Applying Origin-Destination and Trade Data to British Columbia-Washington Truck Border Crossings

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INTRODUCTION

As NAFTA moves into its thirteenth year since ratification in 1992, continuing adaptation to the changing transportation needs of the U.S. and Canada is critical in maintaining efficiency and reducing costs of raw and manufactured goods. 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), knowledge of the composition of commodities crossing the border allow for easier adjustment to and support for the changing needs of industries and transportation providers. Furthermore, as the Western Hemisphere Travel Initiative (WHTI) begins implementation this year, knowing the growth in border crossings is vital for transportation planners to effectively and efficiently implement safety and security measures at the border ports. Since Washington borders Canada and acts as an international trade hub for the state as well as industries throughout the United States, there is a specific need to evaluate the composition of commodities at its key border ports in order to project future truck traffic.

This project identifies key commodity group information to create a profile of major and minor Washington-British Columbia border ports, in order to develop traffic projections. The central resource used to create the profile is the Strategic Freight Transportation Analysis (SFTA) database, a compilation of freight origin-destination survey results. The survey, known to be duplicated by only one other state, allows for the decomposition of freight flows by commodity, both northbound and southbound, thus producing profiles for seven major and minor border ports in British Columbia. The border ports analyzed are: Blaine/Pacific Highway, Lynden/Aldergrove, Sumas/Huntington, Oroville/Osoyoos, Danville/Carson, Laurier/Cascade, and Frontier/Patterson.

This paper focuses on port level border flows by truck between British Columbia and Washington, through decomposing the northbound and southbound flows by industry and commodity and projecting the trade growth in those industries. By knowing the potential growth and increases in commodity flows across border port locations, policy makers can better adapt border ports to allow for continuing efficiency in truck movements. This continuing or even increased efficiency would help maintain low costs and would help to maintain trade competitiveness in the international marketplace.

These projections on the future traffic volume and composition of commodities crossing between Washington and British Columbia serve as a guideline for future transportation of traded goods and the infrastructure investments necessary to support those flows.

METHODOLOGY

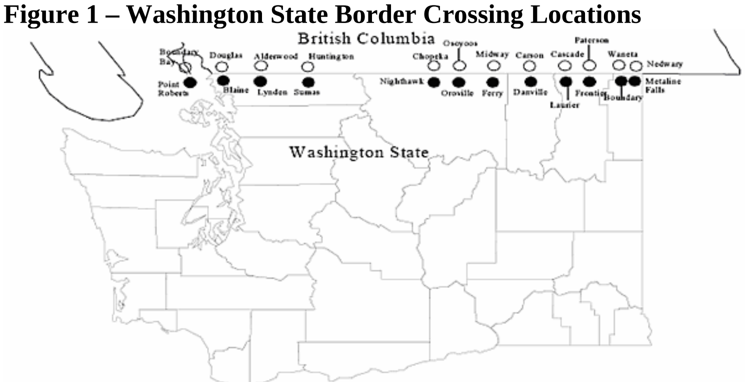
The unique component in this research that enables the creation of border port commodity profiles is the Strategic Freight Transportation Analysis (SFTA) and the Eastern Washington Intermodal Transportation Study (EWITS). SFTA and EWITS are truck freight origin-destination surveys, conducted through the Washington State University Transportation Research Group. EWITS was first conducted from 1992-1993, with SFTA being conducted from 2002-2003. The unique aspect about these surveys is they collect information that is not provided by the census or government organization. The surveys gather information on origin of the movement, destination, route used, main commodity type transferred, payload weight, operating company, number of axles, tractor/trailer type, as well as other characteristics. The surveys were conducted on four different days each and have combined sample observations of over 56,000 trucks. Each day corresponds to a different season in order to account for seasonal differences in truck flows.

