Free and Secure Trade Commercial Vehicle Crossing Times at the Pacific Highway Port of Entry

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Abstract: At the Pacific Highway port of entry between the United States and Canada, typical delays are known to regional carriers and internalized into schedules. Due to their relative infrequency, the largest crossing times are not internalized into schedules and cause significant disruptions to regional supply chains. This technical note describes the recent patterns of very long crossing times (defined as more than 2 h or the largest 1% of crossing times) and explores the relationship between arrival volume and crossing time. To do so, this study uses commercial vehicle crossing time data from GPS technology and volume data from the British Columbia Ministry of Transportation. Results show a weak correlation between border crossing time and arrival volume when considering individual observations, but a stronger correlation when data are aggregated. Results show a high percentage of crossing time can be attributed to sources other than primary booth delay, particularly for the most disruptive, very long crossing times.

DOI: 10.1061/(ASCE)TE.1943-5436.0000159

CE Database subject headings: Vehicles; Delay time; United States; Canada.

Author keywords: Crossing time; Commercial vehicle; FAST; Border delay; Border.

Introduction

The Pacific Highway port of entry (POE) connects Washington State Route 543 and British Columbia Provincial Highway 15, approximately 160-km north of Seattle and 50-km south of Vancouver (Fig. 1). This POE serves Interstate 5 (I-5), as commercial vehicles cannot use the I-5 crossing and must route to SR 543. It is the fourth busiest commercial crossing on the U.S.-Canada border, serving 400,000 U.S. bound trucks in 2007 [Bureau of Transportation Statistics (BTS) 2008].

Southbound free and secure trade (FAST) crossings will be the focus of this paper. FAST hours of operation are Mondays through Fridays 8:00 a.m.–8:00 p.m. At all other times the lane is available to all commercial traffic. The term "FAST" is used here to refer to any vehicle using the FAST lane when transiting the border. The FAST lane offers faster customs and immigration processing for approved commercial vehicle drivers, carriers, and importers, who all must be preapproved through a background and business process evaluation (Bonsor 2004). The requirements apply to all passengers in the commercial vehicles, the commercial vehicles, as well as all goods being carried.

There have been efforts on both sides of the border to evaluate border crossing delay at the major U.S.-Canada and the U.S.-Mexico border crossings including the Pacific Highway POE (abbreviated as Pacific Highway) (Mallett et al. 2006). Detailed studies were undertaken at Pacific Highway in 2001 and 2006 [Jensen et al. 2003; Halcrow Consulting Inc. (HCI) 2007]. These studies collected detailed measurements on queue length, service

Fig. 1. Cascade gateway region [International Mobility and Trade Corridor Project (IMTC) (2008), with permission]

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Note. This manuscript was submitted on April 20, 2009; approved on April 5, 2010; published online on September 15, 2010. Discussion period open until March 1, 2011; separate discussions must be submitted for individual papers. This technical note is part of the ***Journal of Transportation Engineering***, Vol. 136, No. 10, October 1, 2010. ©ASCE, ISSN 0733-947X/2010/10-932–935/$25.00.

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times, and wait times, primarily for the purposes of historical and regional comparisons. These studies collected data for a short time period (approximately 1 week) and so were not able to capture a significant number of very long crossing times due to their limited rate of occurrence. Neither of these studies considered nonprimary crossing times.

Previous research on border crossing time variability for FAST approved commercial vehicle carriers at Pacific Highway found limited immediate economic consequences from typical variability in crossing times (up to two standard deviations from the mean), but rather, found significant consequences of very long crossing times, as these were not anticipated by carriers (Goodchild et al. 2008). This paper will more closely examine the pattern of very long crossing times, which is necessary for solution development. While these crossing times represent a small percentage of crossing times, they are the only crossing times that present significant logistical disruptions because they are not internalized into regional supply chains' logistical planning.

