Port of Portland Commodity Flow Forecast

Final Project Presentation

presented to
Port of Portland and Stakeholders

presented by
Cambridge Systematics, Inc.

Michael J. Fischer

March 31, 2015

Transportation leadership you can trust.
Agenda

- Macro-Economic Context
- Data Methodology
- Summary of Base Year Data
- Summary of Future Year Data
- Summary of Written Tasks
Macro-economic Context
Portland’s Economy is Supported by Three Goods Movement Functions

International Trade. This is done primarily through the Port of Portland and Port of Vancouver, including marine terminals and the Portland International Airport. It provides access to Pacific Rim trading partners.

Domestic Trade. Local consumer base relies on industries across the country. The region also supports population centers in other domestic regions. Warehouse and DCs support this function.

Local Deliveries. As a large population center, the region relies on local goods movement to provide consumer products, food, and parcels to residents and businesses.

Commodity flows associated with the study area reflect all three goods movement functions.
GDP of Industries in Portland Region

Source: Bureau of Economic Analysis.
Employment of Industries in Portland Region

Source: Bureau of Economic Analysis.
Portland’s Key Industries Have Changed Overtime

1. **Forest Products.** Traditionally most important in the region. Currently experiencing domestic declines, but increased overseas import.

2. **Manufacturing.** High-tech electronics is becoming a highly significant sector.

3. **Agriculture.** Traditionally a very important industry in the region. Significant shares of agriculture products are exported to Asia.

4. **Energy.** Energy dependence in the region is shifting from hydroelectric power to other renewable energy sources and natural gas, which creates changes in demand in the future both in terms of commodities and mode.

5. **Waste and Scrap.** Dramatic increases of exports to China in past decade. Waste and scrap is believed to be the most important industry in the U.S. currently.
In 2010, Oregon lumber and wood production is the highest in the country. It also is a mid-ranking state in terms of paper production.

Most forest products comes from West Oregon (Lane and Davis Counties).

Timber production and jobs in these industries has declined, due to reduction of logging on Federal lands.

The movement of forest products is dependent on U.S. housing and construction markets, and increasingly on exports to China.
Hi-tech manufacturing drives growth in manufacturing activities in Portland, especially from Intel’s semiconductor production.

Oregon has the highest concentration of manufacturing in the country based on relative contribution to GDP.

Large recent capital investments means even more high-tech manufacturing activity in the future.

Source: Bureau of Economic Analysis.
Agriculture

- Oregon’s main crops include wheat, hay, nursery products, apples. Wheat farms are concentrated in Umatilla County.

- Oregon agriculture has been rising steadily, but is eroding in terms of total U.S. shares.

- Oregon-origin exports account for 4% total U.S. exports, mostly destined to Asia.

- Food production also is important in Oregon, growing by 17 percent between 2000 and 2010. However, it remained stagnant since 2005.

Source: WISERTrade.
Oregon energy consumption changed considerably since 2000, where energy consumption actually declined even though population increased.

About one-third of electricity comes from hydro power, and as the hydroelectricity has declined in use, it is replaced by renewable and natural gas.

Source: U.S. EIA.
Waste and Scrap

- A fast growing export sector in recent decades due to demand in China for:
  - Waste scrap metal
  - Waste paper/cardboard
  - Waste plastics

- Shredded scrap material comes via rail and truck to the Port of Vancouver. The tonnage of the shredded scrap material has increased dramatically in recent years.

- In the future, though continued demand are expected from China, the market can be volatile.
Data Methodology
Overview of the Project

Overall Purpose

Develop a commodity flow database with future forecast for the Portland-Vancouver Region using baseline FAF data.

Study Area

Overall Methodology

1. FAF3 Data
2. + Clark County using TRANSEARCH
3. Reconcile with Additional Data (triangulation)

Draft Base Year Data
- + Secondary
- + Unchain Multiple Modes and Mail
- + Directions (NESW)
- + BIA Traffic

Draft Forecast Years Data
- Mode Split

Final Database

Port Statistics, Stakeholder Input, Additional Validation
secondary mode split (for international movements)

goal: split foreign ocean modes and air modes into domestic modes.
- results in double-counting, but can toggle on/off depending on purpose.