In order to better estimate future cross-border truck flows between Washington and British Columbia, the SFTA and EWITS databases were 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 highway crossings into specific commodity groups (3-digit NAICS)

For the purposes of this paper, only the SFTA database was used because SFTA offered the most current border port profile. In order to collect the specific information from SFTA, all British Columbia origin and destination locations were isolated. The location of origin and/or destination determined the directional flow of the truck movements at the border ports (i.e. if origin is BC then the direction of flow is "southbound"). After determining the direction of flow, the border ports used for the crossing could be determined through analyzing the route characteristics. Washington has approximately twelve British Columbia border crossing locations. These can be seen in Figure 1.

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

On Figure 1, in order from west to east, they are: Point Roberts/Boundary Bay, Blaine/Douglas, Lynden/Aldergrove, Sumas/Huntington, Nighthawk/Chopaka, Oroville/Osoyoos, Ferry/Midway, Danville/Carson, Laurier/Cascade, Frontier/Patterson, Boundary/Waneta, Metaline Falls/Nelway.

Of these listed border-crossing locations, Pacific Highway, Aldergrove, Huntington, Osoyoos, Cascade, Patterson, and Carson are the only crossings that contained enough observations to dissect to a commodity level.

Only survey sites closest to the border or sites that would best identify trucks crossing the border were used in the analysis. However, a few commodities at certain border ports, especially low truck volume ports in eastern British Columbia, are not accounted for because the SFTA survey site that completed the survey was not near the border.

When border port profiles were created, analysis of the profile was conducted based on the top 5 commodities crossing. Empty, unknown and mixed trucks were also included in the analysis because they made up a significant percentage of crossings.

After evaluation of border port profiles, two separate projections of future truck crossings were made. The first projection (truck crossing method) used truck crossing time series data gathered from the Bureau of Transportation Statistics and Statistics Canada which allowed for regression forecasting of future truck crossings. This gave a basis for growth or decline in the number of trucks crossing at specific border ports. The second projection (trade/profile method) used trade data gathered from Stat-USA (part of the U.S. Department of Commerce), and Statistics Canada for regression analysis and forecasting of trade between Canada and Washington State.

Regression forecasting for truck crossings gave the basis for \for comparing the varying growth rates in trade. Theoretically, the weighted average growth rates of trade[1], 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, this

[1] In this case trade refers to the level of trade between Washington and Canada.

would be a naïve approach 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, trade growth projections should allow for a more accurate depiction of projected truck crossings.

Trade projections were further "ground truthed" with a survey of industry personnel. The survey was designed to determine if the regression results obtained from time series trade data coincide with industry expectations of trade.

The growth level in truck crossings can contain additional elements besides trade. In order to correct for this problem, we assume 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 border port (i) is growing at 3%.

After trade projections are completed, the observed growth rates in trade are then compounded with the current profile of commodities developed from SFTA. The frequency of truck crossings are compounded annually for ten years (from 2006 to 2015) based on the respective growth rates of the commodity categories. At 2015, a new border port profile is developed and analyzed to determine changes in profile structure and final crossing projections.

RESULTS

Port Profiles

The ports analyzed for border port profiles were: Pacific Highway, Aldergrove, Huntington, Osoyoos, Cascade, Frontier, and Danville. These port crossings make up over 95% of both northbound and southbound crossings.

Of first note is the diversity of commodities of the border ports across the state. Pacific highway, British Columbia's largest border port, is by far the most diverse. However, it is very apparent that certain border ports have specific themes in terms of their profiles that make them unique. For instance, Carson and Cascade are predominately wood products, while Patterson has a large percentage flow of chemical products. There also appears to be a shift in main commodities crossing from west to east. In the western side of the province, wood products and food products constitute large percentages of crossings. In the eastern part of British Columbia, chemical products (ie: fertilizer) are heavily transported. Lastly, based on the profiles, the largest northbound and southbound 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, 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. In this section, all ports except Point Roberts/Boundary Bay and Nighthawk/Chopaka were measured, in order to better understand the overall change in truck crossings as well as to investigate the level of year-to-year variability in the port-level crossings. As the results show, a wide spectrum of expected growth difference between border ports is evident. Additionally, a large level of variation in the number of truck crossings can be seen for some ports. This can be explained in part by the use of other modes of transportation, especially on the western side of the state. 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 Pacific Highway 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 Exceptions section of the paper.

Table 1 shows 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.

