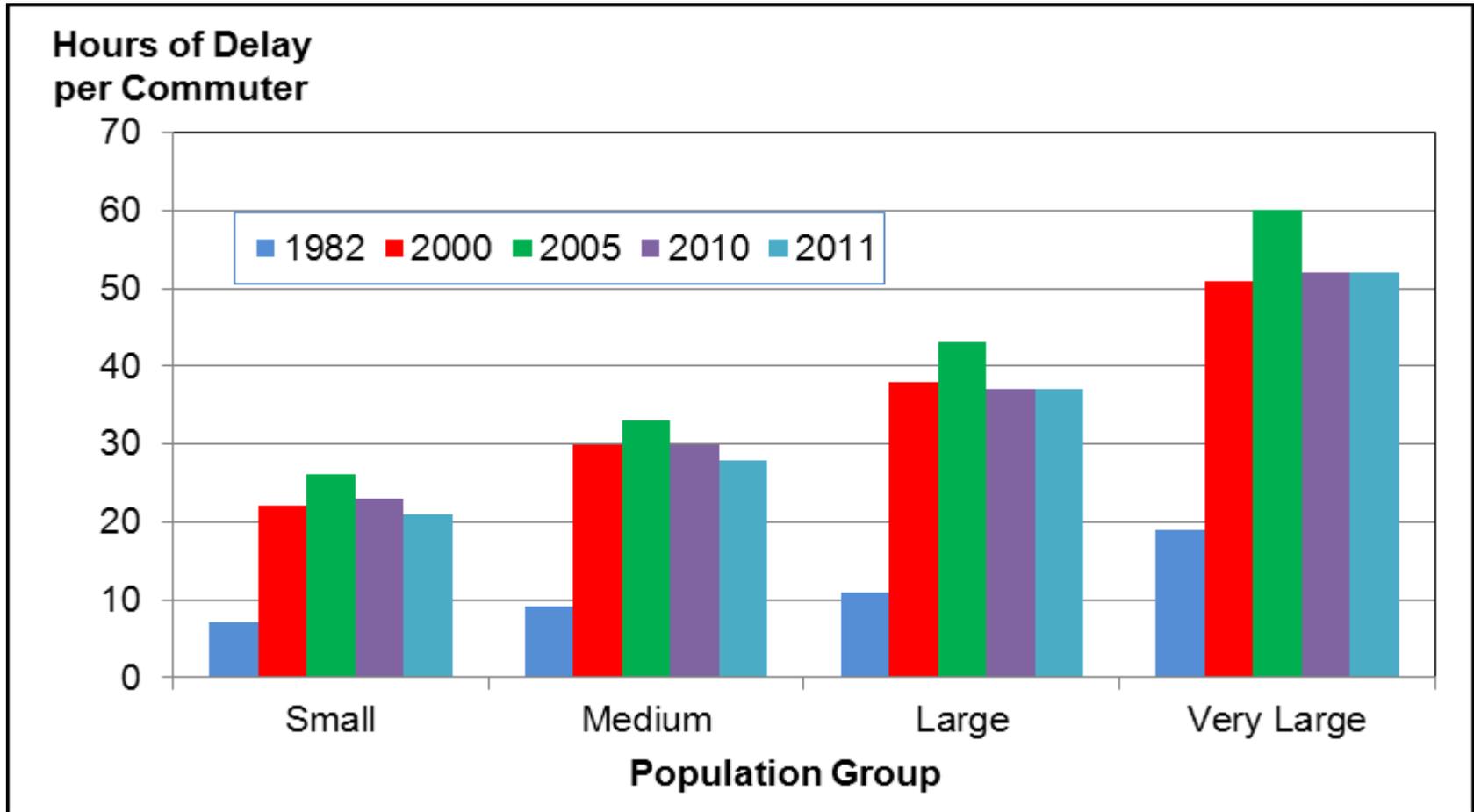
Freight Movement and International Trade

Total Freight Moved by Distance Band: 2007 (2)