<table>
<thead>
<tr>
<th>FAF Database</th>
<th>Our Database</th>
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<tbody>
<tr>
<td>Foreign Mode</td>
<td>Domestic Mode</td>
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<tr>
<td>Water</td>
<td>Truck</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
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</table>

<table>
<thead>
<tr>
<th>Mode</th>
<th>Inbound</th>
<th>Outbound</th>
<th>Intra</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ocean</td>
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<td></td>
<td></td>
<td>100</td>
</tr>
<tr>
<td>Truck</td>
<td></td>
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<tr>
<td>Total</td>
<td>100</td>
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<td>200</td>
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</tbody>
</table>
Goal: Split foreign ocean modes and air modes into domestic modes. - Results in double-counting, but can toggle on/off depending on purpose.

### Portland

1. Drayed on Truck – 100 tons
2. Move onto Rail – 100 tons

<table>
<thead>
<tr>
<th>Foreign Mode</th>
<th>Domestic Mode</th>
<th>Inbound</th>
<th>Outbound</th>
<th>Intra</th>
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<table>
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<tbody>
<tr>
<td>Ocean</td>
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<td></td>
<td></td>
<td>100</td>
</tr>
<tr>
<td>Truck</td>
<td></td>
<td>100</td>
<td></td>
<td>100</td>
</tr>
<tr>
<td>Rail</td>
<td></td>
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</tr>
<tr>
<td>Total</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>300</td>
</tr>
</tbody>
</table>
Unchaining Multiple Modes and Mail

Data used:

» Barge – USACE
» Intermodal and Drayage – TRANSEARCH and STB Waybill
» Air – FAA
Goal: Split multiple modes in study area into its sub-modes. Results in double-counting in some cases. Hard coded in database.

<table>
<thead>
<tr>
<th>Mode</th>
<th>Intra</th>
<th>Inbound</th>
<th>Outbound</th>
<th>Through</th>
<th>Total</th>
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</thead>
<tbody>
<tr>
<td>Mixed Mode</td>
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<td>20</td>
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<td>Total</td>
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</table>

<table>
<thead>
<tr>
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<th>Through</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Truck</td>
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<td>20</td>
<td></td>
<td></td>
<td>20</td>
</tr>
<tr>
<td>Rail</td>
<td></td>
<td></td>
<td>20</td>
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<tr>
<td>Total</td>
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<td>20</td>
<td>20</td>
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<td>40</td>
</tr>
</tbody>
</table>
Goal: Split multiple modes in study area into its sub-modes.
- Results in double-counting in some cases. Hard coded in database.

<table>
<thead>
<tr>
<th>Mode</th>
<th>Intra</th>
<th>Inbound</th>
<th>Outbound</th>
<th>Through</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mixed Mode</td>
<td></td>
<td>30</td>
<td></td>
<td></td>
<td>30</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>30</td>
<td></td>
<td></td>
<td>30</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Mode</th>
<th>Intra</th>
<th>Inbound</th>
<th>Outbound</th>
<th>Through</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water</td>
<td></td>
<td>30</td>
<td></td>
<td></td>
<td>30</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>30</td>
<td></td>
<td></td>
<td>30</td>
</tr>
</tbody>
</table>
Summary of Base Year Data (2007)
Adjustments to Base Year Volumes

- Auto imports. Flows were reassigned so that total rail volumes matched the ports’ statistics, with destination assigned in proportion to the volumes in the 2007 Carload Waybill Sample.

- Waste/Scrap. Base year calculated and adjusted using local municipal and industrial waste and scrap material volumes.

- Multiple other commodity groups checked with calculations from local data sources (such as pipeline flows using Kinder Morgan data). Original FAF3 volumes retains after comparison.
Flows by Direction*

**Tonnage (Thousand of Tons)**
- Inbound: 124,101 (41%)
- Outbound: 103,139 (34%)
- Intra: 75,130 (25%)

**Value (Million of Dollars)**
- Inbound: 148,822 (41%)
- Outbound: 146,018 (41%)
- Intra: 66,040 (18%)
Flows by Trade Type

**Tonnage (Thousands of Tons)**
- Domestic: 213,176 (71%)
- Import: 28,057 (9%)
- Export: 61,137 (20%)

**Value (Million of Dollars)**
- Domestic: 270,433 (75%)
- Import: 59,764 (17%)
- Export: 30,684 (8%)
Flows by Mode

Tonnage
(Thousands of Tons)

- Air: 240 (0%)
- Pipeline: 10,844 (4%)
- Water: 19,180 (6%)
- Ocean: 29,317 (10%)
- Rail: 42,076 (14%)
- Truck: 200,712 (66%)

Value
(Million of Dollars)

