2018-19 IMTC Passenger Vehicle Intercept Survey

Project Description

April 2019

1 INTRODUCTION

The 2018-19 IMTC Passenger Vehicle Intercept Survey (2019 PVIS) is a multi-week, multi-season data collection effort that captures the travel characteristics of cross-border motorists transiting the Cascade Gateway. The project refreshes data from similarly scoped projects in 2013-14, 2007-8, and 2000.

The Cascade Gateway is a border region encompassing the Lower Mainland of British Columbia, Canada and the upper Puget Sound area of Washington State in the U.S. Data collection occurred at the four main ports-of-entry (POE) along the Whatcom County-British Columbia international border: Peace Arch-Douglas (PA), Pacific Highway (PH), Lynden-Aldergrove (LA), and Sumas-Abbotsford-Huntingdon (SH).

The 2019 PVIS comprises of two seasons of data collection. This report describes both the summer data collection effort, which occurred in June and July of 2018, and the winter effort, which occurred in February and March of 2019. Both seasons of data are joined into a single database, the main deliverable of the 2019 PVIS.

The summer effort also included a 4-day bus survey that was conducted at the Pacific Highway POE. This component of the project is detailed in a separate report.

2 PROJECT ORGANIZATION

2.1 SUPPORTING AGENCIES

The 2019 PVIS was jointly funded by the following U.S. and Canadian agencies: U.S. Federal Highway Administration (FHWA), British Columbia Ministry of Transportation and Infrastructure (BC MoTI), Border Policy Research Institute (BPRI) at Western Washington University (WWU), Whatcom Council of Governments (WCOG), Transport Canada (TC).

Critical permissions, data collection coordinating support, and border traffic data were provided by U.S. Customs and Border Protection (US CBP) and Canada Border Services Agency (CBSA).

The project is also advanced by the U.S. and Canadian member organizations that collectively make up the International Mobility and Trade Corridor Program (IMTC).

2.2   MANAGING AGENCIES

Staff at BPRI and WCOG jointly managed the data collection and database organization. The project was advanced by WCOG Director of Planning Hugh Conroy, BPRI Director Laurie Trautman, and WCOG planning staff Melissa Fanucci and Jaymes McClain.

The data collection efforts were carried out by a team of BPRI research assistants and student supervisors from WWU. Data collection was managed by Jaymes McClain.

3   DATA COLLECTION

3.1   METHODOLOGY

Border-crossing motorists were interviewed by project research assistants at each Cascade Gateway POE. When sufficient traffic queues formed leading up to primary inspection, research assistants approached vehicle drivers and administered a 90-second questionnaire to willing respondents, as seen in Photo 1. Intercept stations were set up post-inspection to administer questionnaires to motorists using the NEXUS lane and, when queues were low, to Ready Lane and standard (non-NEXUS or -Ready Lane) motorists, as seen in Photo 2.

Research assistants were trained and certified as Washington State Flaggers to safely conduct traffic-control when necessary. Because of the complex environment at each border facility, research crews administered questionnaires with as little impediment to the border inspection process as possible.

3.2   INSTRUMENTS AND EQUIPMENT

The questionnaire was developed using Pendragon Forms and was loaded on to 8-inch Lenovo Tab 4 tablets. The tablets were equipped with hand-strap holders for ease of use in the field.

Several lines of questioning required use of a map so that respondents could point to locations relevant to their cross-border trip. Maps of Whatcom County and the Lower Mainland British Columbia were printed front-and-back on water- and tear-proof polymer sheets that were

RESEARCHERS IN THE FIELD

Photo 1. Pre-inspection queue interviews in summer 2018

Photo 2. Post-inspection intercept interviews and traffic control in winter 2019

Photo 3. A research assistant using tablet and map in an interview

attached to research assistants by self-retracting Kevlar cords. Photo 3 shows a research assistant using a tablet and map to conduct an interview.

Intercept stations were set up using cones and other traffic control equipment loaned from Whatcom County Public Works, as depicted in Photo 2.

3.3 SCHEDULE

Data collection occurred in one direction of travel each day that research assistants were in the field, with the exception of surveying at the Lynden-Aldergrove POE, where the scale of the port allowed for motorists to be surveyed in both directions of travel during the same day in summer. Each of the four main POEs in the Cascade Gateway were visited at least one weekday and one weekend day in both summer and winter, as shown in Table 1.

Each survey day, two research crews typically conducted questionnaires over combined 14- to 16-hour periods in summer, from 0600 to 0800 until about 2100. Due to shorter days, winter crews combined for 9-hour periods, beginning at 0730-0800 and ending at 1700-1730.

Table 1. Days of week each port-of-entry was visited

PORT-OF-ENTRY	DIRECTION	DAYS OF WEEK - SUMMER	DAYS OF WEEK - WINTER
Peace Arch-Douglas	N	Wed, Sat	Thu, Sat
	S	Thr, Fri, Sun	Thu, Sun
Pacific Highway	N	Wed, Fri, Sat	Tue, Sat, Sun
	S	Thu, Sun	Sat
Lynden-Aldergrove	N	Wed, Thu, Sat, Sun	Tue, Sun
	S	Wed, Thu, Sat, Sun	Thu
Sumas-Abbotsford-Huntingdon	N	Tue, Sat	Thu, Sat
	S	Wed, Sat	Sun

3.4 SAMPLE SIZE

Hourly traffic count data for the days that surveying occurred were provided by US CBP and CBSA. These counts are used to calculate the sample rate of the usable records collected (that is, those records where sufficient data was collected to be included in the database).

During data collection, research assistants also recorded the number of instances motorists refused to participate in all or most of the questionnaire. Some observable data can still be extracted from most refusals and used in certain queries.

Photo 4. Student research assistants at Pacific Highway.

Table 2. Usable records collected in the field, associated traffic volumes that the records represent, sampling and refusal rates by POE and direction of traffic

		PEACE ARCH-DOUGLAS	PACIFIC HIGHWAY	LYNDEN-ALDERGROVE	SUMAS-ABBOTSFORD-HUNTINGDON	TOTAL
NORTHBOUND	Records Collected	3,141	2,154	1,232	1,583	8,110
	Traffic Representing	24,936	15,473	4,764	5,504	50,677
	Sample Rate	13%	14%	26%	29%	**16%**
	Refusal Rate	*11%*	*27%*	*17%*	*11%*	*16%*
SOUTHBOUND	Records Collected	1,733	2,580	1,200	1,652	7,165
	Traffic Representing	17,709	14,307	3,797	6,605	42,418
	Sample Rate	10%	18%	32%	25%	**17%**
	Refusal Rate	*23%*	*11%*	*15%*	*10%*	*15%*
TOTAL	Records Collected	4,874	4,734	2,432	3,235	15,275
	Traffic Representing	42,644	29,780	8,561	12,110	93,095
	Sample Rate	11%	16%	28%	27%	**16%**
	Refusal Rate	*16%*	*19%*	*16%*	*10%*	*16%*

3.5   RECORD WEIGHTING

The interview records are only a sample of the travelers that transited the border during the project. The sample is weighted to expand the records to better represent all cross-border travelers, as shown in the *Traffic Representing* columns in Table 2.

The weight equals the amount of vehicles each record represents in the hour-block that the interview occurred. For example, if 10 records were collected in the 0900-1000 hour-block that saw 20 vehicles total transit the border, the weight for each record in the 0900 hour-block is 2, or 20/10. Each sample record collected between 0900 and 1000 represents 2 vehicles

when weighted. Because of the uniqueness of border inspection lanes in the Cascade Gateway, weights are calculated for NEXUS lane travelers[1] and standard lane travelers separately where possible[2].

Weights are useful for developing analyses that look at the cross-border traveling populace as a whole.

4   ANALYSIS

The main deliverable of the 2019 PVIS is the project database, which contains all usable records collected from the in-field questionnaire, weights, descriptions of the project, and some high-level analyses. The database is housed in Microsoft Access, where queries can be

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[1] Because of small sample sizes and the extensive use of Ready Lanes by NEXUS card holders, Ready Lane-designated records are included in the NEXUS weights for southbound data.

[2] In instances of low sample sizes, a *total* weight is applied to both NEXUS and standard lane records – that is, all records regardless of inspection lane type are weighted to the total traffic observed for that hour.

easily run in-program. Data may also be exported and used in data analytics programs for further analysis.

WCOG has developed high-level analyses from PVIS data using the program Tableau. These analyses can be viewed on the IMTC's data webpage at https://theimtc.com/data/.

The following analysis descriptions serve as examples of the types of queries one can perform in a data querying or analytics platform. They can help answer questions about the Cascade Gateway border-crossing populace, such as:

☐ Where do they live?
☐ Where are they going across the border?
☐ Why are they crossing?
☐ What information sources do they use to help them cross the border?

4.1   COUNTRY OF RESIDENCE

Table 3 is an example of analysis that compares the countries of residence of motorists transiting the border. Note that these data do not necessarily indicate citizenship, as motorists were merely asked in what city they lived.

Table 3. Country of residence by port of entry

PORT-OF-ENTRY	CANADA	USA	OTHER COUNTRY
Peace Arch-Douglas	65%	34%	0.9%
Pacific Highway	69%	30%	0.7%
Lynden-Aldergrove	70%	30%	0.3%
Sumas-Abbotsford-Huntingdon	81%	19%	0.5%
Total	**71%**	**29%**	**0.6%**

4.2   TRAVEL DOCUMENT TYPES

Cross-border motorists using standard, non-NEXUS inspection lanes were asked whether or not they ever use a document other than a passport to cross the border with and, if they do, what kind. Table 4 is another example of analysis that compares the document types used by Canadian and American residents transiting the border northbound[3] through standard, non-NEXUS lanes.

Photo 5. Surveying at Peace Arch.

[3] Because of southbound NEXUS card holders' propensity to use the Ready Lane in addition to NEXUS lanes, this particular analysis only includes northbound records, where lane choices are simply NEXUS or non-NEXUS.

Table 4. Traveler document usage by country of residence

DOCUMENT TYPE	CANADA	USA
Passport only	75%	60%
Enhanced Driver's License	9%	18%
NEXUS Card	11%	10%
Permanent Resident Card	2%	3%
U.S. Passport Card	1%	4%
Global Entry Card	< 0.5%	3%
Non-Immigrant Visa	< 0.5%	1%
SENTRI Card	< 0.5%	< 0.5%
Other	1%	4%

NEXUS card holders responding to this survey question in standard, non-NEXUS lanes may either be traveling at a time that a POE's NEXUS inspection booth is closed or traveling with a passenger that does not also possess a NEXUS card.

4.3 PASSENGERS

The number of passengers in the vehicle, including the driver, was collected at the beginning of each survey interview. Combining the passenger count data with when and at what POE the data was collected, one can determine the patterns in occupancy of cross-border passenger vehicles relative to when and where they are crossing the border.

4.4 ORIGIN-DESTINATION Matrices

Research assistants asked drivers the locations they were coming from and going to across the border. Origin-destination (O-D) analyses should begin with the driver's residence as the origin and the location they are ultimately destined for across the border from their residence as their destination. This way, O-D matrices represent full cross-border trip profiles (or tours) rather than smaller, more broken up O-D trips that one might see in a more formal household travel survey or traffic modeling project.

4.5 LENGTH OF STAY ACROSS THE BORDER AND FREQUENCY OF TRAVEL

Drivers were also asked for how long they were across the border from their residence (or, if traveling out of their home country, how long they anticipated being in the other country) and how frequently they make cross-border trips.

4.6 TRIP PURPOSES

One of the most important elements of a unique travel survey such as the 2019 PVIS, where trips ends are not predominantly tied to work and home as in traditional travel surveys, is understanding why people are making trips to another country, especially when many of the travelers in the Cascade Gateway cross the border frequently. This understanding is furthered by using other data fields in querying trip purpose, such as where travelers live, what cities they are traveling to, and how long and how frequently trips for certain purposes are made.

4.7 TECHNOLOGY USED FOR CROSSING THE BORDER

In the 5 years since the last IMTC passenger vehicle study was conducted, technology's role in helping travelers cross the border has evolved. While certain technology has remained constant, such as border wait-time variable message signs on the highway, the 2019 PVIS was designed to capture how people are using new technologies to better their cross-border travel. This is

evident in questions that seek to understand how smartphone apps and routing software are being used by people transiting the border.

5 FOR MORE INFORMATION

To request the full 2018-19 IMTC Passenger Vehicle Intercept Survey database, please contact:

Jaymes McClain, AICP
Planner II
Whatcom Council of Governments
360-685-8391
jaymes@wcog.org

For more information in general about the project, please contact Jaymes McClain or one of the other project managers:

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

Laurie Trautman
Director
Border Policy Research Institute at Western Washington University
360-650-2642
darianl9@wwu.edu

Preliminary information (collected once each day)

Date and time

mm/dd/yyyy h:mm:ss AM/PM

Direction of traffic being interviewed

Option	Description
N	Northbound
S	Southbound

Port of Entry

Option	Description
PA	Peace Arch-Douglas
PH	Pacific Highway
LA	Lynden-Aldergrove
SH	Sumas-Abbotsford-Huntingdon

Day of Week

Option	Description
Sunday	-
Monday	-
Tuesday	-
Wednesday	-
Thursday	-
Friday	-
Saturday	-

Preamble

Hi. We're working with a university project to gather data to help improve regional cross-border transportation. I have a questionnaire that is <u>anonymous</u> and takes about 90 seconds. May I ask you the questions?