The distribution of very long crossing times (defined as crossing times of more than 2 h) will be shown by using a unique 2.5-year data set. Crossing time is defined as the measured time between the time a commercial vehicle arrives at the back of the queue until the vehicle exits the border. A lower bound is provided for the proportion of crossing time that is attributable to nonprimary booth delay, or delay from any source other than queues at the primary booth. The primary contributions of this research are as follows:

1. Demonstrate that observed crossing times are weakly correlated with arrival volumes. A common perception is that border crossing times are primarily driven by arrival volumes, but empirical crossing time observations suggest that other factors contribute significantly to border crossing time.
2. Describe the frequency and distribution of very long crossing times.
3. Provide a lower bound for the magnitude of nonprimary crossing times (time other than that due to queuing and processing at the primary booth).

These results provide a context for understanding the impacts of the border on regional trade and inform the discussion of strategies designed to reduce the cost of border crossings on regional supply chains.

Data Sources

GPS Freight Carrier Border Crossing Time

The data in this data set represent 2.5 years of border activity and are collected by a private fleet of vehicles that frequently cross the border daily. Upon arrival at the border, drivers self-report their arrival at the back of the queue and departure from the border. The GPS unit records the time and location. Drivers are paid by the hour, whether driving in free flow traffic or waiting at the border. This company and its drivers are FAST approved and use the FAST lane whenever possible.

This data set covers the period between July 10, 2005 to May 5, 2008 and contains 43,912 observations with an average of 19 observations per day. Fig. 4 shows the average crossing time in each 5-min interval for southbound commercial vehicles for all 2007 Monday through Friday observations. Typically these are longer in the morning, peaking at 8:00 a.m., decreasing during the middle of the day, and dropping off about 4:00 p.m.

Arrival at the back of the queue and departure from the border are self-reported. This introduces the possibility of human error. For example, if drivers forget to report, or report more than once. To address this, duplicate observations and observations of greater than 6 h were removed. Drivers have no financial incentive to report longer wait times at the border because this does not affect their level of current remuneration.

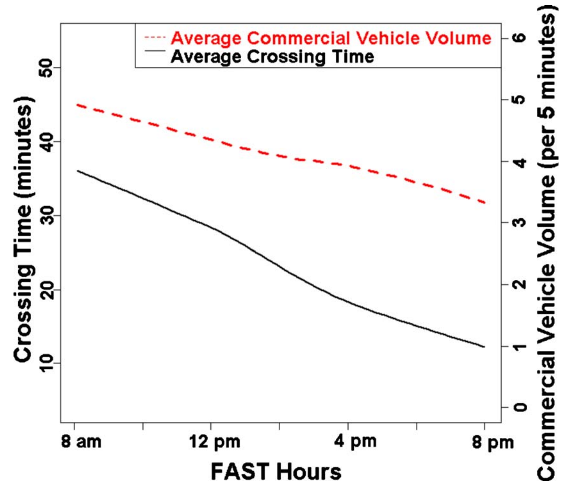

Fig. 2. Average crossing time and average arrival volume for FAST vehicles. All Mondays through Fridays 2007 observations [commercial vehicle volume data from Whatcom Council of Governments (WCOG) (2007)]

British Columbia Ministry of Transportation Loop Detector Vehicle Counts

Commercial vehicle volume data was obtained from the British Columbia Ministry of Transportation (BC MoT) loop detector data and is used to understand the pattern of truck arrivals at the southbound crossing [Whatcom Council of Governments (WCOG) 2007]. Commercial vehicle volume data are collected by a series of double loop detectors placed in the FAST lane on the approach to the border. This volume therefore only represents FAST vehicles. Each observation represents the number of vehicles crossing over the double loop detectors in a 5-min period. The total number of observations for FAST vehicles is 388,500. These loops are typically outside of the congested region. If loop detectors failed, zero volume counts were removed.