- Air: 8,776 (2%)
- Pipeline: 5,241 (2%)
- Water: 11,330 (3%)
- Ocean: 19,034 (5%)
- Rail: 50,583 (14%)
- Truck: 265,917 (74%)
Domestic Flows by Direction (NESW)

Tonnage (Thousand of Tons)

Value (Million of Dollars)
Import Flows by Direction (NESW)

Tonnage (Thousands of Tons)

Value (Million of Dollars)

Entering From
Exiting To

Entering From
Exiting To
Export Flow by Direction (NESW)

Tonnage
(Thousands of Tons)

Entering From
Exiting To

Value
(Million of Dollars)

Entering From
Exiting To
Top Domestic Commodities

**Tonnage** (Thousand of Tons)

<table>
<thead>
<tr>
<th>Commodity</th>
<th>Tonnage</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gravel</td>
<td>28,433</td>
<td>15%</td>
</tr>
<tr>
<td>Other</td>
<td>42,386</td>
<td>23%</td>
</tr>
<tr>
<td>Nonmetal min. prods.</td>
<td>30,551</td>
<td>16%</td>
</tr>
<tr>
<td>Other foodstuffs and alcoholic beverages</td>
<td>10,495</td>
<td>6%</td>
</tr>
<tr>
<td>Cereal grains</td>
<td>11,505</td>
<td>6%</td>
</tr>
<tr>
<td>Wood prods.</td>
<td>13,005</td>
<td>7%</td>
</tr>
<tr>
<td>Gasoline, fuels nec</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mixed freight</td>
<td>5,905</td>
<td>3%</td>
</tr>
<tr>
<td>Basic chemicals</td>
<td>6,096</td>
<td>3%</td>
</tr>
<tr>
<td>Waste/scrap</td>
<td>7,110</td>
<td>4%</td>
</tr>
<tr>
<td>Other</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Value** (Million Dollars)

<table>
<thead>
<tr>
<th>Commodity</th>
<th>Value</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electronics</td>
<td>24,246</td>
<td>11%</td>
</tr>
<tr>
<td>Mixed freight</td>
<td>18,401</td>
<td>9%</td>
</tr>
<tr>
<td>Machinery</td>
<td>17,995</td>
<td>9%</td>
</tr>
<tr>
<td>Motorized vehicles</td>
<td>16,493</td>
<td>8%</td>
</tr>
<tr>
<td>Textiles/leather</td>
<td>12,446</td>
<td>6%</td>
</tr>
<tr>
<td>Other foodstuffs and alcoholic beverages</td>
<td>10,495</td>
<td>6%</td>
</tr>
<tr>
<td>Other</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Misc. mfg. prods.</td>
<td>8,534</td>
<td>4%</td>
</tr>
<tr>
<td>Articles base metal</td>
<td>7,141</td>
<td>3%</td>
</tr>
<tr>
<td>Wood prods.</td>
<td>6,885</td>
<td>3%</td>
</tr>
<tr>
<td>Waste/scrap</td>
<td>7,110</td>
<td>4%</td>
</tr>
<tr>
<td>Basic chemicals</td>
<td>6,096</td>
<td>3%</td>
</tr>
<tr>
<td>Other</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Note: The percentages are approximate and may not sum to 100% due to rounding.*
Top Domestic Commodities – Inbound

<table>
<thead>
<tr>
<th>Item</th>
<th>Tonnage (Thousand of Tons)</th>
<th>Value (Million of Dollars)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gasoline, fuels nec</td>
<td>16,820</td>
<td>9,817</td>
</tr>
<tr>
<td>Cereal grains</td>
<td>9,247</td>
<td>8,774</td>
</tr>
<tr>
<td>Gravel</td>
<td>8,469</td>
<td>6,848</td>
</tr>
<tr>
<td>Wood prods.</td>
<td>6,268</td>
<td>5,264</td>
</tr>
<tr>
<td>Other foodstuffs and alcoholic beverages</td>
<td>5,739</td>
<td>4,545</td>
</tr>
<tr>
<td>Basic chemicals</td>
<td>5,701</td>
<td>4,188</td>
</tr>
<tr>
<td>Natural sands</td>
<td>2,492</td>
<td>2,800</td>
</tr>
<tr>
<td>Nonmetal min. prods.</td>
<td>2,812</td>
<td>2,800</td>
</tr>
<tr>
<td>Newsprint/paper</td>
<td>2,187</td>
<td>2,187</td>
</tr>
<tr>
<td>Waste/scrap</td>
<td>4,188</td>
<td>4,188</td>
</tr>
<tr>
<td>Mixed freight</td>
<td>6,818</td>
<td>7,471</td>
</tr>
<tr>
<td>Pharmaceuticals</td>
<td>4,188</td>
<td>4,188</td>
</tr>
<tr>
<td>Plastics/rubber</td>
<td>3,662</td>
<td>3,662</td>
</tr>
<tr>
<td>Textiles/leather</td>
<td>6,373</td>
<td>6,373</td>
</tr>
<tr>
<td>Electronics</td>
<td>6,816</td>
<td>6,816</td>
</tr>
<tr>
<td>Machinery</td>
<td>6,484</td>
<td>6,484</td>
</tr>
<tr>
<td>Machinery</td>
<td>6,484</td>
<td>6,484</td>
</tr>
<tr>
<td>Other</td>
<td>17,991</td>
<td>35,688</td>
</tr>
</tbody>
</table>