Distance Band (in miles)	Value		Weight		Ton-Miles	
	Percent	Cumulative Percent	Percent	Cumulative Percent	Percent	Cumulative Percent
Below 100	40	40	51	51	7	7
100 - 249	16	56	19	71	10	17
250 - 499	13	69	11	82	13	29
500 - 749	7	76	5	87	9	39
750 - 999	6	82	4	90	10	49
1,000 - 1,499	7	89	6	96	22	71
1,500 - 2,000	4	93	2	98	14	85
Over 2,000	7	100	2	100	15	100

Measures of...	1982	2000	2005	2010	2011
<u>...Individual Congestion</u>					
Yearly delay per auto commuter (hrs)	16	39	43	38	38
Travel Time Index	1.07	1.19	1.23	1.18	1.18
Planning Time Index (Freeway Only)	-	-	-	-	3.09
"Wasted" fuel per auto commuter (gallons)	8	19	23	19	19
CO2 per auto commuter during congestion (lbs)	160	388	451	376	380
Congestion cost per auto commuter (2011 dollars)	\$342	\$795	\$924	\$810	\$810
<u>...The Nation's Congestion Problem</u>					
Travel Delay (billion hrs)	1.1	4.5	5.9	5.5	5.5
"Wasted" fuel (\$billion)	0.5	2.4	3.2	2.9	2.9
CO2 produced during congestion (billions of lbs)	10	47	62	56	56
Truck congestion cost (\$billion)	-	-	-	\$27	\$27
Congestion cost (\$billion)	\$24	\$94	\$128	\$120	\$121

Drawn from TTI's Urban Mobility Report (3)



