whatcom council of governments

IMTC 2018-19 Cross-border Passenger Vehicle Survey – Technical Memo – Final Draft

Applications of 2018 cross-border passenger vehicle survey data.

- Route optimality.
- Evaluation of emerging location-based-services (LBS) data alternatives.
- Development of web-based data visualization tools.
- Lynden-Aldergrove operations - NEXUS

Submitted to: Transport Canada

By: The Whatcom Council of Governments
314 East Champion Street
Bellingham, WA

March 29, 2019

Introduction

The Whatcom Council of Governments (WCOG) in partnership with the Border Policy Research Institute (BPRI) at Western Washington University (WWU), has recently completed all field work for a passenger vehicle intercept survey of personal vehicles crossing the Canada-United States border through the four, land-border ports of entry (POEs) connecting Lower Mainland British Columbia and Whatcom County, Washington. These four POEs are referred to collectively as the Cascade Gateway and are the focus of the International Mobility and Trade Corridor Program (IMTC), a regional cross-border planning coalition administered by WCOG since 1997.

The current passenger vehicle survey (PVS) is the fourth such survey that the IMTC coalition has sponsored, previous efforts having been undertaken in 2000, 2008, and 2014.

A report on the overall 2018-19PVS project as well as the database of all survey records are available as separate deliverables. Also, reports from past surveys are available on the Passenger Intercept Surveys page of the IMTC website.

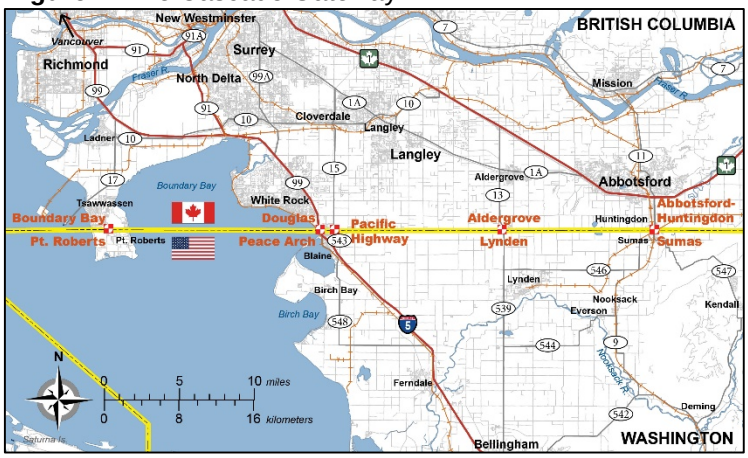
This technical memo focuses on follow-on activities using the origins and destination (OD) data of trips as captured by (and expanded from) the approximately 14,000 sample survey interviews conducted with motorists in Summer 2018. Additionally, this memo describes the use of Tableau data-visualization software to, for the first time, avail IMTC's cross-border survey data through a web-based, customizable dashboard so partner agencies and other interested stakeholders can extract subsets of data, conduct data mining, and build charts and graphs tailored to their information needs.

Cross-border routing though the Cascade Gateway

A basic fact of cross-border travel in many parts of the world is that federal governments require travelers and trade to pass through federally designated and controlled entry points – ports-of-entry (POEs). This is certainly the case for Canada and the United States.

A question for planners on both sides of the border is, as population, employment, and other trip-generating activities change and shift geographically, does the capacity and location of the Cascade Gateway's POEs continue to be sufficient? When might the transportation system benefit from increases (or decreases) in POE processing capacity (infrastructure or operations based) or addition (or removal) of a POE?