Main survey

*Non-verbal data capture

*License plate province/state**

Option	Description
2-letter abbreviation	US State or Canadian Province

Vehicle type*

Option	Description
Car	Car, Truck ,SUV, Pickup, Van
Motorcycle	2 or 3-wheeled motorbike
RV	RV, Camper, Camper-trailer
Other	Vehicles with boats or trailers, other vehicles

Inspection booth/lane type*

Option	Description
Standard	Standard, general purposes primary inspection lanes
NEXUS	NEXUS program lanes
Ready	RFID document-accessible Ready Lanes (US CBP only)

Noticeable GPS/in-vehicle navigation*

Option	Description
Y	Surveyor observes a GPS device or in-vehicle navigation in use
N	Surveyor **does not** observe a GPS device or in-vehicle navigation in use

Count of passengers in vehicle (including driver)*

Option	Description
Integer number	The number of people, including the driver, currently in the vehicle

Residence location and traffic analysis zone (TAZ)

What city do you live in?

Option- North of Border	Option- South of Border
Abbotsford	Acme, Van Zandt
Alaska	Anacortes
Alberta	Arlington
Aldergrove	Bellevue
BC (other)	Bellingham
Burnaby	Birch Bay
Canada (East)	Blaine
Canada (West)	Bothell
Chilliwack	Burlington
Clearbrook	California
Cloverdale	Camano
Coquitlam, Port Coquitlam	Custer
Delta	Deming
Hope	Everett-Tulalip Casino

Islands (via Horseshoe)	Everson
Islands (via Tsawassen)	Ferndale
Ladner	Hwy 2 (Stevens Pass)
Langley (City)	Hwy 20 (N. Cascades)
Langley (Township)	I-90 (Snoqualmie Pass)
Maple Ridge	Kendall, Glacier
Mission	King County (rural)
New Westminster	Kirkland
North Vancouver	Lummi Nation
Null	Lynden
Other	Lynnwood
Other country	Mt. Baker, Maple Falls
Pitt Meadows	Mt. Vernon
Port Moody	Mukilteo
Pt. Roberts	Nooksack
Refuse	Null
Richmond	Olympia
Surrey	Oregon
Tsawassen	Other
Vancouver	Other country
Victoria	Pt. Roberts
West Vancouver	Redmond
Whistler	Refuse
White Rock	Seattle
	Sedro Woolley
	Semiahmoo
	Skagit County (rural)
	Snohomish County (rural)
	Stanwood
	Sudden Valley
	Sumas
	Tacoma
	USA (Rest)
	Washington (East)
	Washington (West)
	Whatcom County (rural)
	Whidbey Island, Oak Harbor

Can you show me on this map where you live?

Option	Description
1-27, 60	Custom aggregate Transportation Analysis Zones (TAZ) in Whatcom County excluding Pt. Roberts
28-58, 61	Custom aggregate TAZs in Lower Mainland British Columbia

59	Pt. Roberts TAZ

Destination location and TAZ

Where are you headed to on your current trip?

Option- North of Border	Option- South of Border
Same as Residence location options	*Same as Residence location options*

Can you show me on this map where you are going?

Option- North of Border	Option- South of Border
Same as Residence TAZ options	*Same as Residence TAZ options*

Origin location and TAZ

Where are you coming from on your current trip?

Option- North of Border	Option- South of Border
Same as Residence location options	*Same as Residence location options*

Can you show me on this map where you are coming from?

Option- North of Border	Option- South of Border
Same as Residence TAZ options	*Same as Residence TAZ options*

Length of stay (across the border from residence)

How long are you planning to be / have you been across the border?

Option	Description
Real number	Amount of time in hours spent across the border from residence

Main trip purpose

What is / was the primary purpose of your cross-border trip?

Option	Description
Airport	-
Business	Relating to employment, but not work commute
Doctor/Dentist	Healthcare related
Family Visit	-
Mail	Picking up a parcel or checking a mail/P.O. box
Other	Purposes that cannot be fit into the pre-defined categories
Purchase Gas	When gas purchasing takes precedent over other purposes as the main reason for crossing the border
Recreation	Recreational event lasting up to 48 hours

Recreation/Vacation	Recreational event with an unknown duration
Religious Event	-
School	-
Shopping	All goods purchasing excluding gas
Vacation	Recreational or vacation event lasting 48 hours or longer
Work Commute	-

Frequency of cross-border travel
How often do you travel across the border?

Option	Description
Integer number	Frequency of cross-border travel in times per year

Why no NEXUS
Is there a reason why you do not have a NEXUS card?

Option
Application a hassle
Application in process
Card being renewed
Cost of card
Don't cross enough
Don't want to
Meaning to
Non-NEXUS passenger in vehicle
No reason/don't know
Not eligible
Other program flaw
Unfamiliar
Waiting for appointment
Other

Use of other documents
Do you ever use a document other than a passport to cross the border?

Option
Y
N

What documents? (if *Use of other documents* is "Y")

Options

NEXUS Card
Enhanced Driver's License
U.S. Passport Card
Global Entry Card
Permanent Resident Card
SENTRI Card
Non-Immigrant Visa
Indian Status Card
Other

Household NEXUS (if *What documents* is "NEXUS Card" or if *Inspection booth/lane type* is "NEXUS")

Is your entire household enrolled in NEXUS?

Option
Y
N

Enhanced Driver's License

Do you have an Enhanced Driver's License (EDL)? (If no) Any reason why not?

Option
Yes- I have an EDL
No- have passport
No- have NEXUS
No- hassle
No- no reason
No- I plan to get one
No- price
No- privacy concern
No- unfamiliar
No- other reason

Border Wait Time (BWT) signs

Do you factor in the border wait-time signs when choosing a border crossing?

Option
Y
N
Sometimes

(If "N") Any reason why not?

Options

Options
Have NEXUS
Directions sent me here
Don't know
Don't think they are accurate
Prefer a specific crossing
Road came here
Other

Do you feel that the border wait-time signs give accurate information?

Option
Y
N
Sometimes
Not Sure

BWT sources of information

What sources (if any) do you use to look up border wait-time information?

Option
None
Website - Government
Website - Other
App - Government
App - Other
Border wait-time signs
Radio
Other

Does this factor into your choosing one border crossing over another?

Option
Y
N

Routing/direction technology sources

Are you using a routing app or in-vehicle navigation to cross the border <u>today</u>?

Option
Y
N

Which one?

Option
In-vehicle navigation
App- Google Maps
App- Waze
App- Apple Maps
App- Bing Maps
App- Other
Detached GPS Device

Thank You.

2018 IMTC Bus Survey Report

August 2018

The Border Policy Research Institute (BPRI) at Western Washington University (WWU) and the Whatcom Council of Governments (WCOG)

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I. Introduction

The 2018 IMTC Bus Survey is an evaluation of commercial passenger traffic northbound and southbound through the Pacific Highway port-of-entry (POE) on the British Columbia-Washington border. The project was carried out in partnership by the Whatcom Council of Governments (WCOG) and the Border Policy Research Institute (BPRI) in the summer of 2018 with the cooperation of U.S. Customs and Border Protection (US CBP) and the Canada Border Services Agency (CBSA).

The project is a component of the 2018 IMTC Passenger Vehicle Survey and refreshes baseline data collected in a 2013 bus survey of similar scope. Analyses in this report include measurements of border processing rates, vehicle type data, origin-destination patterns, bus carrier characteristics, passenger characteristics, and more. An Access Database of all collected data is available through WCOG.

Bus Data collection

Methods

Bus and passenger data were recorded throughout the entire inspection process – from bus arrival at the border to bus departure from the inspection facility. Data points were gathered through observation of the buses themselves, by interviewing the bus drivers, and by interviewing passengers after they cleared inspection. Only the buses that underwent inspection were recorded. Field surveyors were assigned to one of four roles to ensure that all aspects of the inspection process were recorded. A complete copy of the four survey components used is available in the Annex.

Dates, hours, directions

The bus survey was conducted during four consecutive days in the last week of July 2018. Surveys were conducted on buses going into Canada and into the U.S. on one weekday and one weekend day each. Unlike the 2013 survey which only collected data on the weekend, weekdays were included in 2018 to more accurately reflect general bus travel.

Survey schedule

Direction	Day	Date	Hours
Northbound	Friday	July 27, 2018	7:30AM-8:30PM
	Sunday	July 29, 2018	8:00AM-9:00PM
Southbound	Thursday	July 26, 2018	9:30AM-8:00PM
	Saturday	July 28, 2018	8:00AM-9:00PM

Count of buses and passengers surveyed

Direction	Total recorded bus traffic	Passengers that were interviewed
Northbound	85	270
Southbound	59	187
Total	144	457

The survey recorded 144 buses transiting the border. Passengers from 92 buses were interviewed, totaling 457 passengers, or about 15.4 percent of the total occupancy of all buses inspected at the border during the four survey dates. Note that complete surveys do not exist for every bus and passenger approached due to time limitations, language barriers, and other variables.

II. Bus processing

How long does it take buses to cross the border?

The table below summarizes the duration of buses' time at the border – from their first full stop at the border, whether at inspection or in the queue, to their departure from the inspection area. The only notable difference between the 2018 and 2013 data is that the shortest southbound wait was 14 minutes longer in 2018.

Total border wait time

Direction	Average (hr:min)	Longest (hr:min)	Shortest (hr:min)
Northbound	0:21	0:56	0:02
Southbound	0:53	2:55	0:18

Often buses had to wait for entry into the plaza before beginning inspection when traveling southbound. As a bus would wait, a queue sometimes formed behind it, especially during peak hours of bus travel.

How long does the inspection process take?

The tables below summarize duration of buses' time in the inspection area, from their first full stop where passengers could disembark to departing the facility. Survey records are grouped and summarized below by the contents they unloaded at inspection – luggage and passengers, just passengers, or neither.

Northbound inspection duration

Contents unloaded	# of buses	%	Average (min)	Longest (min)	Shortest (min)
Luggage & Passengers	54	81.82%	25	56	2
Passengers Only	8	12.12%	16	25	9
Neither	4	6.06%	7	10	5

Southbound inspection duration[1]

Contents unloaded	# of buses	%	Average (min)	Longest (min)	Shortest (min)
Luggage & Passengers	44	97.78	43	167	18
Passengers Only	1	2.22%	25	25	25
Neither	0	0%	N/A	N/A	N/A

Whereas in 2013, 18 percent of southbound buses were permitted to pass without luggage being unloaded, in 2018 only one bus (two percent of surveyed southbound buses) was given this same privilege. This could be a surveyor error. The vast majority of buses were required to unload both passengers and luggage. Inspection durations were on average 9 minutes longer than they were in 2013.

How do already-full staging areas affect processing time?

As each bus arrived at the inspection area, it was recorded whether the inspection staging area was already full, meaning buses already occupied the area parallel to the inspection buildings. Some buses and vehicles, presumably empty of passengers, were allowed to bypass the inspection area.

The following tables compare the border inspection times for buses arriving when the staging area was full versus when it was not full. Times are recorded from when a bus first comes to a full stop (at inspection or in the queue) to when they depart the inspection area.

The staging area being full does not seem to impact waits in the northbound direction. This stands in contrast to the 2013 survey data, where this factor consistently altered wait times in both directions. There is still a substantial increase in wait time when traveling southbound, with wait times being 85 percent longer on average when the staging area is full. Note that the southbound inspection area has a round plaza that allows passengers to disembark while another bus is being inspected. The northbound inspection area has no plaza between the inspection facility and the highway approach.

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[1] Note that during periods of high bus traffic going southbound, queues sometimes formed within the CPB inspection plaza, where some buses would come to a full stop and wait till the inspection staging area emptied in order to unload passengers near the inspection building.

Border wait when staging area is full

2018

Direction	Average (min)	Longest (min)	Shortest (min)
Northbound	21	53	4
Southbound	65	175	22

2013

Direction	Average (min)	Longest (min)	Shortest (min)
Northbound	29	93	6
Southbound	85	190	18

Border wait when staging area is NOT full

2018

Direction	Average (min)	Longest (min)	Shortest (min)
Northbound	22	56	2
Southbound	35	53	18

2013

Direction	Average (min)	Longest (min)	Shortest (min)
Northbound	18	49	3
Southbound	31	85	4

What is the mix of bus carrier types crossing the border?

Buses were categorized into two groups during surveys. The first group, common carriers, are buses that offer a regularly scheduled service carrying passengers on set routes. The second group, private charters, are buses hired by groups, where passengers are either members of one group occupying the entire vehicle or passengers are of a specific market, such as cruise ship charters or language-specific tours. Some bus carriers provide both services. It's important to note that the survey did not collect carrier type data on the buses that bypassed the inspection area.

In 2013, about two-thirds of the buses surveyed while traveling southbound were chartered. The balance shifted in the 2018 survey, but the sample size may not be large enough to claim significance.

Common carrier vs private charter
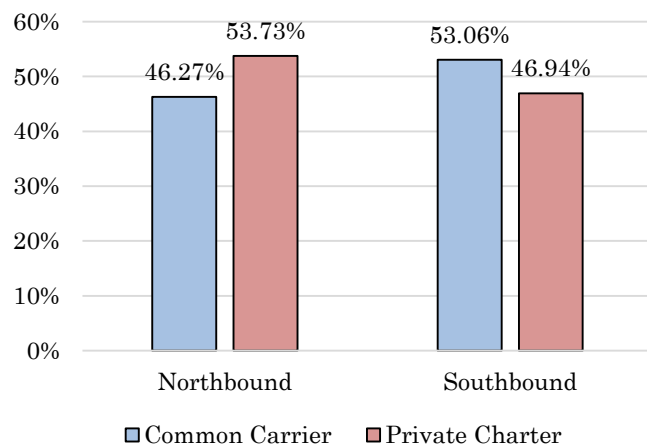
Carrier type counts

Direction	Common Carrier	Private Charter
Northbound	31	36
Southbound	26	23

Carrier type %	*49.14%*	*50.86%*

What types of commercial passenger vehicles cross the border?