**Tonnage (Thousand of Tons)**

- Gasoline, fuels nec: 16,820 (20%)
- Cereal grains: 9,247 (11%)
- Gravel: 8,469 (10%)
- Wood prods.: 6,268 (8%)
- Other foodstuffs and alcoholic beverages: 5,739 (7%)
- Basic chemicals: 5,701 (7%)
- Natural sands: 2,492 (3%)
- Nonmetal min. prods.: 2,800 (3%)
- Newsprint/paper: 2,812 (4%)
- Waste/scrap: 4,188 (5%)
- Mixed freight: 6,818 (7%)
- Pharmaceuticals: 4,188 (4%)
- Plastics/rubber: 3,662 (4%)
- Textiles/leather: 6,373 (6%)
- Electronics: 6,816 (7%)
- Machinery: 6,484 (6%)
- Other: 17,991 (22%)

**Value (Million of Dollars)**

- Gasoline, fuels nec: 9,817 (10%)
- Motorized vehicles: 8,774 (9%)
- Other foodstuffs and alcoholic beverages: 7,471 (7%)
- Mixed freight: 6,818 (7%)
- Electronics: 6,816 (7%)
- Machinery: 6,484 (6%)
- Misc. mfg. prods.: 5,264 (5%)
- Pharmaceuticals: 4,545 (4%)
- Plastics/rubber: 3,662 (4%)
- Textiles/leather: 6,373 (6%)
- Other: 35,688 (35%)
Top Domestic Commodities – Outbound

**Tonnage (Thousands of Tons)**

- Nonmetal min. prods., 11,341 29%
- Wood prods., 4,956 13%
- Other foodstuffs and alcoholic beverages, 2,846 7%
- Gasoline, fuels nec, 2,988 8%
- Fertilizers, 728 2%
- Paper articles, 805 2%
- Base metals, 1,348 3%
- Newsprint/paper, 1,473 4%
- Cereal grains, 1,905 5%
- Mixed freight, 2,489 6%
- Other, 7,964 21%

**Value (Millions of Dollars)**

- Electronics, 11,187 18%
- Mixed freight, 7,726 12%
- Machinery, 5,510 9%
- Textiles/leather, 4,151 7%
- Motorized vehicles, 5,318 9%
- Other foodstuffs and alcoholic beverages, 3,704 6%
- Precision instruments, 2,355 4%
- Wood prods., 2,764 4%
- Articles-base metal, 2,343 4%
- Gasoline, fuels nec, 2,011 3%
- Other, 14,823 24%
Top Import Commodities

### Tonnage (Thousands of Tons)
- Motorized vehicles: 10,458 (32%)
- Gasoline, fuels nec: 4,086 (13%)
- Machinery: 3,416 (10%)
- Textiles/leather: 2,242 (7%)
- Electronics: 1,932 (6%)
- Articles-base metal: 1,105 (3%)
- Nonmetallic minerals: 1,678 (10%)
- Base metals: 1,706 (10%)
- Wood prods. 2,091 (12%)
- Gasoline, fuels nec: 2,068 (12%)
- Fertilizers: 2,469 (14%)
- Other: 2,829 (16%)
- Nonmetallic base metal: 1,012 (6%)
- Basic chemicals: 1,012 (6%)
- Motorized vehicles: 1,090 (6%)
- Articles-base metal: 595 (3%)
- Machinery: 365 (2%)
- Other: 5,975 (18%)