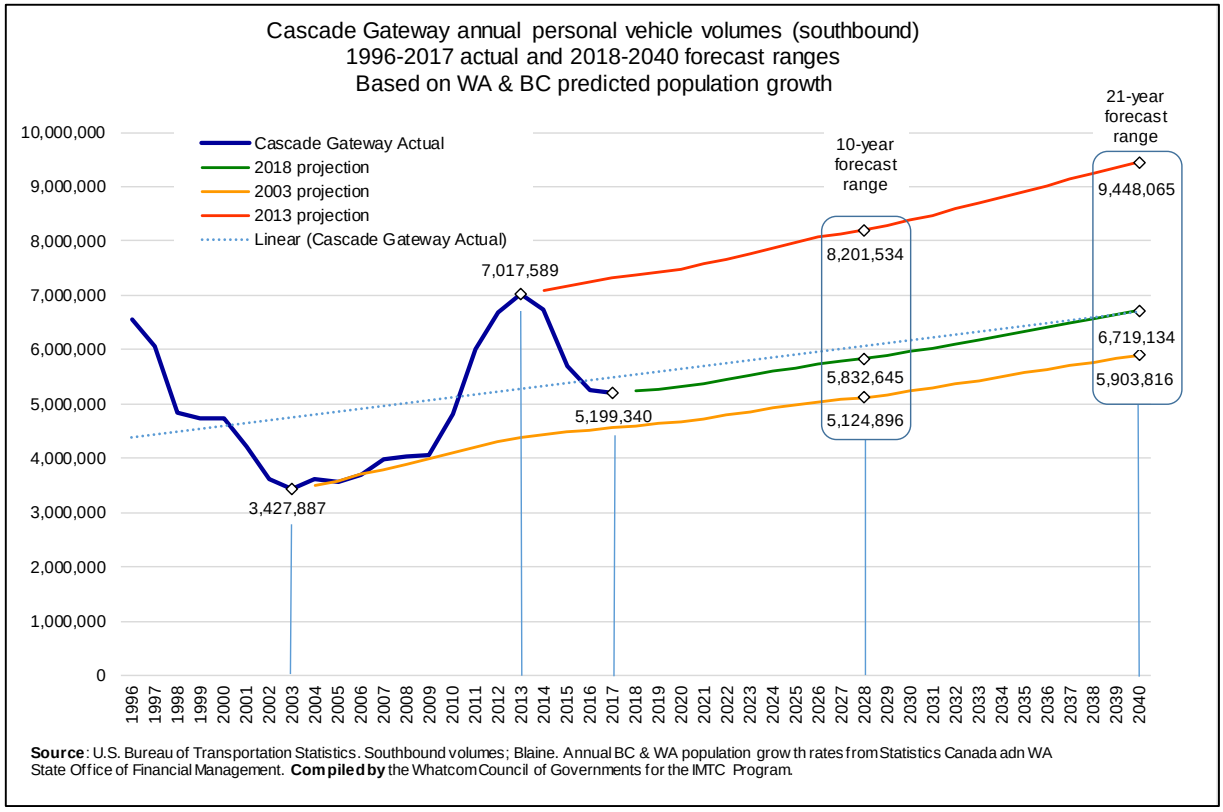
Figure 1: The Cascade Gateway



The IMTC Program has agreed on a current planning assumption of steady traffic volume growth based primarily on other government agencies' (state and provincial) published forecasts of population. But historical regional cross-border traffic volume is commonly understood to be strongly affected by many, difficult-to-forecast variables such as exchange rate, economic conditions, security policies, and relative commodity prices (e.g. gas). Thus, based on regional cross-border traffic volumes over the last 20+ years, population-based forecasts

are built from a recent low year (2003) and recent high year (2013) to form a range of future cross-border vehicle trips for the Cascade Gateway. This is portrayed below in Figure 2.