In addition to buses, vehicles observed crossing the border included vans, small buses or shuttles, limousines, and minivans. The latter two are categorized below as cars. In 2018, 17 percent of southbound vehicles were small buses/shuttles and only 4 percent were vans. This contrasts with 2013 data, when it was observed that only 4 percent of southbound vehicles were small buses/shuttles and 18 percent were vans.

Vehicle types
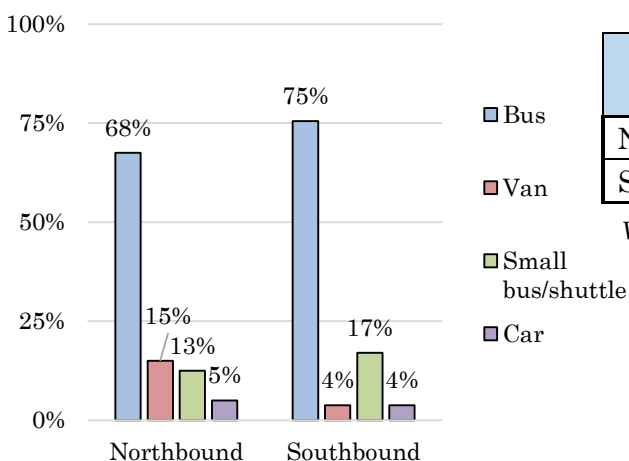
Vehicle type counts

Direction	Bus	Car	Small bus/shuttle	Van
Northbound	54	4	10	12
Southbound	40	2	9	2

|				
Vehicle type %	*70.7%*	*4.5%*	*14.3%*	*10.5%*

What are passengers' destinations?

Passengers were asked where they were ultimately headed on their cross-border trip. For passengers crossing northbound, top-of-mind answers were overwhelmingly Vancouver, BC and Alaska. A few survey respondents traveling northbound claimed to be traveling to southbound destinations and vice versa. It is possible that these bus passengers were flying out of Vancouver International Airport (YVR) or were taking a roundabout route. Compared to 2013, far fewer respondents said they were traveling to Vancouver.
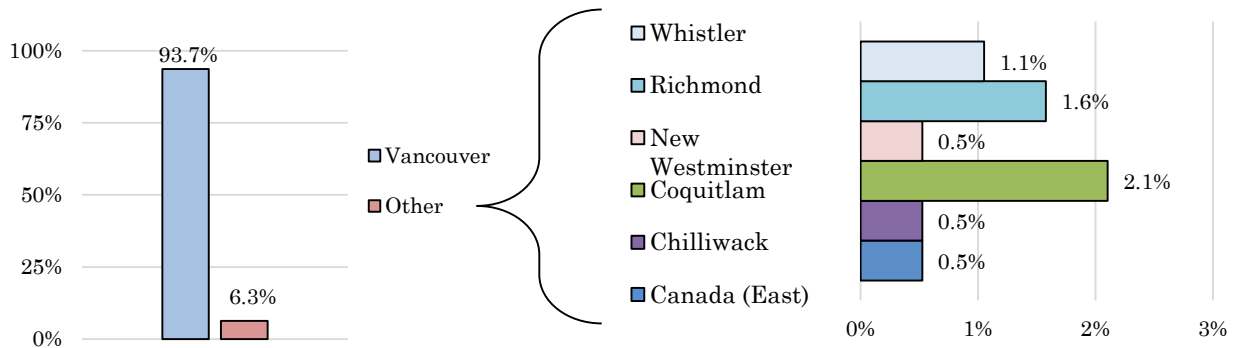
Note that in 2013, top-of-mind answers were given to the question "What is your destination?", whereas in 2018 respondents were asked their bus drop-off location and ultimate trip destination separately.

### Northbound destinations[2]

2018
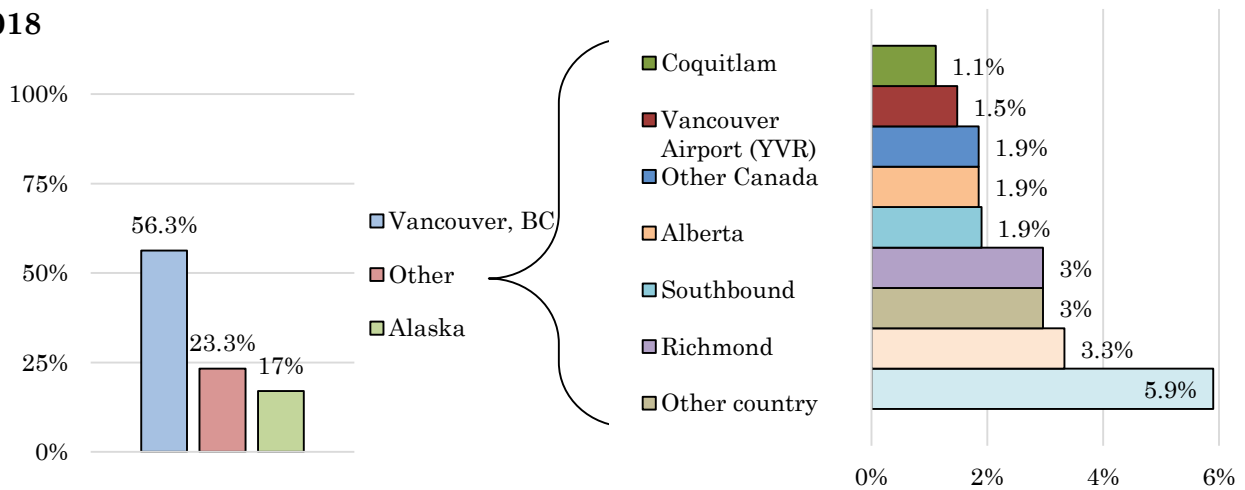
2013

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[2] During one survey day in 2018, a large number of charter buses headed to the Vancouver Cruise Terminal for a cruise to Alaska came through the port. This is likely the reason why Alaska was a more popular destination in 2018 than in 2013.
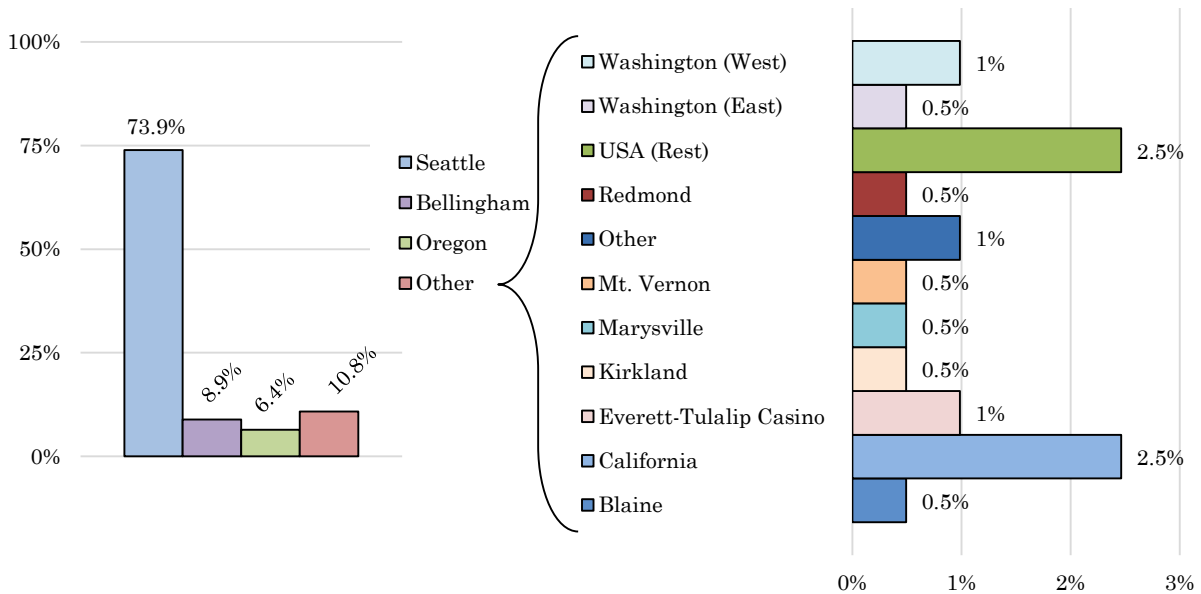
Southbound destinations

About half of southbound passengers said they were going to Seattle with others mainly traveling to Bellingham, Oregon, or California. Again, a few respondents claimed to be traveling to a northbound destination despite traveling southbound. Compared to 2013, fewer respondents said they were traveling to Seattle.
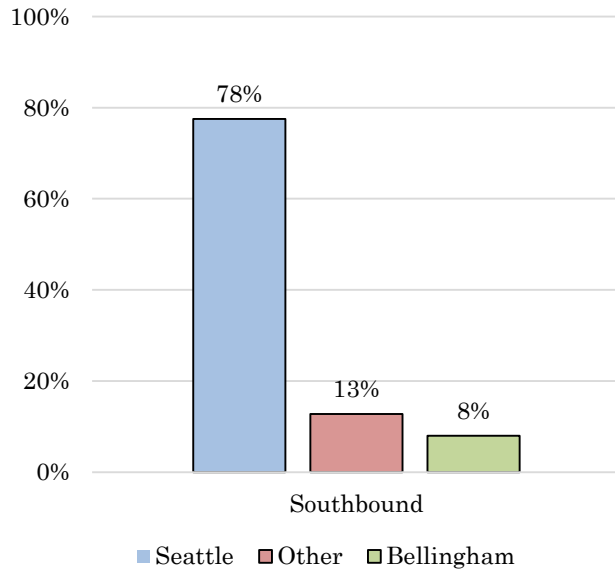
2018
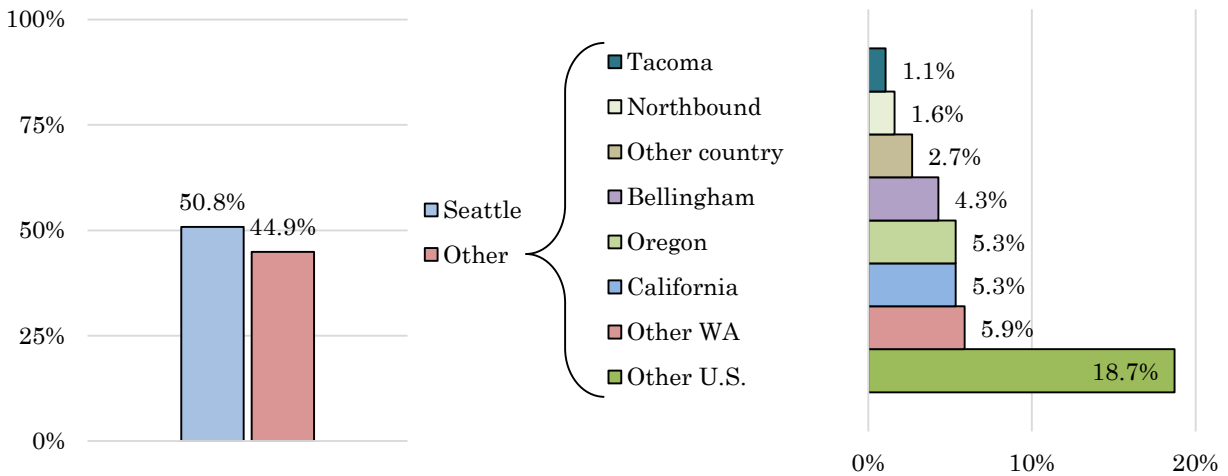
2013

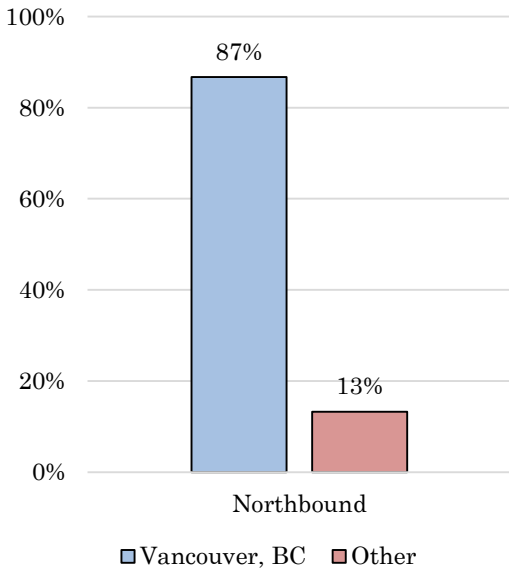## Passenger drop-off locations

Passengers were also asked where they planned to get dropped off from the bus as opposed to where they were ultimately traveling to on their cross-border trip. These answers were overwhelmingly Vancouver and Seattle.
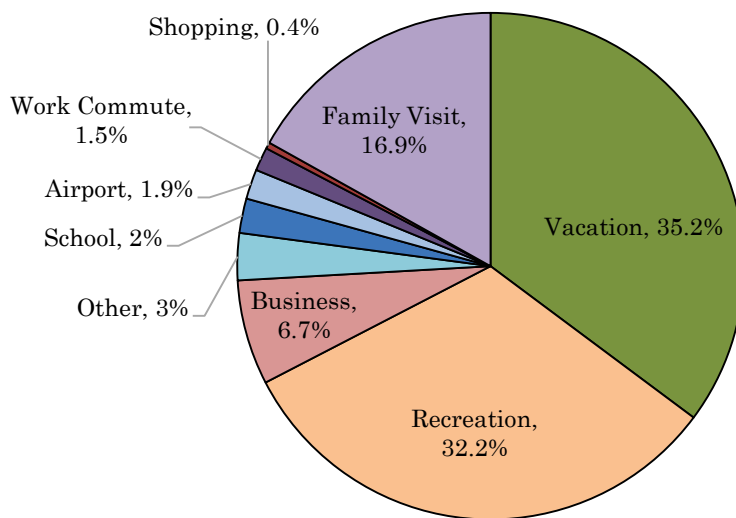
What are the trip purposes for passengers?