### Value (Millions of Dollars)
- Motorized vehicles: 10,458 (32%)
- Gasoline, fuels nec: 4,086 (13%)
- Machinery: 3,416 (10%)
- Textiles/leather: 2,242 (7%)
- Electronics: 1,932 (6%)
- Articles-base metal: 1,105 (3%)
- Nonmetallic minerals: 1,678 (10%)
- Base metals: 1,706 (10%)
- Wood prods.: 2,091 (12%)
- Gasoline, fuels nec: 2,068 (12%)
- Fertilizers: 2,469 (14%)
- Other: 2,829 (16%)
- Nonmetallic base metal: 1,012 (6%)
- Basic chemicals: 1,012 (6%)
- Motorized vehicles: 1,090 (6%)
- Articles-base metal: 595 (3%)
- Machinery: 365 (2%)
- Other: 753 (2%)
- Transport equip.: 954 (3%)
- Base metals: 1,027 (3%)
- Wood prods.: 1,050 (3%)
- Misc. mfg. products: 1,105 (3%)
- Electronics: 1,932 (6%)
- Textiles/leather: 2,242 (7%)
- Other: 2,829 (16%)
Top Export Commodities

**Tonnage (Thousands of Tons)**

- **Cereal grains**: 15,166 (45%)
- **Other ag prods.**: 2,970 (9%)
- **Fertilizers**: 2,797 (8%)
- **Basic chemicals**: 2,227 (7%)
- **Waste/scrap**: 1,455 (4%)
- **Metallic ores**: 1,650 (5%)
- **Animal feed**: 1,666 (5%)
- **Newsprint/paper**: 622 (2%)
- **Other**: 3,514 (10%)

**Value (Million Dollars)**

- **Cereal grains**: 2,451 (14%)
- **Other ag prods.**: 1,683 (9%)
- **Machinery**: 1,652 (9%)
- **Motorized vehicles**: 1,410 (8%)
- **Electronics**: 1,376 (8%)
- **Transport equip.**: 1,374 (8%)
- **Precision instruments**: 703 (4%)
- **Misc. mfg. prods.**: 445 (2%)
- **Other foodstuffs and alcoholic beverages**: 508 (3%)
- **Metallic ores**: 1,158 (6%)
- **Other**: 5,091 (29%)
Future Year Data
Adjustments to Future Volumes

- **Cereal Grain.** Existing FAF forecasts for originated grain could not be supported. Grain tons were forecasted using IHS production forecasts.

- **Auto imports.** Flows were reassigned so that total rail volumes matched the ports’ statistics, with destination assigned in proportion to the volumes in the 2007 Carload Waybill Sample.

- **Non-metallic mineral products.** FAF3 growth is unrealistically high. Growth rates adjusted using HIS forecast rates based on the most recent County Business Forecasts.

- **Precision Instruments.** FAF3 growth unrealistically high. Growth rates adjusted based on most recent version of County Business Forecasts.
Growth of Flows by Direction*

<table>
<thead>
<tr>
<th>Tonnage (ktons)</th>
<th>Value ($M)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.6%</td>
<td>2.1%</td>
</tr>
<tr>
<td>2.2%</td>
<td>2.6%</td>
</tr>
<tr>
<td>3.1%</td>
<td>2.7%</td>
</tr>
</tbody>
</table>

Intra  Outbound  Inbound

2007  2040  2007  2040  2007  2040
Growth of Flows by Trade Type

### Tonnage (ktons)

- **Domestic**: 20,000 (2007), 30,000 (2040) with 1.5% growth
- **Import**: 50,000 (2007), 100,000 (2040) with 3.2% growth
- **Export**: 30,000 (2007), 45,000 (2040) with 3.0% growth

### Value ($M)

- **Domestic**: 100,000 (2007), 150,000 (2040) with 2.4% growth
- **Import**: 200,000 (2007), 300,000 (2040) with 3.8% growth
- **Export**: 300,000 (2007), 450,000 (2040) with 4.1% growth
Growth of Flows by Mode

Tonnage (ktons)

Value ($M)

- 2007 2010 2020 2030 2040
- 2007 2010 2020 2030 2040

Truck (2.0%)
Rail (1.8%)
Ocean (3.1%)
Water (2.0%)
Pipeline (1.7%)
Air (3.0%)

Truck (2.8%)
Rail (2.5%)
Ocean (3.1%)
Water (3.0%)
Pipeline (1.6%)
Air (4.3%)
### Growth of Domestic Flows by Direction (NSEW)