Table 1

Growth Rate of Truck Border Crossings Average Annual Growth for 2006-2015				
Border Port	**North Average Growth**	**Annual Truck Increase**	**South Average Growth**	**Annual Truck Increase**
Douglas	1.88%	10,052	1.90%	11,014
Aldergrove	3.82%	5,226	3.64%	3,014
Huntington	2.36%	2,281	3.21%	6,616
Osoyoos	3.34%	2,075	2.39%	1,321
Midway	0.89%	51	-1.05%	-33
Carson	-6.10%	-48	-3.51%	-43
Cascade	0.46%	71	2.07%	309
Patterson	1.68%	479	2.29%	662
Waneta	2.19%	4	5.16%	38
Nelway	3.14%	411	3.14%	290
Total		20,602		23,188

The growth rates and projections in Table 1 are the basis for comparing the projected crossings based on trade growth rates. An analysis of trade growth by commodity (trade/profile method) was conducted in order to fine tune the truck crossing projections.

Trade Growth Projections

Regression analyses were conducted for each commodity to determine a 10-year average projected trade growth. Time series trade data were collected between the years 1992-2005 for Washington and Canadian trade. Regression analyses for the respective industry outputs were conducted to insure industry growth. Given the exception of the Canadian non-metallic mineral industry, all other industries show relative stability in terms of output growth. For trade, most commodities are relatively consistent in growth (i.e.: plastics & rubber products, and paper products), while others show a high level of trade variability, such as non-metallic mineral products, northbound food products, and northbound wood products. Based on the high variation, and other market conditions that can affect growth, true long term forecasting is very difficult for certain products. However, a general trend can be established that will allow for evaluations in profile changes, knowing that high trade volatility for certain products can change projected profile outcomes.

Due to a low response rate, the industry inverviews provided little insight for long-run trade projections for some specific commodities. However, basic conclusions for two of the evaluated commodities were made. First, chemical products, which include fertilizers, adhesives, paints, detergents, and other miscellaneous chemicals appears to be on the projected trade growth path. Second, the wood products industry and southbound trade which include lumber, plywood, trusses, containers, and other miscellaneous wood products, may be slightly overestimated based on historical trade data. Current market conditions for wood products are expected to decline in the short to medium run. However, no adjustments to trade growth have been made because of lack of information for long-run projections.

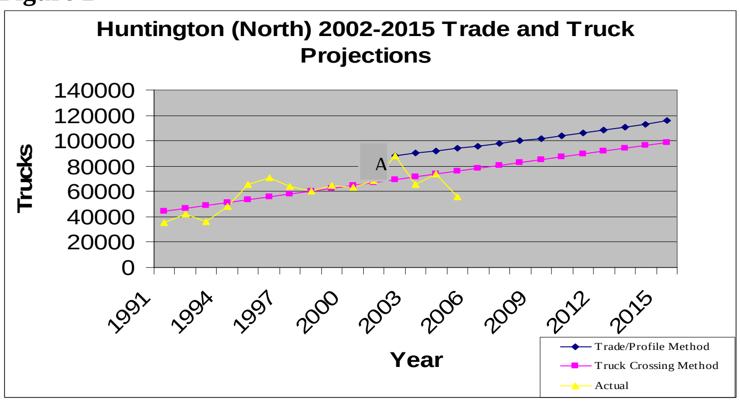
The Effect of Trade Growth on Border Crossings and Commodity Profiles

As stated above, in order to translate the trade growth into real truck movements, the percentage growth in trade was assumed to have a direct correlation with percentage growth in truck movements. With the knowledge of the commodity composition of the border ports and the trade growth of those commodities, estimates of future commodity profiles at each border port can be made. Changes in specific commodity profiles range from -5.73% to 6.82%, depending on the growth of trade for the commodity and the percentage composition of the commodity for its respective border port.

Due to deviation from the trend line in year-to-year crossings, starting dates for calculating growth and profile changes differ. The starting dates used are those closest to the truck crossing trend line. This is 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 does not reflect the projected number of truck crossings. Figure 2 depicts this error. Point A reflects the year for which the SFTA survey was completed and the corresponding growth using the trade/profile method.