Correlating Crossing Times and Arrival Volume

In the dashed line, Fig. 2 shows the average number of commercial vehicle arrivals in each 5 min interval for southbound commercial vehicles for 2007 Mondays through Fridays observations during FAST hours. FAST vehicle volume peaks at 8:00 a.m., leveling off slightly during the middle of the day, and dropping off about 4:00 p.m. In the solid line, Fig. 2 shows the average crossing time for all observations Mondays through Fridays in 2007 during FAST hours. At this aggregate level, the patterns are similar, with the largest volume and crossing times early in the day, declining throughout the day. The arrival volume shows a leveling off during midday and the crossing time show a steeper drop during this period.

The relationship is much less clear when considering a less aggregated set of observations. Take for example the observations

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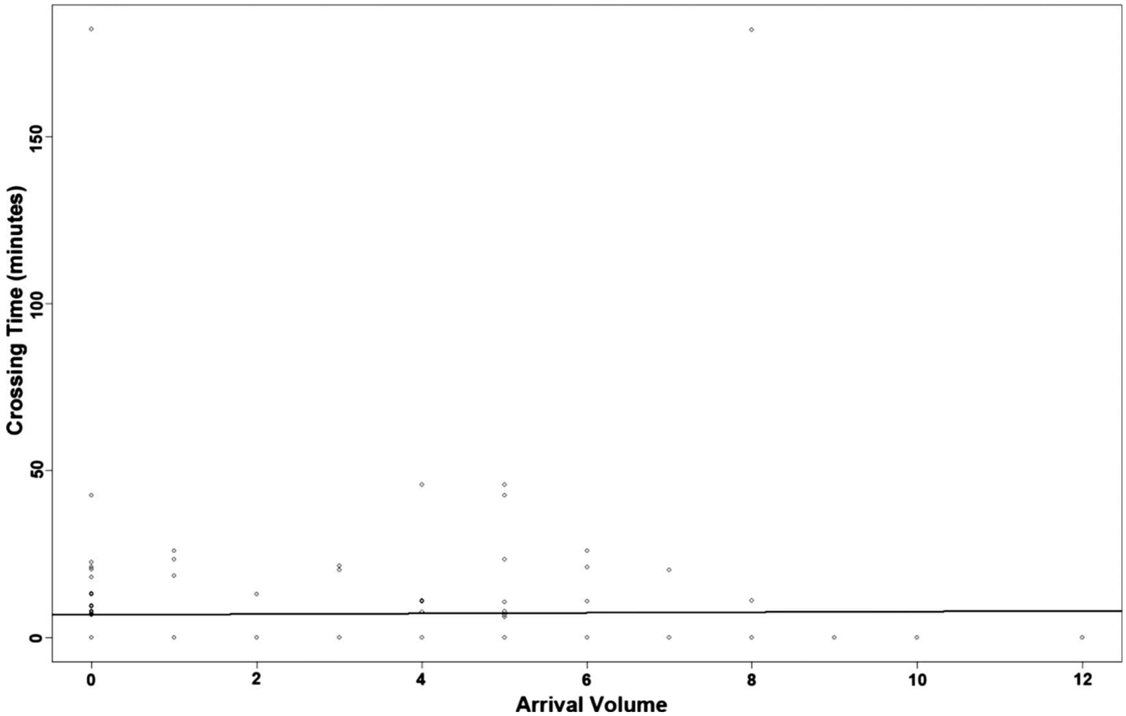

Fig. 3. Arrival volume (number of vehicles) versus crossing time (min) between 8:00 a.m. and 8:00 p.m. for May 7, 2007

of May 7, 2007 shown in Fig. 3. Again, arrival volumes for each 5-min period count only FAST approved vehicles. This single lane arrival volume is compared to FAST crossing times from the GPS data. In each 5-min period, if a truck arrives at the back of the queue, its crossing time is compared with the arrival volume in this 5-min interval. If two vehicles arrive in this period, their crossing times are averaged. However, this is not typical due to the density of crossing times in this study data set. Upon inspection, it is clear that the crossing times are not well correlated with arrival volume. The regression equation is estimated as $\hat{Y}=6.60+0.11X$ and plotted in Fig. 3. The coefficient of determination (R^2) is 0.00 along with a correlation coefficient (R) of 0.01. While it is not anticipated that crossing time and arrival volume would be perfectly correlated due to the nonlinear characteristics of delay, if demand were the primary cause of very long crossing time, arrival volume, a stronger correlation would be observed.