#### Tonnage (ktons)

<table>
<thead>
<tr>
<th>Entering from</th>
<th>2007</th>
<th>2040</th>
<th>CAGR</th>
<th>Exiting to</th>
<th>2007</th>
<th>2040</th>
<th>CAGR</th>
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<tr>
<td>N</td>
<td>27,440</td>
<td>47,797</td>
<td>1.7%</td>
<td>N</td>
<td>15,882</td>
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<tr>
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<td>15,866</td>
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</tr>
<tr>
<td>S</td>
<td>14,564</td>
<td>27,340</td>
<td>1.9%</td>
<td>S</td>
<td>17,378</td>
<td>22,829</td>
<td>0.8%</td>
</tr>
<tr>
<td>W</td>
<td>10,691</td>
<td>17,398</td>
<td>1.5%</td>
<td>W</td>
<td>3,246</td>
<td>4,251</td>
<td>0.8%</td>
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</table>

#### Value ($M)

<table>
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<tr>
<th>Entering from</th>
<th>2007</th>
<th>2040</th>
<th>CAGR</th>
<th>Exiting to</th>
<th>2007</th>
<th>2040</th>
<th>CAGR</th>
</tr>
</thead>
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<tr>
<td>N</td>
<td>27,203</td>
<td>69,427</td>
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</tr>
<tr>
<td>S</td>
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<td>62,443</td>
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<td>S</td>
<td>28,279</td>
<td>53,980</td>
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<tr>
<td>W</td>
<td>5,024</td>
<td>9,555</td>
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<td>W</td>
<td>1,883</td>
<td>3,717</td>
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## Growth of Import Flows by Direction (NSEW)

### Tonnage (ktons)

<table>
<thead>
<tr>
<th>Entering From</th>
<th>2007</th>
<th>2040</th>
<th>CAGR</th>
<th>Exiting To</th>
<th>2007</th>
<th>2040</th>
<th>CAGR</th>
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</thead>
<tbody>
<tr>
<td>N</td>
<td>7,243</td>
<td>19,511</td>
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<td>2,325</td>
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<tr>
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<td>1,700</td>
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<tr>
<td>S</td>
<td>1,342</td>
<td>4,922</td>
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<td>S</td>
<td>2,812</td>
<td>7,377</td>
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</tr>
<tr>
<td>W</td>
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<td>18,748</td>
<td>2.9%</td>
<td>W</td>
<td>247</td>
<td>478</td>
<td>2.0%</td>
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</table>

### Value ($M)

<table>
<thead>
<tr>
<th>Entering From</th>
<th>00</th>
<th>00</th>
<th>CAGR</th>
<th>Exiting To</th>
<th>00</th>
<th>00</th>
<th>CAGR</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>11,946</td>
<td>44,924</td>
<td>4.1%</td>
<td>N</td>
<td>2,550</td>
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<tr>
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<td>18,226</td>
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<td>9,754</td>
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<tr>
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<td>9,529</td>
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</tr>
<tr>
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<td>W</td>
<td>73</td>
<td>288</td>
<td>4.2%</td>
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</table>
## Growth of Export Flows by Direction (NSEW)

### Tonnage (ktons)

<table>
<thead>
<tr>
<th>Entering From</th>
<th>2007</th>
<th>2040</th>
<th>CAGR</th>
<th>Exiting To</th>
<th>2007</th>
<th>2040</th>
<th>CAGR</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>2,635</td>
<td>6,447</td>
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<td>N</td>
<td>11,642</td>
<td>37,624</td>
<td>3.6%</td>
</tr>
<tr>
<td>E</td>
<td>12,484</td>
<td>26,765</td>
<td>2.3%</td>
<td>E</td>
<td>1,201</td>
<td>3,706</td>
<td>3.5%</td>
</tr>
<tr>
<td>S</td>
<td>6,023</td>
<td>19,545</td>
<td>3.6%</td>
<td>S</td>
<td>197</td>
<td>831</td>
<td>4.5%</td>
</tr>
<tr>
<td>W</td>
<td>209</td>
<td>862</td>
<td>4.4%</td>
<td>W</td>
<td>18,937</td>
<td>44,084</td>
<td>2.6%</td>
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</table>

