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# Projecting Washington - British Columbia Truck Freight Border Crossings and Arterial Usage

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*This report is available at http://www.ac.wwu.edu/~bpri/resources.html*

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## PROBLEM STATEMENT

*Continuing adaptation to changing transportation needs is critical in maintaining efficiency and reducing costs of raw and manufactured goods to ensure economic stability and growth. With bilateral trade in excess of $1.4 billion per day between the U.S. and Canada and over 200 million annual crossings (passenger vehicles and freight trucks) (U.S. Embassy, Ottawa, 2006), knowledge of the composition of commodities crossing the border and the growth in the flow of those commodities is vital to future policy making. This report focuses on cross-border flows by truck between Washington and British Columbia, through decomposition of the northbound and southbound flows by industry and commodity, coupled with projection of the trade growth in those industries. By knowing expected increases in commodity flows across border port locations, policy makers can better adapt border ports to ensure efficiency in truck movements. Increased efficiency is important to trade competitiveness in the international marketplace.*

*Furthermore, as trade continues to grow between Canada and the U.S., route and road systems are impacted. Therefore, an analysis of the routes utilized (North-South and East-West) for border crossings will also help in determining the future development and maintenance of trade-supporting highway networks.*

## TRADE/PROFILE METHODOLOGY

The unique component in this research that enables the creation of border port commodity profiles is the Strategic Freight Transportation Analysis (SFTA) and the Eastern Washington Intermodal Transportation Study (EWITS). SFTA and EWITS are truck freight origin-destination surveys conducted through the Washington State University Transportation Research Group (TRG) and are known to be duplicated in only one other state. EWITS, the first survey, was conducted in the years 1992-1993 and SFTA, the second survey, was conducted in the years 2002-2003. The surveys collected information that is not provided by the U.S. Census or other government organizations. Information was gathered on origin, destination, route used, main commodity type carried, payload weight, operating company, number of axles, tractor/trailer type, and other characteristics. The surveys were conducted on four different days each year and have combined sample observations of over 56,000 trucks. Each day

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was in a different season in order to account for seasonal variations in truck flows.

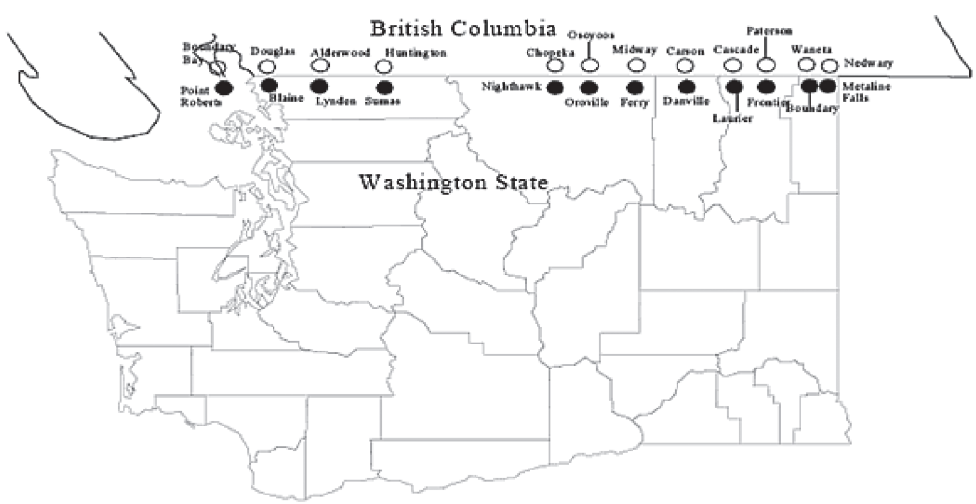
In order to better estimate future cross-border freight flows between Washington and British Columbia, the SFTA database was used to:

a. determine cross-border truck freight flows
b. dissect total cross-border flows into individual highway crossings
c. separate crossings into northbound or southbound directional flows
d. further dissect border crossings into specific commodity groups (3-digit NAICS)

For the purposes of this paper, only the SFTA database was used because SFTA was the most recent survey, offering the most current border port profile and arterial route use. In order to collect the specific information from SFTA, all British Columbia origin and destination locations were analyzed. The location of origin and/or destination determined the directional flow of the truck movements at the border ports (i.e. if origin is British Columbia then the direction of flow is "southbound"). After determining the direction of flow, the border ports used for the crossing could be determined based on the route characteristics. Washington has twelve border crossings with British Columbia. In order, from west to east, they are:

Point Roberts/Boundary Bay, Blaine/Douglas, Lynden/Alderwood, Sumas/Huntington, Nighthawk/Chopaka, Oroville/Osoyoos, Ferry/Midway, Dan-

**Figure 1 – Washington State Border Crossing Locations**




Source: Federal Highway Administration. Descriptive Report of Cross-Border Traffic and Transportation in the Western U.S.-Canada Region. Washington, D.C., September 1993 ville/Carson, Laurier/Cascade, Frontier/Paterson, Boundary/Waneta, Metaline Falls/Nelway (see Figure 1).

Of these listed border crossing locations, Blaine (SR 543 Pacific Highway), Lynden (SR 539), Sumas (SR 9), Oroville (US 97), Laurier (US 395) and Frontier (SR 25), were analyzed at a commodity level. These ports account for over 95% of the Washington-British Columbia truck crossings.