The observation with a very long crossing time (more than 120 min), and very low arrival volume is clearly not congestion related and is due to sources other than delay at the primary booth. This single day serves only as an example but indicates the large variability with respect to arrival volume present in the data.

Current Patterns of Very Long Crossing Times

Crossing times within two standard deviations of the mean are anticipated by frequent crossers and internalized into their scheduling. However, very long crossing times are much more problematic (Goodchild et al. 2008). These two standard deviations represent 95% of the crossing times, and crossing times of 1 h or less. This last 5%, beyond 1 h are not planned for in strategic scheduling. In this analysis, crossing times of more than 2 h were considered, which represents the largest 1% of crossing times. The largest 1% was chosen as these are clearly disruptive. Although the top 5% are not planned for, those crossing times only just over 1 h would not be particularly problematic.

Figs. 4(a and b) show the distribution of very long crossing times over a 24 h period. Fig. 4(a) shows the total number of days for which a crossing time of more than 2 h is observed across all weekdays between July 10, 2005 and May 5, 2008. Fig. 4(b) shows the *proportion* of days in this time period when a crossing time of more than 2 h was observed in each hour. This indicates that, while most very long crossing times occur during business hours, one is more *likely* to experience a very long crossing time outside of business hours. Very long crossing times during the night are likely contributed to by the limited availability of resources such as brokers and FDA representatives, while crossing times during the day are more likely to be caused in part by congestion. The period between 20:00 and 03:00 is excluded due to a small sample size.

Primary and Nonprimary Crossing Time

This study differentiates between two types of crossing time—*primary* and *nonprimary*. As suggested by the comparison of crossing times and arrival volumes, crossing times may be long due to delays at the primary booth, or other causes. Primary crossing time occurs when a vehicle waits in the queue prior to primary inspection and is processed through the primary inspection booth. Nonprimary crossing time is due to all other sources, for example, occasionally when a secondary inspection is required, an agent requires an interview with immigration, or the load requires inspection by an agricultural specialist.

The GPS freight carrier data set contains information about truck arrival and departure times at the border. With these observations, some primary and nonprimary crossing times can be differentiated. Given that the FAST lane is one lane of traffic and the primary booth is operated in a first come-first served manner, if a vehicle departed after a vehicle that arrived before it, there must

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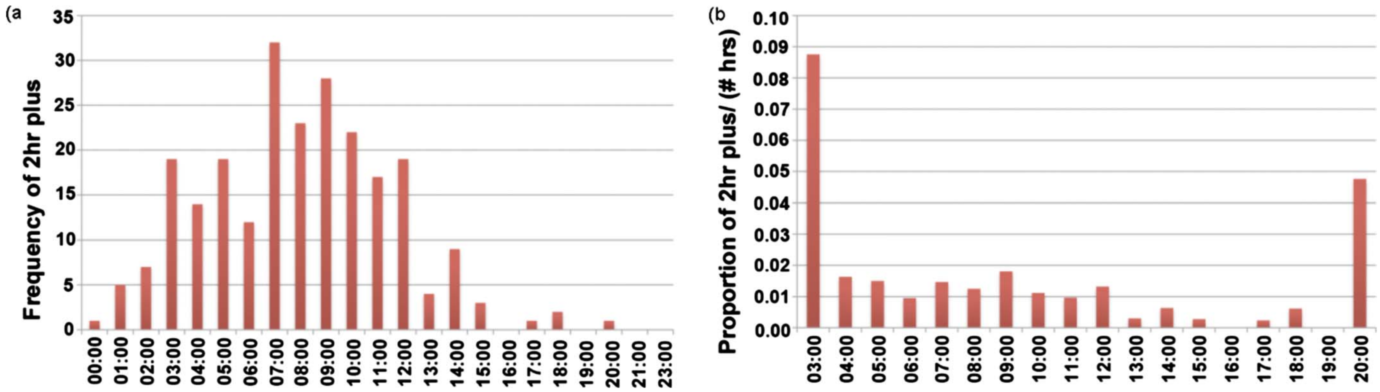