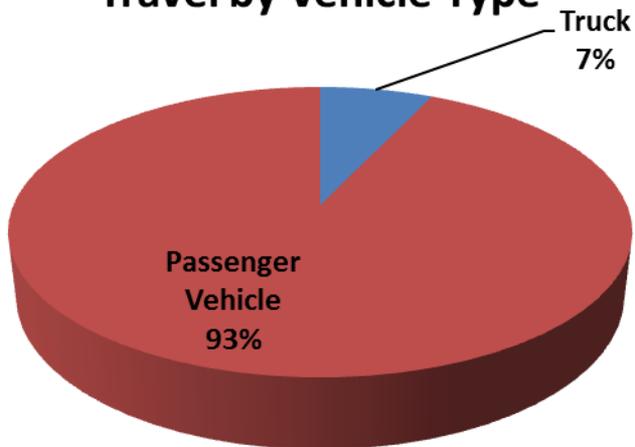
Small = <500,000

Medium = 500,000 to 1 million

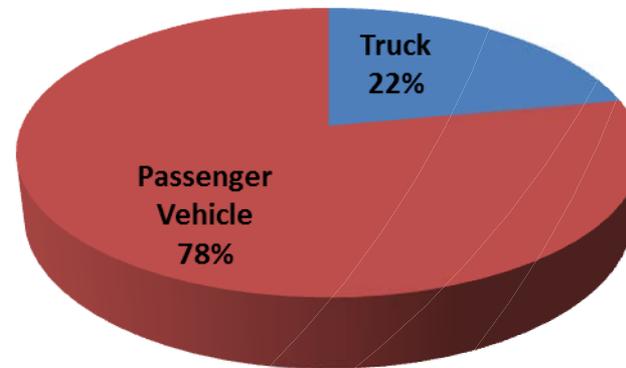
Large = 1million to 3 million

Very Large = >3 million

Travel by Vehicle Type



Congestion Cost by Vehicle Type

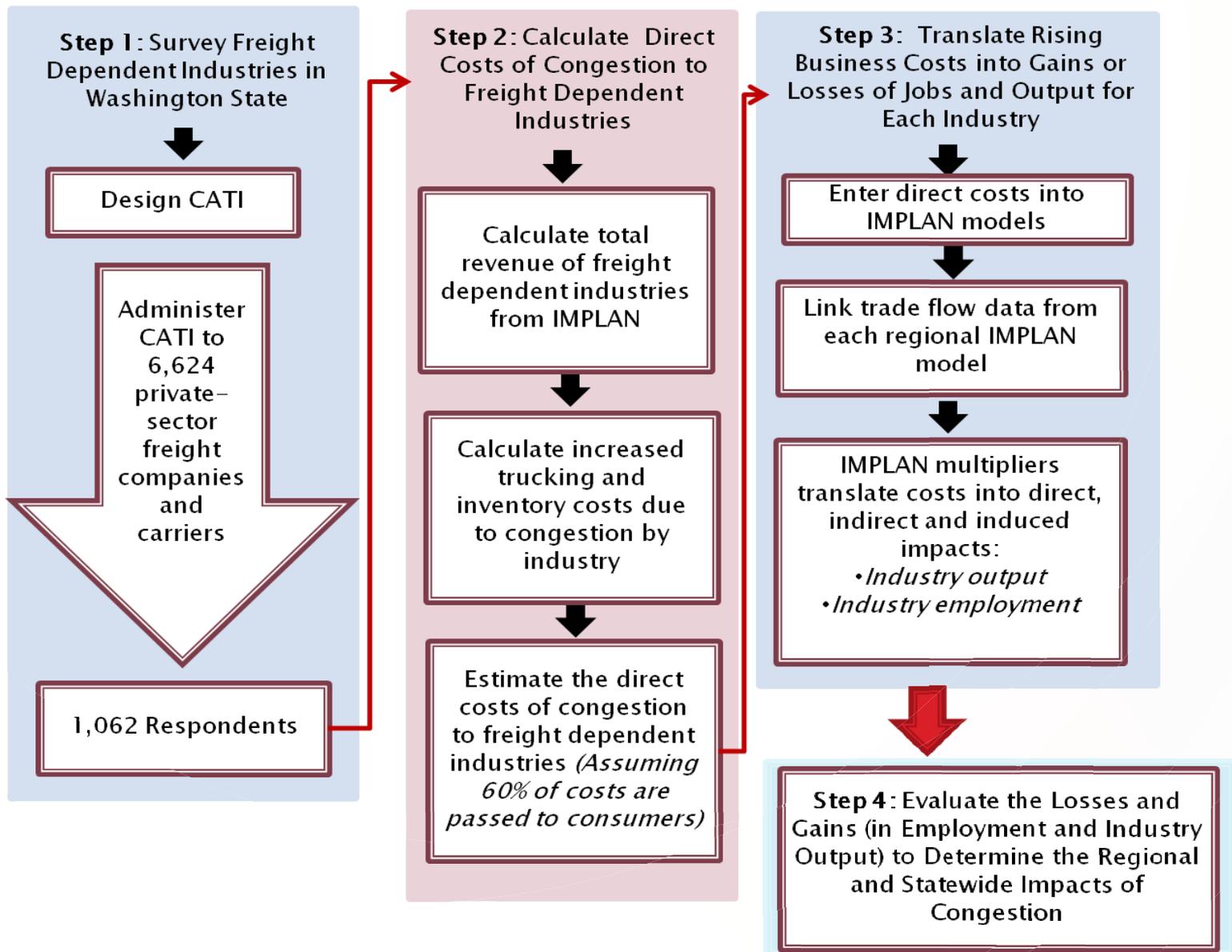


...and this is just to operate the trucks.

Which brings us to the first FPTI project.

Project Overview:

- Congestion on the urban road network in the United States is estimated to cost the nation in excess of \$100 billion, as each and every vehicle using the public roadway system experiences some degree of:
 - Wasted fuel
 - Lost productivity
 - Reduced mobility
- The cost value is large, but can it inform state level policy?
 - Additional knowledge is needed to understand:
 - **How** industries are impacted by congestion
 - **What** their likely response will be to increasing congestion
 - The **net impact** of these industry responses to the Washington State economy.



STEP 2: CALCULATE THE DIRECT COSTS OF CONGESTION TO FREIGHT-DEPENDENT INDUSTRIES

<u>Industry</u>		<u>Revenue</u>
Agriculture, Forestry, Fishing*	\$	14,025,087,392
Mining*	\$	1,722,882,632
Construction	\$	39,590,105,088
Manufacturing*	\$	160,187,755,858
Retail Trade**	\$	111,814,709,161
Wholesale Trade**	\$	142,323,314,397
Transportation/Warehousing*	\$	16,754,995,185
Waste Management	\$	3,589,177,344

- Calculating Total Revenue:
 - Two modifications from IMPLAN's output values:
 - Subtracted the value of inventory from output to reflect actual sales (*)
 - Adjusted using margins (sales receipts less the cost of the goods sold) to show the total value of the goods sold (**)