Answers to the question, "What is the purpose of your cross-border trip?" were grouped into pre-defined categories. During the survey Recreation/Vacation was a single category. Recreation and Vacation were later segregated, with Vacation being any Recreation/Vacation trip lasting longer than two days and Recreation being shorter. Fewer people traveled for vacation in 2018 than 2013, but more crossed for recreation.

The first graph is all data for one direction and the three following graphs include data in one direction broken out by the passenger's country of residence.

Northbound trip purposes

Shopping, 0.4%
Work Commute, 1.5%
Airport, 1.9%
School, 2%
Other, 3%
Family Visit, 16.9%
Vacation, 35.2%
Business, 6.7%
Recreation, 32.2%

Legend:
- Airport
- Business
- Doctor/Dentist
- Family Visit
- Other
- Recreation
- School
- Shopping
- Vacation
- Work Commute

Canada

5% 2% 3%
21%
47%
6%
17%

N = 66

USA

1% 1% 11%
32%
17%
3%
3%
33%

N = 149

Other country

4% 10%
30%
2%
4%
50%

N = 50

Southbound trip purposes

Doctor/Dentist, 0.5%
Shopping, 1.6%
Family Visit, 15.8%
Work Commute, 1.5%
Airport, 2.7%
School, 6.5%
Other, 2.2%
Business, 2.2%
Vacation, 41.3%
Recreation, 26.1%

Legend:
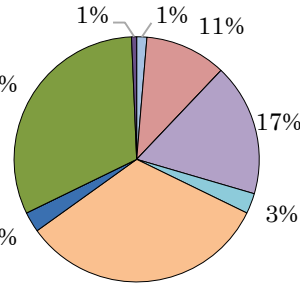- Airport
- Business
- Doctor/Dentist
- Family Visit
- Other
- Recreation
- School
- Shopping
- Vacation
- Work Commute

Canada

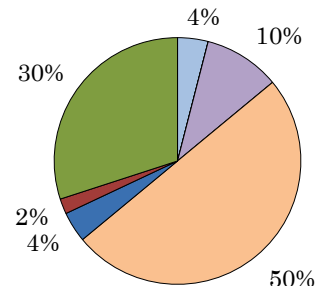2%, 37%, 31%, 2%, 3%, 25%

N = 59

USA

3% 4% 5%, 14%, 47%, 3%, 21%, 3%

N = 76

Other country

4% 2%, 38%, 35%, 2%, 19%

N = 48
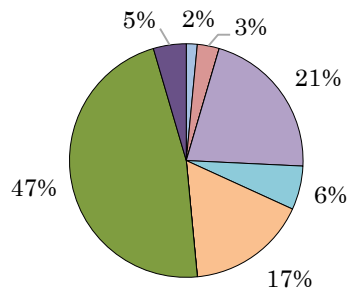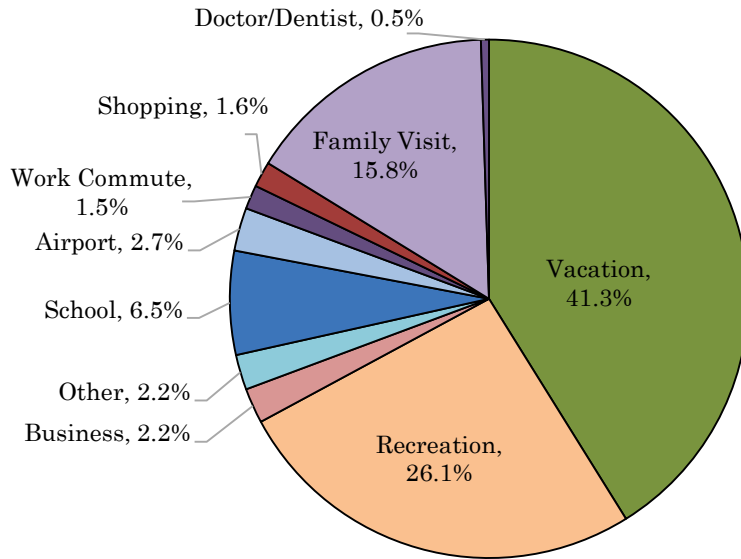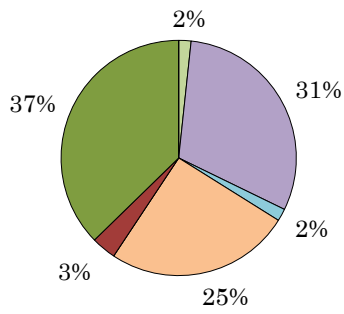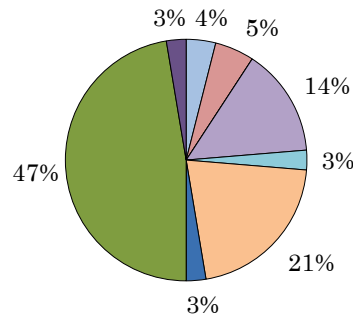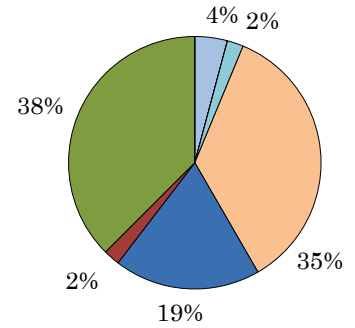
Data used to answer the following questions came from bus driver responses to questions about their current routes.

How many buses planned on all passengers disembarking at their next stop after the border?

Direction	No	Yes
Northbound	44.9%	55.1%
Southbound	56.8%	43.2%

How many buses planned on picking up more passengers before their final stop?

Direction	No	Yes
Northbound	100.0%	0.0%
Southbound	47.6%	52.4%

What locations were listed as the *most recent stops* before coming to the border? Northbound last stops before coming to border (bus count)
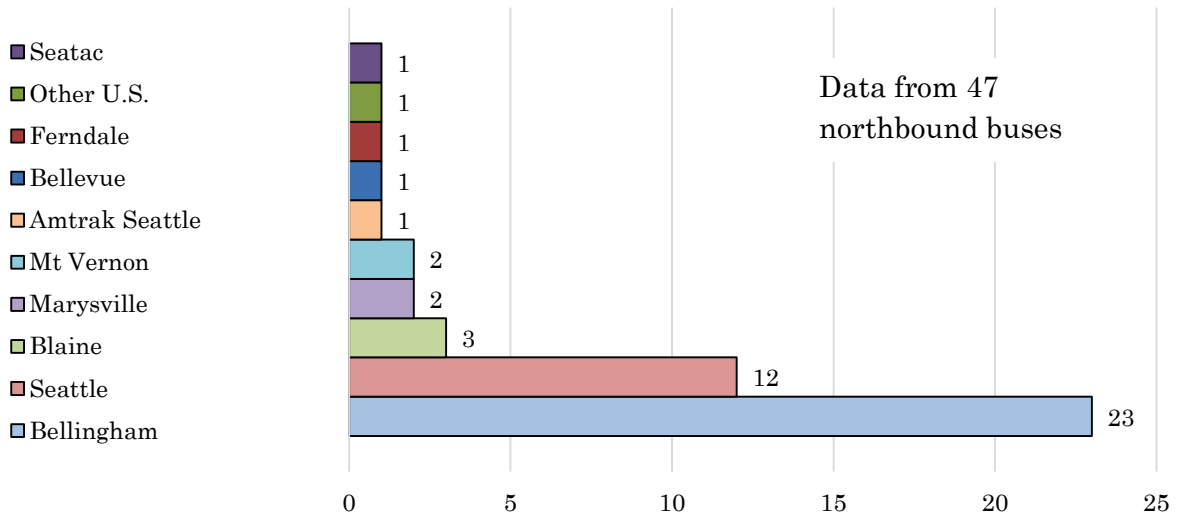
Data from 47 northbound buses

Location	Bus count
Seatac	1
Other U.S.	1
Ferndale	1
Bellevue	1
Amtrak Seattle	1
Mt Vernon	2
Marysville	2
Blaine	3
Seattle	12
Bellingham	23

Southbound last stops before coming to border (bus count)

Data from 39 southbound buses

Location	Bus count
White Rock	1
Vancouver Airport (YVR)	1
Pacific Inn	1
Coquitlam	3
Campbell River Store	3
Surrey	4
Richmond	4
Vancouver, BC	22
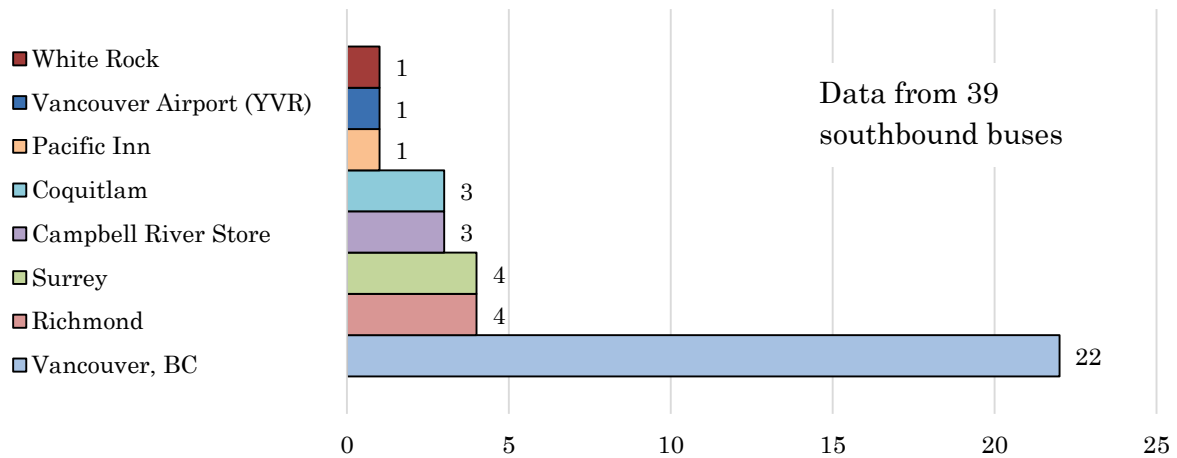
What locations were listed as the *very next stops* after the border?

Northbound next stops after crossing to border (bus count)
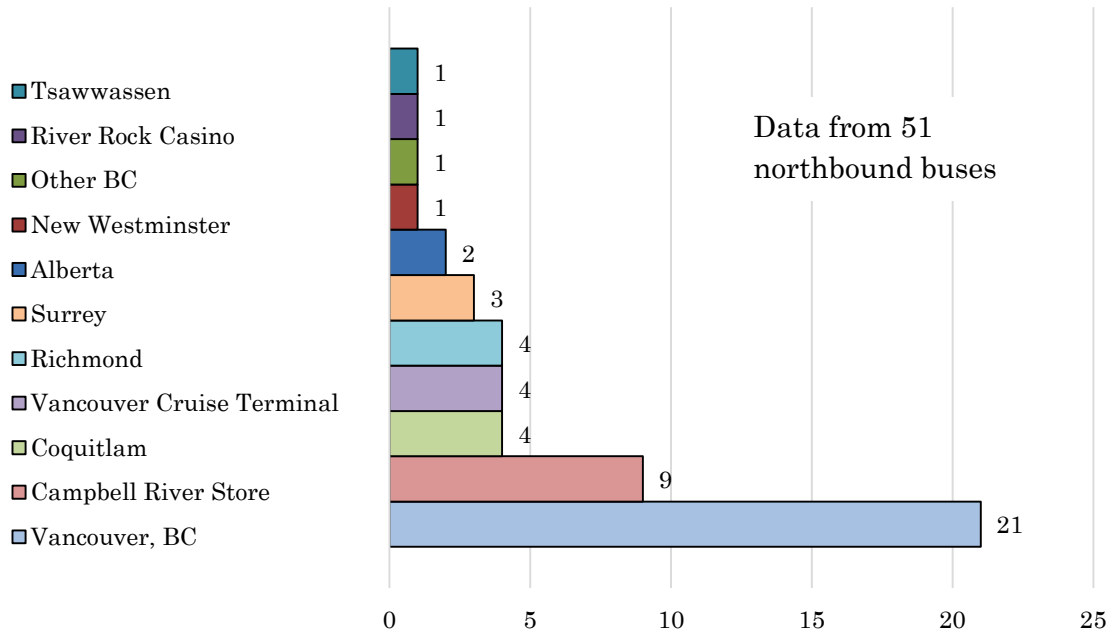
Data from 51 northbound buses

Location	Count
Tsawwassen	1
River Rock Casino	1
Other BC	1
New Westminster	1
Alberta	2
Surrey	3
Richmond	4
Vancouver Cruise Terminal	4
Coquitlam	4
Campbell River Store	9
Vancouver, BC	21