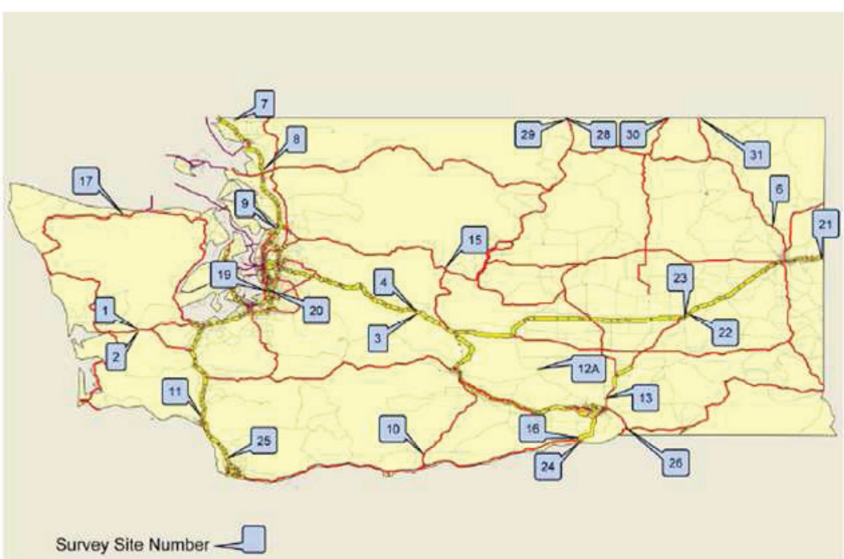
Only survey sites closest to the border or sites that would best identify trucks crossing the border were used in the data analysis. Figure 2 indicates the survey locations.

Using the survey data, the truck crossings were broken down into their respective 3-digit NAICS categories based on the description of the commodities contained in each truckload. The grouping of the commodities allowed for the development of border port commodity profiles, through which trade projections and analyses were conducted. The data provided in SFTA also allowed for analysis of Washington highway routes used in bi-directional border crossings. As a result, the relative usage of specific Washington highways and corridors were evaluated by border crossing.

Analysis of the border port profiles was conducted based on the commodities with the highest volume crossing at a given port. It is also important to note that most border port profiles contained a large percentage of empty, unknown, or mixed trucks. These were included in the evaluation, in addition to the commodity categories.

After evaluation of border port profiles, projections of future truck cross-

**Figure 2 – SFTA Survey Locations**



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ings and future trade were made. Truck crossing time-series data gathered from the Bureau of Transportation Statistics and Statistics Canada allowed for trend line regression forecasting of future truck crossings (referred to as the truck crossing method). This allowed projections of growth or decline in the number of trucks crossing at specific border ports, as well as giving a basis for comparison with the new method. Then, trade data gathered from Stat-USA (part of the U.S. Department of Commerce) allowed for trend line regression analysis and forecasting of trade by commodity (referred to as the trade/profile method) between Washington State and Canada.

When comparing the two methods, theoretically, the weighted average growth rates of trade, by commodity and frequency of crossing at each border port should be roughly equal to the growth rate of truck crossings at each border port. However, caution is advised because different rates of changes in commodity trade growth may lead to a higher or lower level of truck crossings than those projected from the simple truck crossing data. Therefore, these trade growth projections should allow for a more accurate depiction of projected truck crossings and greater understanding of border crossing dynamics.

Projections of the frequency of truck crossings can contain additional elements besides trade, such as exchange rates and market locations. In order to correct for this, we assumed that the percentage growth in trade is indicative of and equal to the percentage growth in the number of truck crossings. Therefore, if trade in the food sector is growing at 3%, then the number of truck crossings that contain food products at any individual border port is growing at 3%.

After trade projections were completed, the observed growth rates in trade were then combined with the current profile of commodities developed from SFTA. The resulting truck crossings were then compounded annually for ten years (from 2006 to 2015) based on the respective trade growth rates of the commodity categories. At 2015, the resulting new border port profile was determined and analyzed to determine changes in profile structure. A new border port profile allows a policy and/or decision maker to see the relative shifts in the percentage of commodities crossing at a specific border port.[1]

One advantage of using this methodology is as more information becomes available adjustments to commodity trade can be made very easily, thereby producing new and more accurate projections. Secondly, this method allows for tracking changes in port profiles over time because growth in trade for different commodity groups varies.

To project growth in empty truck crossings, a weighted average of the

*[1]For example, northbound trade growth in wood products is roughly 1%, while trade growth in northbound non-metallic mineral is over 4%. If the Laurier border crossing were evaluated over ten years, given these growth rates, the percentage of northbound wood product crossings would decrease by almost 6% and the percentage of northbound non-metallic mineral crossings would increase by over 2%.*