STEP 2: CALCULATE THE DIRECT COSTS OF CONGESTION TO FREIGHT-DEPENDENT INDUSTRIES

<u>Industry</u>	<u>Inventory Cost</u>	<u>Trucking Cost</u>
Agriculture, Forestry, Fishing	0.01%	6.00%
Mining	0.00%	9.24%
Construction	0.04%	8.28%
Manufacturing	0.42%	6.04%
Retail Trade	0.34%	2.59%
Wholesale Trade	0.23%	3.16%
Transportation/Warehousing	0.04%	6.51%
Waste Management	0.00%	2.86%

- Inventory Costs (as percent of total revenue) based on need to hold inventory to combat congestion.
- Trucking Costs represent need for additional trucks, and used in conjunction with reported hourly trucking costs (\$55-light, \$76-heavy, \$59-mixture)

STEP 2: CALCULATE THE DIRECT COSTS OF CONGESTION TO FREIGHT-DEPENDENT INDUSTRIES

<u>Industry</u>	<u>Direct Cost of Congestion</u>	
Agriculture, Forestry, Fishing	\$	505,744,651
Mining	\$	95,516,613
Construction	\$	1,976,338,046
Manufacturing	\$	6,208,877,417
Retail Trade	\$	1,965,702,587
Wholesale Trade	\$	2,894,856,215
Transportation/Warehousing	\$	658,471,311
Waste Management	\$	61,590,283

- Totals nearly \$14.4 billion
- 20% congestion increase
- 60% cost realization

STEP 3: TRANSLATE RISING BUSINESS COSTS INTO GAINS OR LOSSES OF JOBS AND OUTPUT FOR EACH INDUSTRY:

STEP 3: TRANSLATE RISING BUSINESS COSTS INTO GAINS OR LOSSES OF JOBS AND OUTPUT FOR EACH INDUSTRY: CONSUMER COSTS

- Consumers must decrease purchases of services and non-freight dependent goods to pay for the increased costs of freight dependent goods.
- Household consumption function in IMPLAN was modified to incorporate the spending decrease.
 - Weighted by population and income

STEP 3: TRANSLATE RISING BUSINESS COSTS INTO GAINS OR LOSSES OF JOBS AND OUTPUT FOR EACH INDUSTRY:

STEP 3: TRANSLATE RISING BUSINESS COSTS INTO GAINS OR LOSSES OF JOBS AND OUTPUT FOR EACH INDUSTRY: SOCIETAL BENEFITS

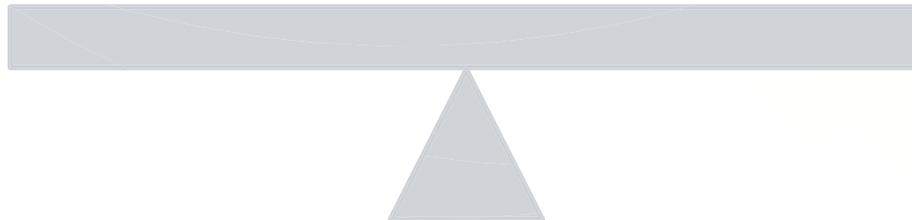
- Freight dependent business must increase spending on resources to counteract increased congestion.
 - Congestion as an inefficiency
 - Spending on Insurance and Capital is placed in corresponding IMPLAN industries.
 - Wages modeled as an increase to employee compensation

STEP 4: EVALUATE THE LOSSES AND GAINS TO DETERMINE THE STATEWIDE AND REGIONAL IMPACTS OF CONGESTION

STEP 4: EVALUATE THE LOSSES AND GAINS TO DETERMINE THE STATEWIDE AND REGIONAL IMPACTS OF CONGESTION

Positive Economic Impacts:
Industries add employees and assets to combat congestion