Figure 2: Cascade Gateway forecast traffic volumes



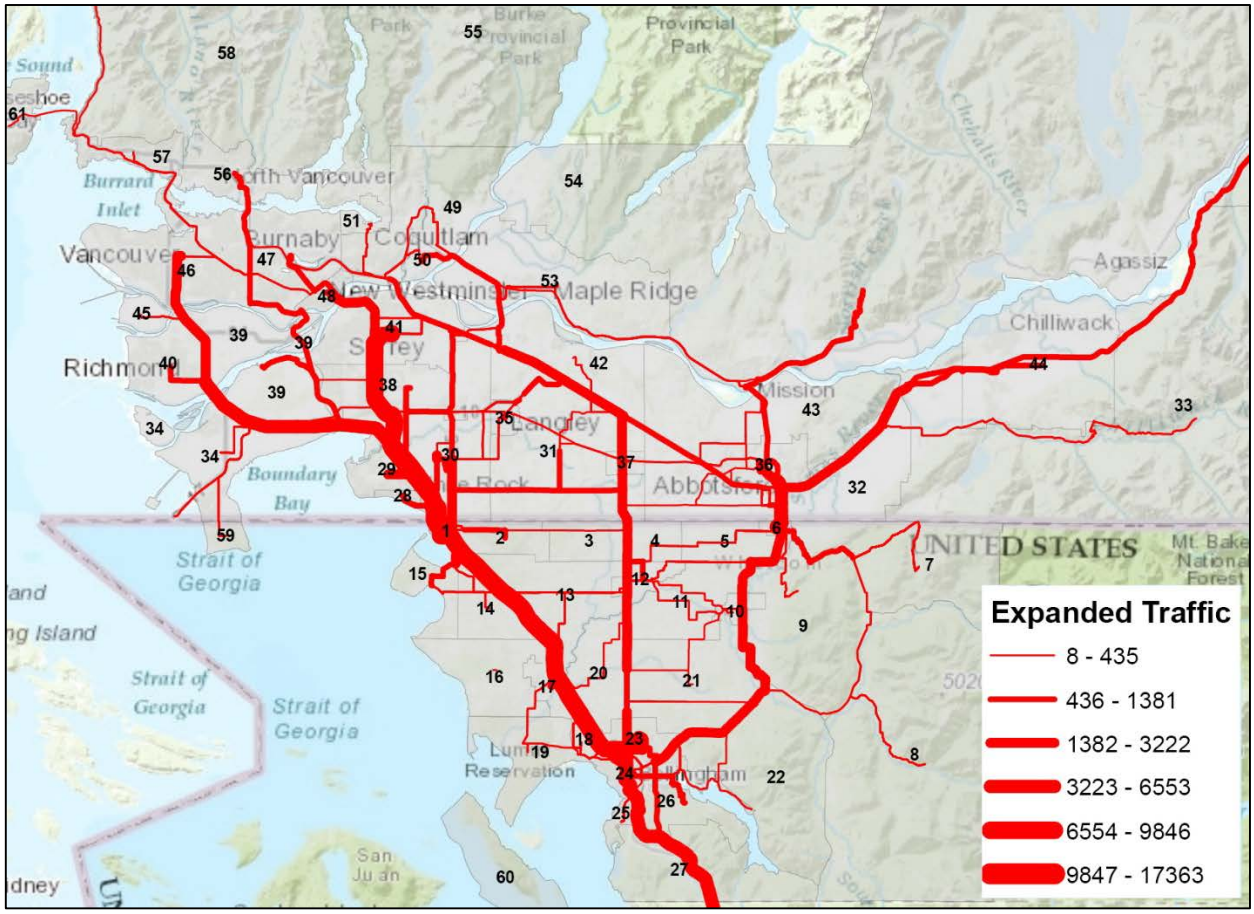
Source: U.S. Bureau of Transportation Statistics. Southbound volumes; Blaine. Annual BC & WA population growth rates from Statistics Canada adn WA State Office of Financial Management. **Compiled by** the Whatcom Council of Governments for the IMTC Program.

One way to evaluate the status of how well the cross-border road network (including POEs) is serving current trip volume is to observe how travelers are routing their trips relative to what *should* be the most direct (fastest) route between origin and destination. All things being equal, if significant portions of cross-border travelers are driving several kilometers/miles off of the road network's shortest route and crossing at a suboptimal (from a routing perspective) POE, this is an indicator that wait-times at one or more POEs or congestion on roads serving certain POEs may be causing drivers to use inefficiently long routes.

For this analysis, based on the survey data, WCOG developed an OD matrix – a table in which traffic-analysis zones (TAZs) on one side of the border are the rows, the TAZs on the other side of the border are the columns, and the intersecting cells contain the number of trips between the respective O-TAZ and D-TAZ. Using ArcGIS® tools, WCOG ran two assignments of the survey-based O-D matrix – one for trips made by Canadian residents to the U.S. destinations and one for trips made by U.S. residents to Canadian destinations.

In addition to the map-based results of the assignments shown in **figures 3 and 4**, the percentage of trips that the ArcGIS network assignment routed through each crossing is compared to observed traveler choices in **table 1** below.