**Table 1 – Border Port Commodity Profile**

| | Northbound | | Southbound | |
|---|---|---|---|---|
| Border Port | Commodity | Percent | Commodity | Percent |
| Blaine | Empty | 37.4% | Empty | 24.5% |
| | Crop Production (111) | 10.1% | Wood Products (321) | 19.7% |
| | Other | 7.4% | Paper Products (322) | 8.5% |
| | Processed Food (311) | 6.9% | Processed Food (311) | 7.1% |
| | Unknown | 6.1% | Non-Metallic Mineral (327) | 6.2% |
| | Paper Products (322) | 4.9% | Fabricated Metal (332) | 5.8% |
| | Chemical Products (325) | 3.7% | | |
| Blaine (cont.) | Plastics & Rubber (326) | 3.3% | | |
| Lynden | Empty | 33.6% | Wood Products (321) | 39.9% |
| | Crop Production (111) | 19.0% | Unknown | 25.7% |
| | Plastics & Rubber (326) | 9.5% | Fabricated Metal (332) | 11.8% |
| | Machinery (333) | 9.5% | Beverage Products (312) | 11.8% |
| | Other | 9.5% | Transportation Equip (336) | 10.7% |
| | Wood Products (321) | 4.8% | | |
| | Processed Food (311) | 4.8% | | |
| Sumas | Unknown | 17.8% | Empty | 38.1% |
| | Forestry & Logging (113) | 11.2% | Wood Products (321) | 23.6% |
| | Other | 15.7% | Chemical Products (325) | 17.4% |
| | Fabricated Metal (332) | 10.3% | Plastics & Rubber (326) | 8.7% |
| | Empty | 11.5% | Processed Food (311) | 6.0% |
| | Printed Material (323) | 15.2% | Miscellaneous (339) | 6.0% |
| | Chemical Products (325) | 7.6% | | |
| | Crop Production (111) | 7.5% | | |
| Oroville | Empty | 57.6% | Wood Products (321) | 36.4% |
| | Crop Production (111) | 14.2% | Empty | 11.8% |
| | Wood Products (321) | 5.7% | Non-Metallic Mineral (327) | 7.3% |
| | Beverage Products (312) | 4.1% | Plastics & Rubber (326) | 6.7% |
| | Non-Metallic Mineral (327) | 3.6% | Crop Production (111) | 5.7% |
| | Transportation Equip (336) | 3.5% | Transportation Equip (336) | 5.3% |
| | | | Unknown | 5.1% |
| Laurier | Empty | 50.5% | Wood Products (321) | 69.9% |
| | Wood products (321) | 34.9% | Empty | 16.7% |
| | Non-Metallic Mineral (327) | 9.7% | Non-Metallic Mineral (327) | 7.2% |
| | Unknown | 2.7% | Forestry & Logging (113) | 1.7% |
| | | | Chemical Products (325) | 1.7% |
| | | | Unknown | 1.7% |
| | | | Processed Food (311) | 1.2% |
| Frontier | Empty | 64.4% | Chemical Products (325) | 73.4% |
| | Chemical (325) | 22.6% | Empty | 16.8% |
| | Wood Products (321) | 13.0% | Wood Products (321) | 4.9% |
| | | | Unknown | 4.9% |

profile and trade growth in the opposite direction of the crossing was calculated. For mixed and unknown commodity crossings, a weighted average of the profile and trade growth in the same direction of the crossing was calculated.

## RESULTS

Port Profiles

The following ports were analyzed to create border port profiles: Blaine (SR 543), Lynden (SR 539), Sumas (SR 9), Oroville (US 97), Laurier (US 395) and Frontier (SR 25). The border ports and their major bi-directional commodity profiles are presented in Table 1.

Of note is the diversity of commodities at the border ports across the state. Blaine, the state's largest border port, is by far the most diverse. The Blaine port reveals a heavy emphasis on food and agriculture products, which combine to represent almost one-fifth of the northbound truck crossings and one-tenth of the southbound crossings. This translates into over 66,000 northbound crossings and 41,000 southbound crossings in 2005. It is apparent that certain border ports have specific profile characteristics that make them somewhat unique. For instance, the Laurier profile reveals a preponderance of wood products, while the Frontier profile includes a large percentage flow of chemical products. Many ports differ with respect to their northbound and southbound commodity profiles. How-

**Table 2 – Truck Crossing Average Annual Growth Rate 2006-2015**

| Border Port | Northbound Average Growth | Average Increase Trucks Per Year | Southbound Average Growth | Average Increase Trucks Per Year |
|---|---|---|---|---|
| Blaine | 1.88% | 10,052 | 1.90% | 11,014 |
| Lynden | 3.82% | 5,226 | 3.64% | 3,014 |
| Sumas | 2.36% | 2,281 | 3.21% | 6,616 |
| Oroville | 3.34% | 2,075 | 2.39% | 1,321 |
| Ferry | 0.89% | 51 | -1.05% | (33) |
| Danville | -6.10% | (48) | -3.51% | (43) |
| Laurier | 0.46% | 71 | 2.07% | 309 |
| Frontier | 1.68% | 479 | 2.29% | 662 |
| Boundary | 2.19% | 4 | 5.16% | 38 |
| Metaline Falls | 3.14% | 411 | 3.14% | 290 |
| Total | | 20,602 | | 23,188 |

ever, certain products consistently appear in the top categories, such as food products and wood products. Lastly, based on the profiles, the largest northbound movements are empty trucks. Empty trucks account for over 35% of total northbound movements and 25% of the total southbound movements in the evaluated ports.

Given the respective port profiles (as shown in Table 1), nine industries were identified as "major" movers of freight trade across the ports. These industries according to NAICS codes at the 3-digit level are: Food Products (111, 311), Chemical Products (325), Plastics & Rubber (326), Wood Products (321), Paper Products (322), Metals (331, 332), Non-Metallic Mineral (327), Transportation Equipment (336), and Machinery/Electrical (333, 335).

Truck Crossing Projections

Once profiles were created, initial projections of the number of future truck crossings were made based on the current trend of growth or decline in truck crossings by border port (i.e., truck crossing method). All ports except Point Roberts/Boundary Bay and Nighthawk/Chopaka were measured, in order to create a basis for comparison between the truck crossing and trade/profile methods, as well as to investigate the level of year-to-year variability in the port-level crossings. As the results show, there is a wide spectrum of expected growth difference between border ports. Additionally, for some ports, there is a large level of variation in the number of truck crossings. This can be explained in part by the use of other modes of transportation, especially on the western side of the state (Puget Sound Regional Council, 2006). Use of rail can help relieve the highway congestion resulting from high traffic volume at the ports. Furthermore, construction currently underway at ports such as Blaine may temporarily reduce the level of traffic flow as alternative routes or methods are used to transport goods. This is analyzed more thoroughly in the "Implications and Explanations" section of the paper. The predicted average annual percentage growth of truck crossings based on historical truck crossing data as well as the predicted number of yearly truck crossings are shown in Table 2.