Southbound next stops after crossing to border (bus count)

Data from 39 southbound buses

Location	Count
Tulalip	1
Marysville	1
Leavenworth	1
Cruise Terminal	1
Seatac	3
Seattle	16
Bellingham	16
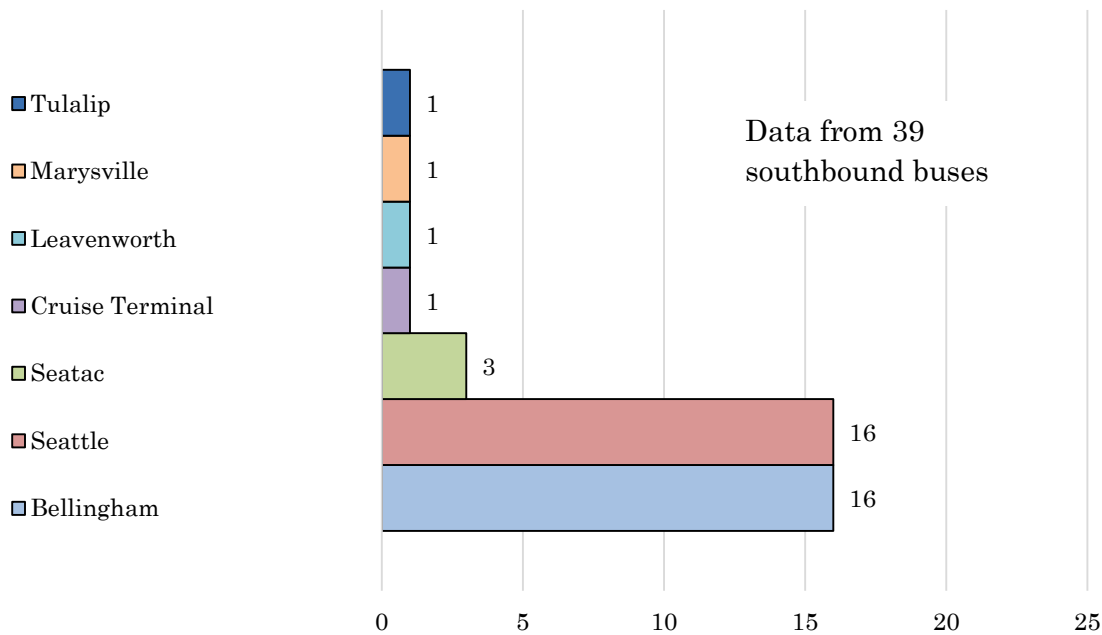
III. Passenger processing

How long does it take to process each passenger?

It was recorded how long passengers were off their bus for inspection. This length of time was divided by the number of passengers for the bus, resulting in an estimated length of time it takes to process each passenger.

Processing time per passenger (min:sec)

2018

Direction	Average	Longest	Shortest
Northbound	0:31	1:38	0:03
Southbound	0:56	2:44	0:08

2013

Direction	Average	Longest	Shortest
Northbound	0:53	12:17	0:10
Southbound	1:10	6:00	0:09

Compared to 2013, processing times in 2018 were faster in both directions. The lengthiest processing times per passenger in 2013 were due to buses with low passenger counts. Note that the southbound inspection plaza at Pacific Highway POE allows for more opportunities for buses to unload passengers before reaching the inspection facility than northbound. This may inflate the southbound processing-time-per-passenger if unloaded passengers from multiple buses are going through inspection.

What is the average capacity per bus?

Data was taken from carrier information displayed on sides of vehicles or from drivers. The maximum capacity for both types of carriers in both directions was 56. In 2013, buses with an 84-person capacity were recorded traversing the border, but no such buses were encountered in 2018.

Bus capacity
Common Carrier

Direction	Average	Median	Highest	# of Buses
Northbound	53	56	56	29
Southbound	54	56	56	26

Charter

Direction	Average	Median	Highest	# of Buses
Northbound	36	36	56	29
Southbound	40	54	56	23

What is the average number of passengers per bus, not counting empty buses?
Passengers per bus

Common Carrier

Direction	Average	Median	Highest
Northbound	36	36	55
Southbound	34	34	55

Charter

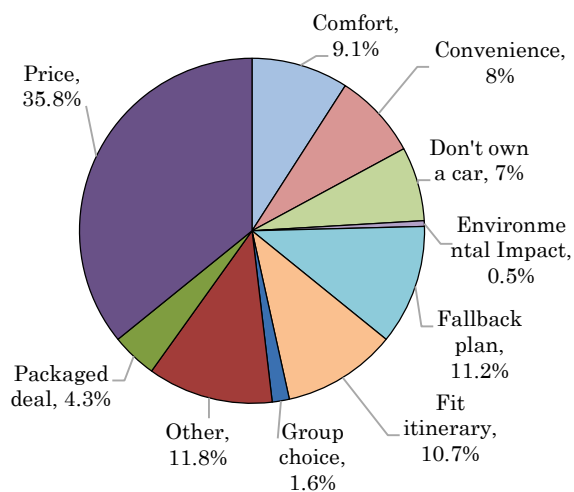| Direction	Average	Median	Highest
Northbound	26	22	54
Southbound	28	24	54

Why do people choose to use the bus?

Passenger responses were grouped into predefined categories. Many of the Northbound Charter passengers chose the bus because it was included in their cruise package. In 2018, Convenience was added as a category after a number of survey respondents named it as their reason for using the bus. In the 2013 survey, these responses may have been categorized as Fit Itinerary, Other, or Comfort. The 2013 survey also included the Destination category (which was folded into Fit Itinerary for 2018) and Amtrak Charter, which was not a response received in 2018.

The 2018 responses were segregated by carrier type, because group choice and the inclusion of bus tickets in a package with other services is unusually high for respondents traveling on charter buses. Responses from 2013 are most consistent with Common Carrier responses in 2018.

2018 Common Carrier

Northbound bus choices

Comfort, 9.1%
Convenience, 8%
Price, 35.8%
Don't own a car, 7%
Environmental Impact, 0.5%
Fallback plan, 11.2%
Fit itinerary, 10.7%
Group choice, 1.6%
Other, 11.8%
Packaged deal, 4.3%

Southbound bus choices

Comfort, 7%
Convenience, 4.7%
Price, 45.7%
Don't own a car, 7.8%
Fallback plan, 9.3%
Fit itinerary…
Group choice, 1.6%
Other, 10.9%
Packaged deal,…
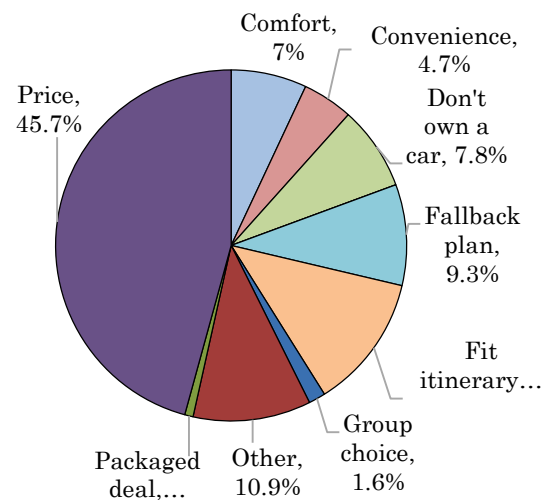
2018 Charter

Northbound bus choices

Comfort, 1.8%
Convenience, 7%
Price, 5.3%
Fit itinerary, 1.8%
Group choice, 15.8%
Other, 7%
Packaged deal, 61.4%

Southbound bus choices

Price, 11.1%
Comfort, 8.9%
Convenience, 4.4%
Don't own a car, 4.4%
Fallback plan, 2.2%
Fit itinerary, 6.7%
Packaged deal, 26.7%
Group choice, 24.4%
Other, 11.1%
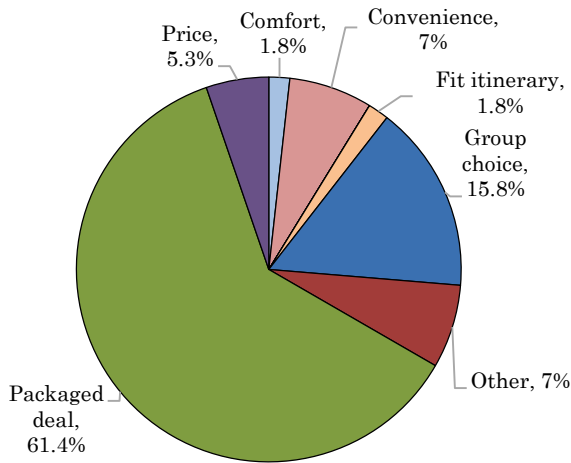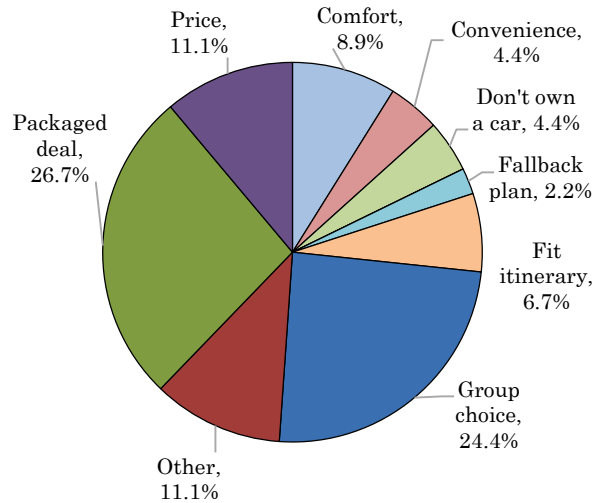
2013 Charter and Common Carrier[3]

Northbound

Other 8%
Comfort 8%
Don't own a car 7%
Group choice 6%
Packaged 5%
Fit itinerary 20%
Fallback 4%
Amtrak charter 2%
Destination 1%
Price 38%
Carbon footprint 1%

Southbound

Other 15%
Comfort 9%
Don't own a car 6%
Group choice 5%
Packaged 10%
Fit itinerary 11%
Fallback 2%
Amtrak charter 2%
Destination 3%
Price 36%
Carbon footprint 1%

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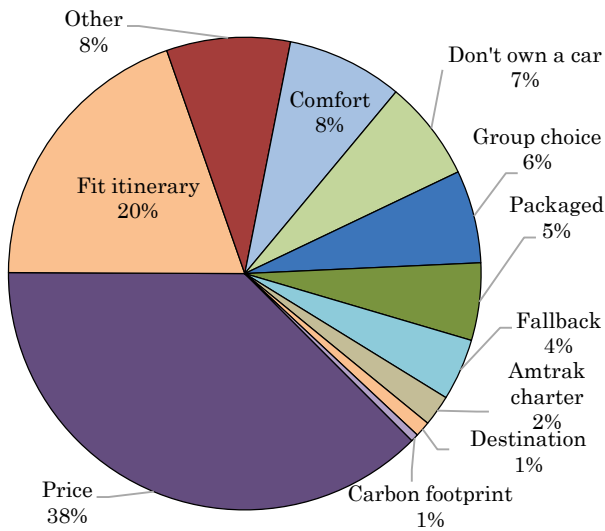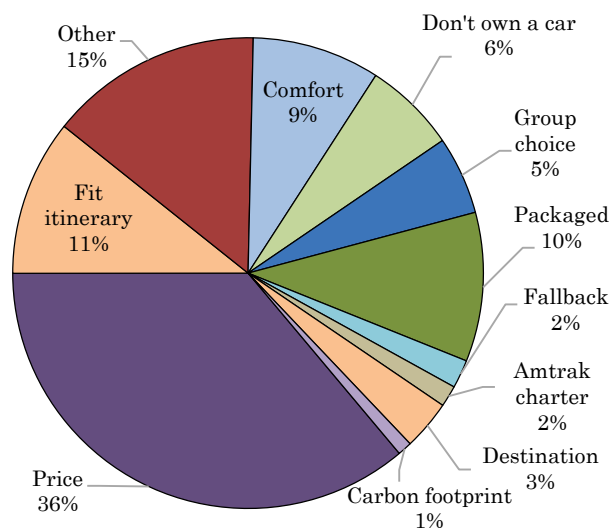
[3] Destination has been assigned the same color as Fit Itinerary to reflect that they were combined in 2018.

Where do the passengers reside?