Figure 3: ArcGIS assignment of 2018 Survey O-D matrix – Canadian resident trips to U.S.



In figure 3, above and figure 4 below:

Expanded Traffic is the volume of cross-border vehicle trips, assigned to the route as shown, based on the survey-recorded origins and destinations, expanded to total hourly traffic volumes, by POE and direction, for the 15-hr survey days conducted in Summer 2018.

TAZ Numbers are plotted at the centroid locations of the 61 traffic analysis zones (TAZs) developed for this survey. These relatively large TAZs are aggregations of the smaller TAZs used in both Whatcom Council of Governments regional travel demand model and South Coast British Columbia Transportation Authority's regional travel demand model. This will support additional analysis using WCOG's TransCAD model with a cross-border road-network.

Figure 4: ArcGIS assignment of 2018 Survey O-D matrix – U.S. resident trips to Canada

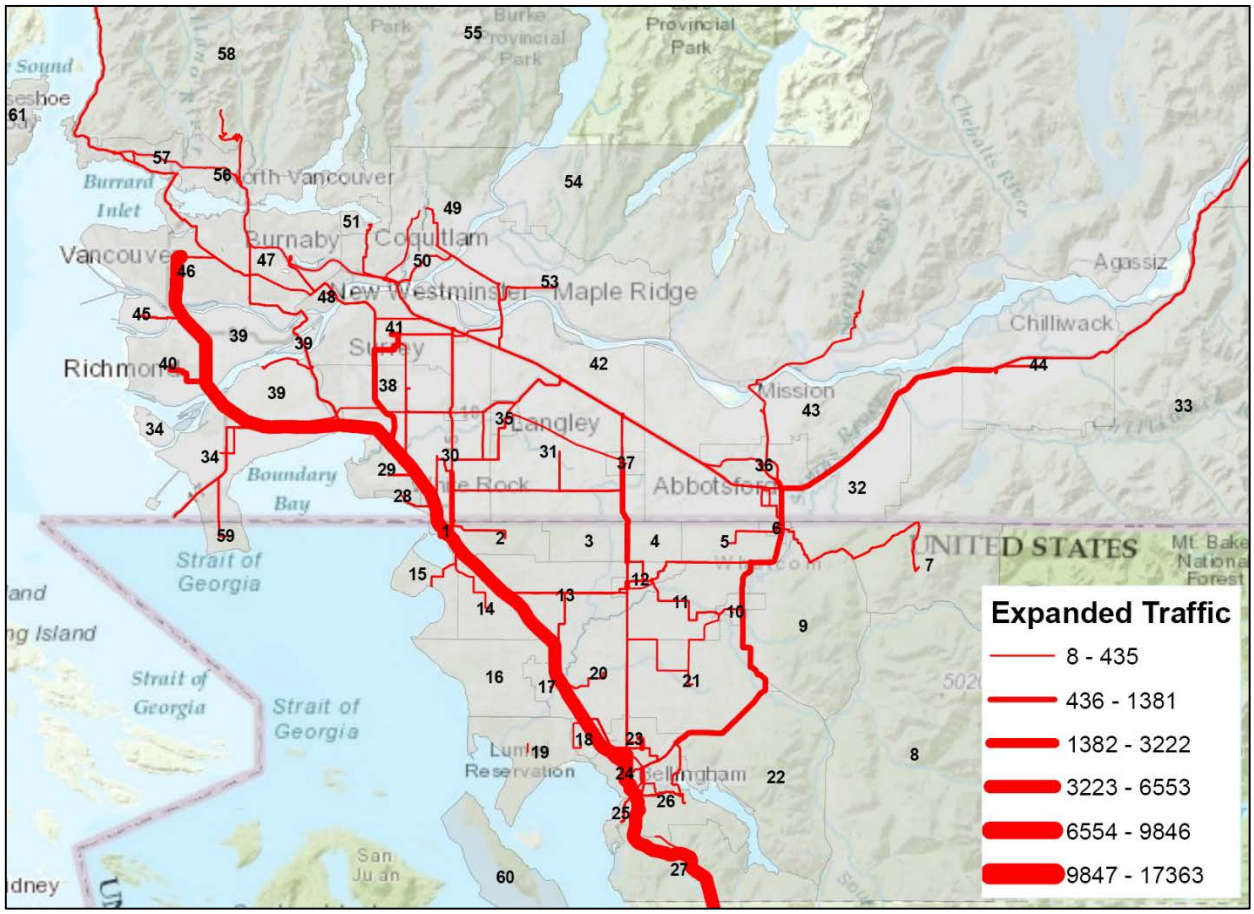


Table 1. Comparison of shortest-path-*assigned* routing with observed routing

	POEs – U.S. Resident trips to Canada		
	Douglas or Pacific Highway	Aldergrove	Abbotsford-Huntingdon
Network assignment	82%	7%	11%
Observed routing	85%	6%	9%
Difference	-3%	1%	2%

	POEs – Canadian Resident trips to U.S.		
	Peace Arch or Pacific Highway	Lynden	Sumas
Network assignment	69%	9%	22%
Observed routing	73%	6%	21%
Difference	-4%	3%	1%

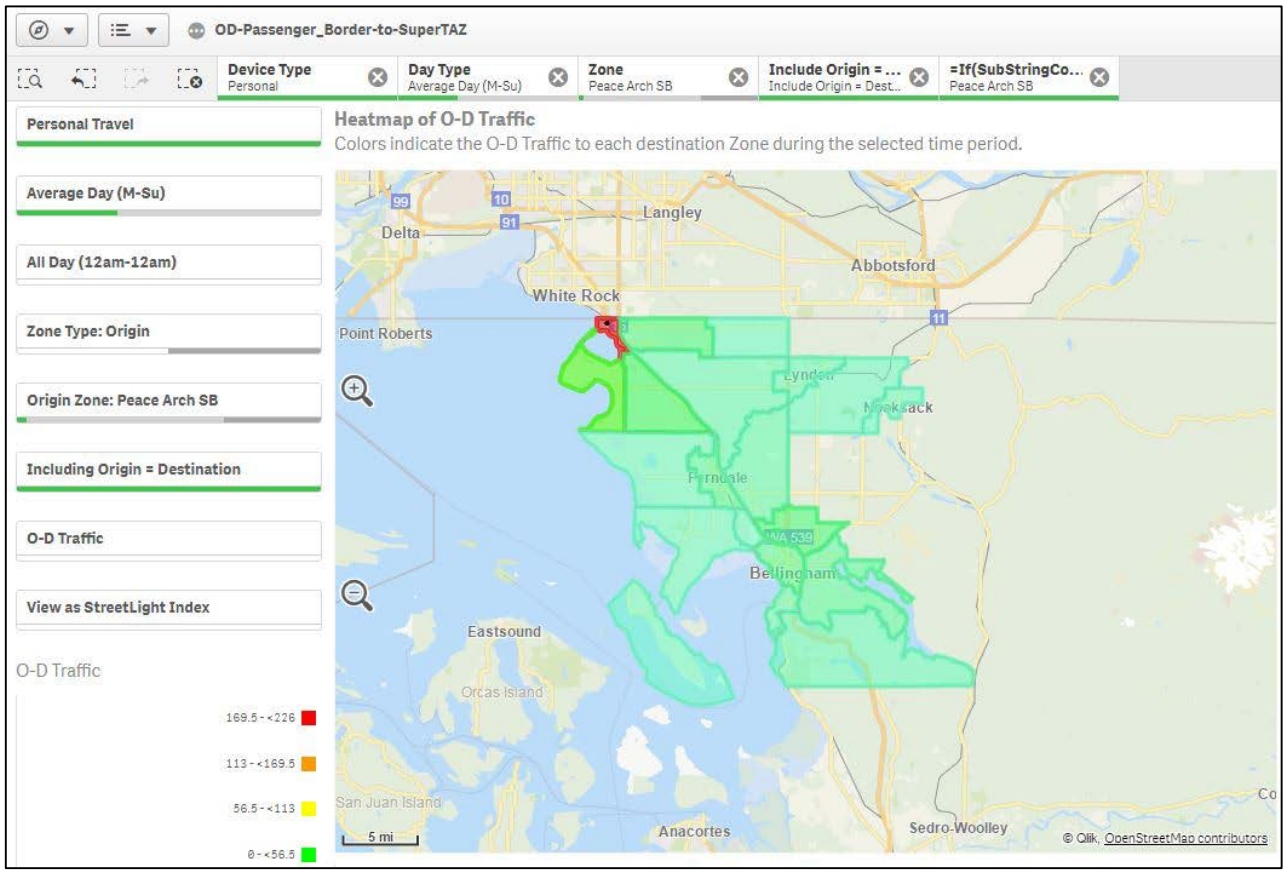
For the most part, this analysis indicates that most trips are crossing at the POE along the optimal route. While the differences are small, it is curious that, of the three percent of U.S. resident trips at Douglas & Pacific Highway that the network assignment estimates should be better served by another crossing, two thirds of those trips should be using Abbotsford-Huntingdon (32 km away) rather than Aldergrove (16 km away).