Trade Growth Projections

The commodities identified under the 3-digit NAICS categories were examined at the 2-digit HS categories in order to estimate trade growth. Regression analyses were conducted for each commodity category to determine a 10-year average projected trade growth. Trade time-series data between Washington and Canada was collected over the years 1990-2005. Regression analyses for the respective industry outputs were also conducted to determine relative industry growth and stability. With the exception of the Canadian non-metallic mineral industry (HS 25-27 & 68-71), all other industries show relative stability in terms of consistent output growth (Statistics Canada, 2006). When trade growth was evaluated, some commodities were relatively stable and consistent in growth (i.e., plastics & rubber products, and paper products), while others showed a high level of variability in trade, such as non-metallic mineral products, northbound food products, and northbound wood products (STAT-USA and Statistics Canada, 2006). This variability and the fact that market conditions can affect growth made true long term forecasting very difficult for certain products. However, a general trend could be established that would allow for evaluations in profile changes, knowing that high trade volatility for certain products can change projected profile and truck crossing outcomes. The ten year average annual growth in commodity trade is summarized in Table 3.

**Table 3 - Compounded Annual Growth Rates for Northbound and Southbound Trade**

| Commodity | North | South |
|---|---|---|
| Food Product | 2.80% | 2.68% |
| Wood Product | 0.81% | 2.58% |
| Paper Product | 3.39% | 1.84% |
| Chemical Product | 2.46% | 2.46% |
| Plastics & Rubber | 2.73% | 4.70% |
| Non-Metallic Mineral | 4.15% | 4.70% |
| Metal | 2.79% | 3.46% |
| Machinery | 1.47% | 3.16% |
| Transportation Equipment | 0.62% | 4.15% |

<u>The Effect of Trade Growth on Border Crossings and Commodity Profiles</u>

As stated earlier, in order to translate the trade growth into real truck movements, we assumed that the percentage growth in trade has a direct correlation with percentage growth in truck movements. With knowledge of the commodity composition of the border ports and the trade growth of those commodities, estimates of future commodity profiles of those border ports were made.

Due to deviation from the truck crossing trend line in the actual year-to-year crossings, starting dates for calculating growth and profile changes differ. The starting dates used are those closest to the truck crossing method regression line, based on the assumption that the growth in truck crossings is closely related to the growth in trade. If there is significant deviation from the trend line in the base year for calculating growth, then as trade growth is translated into growth in truck crossings, a new growth line is created that will not reflect the projected number of truck crossings. Figure 3 depicts this error. Point A reflects the year for which the SFTA survey was completed and the corresponding growth in truck crossings based on the trade/profile method.

To correct for this, use is made of a year in which the number of actual truck crossings has a small deviation from the truck crossing method line. Additionally, the compounded annual growth rate is adjusted in order to reflect the year used for growth projections. When this is done, the two projections are similar with a smaller level of deviation. For the example above, the number of truck crossings at Sumas in 2004 is closely related to the truck crossing method trend line. When the trade growth pro-

**Figure 3**

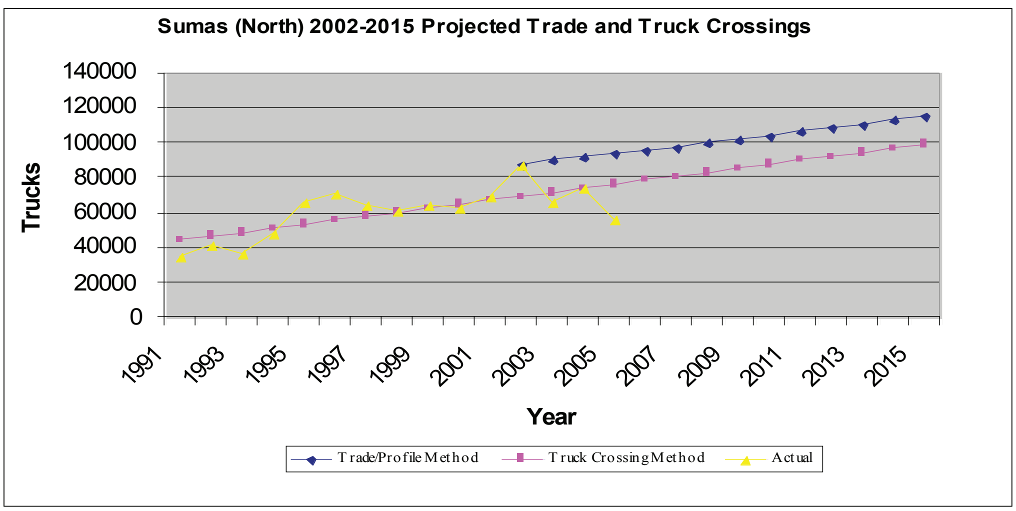
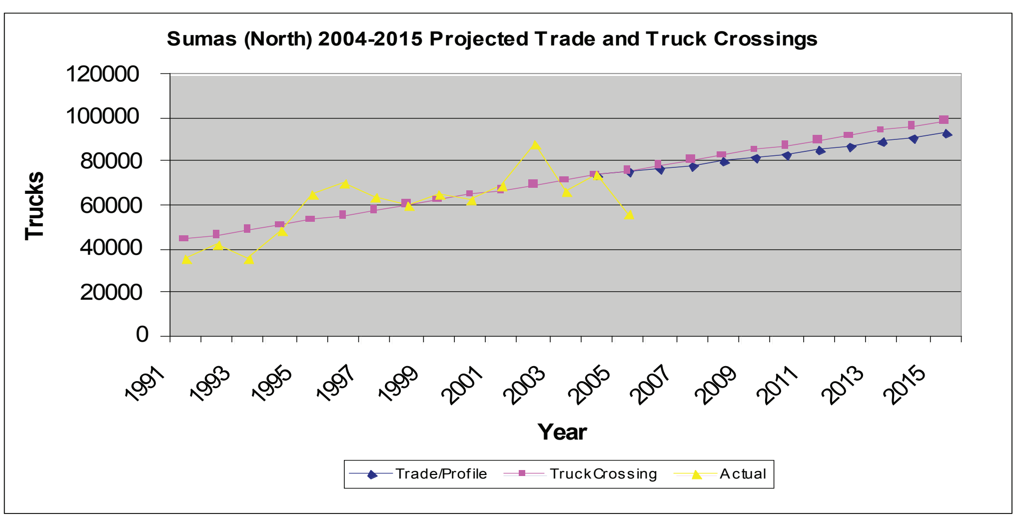