Northbound-passenger residences*

Residence Location	Count	%
Other U.S.	71	26.8%
Other country	50	18.9%
Vancouver, BC	42	15.8%
Seattle	34	12.8%
California	15	5.7%
Other WA	15	5.7%
Bellingham	8	3%
Other BC	8	3%
Other Canada	4	1.5%
Richmond	4	1.5%
Coquitlam	3	1.1%
Oregon	3	1.1%
Burnaby	2	0.8%
Alberta	1	0.4%
Burlington	1	0.4%
Everett	1	0.4%
Langley	1	0.4%
Tacoma	1	0.4%
Whistler	1	0.4%
TOTAL	265	

Southbound-passenger residences*

Residence Location	Count	%
Other country	48	25.9%
Other U.S.	45	24.3%
Vancouver, BC	39	21.1%
Seattle	19	10.3%
Other BC	8	4.3%
Coquitlam	5	2.7%
California	4	2.2%
Other WA	4	2.2%
Bellingham	3	1.6%
Burnaby	3	1.6%
Oregon	3	1.6%
Other Canada	3	1.6%
Alberta	1	0.5%
TOTAL	185	

Country of Residence	Count	%
USA	149	55.2%
Canada	66	24.4%
Other country	55	20.4%
TOTAL	270	

Country of Residence	Count	%
USA	79	42.2%
Canada	59	31.6%
Other country	49	26.2%
TOTAL	187	

*Note the geography of some of the location categories:

BC (other) = BC locations mentioned infrequently
Other Canada = Locations outside of BC and Alberta
Other WA = Washington locations mentioned infrequently
Other U.S. = Locations east of WA, OR, and CA
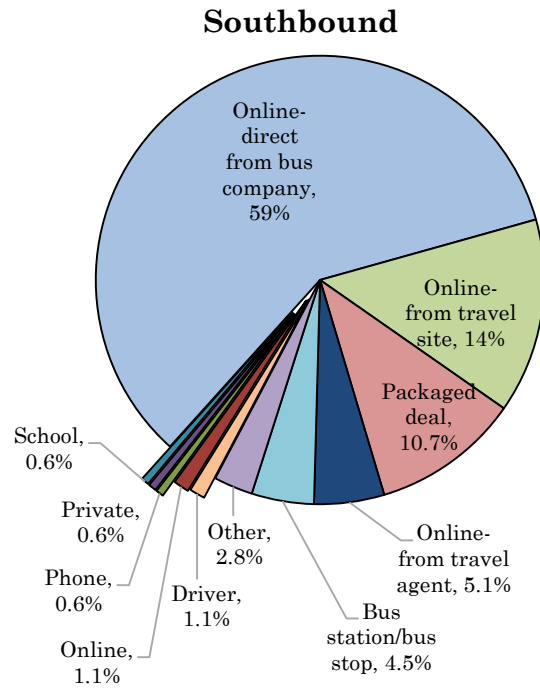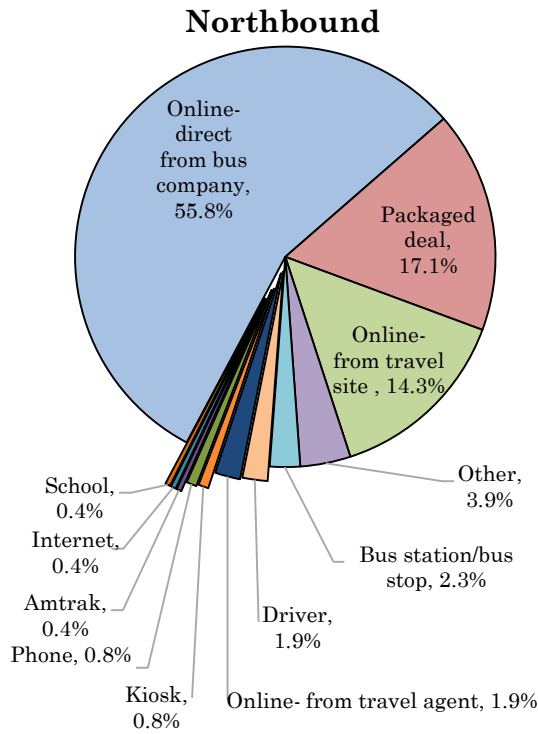Other country = Country besides the U.S. and Canada

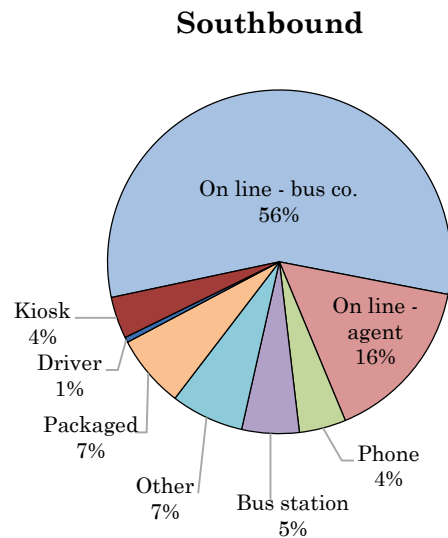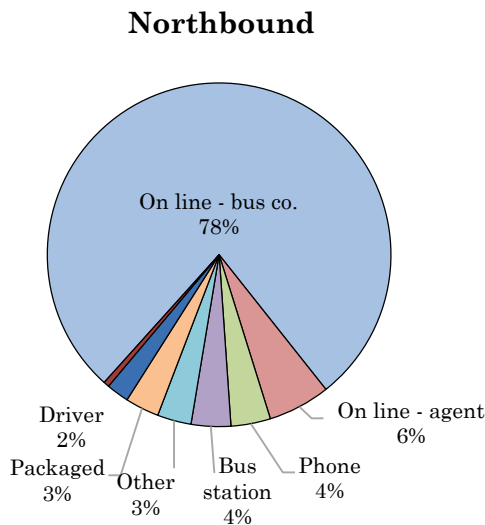These descriptions also apply to the destination graphs.

How do passengers buy their tickets?

The 2013 category *On line – bus co.* was split into *Online- direct form bus company* and *Online- from travel site* in 2018. Percentages remained approximately the same, with fewer travelers purchasing tickets through a travel agent and more receiving their tickets as part of a packaged deal with other services.

2018

Northbound

- Online- direct from bus company, 55.8%
- Packaged deal, 17.1%
- Online- from travel site , 14.3%
- Other, 3.9%
- Bus station/bus stop, 2.3%
- Driver, 1.9%
- Online- from travel agent, 1.9%
- Kiosk, 0.8%
- Phone, 0.8%
- Amtrak, 0.4%
- Internet, 0.4%
- School, 0.4%

Southbound

- Online- direct from bus company, 59%
- Online- from travel site, 14%
- Packaged deal, 10.7%
- Online- from travel agent, 5.1%
- Bus station/bus stop, 4.5%
- Driver, 1.1%
- Online, 1.1%
- Phone, 0.6%
- Private, 0.6%
- School, 0.6%
- Other, 2.8%

2013

Northbound

- On line - bus co. 78%
- On line - agent 6%
- Phone 4%
- Bus station 4%
- Other 3%
- Packaged 3%
- Driver 2%

Southbound

- On line - bus co. 56%
- On line - agent 16%
- Phone 4%
- Bus station 5%
- Other 7%
- Packaged 7%
- Driver 1%
- Kiosk 4%

In what size groups do passengers travel?

Those traveling in a group of "1" are traveling alone. Data does not include charter groups where the entire vehicle is occupied by one definable group. One outlier traveling northbound reported that they were traveling in a group of 30. This has been excluded from the data.

Northbound group sizes

Southbound group sizes
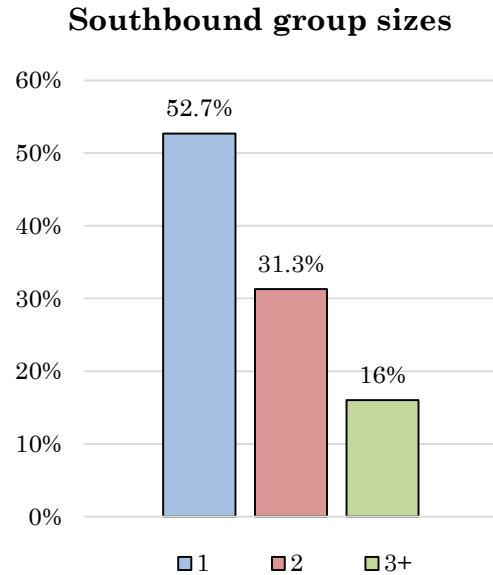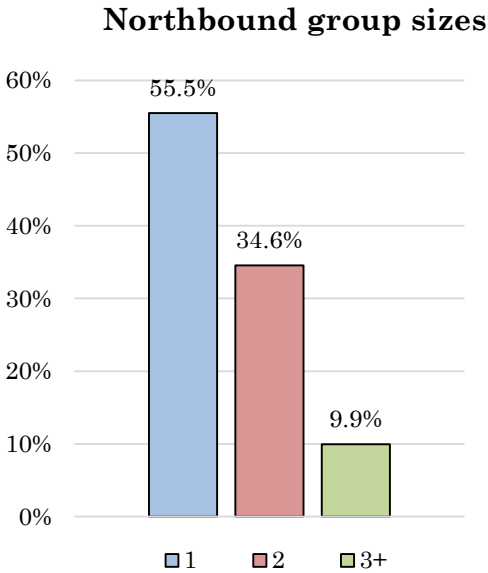
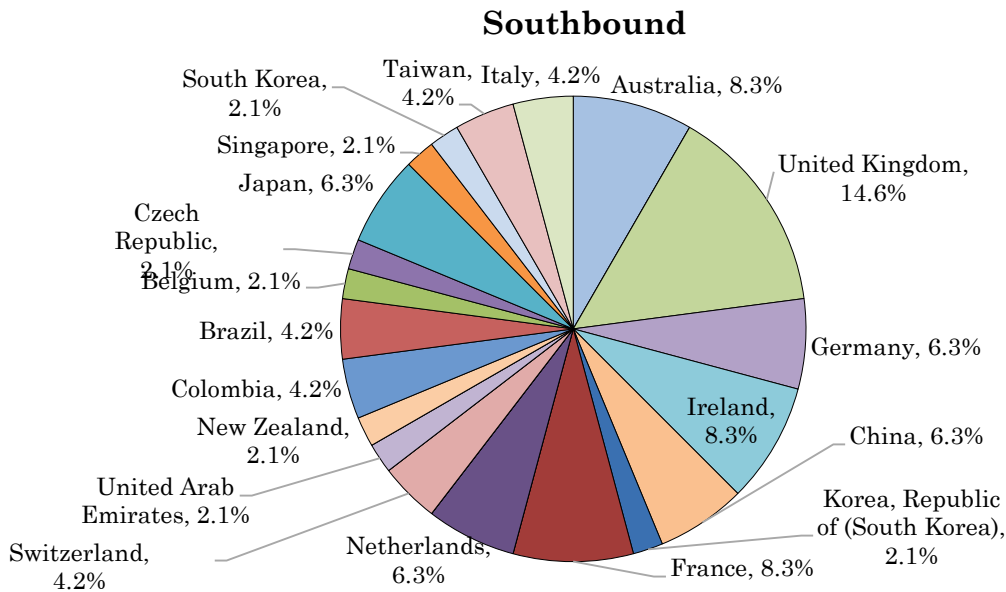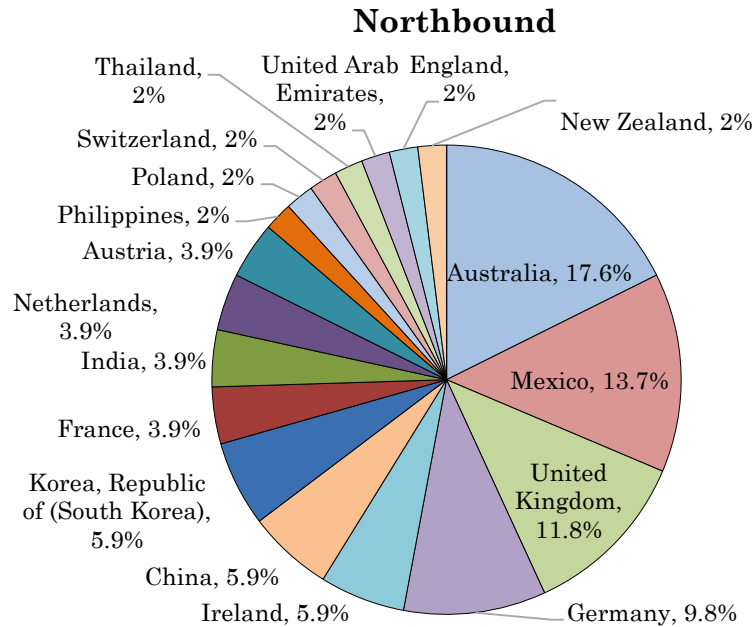**Where were passengers from besides the U.S. and Canada?**

The following charts show the countries of residence for respondents who were not from the U.S. and Canada. Surveyors did encounter language difficulties during the survey, which may have affected the sample.

Northbound

- Thailand, 2%
- United Arab Emirates, 2%
- England, 2%
- New Zealand, 2%
- Switzerland, 2%
- Poland, 2%
- Philippines, 2%
- Austria, 3.9%
- Netherlands, 3.9%
- India, 3.9%
- France, 3.9%
- Korea, Republic of (South Korea), 5.9%
- China, 5.9%
- Ireland, 5.9%
- Australia, 17.6%
- Mexico, 13.7%
- United Kingdom, 11.8%
- Germany, 9.8%

Southbound

- South Korea, 2.1%
- Taiwan, 4.2%
- Italy, 4.2%
- Australia, 8.3%
- Singapore, 2.1%
- Japan, 6.3%
- Czech Republic, 2.1%
- Belgium, 2.1%
- Brazil, 4.2%
- Colombia, 4.2%
- New Zealand, 2.1%
- United Arab Emirates, 2.1%
- Switzerland, 4.2%
- Netherlands, 6.3%
- France, 8.3%
- Korea, Republic of (South Korea), 2.1%
- China, 6.3%
- Ireland, 8.3%
- Germany, 6.3%
- United Kingdom, 14.6%

How did respondents cross the border in the other direction?

Bus passengers crossing the border for a temporarily visit were asked about the transportation mode they were using to cross the border on the other leg of their roundtrip.