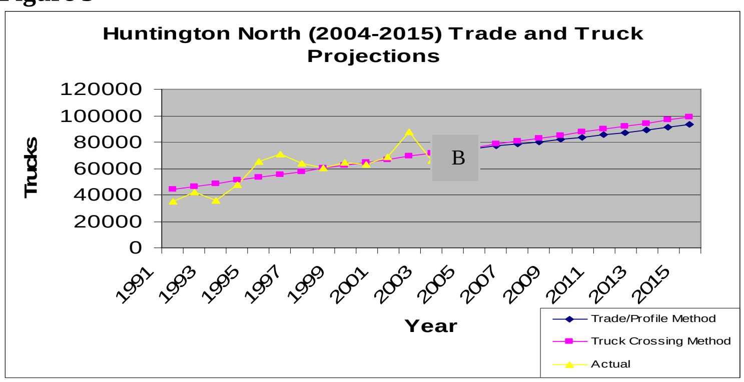
Figure 2



As a result, a year in which the number of actual truck crossings has a small deviation from the truck crossing regression line is used. 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 emulate each other with a smaller level of deviation. For the example above, the number of actual truck crossings in 2004 is closely related to the truck crossing regression line. When the trade growth projections begin in 2004, the trade/profile line closely resembles the truck crossing line. Figure 3 depicts this relationship. Point B reflects the year closest to the regression line and the corresponding growth in truck crossings based on trade growth. Note that there is less than 6% difference between the projected truck crossings based on trade and the regression line.

The ten-year change in number of trucks reflects the difference between the 2006 and 2015 projected number of truck crossings (all are positive values). 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.

Figure 3



Using the trade/profile methodology explained above, estimates of the number of truck crossings are shown in Table 2. These estimates are compared with the truck crossing method.

Table 2

2015 Projected Annual Truck Crossings				
	Northbound		Southbound	
Border Port	Truck Crossing Method	Trade/ Profile Method	Truck Crossing Method	Trade/ Profile Method
Pac. Hwy.	531,274	598,455	576,415	626,183
Aldergrove	150,422	132,493	90,173	81,215
Huntington	98,823	92,985	219,656	214,813
Osoyoos	66,606	65,056	56,572	61,729
Cascade	14,127	16,611	15,026	15,272
Patterson	28,106	35,144	29,422	34,487

As shown in Table 2, there are some significant differences in the number of projected truck crossings between the two methodologies. The border ports that exceed 10% deviation from the truck crossing method projections are Pacific Highway (northbound), Aldergrove (northbound), Cascade (northbound), and Patterson. The deviation at the Aldergrove and Patterson border ports can be explained by the growth changes in 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. Cascade (northbound) has a high level of year to year deviation, thus providing little information towards an explanation. Pacific Hwy. is analyzed further in the following section.

IMPLICATIONS AND EXPLANATIONS

Of note is the fact that recent time series data for the Pacific Hwy. border port has shown a decline in the number of truck crossings since 2001. This decline contradicts the projected growth in trade. Since Pacific Hwy. is the largest Canadian border port in the Western United States, follow up research was conducted. Figures 4 and 5 depict this decline over the last several years. Four contributions to this occurrence were determined.[2] First, based on current trends, there appears to be a slight increase in cross border rail movements, especially for southbound flows. 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 20-30 minutes. The costs associated with these wait times may cause shifts to alternative transportation methods or alternative routes. This is especially practical under the assumption that the carriers have brokers at multiple border ports to facilitate crossings or the carriers