Fig. 4. (a) frequency of >2 h crossing times per hour; (b) proportion of >2 h crossing times per hour

have been a nonprimary cause of delay. However, this is only possible where two vehicles from the probe vehicle fleet are present at the border in the same time period. This approach misses the nonprimary crossing times if two vehicles are not present at the same time, and so presents a lower bound. Nonprimary crossing time is the difference in departure times between these drivers. The extent to which nonprimary time is underestimated is unknown.

For all crossing times during FAST hours, primary crossing times make up 77% of observed crossing times and nonprimary crossing times make up 23%. Therefore, almost a quarter of observed crossing times are not due to being processed through primary inspection. Of those vehicles that experience a very long crossing time, 99% of these experienced some nonprimary delay.

Conclusions

Although at an aggregate level observed crossing times compare well with arrival volumes, these variables are less correlated when considered at a more detailed level due to the significance of nonprimary delay. Almost all very long delays are incurred, at least in part, by nonprimary sources of delay. These results indicate that crossing time reduction strategies other than increasing primary booth capacity have significant potential for benefit. Increased availability of resources outside of daytime crossing periods may reduce the frequency of very long crossing times during these periods. In addition, "border preparedness" may reduce secondary processing and support quick and efficient transit of the Pacific Highway POE from Canada to the United States.

Efficient transportation flows across the U.S.-Canada border are necessary for continued economic stability and growth in both countries. As these two countries move forward in trade, continuing adaptation to changing transportation needs will be critical in maintaining efficiency and reducing costs to ensure mutual stability and growth.

References

Bonsor, N. C., and Policy Institute for Research on Public. (2004). *Fixing the potholes in North American transportation systems: Canada's options in North America*, Institute for Research on Public Policy, Montreal, Canada.

Bureau of Transportation Statistics (BTS). (2008). *National Transportation Statistics*, Table, Washington, D.C., 1–48.

Goodchild, A., Globerman, S., and Albrecht, S. (2008). "Service time variability at Blaine, Washington, international border crossing and impact on regional supply chains." *Transportation Research Record: Journal of the Transportation Research Board*, 2066(1), 71–78.

Halcrow Consulting Inc. (HCI). (2007). "International mobility and trade corridor project." *Pacific Highway Port-of-Entry Commercial Vehicle Border Operations Survey Final Rep.*, Transport Canada, Burnaby, British Columbia, Canada.

International Mobility & Trade Corridor Project (IMTC). (2008). "Cascade gateway border data." ⟨http://www.wcog.org/Data/Cross-border-Data/46.aspx⟩ (May 1, 2008).

Jensen, M., Wik, E., Hoff, C., Stock, D., and Mitchell, C. (2003). "Washington State-British Columbia international mobility and trade corridor." *(IMTC) ITS-CVO Border Crossing Deployment Evaluation Final Rep. 233*, USDOT Office of Intermodalism, Washington, D.C.

Mallett, W., Jones, C., Sedor, J., and Short, J. (2006). *Freight performance measurement: Travel time in freight-significant corridors*, Vol. 44, US. Department of Transportation, Washington, D.C.

Whatcom Council of Governments (WCOG). (2007). "The border data warehouse." ⟨http://cascadegatewaydata.com⟩ (May 1, 2008).

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