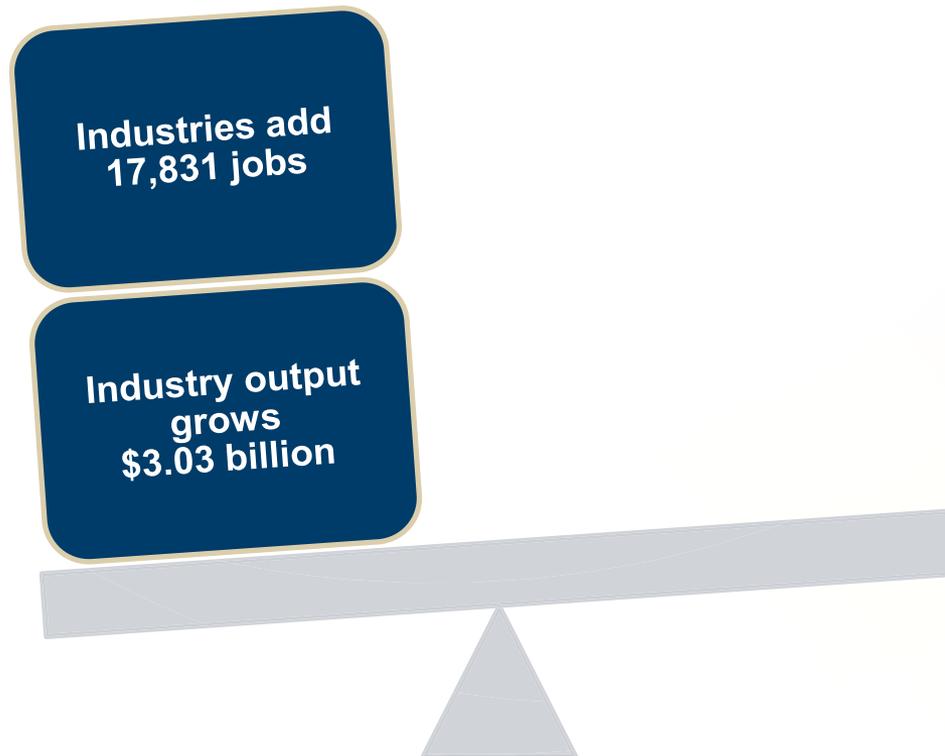
Negative Economic Impacts:
Costs to consumers rise and lead to decreased spending on other industries



STEP 4: EVALUATE THE LOSSES AND GAINS TO DETERMINE THE STATEWIDE AND REGIONAL IMPACTS OF CONGESTION

Positive Economic Impacts:
Industries add employees and assets to combat congestion

Negative Economic Impacts:
Costs to consumers rise and lead to decreased spending on other industries



STEP 4: EVALUATE THE LOSSES AND GAINS TO DETERMINE THE STATEWIDE AND REGIONAL IMPACTS OF CONGESTION

Positive Economic Impacts:

Industries add employees and assets to combat congestion

Negative Economic Impacts:

Costs to consumers rise and lead to decreased spending on other industries

Industries add
17,831 jobs

Industries lose
45,088 jobs

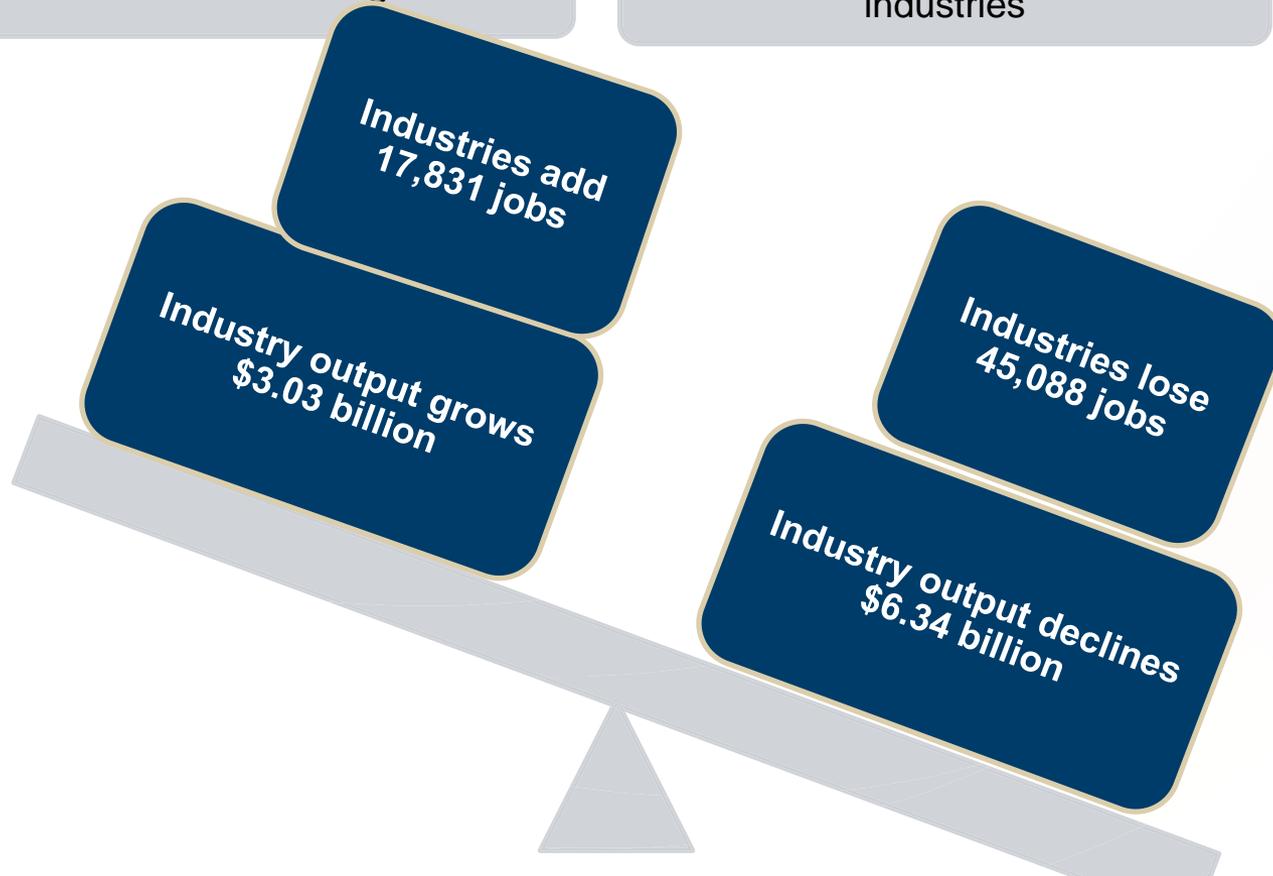
Industry output grows
\$3.03 billion

Industry output declines
\$6.34 billion

STEP 4: EVALUATE THE LOSSES AND GAINS TO DETERMINE THE STATEWIDE AND REGIONAL IMPACTS OF CONGESTION

Positive Economic Impacts:
Industries add employees and assets to combat congestion

Negative Economic Impacts:
Costs to consumers rise and lead to decreased spending on other industries



STEP 4: EVALUATE THE LOSSES AND GAINS TO DETERMINE THE STATEWIDE AND REGIONAL IMPACTS OF CONGESTION

Positive Economic Impacts:
Industries add employees and assets to combat congestion

Negative Economic Impacts:
Costs to consumers rise and lead to decreased spending on other industries

Industries add
17,831 jobs

Net loss of 27,257 jobs
(0.7 percent of statewide total) and \$3.3 billion
(0.5 percent of statewide total) of industry
output

STEP 4: EVALUATE THE LOSSES AND GAINS TO DETERMINE THE STATEWIDE AND REGIONAL IMPACTS OF CONGESTION

Industries incurring additional expenditures (positive impacts) in order to combat congestion

Transportation and Information

Administrative Services

Retail Trade

Wholesale Trade

Government

Manufacturing

Management of Companies

Mining

Industries suffering from reduced expenditures (negative impacts)