Evaluating emerging options for using location-based services (LBS) data for understanding cross-border trips

This year WCOG purchased a project-based subscription to use LBS data and analysis tools sold by StreetLight Data. LBS geographic position data is generated by myriad smart-phone and device applications and StreetLight and other companies are purchasing and aggregating this data to develop and sell high-resolution travel data including road-performance/congestion metrics, origins and destinations, trip routing, screen-line analysis, and inferred mode split.

Evaluation of LBS data for application to border-related questions has come from: 1) WCOG's observations having used Streetlight to build an external trips matrix – which included external station screen-lines set up at the four U.S.-Canada ports of entry and 2) from conversations with StreetLight and INRIX about possible interest in analyzing cross-border trips, the current challenges the border itself likely presents at this time, and ways that some custom data preparation could address some of the current issues (if someone is willing to pay for that).

Figure 5: Sample StreetLight external station to Whatcom County super-TAZs – SB @ I-5



Observations regarding LBS external-trip data originating at the Canada-U.S. border

In developing its 2018 Whatcom County external trip matrix, WCOG contracted for a week of traffic counts on all road-lanes entering and exiting the county. The StreetLight O-D observations were then used to allocate these volumes for use in WCOG's travel demand model. Figure 5 above is a screenshot of StreetLight's dashboard rendering of the LBS-based distribution of trips entering Whatcom County at the Peace Arch border crossing to the aggregated TAZ geography set up in the StreetLight project-subscription geography.

While the LBS approach was much less costly than the alternative video-license-plate matching method ($14K USD vs. over $100K) the capture rate of LBS-captured trips to volume counts was lower than expected and even lower for trips entering and exiting across the international, Whatcom County-British Columbia border than across the Whatcom County-Skagit County line. The LBS capture rate at the domestic county border was about 20 percent of actual volume. The U.S.-Canada border LBS capture rate was between 5 and 10 percent.

As WCOG considers future LBS data purchases and possible applications to cross-border travel we will ask vendors to explain the status and dynamics of how their data acquisition and preparations affect data quality including:

- How does changing cell-phone/mobile data coverage geography, like at an international border, relate to or affect how LBS-based trip records are created, marked as ended, etc?
- Does the country that an individual's mobile phone/data plan is based in affect whether or not LBS data originating from a device later becomes part of aggregated LBS data set typically packaged for defined geographies?

<u>Discussions with vendors re: issues and possible improvements to using LBS to analyze cross-border trips</u>

WCOG has spoken with StreetLight and INRIX about some acknowledged issues currently affecting how in-vehicle navigation device data (mostly INRIX) and LBS data (as is sold by StreetLight)

Both vendors acknowledged that, currently, algorithms mark a trip as ended when a device has not moved fifteen feet in five minutes. For this reason alone, many devices (vehicles, phones, etc.) waiting in line at a border crossing, would regularly result in a trip record that ends at the border rather than continues across. StreetLight has discussed that it would likely be possible to do a custom data preparation where the algorithm is modified to accept longer dwell times (60 minutes?) within a screened geography (highway approaches to and at ports of entry) so that cross-border trips are not excluded from the sample.