### Value ($M)

<table>
<thead>
<tr>
<th>Entering From</th>
<th>00</th>
<th>00</th>
<th>CAGR</th>
<th>Exiting To</th>
<th>00</th>
<th>00</th>
<th>CAGR</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>778</td>
<td>2,618</td>
<td>3.7%</td>
<td>N</td>
<td>8,991</td>
<td>33,593</td>
<td>4.1%</td>
</tr>
<tr>
<td>E</td>
<td>2,618</td>
<td>8,079</td>
<td>3.5%</td>
<td>E</td>
<td>2,392</td>
<td>8,201</td>
<td>3.8%</td>
</tr>
<tr>
<td>S</td>
<td>5,986</td>
<td>23,881</td>
<td>4.3%</td>
<td>S</td>
<td>243</td>
<td>1,128</td>
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</tr>
<tr>
<td>W</td>
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<td>957</td>
<td>4.4%</td>
<td>W</td>
<td>4,794</td>
<td>17,410</td>
<td>4.0%</td>
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</tbody>
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Growth of Top Domestic Commodities – Tonnage

Tonnage (ktons)

- 350,000
- 300,000
- 250,000
- 200,000
- 150,000
- 100,000
- 50,000
- 0

2007 2010 2020 2030 2040

- Other (2.1%)
- Newsprint/paper (0.8%)
- Mixed freight (2.4%)
- Basic chemicals (1.3%)
- Waste/scrap (2.2%)
- Other foodstuffs and alcoholic beverages (2.0%)
- Cereal grains (1.7%)
- Wood prods. (0.8%)
- Gasoline, fuels nec (0.7%)
- Gravel (1.6%)
- Nonmetal min. prods. (0.9%)
Growth of Top Domestic Commodities – Inbound by Tonnage

Tonnage (ktons)

- Other (2.4%)
- Natural sands (-0.2%)
- Nonmetal min. prods. (1.7%)
- Newsprint/paper (1.7%)
- Waste/scrap (2.7%)
- Basic chemicals (1.4%)
- Other foodstuffs and alcoholic beverages (1.8%)
- Wood prods. (1.2%)
- Gravel (1.8%)
- Cereal grains (1.9%)
- Gasoline, fuels nec (1.3%)
Growth of Top Domestic Commodities – Outbound by Tonnage

Tonnage (ktons)

- Other (2.4%)
- Fertilizers (-2.9%)
- Paper articles (-1.1%)
- Base metals (-0.3%)
- Newsprint/paper (-1.3%)
- Cereal grains (0.8%)
- Mixed freight (1.3%)
- Other foodstuffs and alcoholic beverages (1.9%)
- Gasoline, fuels nec (-0.7%)
- Wood prods. (0.3%)
- Nonmetal min. prods. (0.6%)
Growth of Top Domestic Commodities – Inbound by Value

Value ($M)

- Other (2.1%)
- Plastics/rubber (2.8%)
- Pharmaceuticals (4.1%)
- Misc. mfg. prods. (4.5%)
- Textiles/leather (2.4%)
- Machinery (3.4%)
- Electronics (3.1%)
- Mixed freight (3.3%)
- Other foodstuffs and alcoholic beverages (1.8%)
- Motorized vehicles (2.1%)
- Gasoline, fuels nec (1.4%)
Growth of Top Domestic Commodities – Outbound by Value

Value ($M)

- Other (2.9%)
- Gasoline, fuels nec (-0.6%)
- Articles-base metal (-0.2%)
- Precision instruments (0.7%)
- Wood prods. (0.4%)
- Other foodstuffs and alcoholic beverages (2.0%)
- Textiles/leather (3.5%)
- Motorized vehicles (0.3%)
- Machinery (2.5%)
- Mixed freight (1.2%)
- Electronics (0.9%)
Growth of Top Import Commodities – Tonnage

Tonnage (ktons)

- Other (4.55)
- Machinery (7.2%)
- Articles-base metal (3.5%)
- Basic chemicals (3.7%)
- Motorized vehicles (1.8%)
- Nonmetallic minerals (2.5%)
- Base metals (2.5%)
- Nonmetal min. prods. (3.9%)
- Gasoline, fuels nec (2.8%)
- Wood prods. (-0.2%)
- Fertilizers (2.45)
Growth of Top Import Commodities – Value

Value ($M)

- 140,000
- 120,000
- 100,000
- 80,000
- 60,000
- 40,000
- 20,000
- 0

2007 2010 2020 2030 2040

- Other (4.850)
- Misc. mfg. prods. (4.6%)
- Transport equip. (5.3%)
- Base metals (2.6%)
- Wood prods. (-0.2%)
- Articles-base metal (3.5%)
- Electronics (4.3%)
- Textiles/leather (3.8%)
- Machinery (7.3%)
- Gasoline, fuels nec (1.4%)
- Motorized vehicles (1.6%)
Growth of Top Export Commodities – Value