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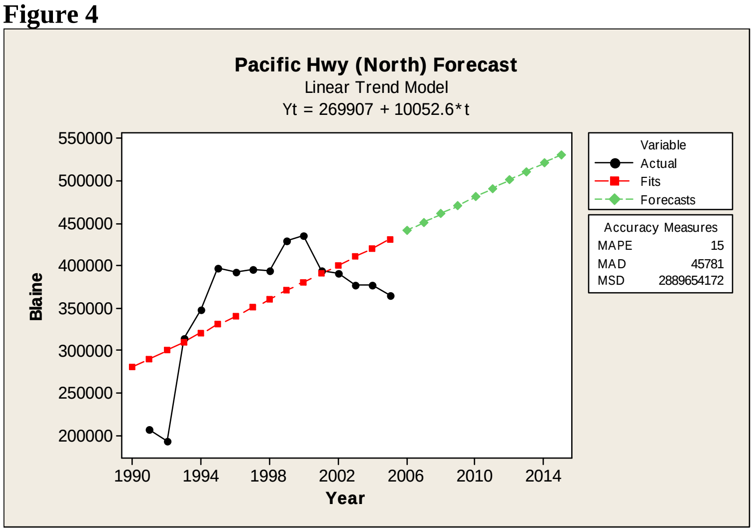
[2] Explanations were gathered from a phone interview with Anne Goodchild, Assistant Professor at the University of Washington Department of Civil Engineering. AND "Talking Points" by Mitchell Optican. Canada Policy Advisor, Department of Homeland Security April 1, 2004.
http://www.irpp.org/events/archive/apr04/optican.pdf

are operating under Free and Secure Trade (FAST) program or a form of Electronic Data Interchange (EDI) system.

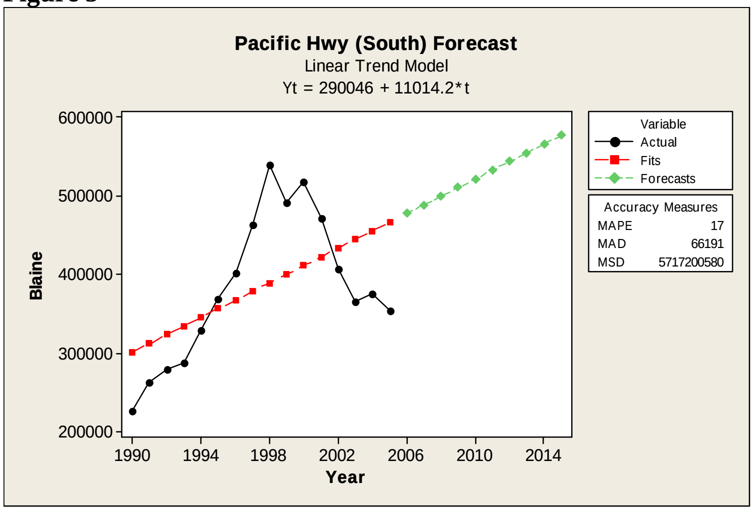
Figure 4



Third, economic downturn in Canada and stagnation in the U.S. may have resulted in slower truck movements to a certain degree. However, recent and projected trade growth contradicts this argument as being other than a minor factor causing the decrease in truck crossings.

The fourth and most plausible argument stems from the September 11, 2001 terrorist attacks. The resulting heightened security and full inspections at border ports would have created increasing congestion, ultimately reducing the number of crossings. Given these arguments, there is still an expectation of increases in the number of bi-directional truck crossings. The reasons for this are the development of programs to help facilitate the border crossing procedure while still maintaining security, and as the Canadian economy becomes more robust.

Figure 5



CONCLUSIONS

Fine tuning the crossing projections using the trade/profile methodology is possible because of the unique and detailed information available through SFTA, supplemented by the border crossing/entry data from the Bureau of Transportation Statistics, and the availability of trade data. The methodology allows projections of crossings and border port profiles to be modified based on expected trade growth changes in specific industries. Furthermore, projections can be easily modified in the short run and long run to adjust for exogenous market changes or improved information. This methodology is preferred because it provides scope and scale for projecting truck and commodity crossings at border ports.

There is an expectation of increased flows for Washington's major border ports as evidenced in the data and subsequent analysis. Increases in bi-directional flows have implications ranging from crossing times, road deterioration, security, supply chain management, and border port processing capacity.

The goal of this paper was to present information that will help in the policy decisions of border ports and infrastructure improvements. The information presented will help to prioritize investment projects that will enable British Columbia and Washington to increase its trading efficiency and competitiveness on the world market.

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