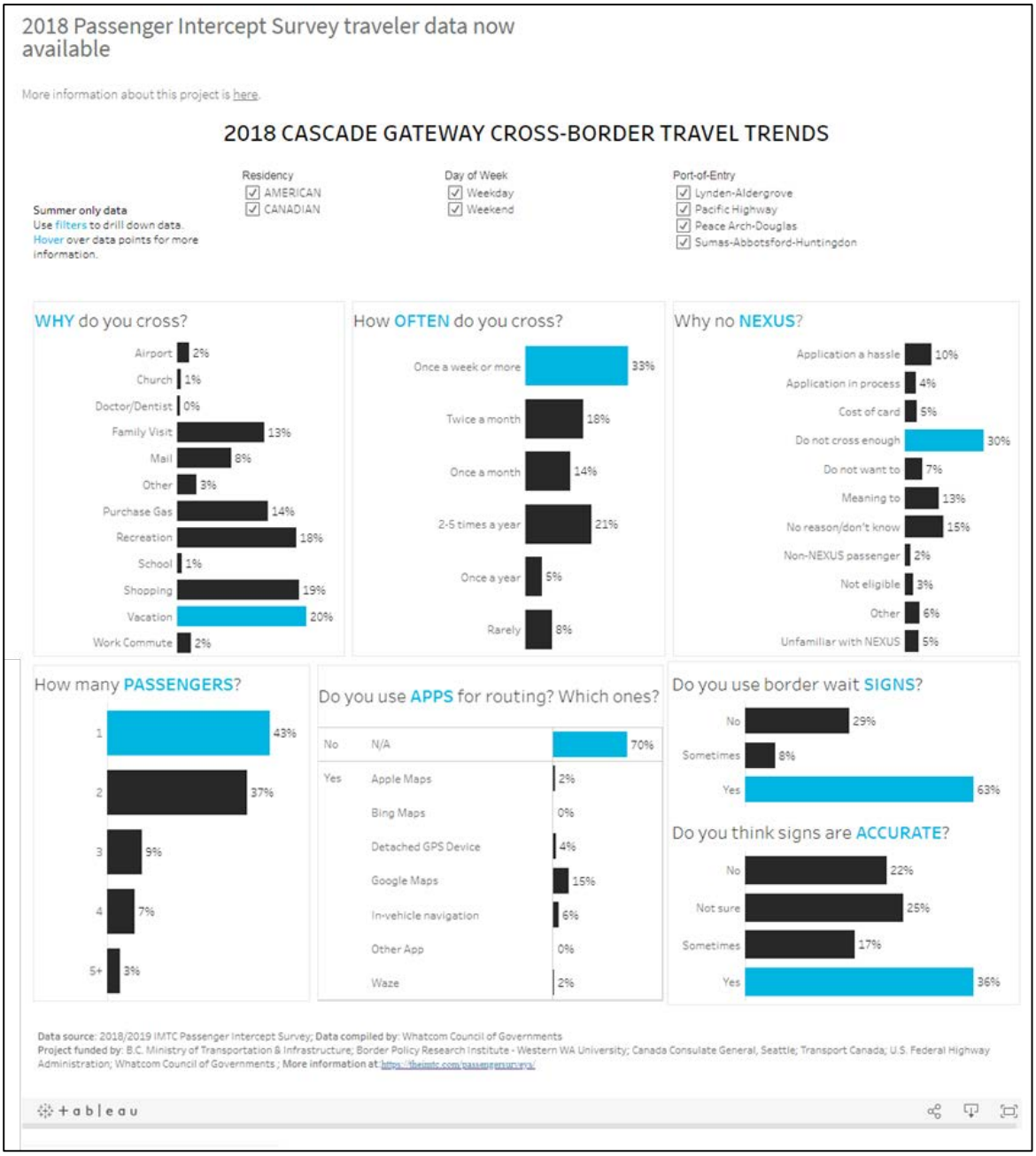
While StreetLight does include a discrete data set for commercial vehicles, this data is sourced from INRIX who obtains it largely from fleet-management systems installed in trucks, used mostly by large-fleet carrier firms. While pretty good for looking at questions of road performance (speed, choke points, etc.) this sample would be too limited and possibly too biased for O-D questions. StreetLight was asked that, since the routing of trucks through border crossings is mostly separated from personal vehicle traffic, would it be appropriate to create a screen line on the truck lanes and expect that LBS records generated by truck drivers' own mobile devices could create a usable, cross-border truck O-D data set. This did sound reasonable to the StreetLight representative – although there are still the questions discussed above about the impact of the border itself and "mobile data geography."