Health and Social Services

Real Estate and Rental

Finance and Insurance

Accommodation and Food

Arts and Entertainment

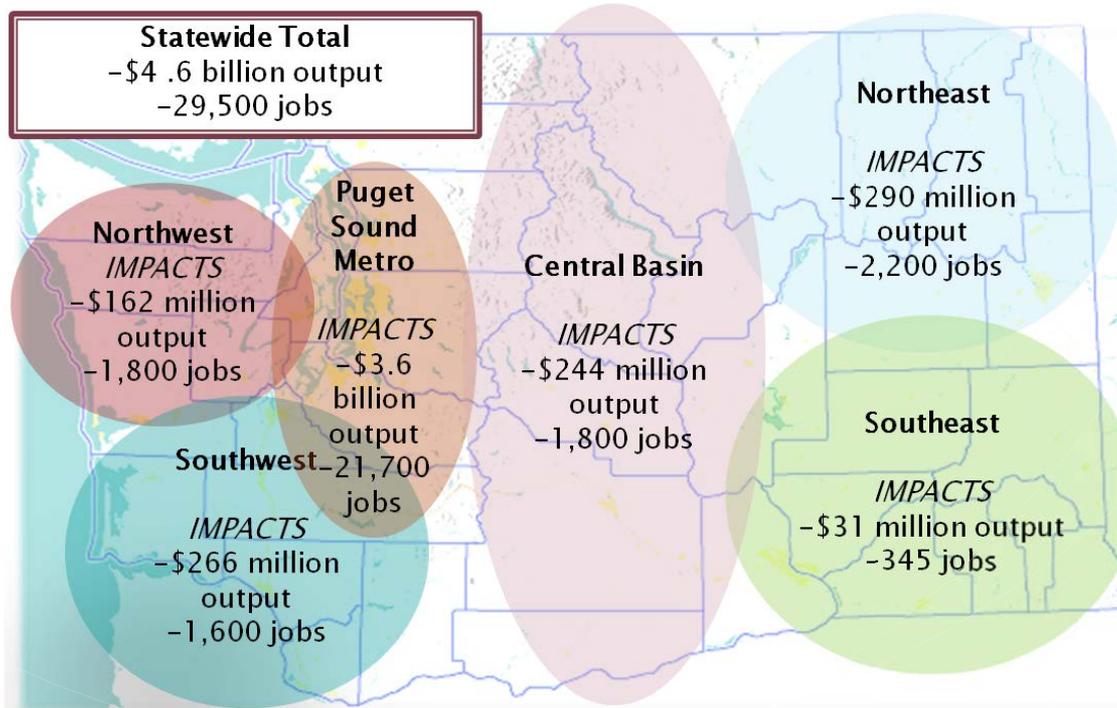
Construction and Utilities

Professional and Scientific

Educational Services

Ag, Forestry, and Fishing

STEP 4: EVALUATE THE LOSSES AND GAINS TO DETERMINE THE STATEWIDE AND REGIONAL IMPACTS OF CONGESTION



Region	Employment	Output (\$millions)	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%
Statewide Total	-29,500	-\$4,600	-0.76%	-0.72%

Lessons Learned and Recommendations:

- What do these Findings Suggest for WSDOT's Policies Towards Addressing Congestion on Corridors Used by Trucks?
 - The state's economic vitality and livability depend on reliable, responsible, and sustainable transportation.
- Congestion causes increased direct transportation costs to freight-dependent industries – which translate to increased costs of goods and services to consumers in Washington State.
 - Creates an operational efficiency problem for freight dependent firms: Trip Time ↑ Unproductive time in Traffic ↑ Productivity ↓ resulting in \$14 Billion of increased operating costs.
- 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.

FPTI Moving Forward :

- *Current Projects:*
 - *Origin-Destination Surveys*
 - *Snoqualmie Pass*
 - *Wenatchee*
 - *NE segment of US 395*
 - *Reliability Measures*
- *Developing/Proposed Projects*
 - *Tier I – University Transportation Center*
 - *Keeping Freight Moving*
 - *Disaster Resilient Networks*
 - *Responding to International Changes*
 - *Impacts of Policy Induced Freight Modal Shifts*
 - *Asset Management for Rural Freight Mobility*



Sources

- (1) U.S. Department of Transportation, Research and Innovative Technology Administration. *2013 Pocket Guide to Transportation*, Pp 54.
- (2) U.S. Department of Transportation, Federal Highway Administration. *Freight Facts and Figures 2012*, Pp 86.
- (3) Texas Transportation Institute. *2012 Urban Mobility Report*, Pp 64.

For more Information:

Freight **P**olicy **T**ransportation **I**nstitute

Washington State University

School of Economic Sciences

301 Hulbert Hall

Pullman, WA 99164-6210

Phone: 509-335-8489

Email: jlsage@wsu.edu or

casavantk@wsu.edu