Northbound

Train (Amtrak, Rocky Mountaineer), 7.4%

Walking/Biking, 0.4%

Airplane, 33.2%

Same bus company, 43.8%

Boat, 2%

Car, 4.3%

One-way trip, 2.7%

Other, 0.8%

Other private bus, 5.5%

Southbound

Train (Amtrak, Rocky Mountaineer), 7.1%

Airplane, 21.2%

Boat, 3.5%

Car, 4.7%

One-way trip, 2.4%

Other, 1.2%

Other private bus, 2.9%

Same bus company, 57.1%
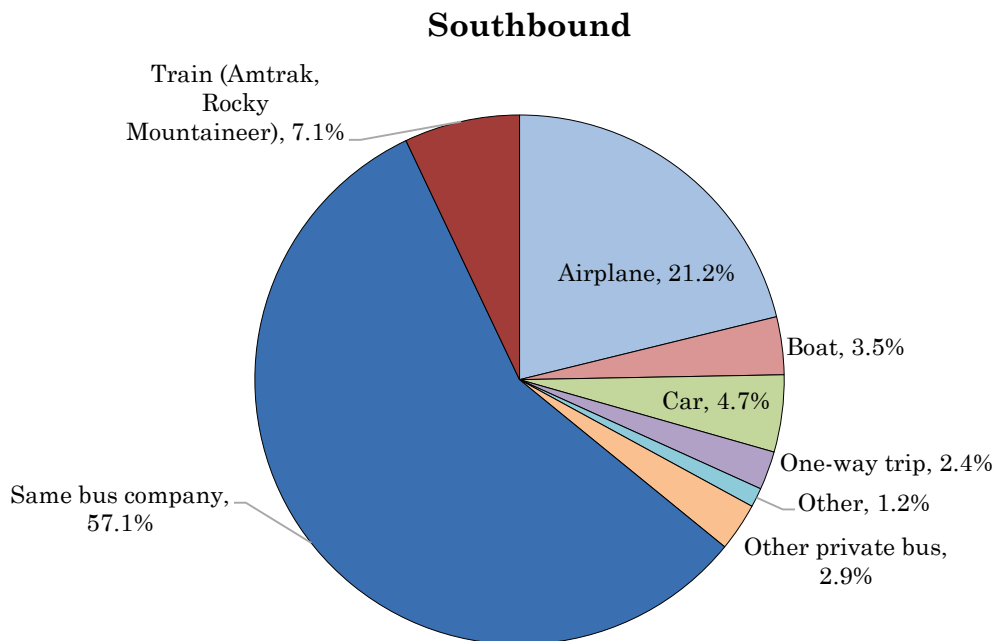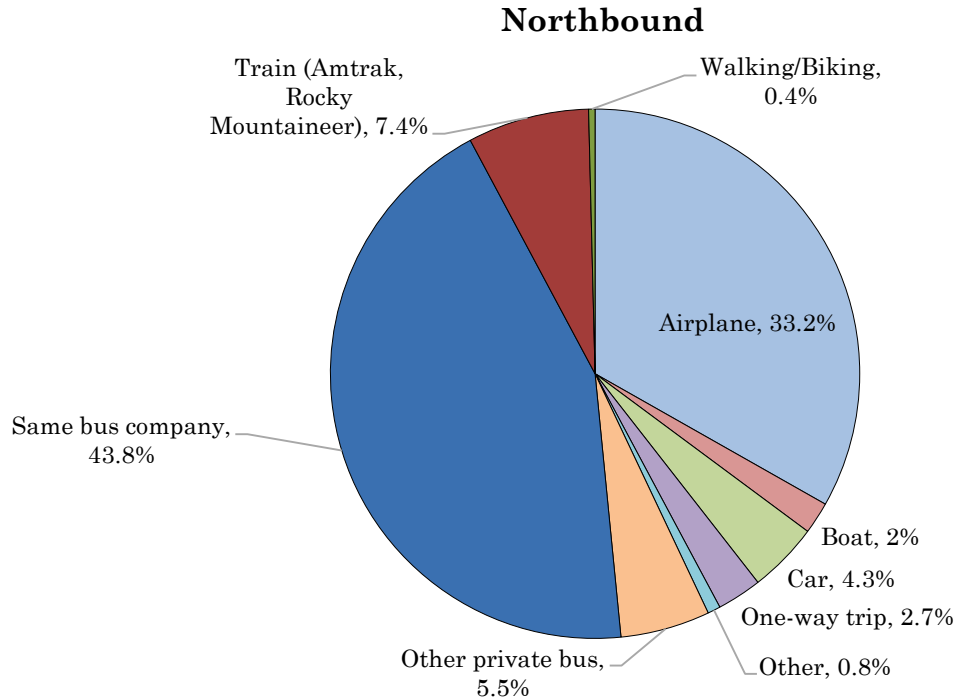
What mode of transportation did bus passengers plan to use once they disembarked the bus?
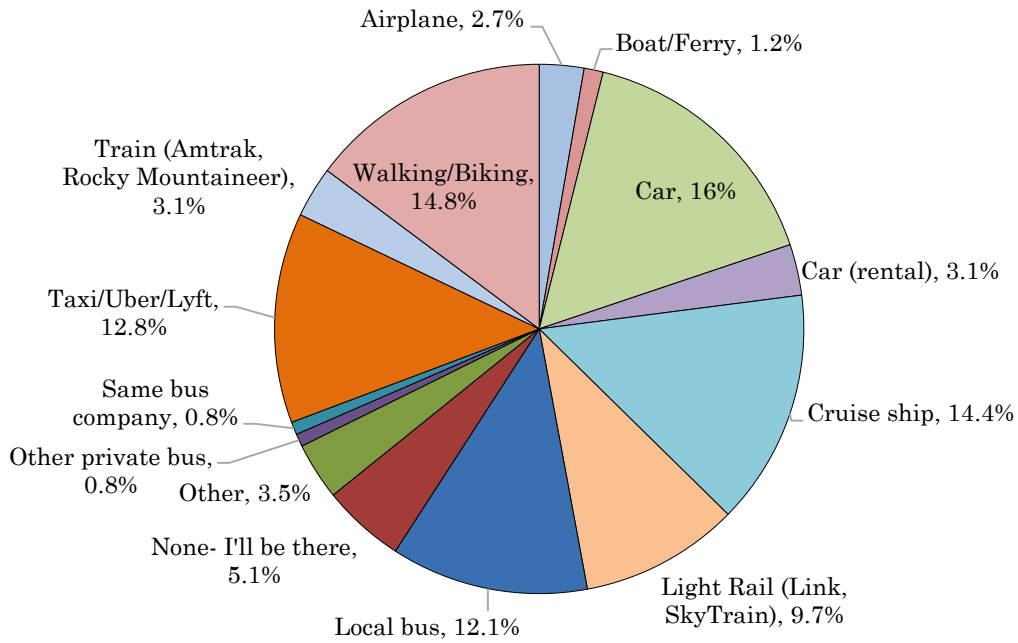
Northbound

Airplane, 2.7%
Boat/Ferry, 1.2%
Train (Amtrak, Rocky Mountaineer), 3.1%
Walking/Biking, 14.8%
Car, 16%
Car (rental), 3.1%
Taxi/Uber/Lyft, 12.8%
Cruise ship, 14.4%
Same bus company, 0.8%
Other private bus, 0.8%
Other, 3.5%
None- I'll be there, 5.1%
Light Rail (Link, SkyTrain), 9.7%
Local bus, 12.1%

Southbound

Train (Amtrak, Rocky Mountaineer), 0.6%
Walking/Biking, 14.7%
Airplane, 10%
Car, 25.3%
Taxi/Uber/Lyft, 18.2%
Same bus company, 3.5%
Car (rental), 3.5%
Other private bus, 1.8%
Cruise ship, 1.2%
Other, 0.6%
None- I'll be there, 0.6%
Light Rail (Link, SkyTrain), 7.6%
Local bus, 12.4%
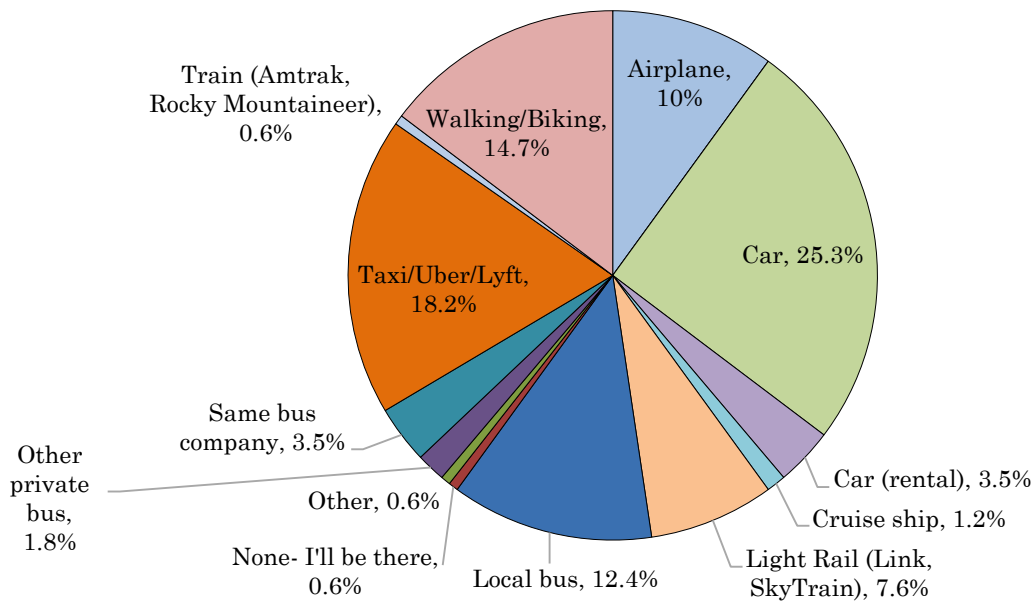
For more information...

Please direct any questions or comments regarding the 2018 IMTC Bus Survey to:

Jaymes McClain
Planner II
Whatcom Council of Governments
360-650-8391
jaymes@wcog.org

This report was created by:
Mary Moeller
Field Supervisor and Data Analyst Intern
Border Policy Research Institute
360-594-1346
mary.lynne.moeller@gmail.com

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Annex: The 2018 IMTC Bus Surveys

To more accurately observe buses at every stage of inspection, data collection in 2018 was split into four parts. Each of these parts was assigned to one or more persons. Most of the questions have a picklist with an optional short answer text box in case a response could not be fit into a category.

1) **Queue End Arrival**

Bus arrival at queue end: Arrival time
> *Timestamp*

License Plate #
> *Short answer (text)*

LP[4] State/Province
> *Pick list: all 50 U.S. states and D.C., all Canadian provinces, and UNKNOWN*

Carrier Name or other description
> *Long answer (text)*

2) **Inspection Arrival/Bus Info**

Bus ARRIVAL at inspection building/plaza: Arrival time
> *Timestamp*

Bus DEPARTURE from inspection area: Departure time
> *Timestamp*

License Plate #
> *Short answer (text)*

Bus ID #[5]
> *Integer*

---

[4] License plate.

[5] Assigned by surveyors as the bus entered the inspection area.

Is inspection area next to building already occupied by a bus?
> *Checkbox*

Vehicle Type
> *Picklist: Bus, Car, Mini van, RV, Small bus/shuttle, Van*

Carrier Name
> *Short answer (text)*

Carrier Base City
> *Short answer (text)*

Carrier Base State/Province
> *Pick list: all 50 U.S. states and D.C., all Canadian provinces, and UNKNOWN*

Seating Capacity
> *Integer*

Was luggage taken off the bus?
> *Yes/No*

Did passengers disembark the bus?
> *Yes/No*

All passengers off the bus: Disembark time
> *Timestamp*

All passengers on the bus: Board time
> *Timestamp*

Notes
> *Long answer (text)*

3) Driver Interview

Bus ID #
> *Integer*

Bus description
> *Short answer (text)*

Carrier type
> *Charter/Common Carrier/Other*

Bus seating capacity
> *Integer*

Passenger count
> *Integer*

Previous stop before border?
> *Picklist with common destinations in the B.C. Lower Mainland south of and including Vancouver and destinations in Washington north of and including Tacoma. Included Oregon, California, Other BC, Other Canada, and Other U.S.*

Next stop after border?
> *Picklist with common destinations in the B.C. Lower Mainland south of and including Vancouver and destinations in Washington north of and including Tacoma. Included Oregon, California, Other BC, Other Canada, and Other U.S.*

All passengers off there?
> *Yes/No/(x)*

In next stop the final stop?
> *Checkbox*

Last city bus will reach on this trip?
> *Picklist with common destinations in the B.C. Lower Mainland south of and including Vancouver and destinations in Washington north of and including Tacoma. Included Oregon, California, Other BC, Other Canada, and Other U.S.*

Any more passengers being picked up before the last stop?
> *Yes/No*

Will this bus make more cross-border trips today?
> *Yes/No*

How many more?
> *Integer*

Driver's remaining hours of service today
> *Integer*

Notes
> *Long answer (text)*

4) Passenger Survey

Bus ID #
> *Integer*

Are you traveling with anyone else today?
> *Yes/No*

Group size
> *Integer*

Where do you live?
> *Picklist with common destinations in the B.C. Lower Mainland south of and including Vancouver and destinations in Washington north of and including Tacoma. Included Oregon, California, Other BC, Other Canada, and Other U.S.*

Country of residence
> *Picklist with countries recognized by the United States and UNKNOWN.*

What is the purpose of your trip across the border?
> *Picklist: Airport, Business, Church, Doctor/Dentist, Family Visit, Mail, Other, Purchase Gas, Recreation/Vacation,[6]School, Shopping, Work Commute, (Type own answer)*

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[6] Recreation and Vacation were combined during the survey period, then separated later by duration of stay across the border.