Observation: LBS data is a new product and likely additional vendors will enter the market and quality and options will improve (and perhaps price go down as well). WCOG will continue to assess options and also seek to discuss LBS data with other border stakeholders via the Canada-U.S. Transportation Border Working Group (TBWG).

Web-based data visualization of the 2018 Passenger Vehicle Survey data

Past cross-border survey efforts have stored and shared the data in a Microsoft Access database. Having recently acquired the data visualization software Tableau® along with training, the 2018 survey data is now being made available on-line through dynamic dashboards. Tableau enables filtering (check boxes), additional related data with hovering, and data download options. Figure 6 below is a screen-shot of the initial Tableau dashboard screen. The dashboard is now part of the IMTC website at https://theimtc.com/data/. On the same page, you can find the Tableau version of IMTC's 2018 Resource Manual.

Figure 6: Screenshot of Tableau dashboard for the 2018 Passenger Vehicle Survey



Initial assessment of operational opportunities at Aldergrove-Lynden

As B.C. Ministry of Transportation and Investment is finishing up improvements to BC Highway 13 at the Lynden-Aldergove port of entry, they have expressed an interest in encouraging and planning for how improved approach road infrastructure could complement a U.S. Customs and Border Protection (CBP) decision to begin operating the NEXUS trusted traveler program at that location. Improvements on BC Highway 13 would now accommodate a dedicated NEXUS access lane for card-carrying enrollees. Additionally, Canada Border Services Agency (CBSA) has operated NEXUS for Canada-bound travelers at this location since opening its new port facility in 2015. NEXUS operates in both directions at all other ports in the Cascade Gateway leaving Lynden as the last, no-NEXUS port.

Drivers' reported cross-border trip frequency

While NEXUS is in large part a strategy for increasing system capacity and decreasing border wait-times, today's trusted traveler programs were originally developed and proposed as "dedicated commuter lane" or DCL programs. The objective here is to recognize that regular, frequent cross-border travelers should have a way to voluntarily provide additional background information and, in return, become eligible for a dedicated lane and typically shorter primary-inspection experience with the inspector. Through this lens, the 2018 survey database was queried to compare the average cross-border trip frequency of drivers across all four Cascade Gateway crossings. Results are shown in the table below.

Port	Drivers' Avg. Annual X-border Trips
Lynden-Aldergrove	49
Pacific Highway	41
Peace Arch-Douglas	40
Sumas-Abbotsford-Huntingdon	42

Observation: Travelers across the Lynden-Aldergrove border are, make, on average making 22.5 percent more trips per year than travelers at the Peace Arch – Douglas crossing. While a smaller volume of traffic, it has the strongest frequent-traveler profile.

Existing NEXUS Card use

Often when NEXUS is being considered for a new location, a concern is that, without advanced marketing and enrollment, a dedicated lane and booth would open to an insufficient number of users to warrant the allocation of processing capacity. The 2018 Passenger Vehicle Survey was queried to determine the number of drivers already using NEXUS cards as their primary cross-border travel document at Lynden-Aldergrove.

Northbound, Aldergrove POE, where NEXUS is in operation	
NEXUS cards used in NEXUS lane/booth	17.5 %
NEXUS cards used at standard inspection booths	7 %
Total Northbound, existing NEXUS card use	**24.5%**

Southbound, Lynden POE (no current NEXUS operation)	
NEXUS cards used at standard inspection booths	**22 %**

Observation: With today's operational capability dynamically switch operation of inspection booths between standard or NEXUS, there is certainly enough NEXUS card penetration in the existing Lynden-Aldergrove

traveler stream to expect operational advantages and travel time savings from operating a southbound NEXUS program here – even if only at the peak hours.

For questions about this memo, please contact:

Hugh Conroy
Director of Planning
Whatcom Council of Governments
360 685-8384
hugh@wcog.org