**Figure 4**



jections begin in 2004, the trade/profile method line closely fits the truck crossing method trend line (see Figure 4).

Point B reflects the year closest to the regression line and the corresponding growth in truck crossings based on trade growth. By choosing 2004 as a starting year, an analysis of the differences between the two methods could be completed more easily.

The ten year change in number of trucks reflects the difference between the 2006 and 2015 projected number of truck crossings. Though a specific commodity composition at a specific port may decline in terms of the port's overall profile, growth in trade for that commodity is still positive which results in increased truck crossings. For many of these border port commodity profiles, there is significant trade growth in one or more of the commodities relative to the other commodities in the profile. As a result, some significant drops in the percentage composition of commodities for smaller ports such as Oroville, Laurier, and Frontier are evident.

When comparing the truck crossing method with the trade/profile method, a small level of deviation is evident for most ports. Table 4 shows the percentage of deviation from the fitted truck crossing regression line.

The trade/profile projections that exceed 10% deviation from the truck crossing method projections were Blaine (northbound), Lynden (northbound), Laurier (northbound), and Frontier. The deviation at the Lynden and Frontier border ports could be explained by the changes in the number of truck crossings over the past few years. If a trend line were projected using only the more recent level of truck crossings, the projected level of truck crossings from the trade/profile method would more closely reflect the growth. Laurier (northbound) on the other hand has a high level of year to year variation. Blaine is analyzed more thoroughly in the "Implications and Explanations" section. A comparison of the number of truck crossings between the two methods used can be found in Table 5.

**Table 4 – Percent Difference Between Truck Crossing and Trade/Profile Methods**

| Port | Northbound | Southbound |
|---|---|---|
| Blaine | 12.65% | 8.63% |
| Lynden | -11.92% | -9.93% |
| Sumas | -5.91% | -2.20% |
| Oroville | -2.33% | 9.12% |
| Laurier | 17.58% | 1.63% |
| Frontier | 25.04% | 17.22% |

*Positive sign shows the projection is greater than the fitted regression line and negative sign shows the projection is less than the fitted regression line.

## IMPLICATIONS AND EXPLANATIONS

Of note is the fact that recent time-series data for the Blaine/Douglas border

**Table 5 – Northbound and Southbound 2015 Projected Annual Truck Crossings**

| Northbound | | |
|---|---|---|
| Border Port | Truck Crossing Method | Trade/Profile Method |
| Blaine | 531,274 | 598,455 |
| Lynden | 150,422 | 133,607 |
| Sumas | 98,823 | 92,316 |
| Oroville | 66,606 | 65,304 |
| Laurier | 14,127 | 16,703 |
| Frontier | 28,106 | 35,144 |
| Danville | 485* | - |
| Metaline Falls | 13,898 | - |
| Ferry | 5,369 | - |
| Boundary | 185* | - |

| Southbound | | |
|---|---|---|
| Border Port | Truck Crossing Method | Trade/Profile Method |
| Blaine | 576,415 | 621,837 |
| Lynden | 90,173 | 80,281 |
| Sumas | 219,656 | 204,410 |
| Oroville | 56,572 | 61,092 |
| Laurier | 15,026 | 14,986 |
| Frontier | 29,422 | 34,487 |
| Danville | 906* | - |
| Metaline Falls | 9,842 | - |
| Ferry | 2691* | - |
| Boundary | 868 | - |