Value ($M)

- Other
- Newsprint/paper (3.2%)
- Other foodstuffs and alcoholic beverages (4.1%)
- Wood prods. (4.9%)
- Waste/scrap (3.4%)
- Metallic ores (1.7%)
- Animal feed (5.2%)
- Basic chemicals (2.5%)
- Fertilizers (5.3%)
- Other ag prods. (4.5%)
Summary of Written Tasks
Task F and H: Factors Specific to Top Commodity Groups for Growth and Mode

- **Cereal Grains.** Rail Congestion and barge congestion will have biggest impact on growth. Product likely to continue to move on rail.

- **Waste and Scrap.** Biggest driver of export will be price on the international market. Metallic scrap usually arrive by multiple modes to be exported by vessel. Non-metallic scrap arrives in trucks usually to be exported in containers. Shifts in modes can occur depending on demand.

- **Non-Metallic Mineral Products.** Domestic oil and gas production will drive imports of such products as barite. This will likely to continue move on rail, depending on rail pricing. Diversion of short haul movements to truck is also likely.

- **Gasoline and Fuels.** Future volume will be determined by success/failure of domestic extraction and refining of oil, and growth of alternative fuels (e.g., natural gas).
Precision Instrument. This time sensitive commodity can be affected by delays on roadways and rail. Air transportation can be increasingly utilized in the future in addition to road and rail.

Machinery. Movement will grow at the pace of local and U.S. economy but can be affected by outsourcing/reshoring of production. Traditionally break-bulk moved by truck, it can be increasingly moved on intermodal rail.

Electronics. Volumes will growth with the economy, as well as outsourcing/reshoring trends. Intermodal trucking/rail will continue, with potential increases in air shares for more time sensitive electronics.

Motorized Vehicles. Future imports will largely be driven by domestic demand, while exports by foreign demand. Trucking/rail will continue as dominant mode of transport.
Task G: Trends/Changed in Transportation Technologies

1. Conversion of shipment from pipeline to rail (e.g., crude by rail)
2. Increase of LTL shipments of fast moving consumer goods
3. Increase in transloading of imported goods from international containers to domestic containers (40ft to 53ft containers)
4. Increased exportation of minerals and bulk products such as copper ore, LNG, and coal
5. Conversion of fuel used in freight from diesel to LNG
6. Adoption of electric vehicles for freight movements
7. Continued concern of freight movement security
8. Continued pressure to reduce health/environmental impacts from freight
9. Environmental pressure to increase fuel mileage in all vehicles
## Task I. Strength and Weakness of the Portland Region

### Strengths
- Natural advantage of Columbia River to assist in moving bulk products
- Port of Portland’s capacity and transfer of bulk products
- Solid base and good incentive of attracting high value manufacturers
- Class I and shortlines offer good modal alternative for BCOs
- Port of Vancouver pipeline facility, heavy lift cranes, and other specialized facilities enable movement of gasoline, clean energy products, and other niche products.

### Weaknesses
- Increasing highway and local congestion
- Limited direct airfreight service at PDX
- Modal choice restricted for products sources from remote areas (e.g. ag products)
- Lack of highway redundancy
- Cumbersome OSOW permitting process
- Few roads across coastal range, especially affecting fish and seafood

### Opportunities
- Clustering of hi-tech sectors provide synergies and attract economy of scale and human capital.
- Large dry cargo market can create possibility to attract further service if ag products, footwear/apparel shippers can cluster with hi-tech to form a strong cargo base.

### Threats
- Dwindling containerized ocean carrier service can reduce competitiveness
- Scarcity of industrial land for logistics
- Failure to replace the Columbia River Crossing I-5 bridge that affects reliability and mobility
Task J: Global Trends that Can Affect Freight Flows

- Re-shoring of Manufacturing to the U.S.
- BCOs distribution strategy shift from “push” to “pull” supply chains, and the increase of ecommerce
- Increase use of Mega Vessels
- Changing Asian demand for raw materials
- Changing demand for recycled products
Task K: Potential Methodologies for Transshipment

1. TRANSEARCH approach to estimating warehouse and distribution center commodity flows as applied to the Portland – Vancouver regional commodity flow database

2. Transload secondary trip estimation methodology for the San Pedro Bay ports’ PortTAM

3. CMAP mesoscale supply chain model
Thank You