*Indicates difficulty in prediction due to high annual variation

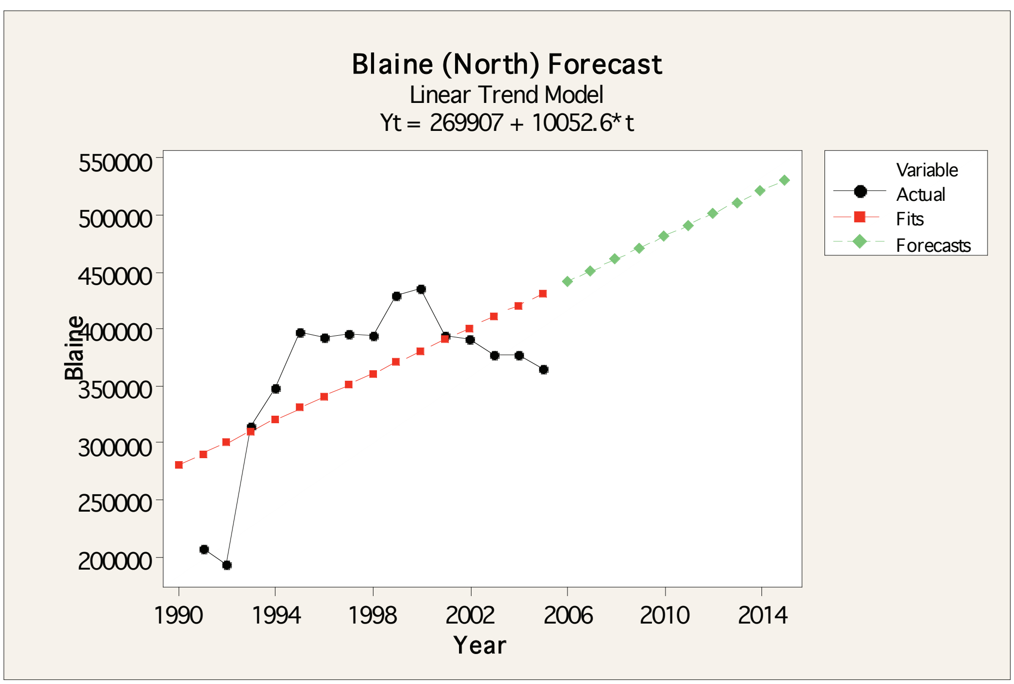
port has shown a decline in the number of truck crossings since 2001. This decline runs contrary to the projected growth in trade (see Figures 5 and 6). Three main explanations for this occurrence were identified. First, based on current trends, there appears to be a slight increase in cross border rail movements, especially for southbound flows (Goodchild, 2006). This small change from truck to rail helps to relieve congestion pressures at the border, especially for time insensitive, low value, and high volume goods. Secondly, wait times at the border, especially southbound, average between 15-25 minutes (U.S. DOT, 2005). The anticipated costs associated with these wait times (which would increase during peak operating hours), may cause shifts to alternative transportation methods, or alternative routes, such as Lynden. This is all the more likely because carriers have brokers at multiple border ports to facilitate crossings, or the carriers are operating under Free and Secure Trade (FAST) program, or a form of Electron Data Interchange (EDI) system.

The third and most plausible argument stems from the September 11, 2001, attacks on the World Trade Center. The resulting heightened security and full inspections at border ports created severe congestion and ultimately reduced the number of crossings (U.S. DOT, 2006). Given these arguments, there is still expectation of increases in the number of bi-directional truck crossings as programs are developed to help facilitate the border crossing procedure while maintaining security, and as the Canadian economy continues to become more robust.

## ROADWAY IMPACTS

This section briefly deals with the impacts of increased usage of arterial roads associated with the border ports and their respective flows. As trade continues to increase between the United States and Canada the level of highway usage is expected to increase, resulting in increased road deterioration and other potential infrastructure problems. It is useful to understand the level of arterial usage by each border port in order to better prioritize infrastructure im-

**FIgure 5**



provements.

As stated in the methodology section, SFTA collected information on origin and destination as well as route used. Using this information, a frequency table and corresponding map was created showing the level of highway usage for each border port.

Nine arterial highways were identified from the SFTA survey, namely: Interstate 5, Interstate 405, Interstate 82, Interstate 90, U.S. Highway 97, U.S. Highway 395, U.S. Highway 2, U.S. Highway 12, and State Highway 14. These highways and interstates represent the bulk of north-south and east-west travel in Washington.

A frequency analysis was conducted to determine the use of arterials by border crossing. The frequency table (Table 6) does not focus on specific distances traveled on the arterial; the focus is on road network usage. Interstate 5 and Interstate 405 capture much of the north-south traffic flows between Washington, Oregon, and California. U.S. 97 and U.S. 395 capture the majority of the remainder of the north-south traffic flows, especially for goods that have origins and destinations in regions located east of the Cascade mountain range.

Most border crossings are located on or near major north-south arterials. As a result, there tends to be 100% usage of

**FIgure 6**

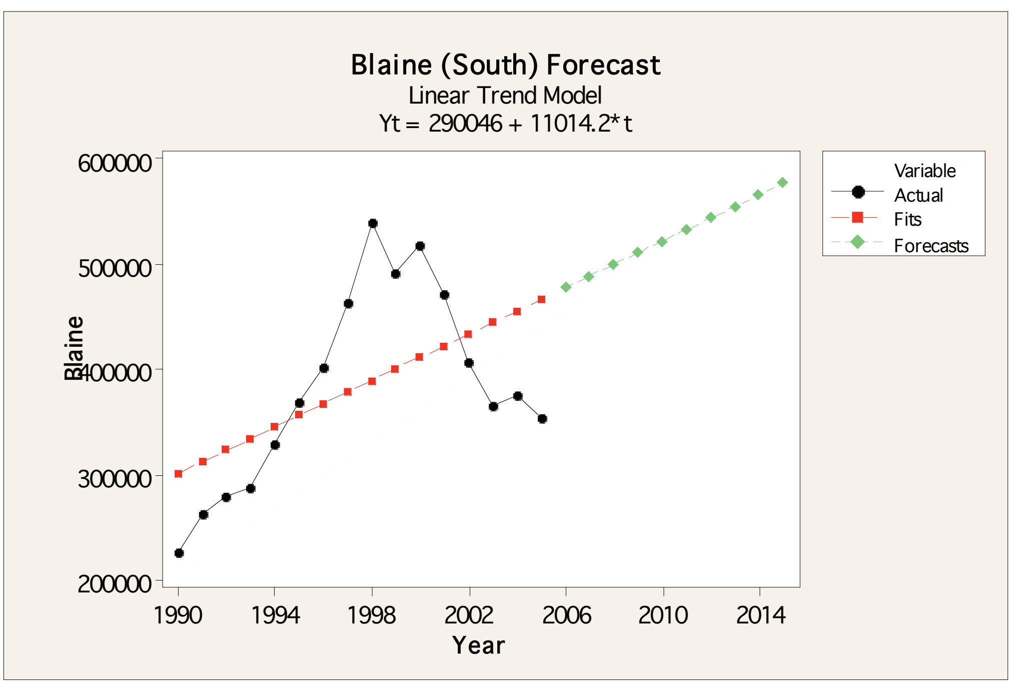


**Table 6 - SFTA Average Annual Daily Truck (AADT) Arterial Usage**

| Port | Northbound | | Southbound | |
|---|---|---|---|---|
| Blaine | Highway | %AADT | Highway | %AADT |
| | I-5 | 97.87% | I-5 | 100.00% |
| | I-5 (only) | 77.83% | I-5 (only) | 71.29% |
| | I-90 | 12.09% | I-90 | 12.54% |
| | I-82 | 4.02% | I-405 | 9.96% |
| | SR543 | 2.13% | I-82 | 3.70% |
| | I-405 | 2.12% | US97 | 0.46% |
| | US2 | 0.99% | US2 | 0.46% |
| | US97 | 0.75% | US12 | 0.46% |
| | US12 | 0.51% | | |
| | US395 | 0.16% | | |
| | | | | |
| Lynden | I-5 | 100.00% | I-5 | 100.00% |
| | I-5 (only) | 57.02% | I-405 | 48.55% |
| | I-90 | 23.76% | I-90 | 34.39% |
| | I-82 | 19.01% | I-5 (only) | 25.73% |
| | I-405 | 18.97% | I-82 | 23.67% |
| | US97 | 4.75% | | |
| | US2 | 4.75% | | |
| | | | | |
| Sumas | I-5 | 100.00% | I-5 | 100.00% |
| | I-5 & SR542(only) | 84.91% | I-405 | 24.18% |
| | I-405 | 7.58% | I-90 | 15.45% |
| | US97 | 7.51% | US12 | 7.63% |
| Port | Northbound | | Southbound | |
| Sumas (cont.) | US2 | 7.51% | I-82 | 6.73% |
| | | | | |
| Oroville | US97 | 100.00% | US97 | 100.00% |
| | US97 only | 51.58% | US97 only | 35.54% |
| | I-90 | 21.70% | I-90 | 29.48% |
| | US2 | 11.96% | US395 | 23.40% |
| | US395 | 10.94% | US2 | 22.94% |
| | I-5 | 5.72% | I-5 | 5.35% |
| | I-82 | 2.38% | I-82 | 3.38% |
| | US12 | 1.42% | US12 | 1.69% |
| | I-405 | 0.85% | | |
| | | | | |
| Laurier | US395 | 100% | US395 | 100.00% |
| | US395 only | 85.44% | US395 only | 63.57% |
| | | | I-90 | 19.66% |
| | | | | |
| Frontier | US395 | 100% | US395 | 82.77% |
| | I-90 | 63.45% | I-90 | 45.30% |
| | US97 | 13.94% | US395 only | 37.18% |
| | US2 | 13.94% | US97 | 7.01% |
| | US395 only | 13.94% | | |
| | I-5 | 12.96% | | |

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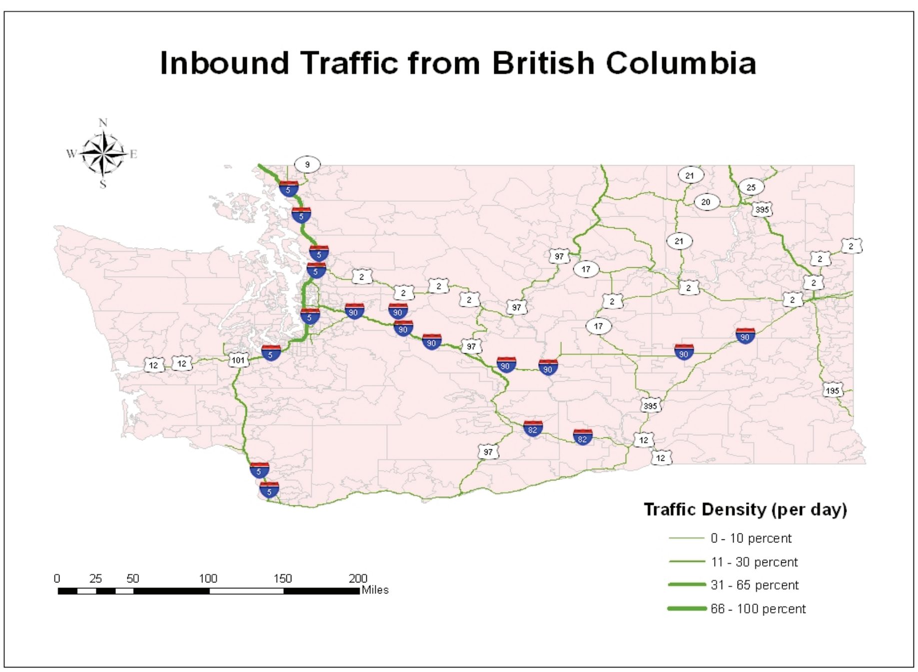
the arterial located near the border crossing. The presented information should be cautiously used because many of the truck movements only use a portion of the arterial near the border crossing. To help further understand the road networks used, an additional indicator (e.g. I-5 only) is added in Table 6 to specify if only one arterial was used.

I-90 is the main arterial for east-west travel in Washington and in terms of border crossings is used in part or in full depending on the destination of the goods being transported. For example, goods crossing at Oroville, WA (U.S. 97) may only use a part of I-90, whereas goods crossing at Blaine, WA (SR543) may have an origin in Spokane and use the entire Washington portion of I-90. U.S. Highway 2 is heavily used for East-West travel across northern Washington and it is an important arterial for eastern Washington border ports. U.S. Highway 12 and State Highway 14, though not as heavily used as other arterials, represent the main east-west travel route across southern Washington and are important entrances into the Washington road-network system from areas such as Idaho and Oregon.

Through the use of geographic information systems (GIS) technology, the SFTA survey data collected on the routes used to transfer goods both northbound and southbound was geocoded. Geocoding is a method of using characteristic data information and translating that data to a real map. Utilizing the map

**Figure 7 - Source: Puenpatom, Jessup and Casavant, 2006**



in Figure 7, a better understanding of the flow and dissemination of inbound truck volumes can be made.

I-5 is the most heavily used arterial since the majority of goods traveling to and from British Columbia come from either out of state, seaports, or airports, and cross at either Blaine, Lynden, or Sumas. However, U.S. 97 at the Oroville border port is also heavily used.

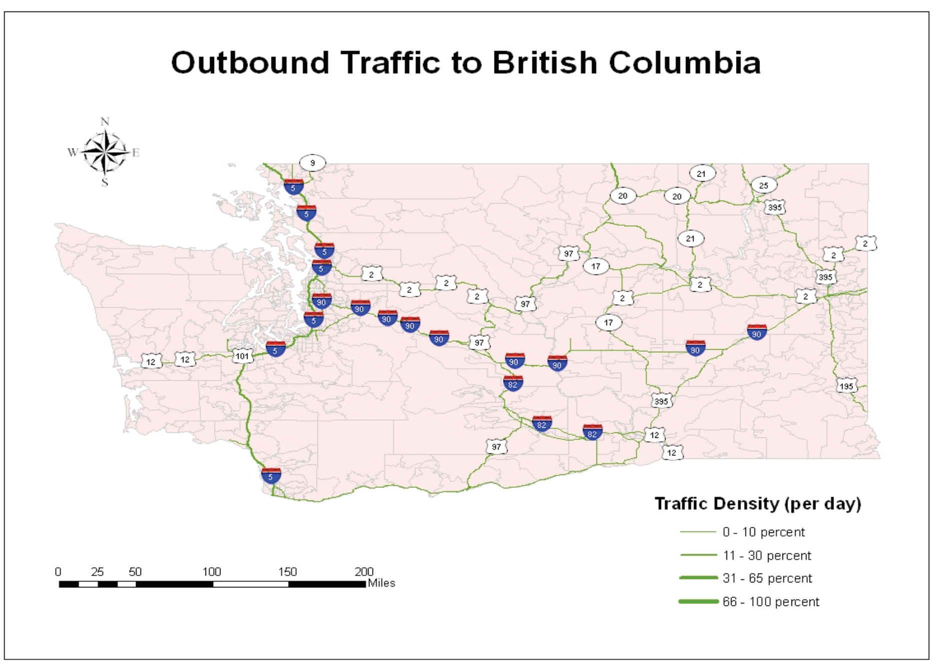
The traffic volume density for freight traveling northbound to British Columbia is shown in Figure 8.

Much of the same level of density can be seen for the bi-directional flow of traffic, though in some cases, the density is lower. However, the density differences, especially those associated with the I-5 corridor, correspond to a higher level of southbound border crossings at Blaine, Lynden, and Sumas. With this information, potential degrees of damage to roadway infrastructure due to increased volume can be better estimated and potential locations of roadway bottlenecks identified.

## CONCLUSIONS

From the onset of this research, the authors' perspective of border crossings encompassed more than just a point of entry to another market. The viewpoint taken conceptualized border crossings/ports as dynamic facilitators of commodity trade, through which transport of goods for consumption, manufacturing, or further market ex-

**Figure 8 - Source: Puenpatom, Jessup and Casavant, 2006**



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port would be achieved in an efficient manner. This study shows ports are not just physical and geographic locations. They have commodity and trade profiles that affect their efficiency, usage, operations, and infrastructure (including the port facility itself, together with the supporting road network). In other words, transportation efficiency provides a crucial component to market efficiency and knowing the various components contributing to trade and transportation allows a decision maker to maximize cross-border trade efficiency in order to remain competitive in the global market.

This project draws on the detailed information available through SFTA. The reasoning for profile development was to utilize trade growth of commodities to estimate truck flows. This is based on the argument that trade growth is a more reliable predictor of international truck crossings than historical truck crossing data. Profiles were also developed to increase understanding of what and where commodities are crossing the Washington-British Columbia border. This knowledge can benefit cross-border shippers if port profiles indicate significant levels of certain commodities at specific ports (i.e. border port facilities may be able to better accommodate the shippers of the commodities) and also provide policy makers detailed information about future truck crossings and trade expectations. The methodology chosen follows in line with the available resources, data, and information, whereby projections of crossings and border port profiles can be modified based on expected trade growth changes. Furthermore, given the current data and methodology used, projections can be easily adapted in the short run and long run to adjust for exogenous market changes or improved information.

Given the data and analysis, there is an expectation of increased flows for Washington's major border ports. Increases in bi-directional flows have implications for factors such as crossing times, road deterioration, security, supply chain management, and border port processing capacity. A major question is: Are the border ports adequate to process the projected growth in truck crossings?

The purpose of this paper is to provide data and information to help the policy process related to improving border ports and roads. The information presented will help in prioritizing investment and infrastructure improvement projects critical to Washington State's efficiency and international competitiveness.

For detailed report, go to http://sfta.wsu.edu/research/reports.htm, report #22.

# Projecting Washington-British Columbia Truck Freight Border Crossings and Arterial Usage

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