Where are you getting off the bus?

> *Picklist with common destinations in the B.C. Lower Mainland south of and including Vancouver and destinations in Washington north of and including Tacoma. Included Oregon, California, Other BC, Other Canada, and Other U.S.*

When do you expect to get there?

> *Time, HR:MN:SC AM/PM*

Where are you ultimately traveling to?

> *Picklist with common destinations in the B.C. Lower Mainland south of and including Vancouver and destinations in Washington north of and including Tacoma. Included Oregon, California, Other BC, Other Canada, and Other U.S.*

Where did you get on the bus?

> *Picklist with common destinations in the B.C. Lower Mainland south of and including Vancouver and destinations in Washington north of and including Tacoma. Included Oregon, California, Other BC, Other Canada, and Other U.S.*

What time did you get on the bus?

> *Time, HR:MN:SC AM/PM*

Why are you using the bus for this trip?

> *Picklist: Comfort, Cruise, Destination, Don't own a car, Environmental Impact, Fallback plan, Fit itinerary, Group choice, Other, Packaged deal, Price, (Type own answer)[7]*

Where did you buy your bus ticket?

> *Picklist: Bus station/bus stop, Driver, Kiosk, Online- direct from bus company, Online- from travel agent, Online- from travel site (e.g. Expedia, Kayak), Other, Packaged deal, Phone, (Type own answer)*

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[7] Although 'Convenience' was not an option given during the survey, a large number of respondents gave convenience as an answer, resulting in it being added as a category after the survey was over. Surveyors recorded 'convenience' answers by typing it in.

How long were you/will you be out of country?[8]
> *Integer and a time unit chosen from Hours/Days/Weeks/Months*

How are you going to return across the border? - OR - How did you initially cross the border?
> *Picklist: Airplane, Boat, Car, Car (rental), One-way trip, Other, Other private bus, Same bus company, Train (Amtrak, Rocky Mountaineer), Walking/Biking, (Type own answer)*

What mode of transportation will you use when you get off the bus?
> *Picklist: Airplane, Boat/Ferry, Car, Car (rental), Cruise ship, Light Rail (Link, Skytrain), Local bus, None- I'll be there, Other, Other private bus, Same bus company, Taxi/Uber/Lyft, Train (Amtrak, Rocky Mountaineer), Walking/Biking, (Type own answer)*

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[8] For respondents traveling to Alaska, this answer was generally less than a day, meaning some records were marked as recreation when they may actually be vacation.

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?
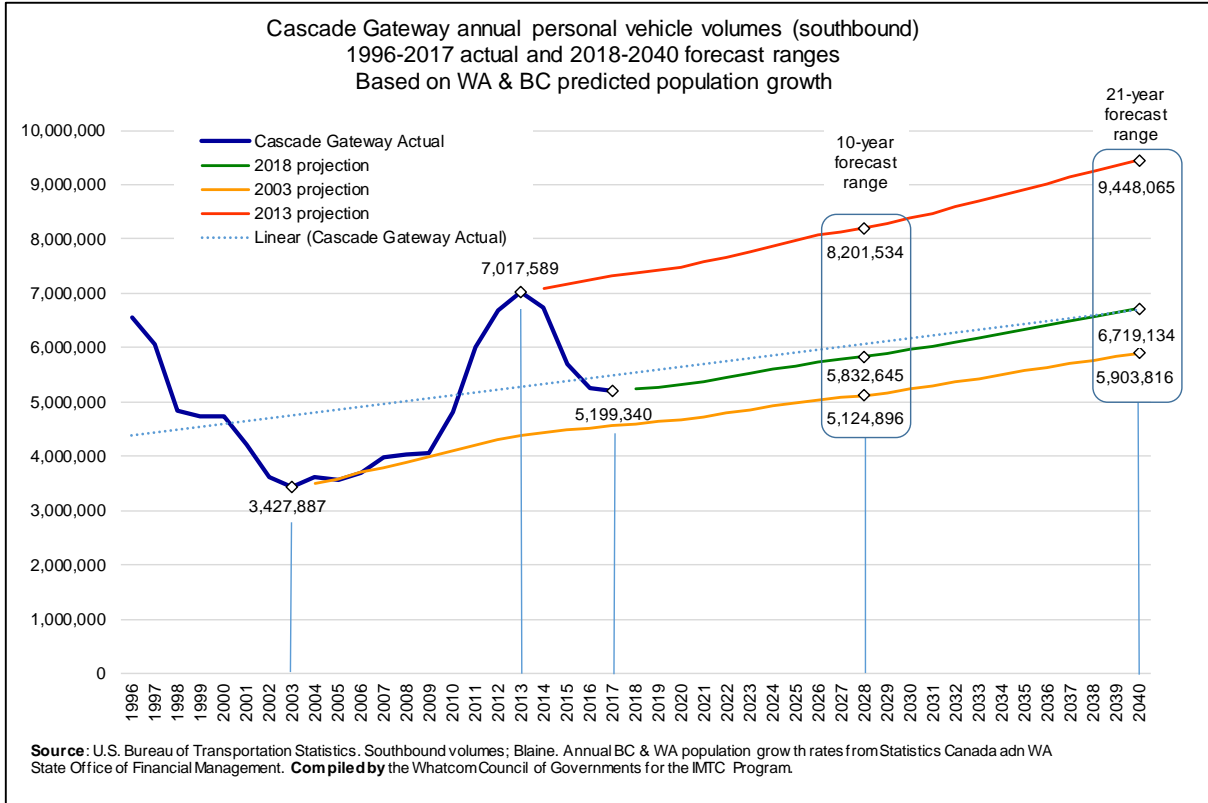
Figure 1: The Cascade Gateway

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

Cascade Gateway annual personal vehicle volumes (southbound)
1996-2017 actual and 2018-2040 forecast ranges
Based on WA & BC predicted population growth

Source: U.S. Bureau of Transportation Statistics. Southbound volumes; Blaine. Annual BC & WA population grow th 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 – <u>Canadian resident trips to U.S.</u>
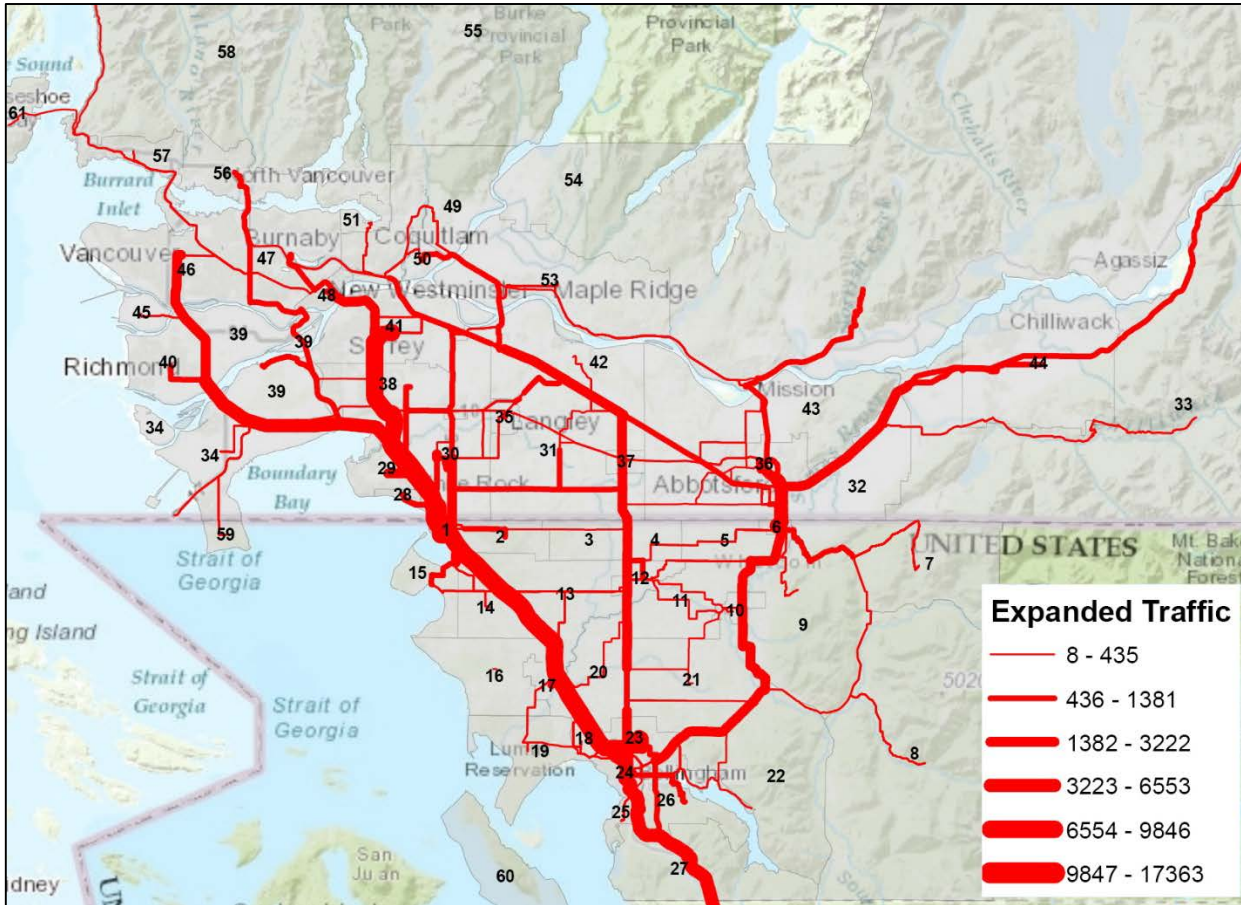
In figure 3, above and figure 4 below:

> **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>U.S. resident trips to Canada</u>
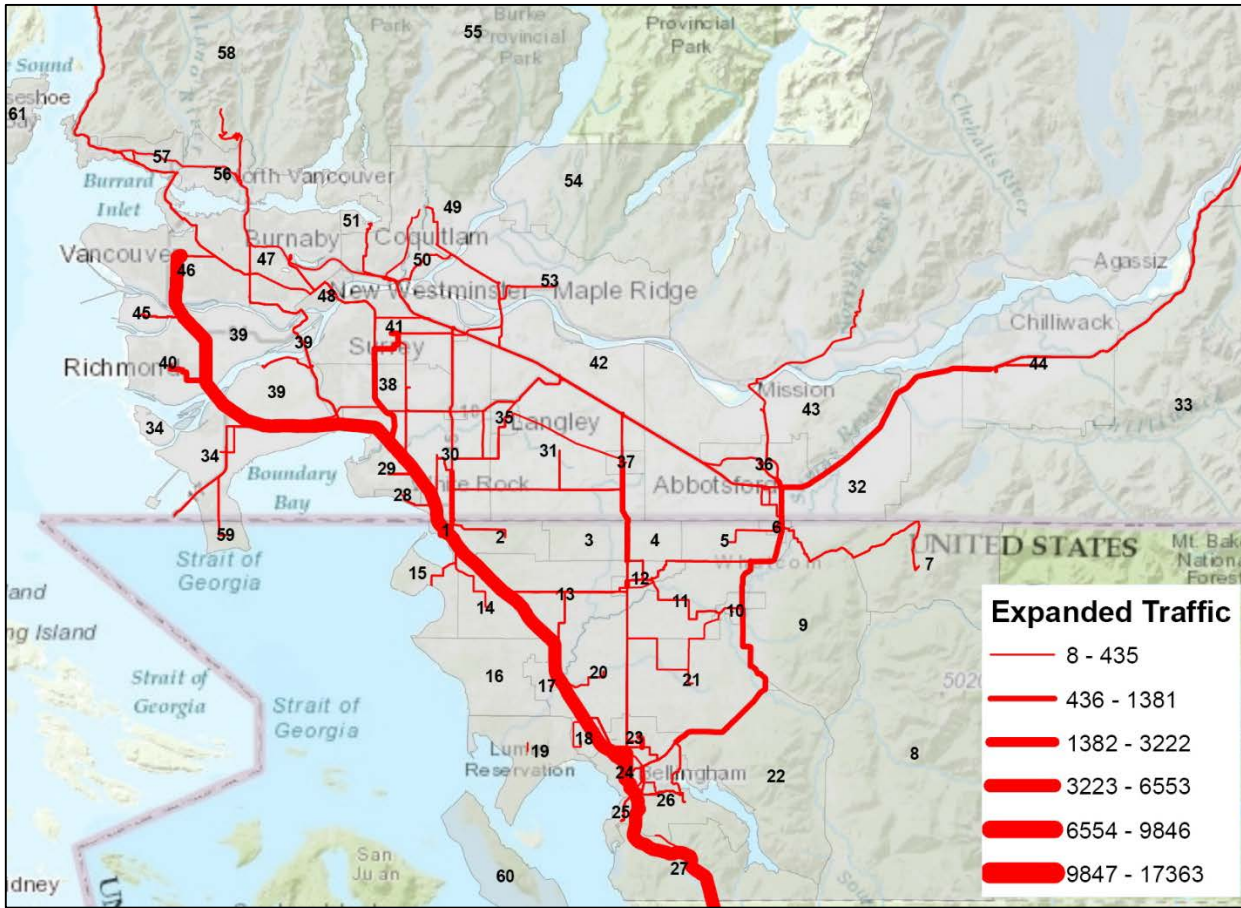

Table 1. Comparison of shortest-path-*assigned* routing with observed routing

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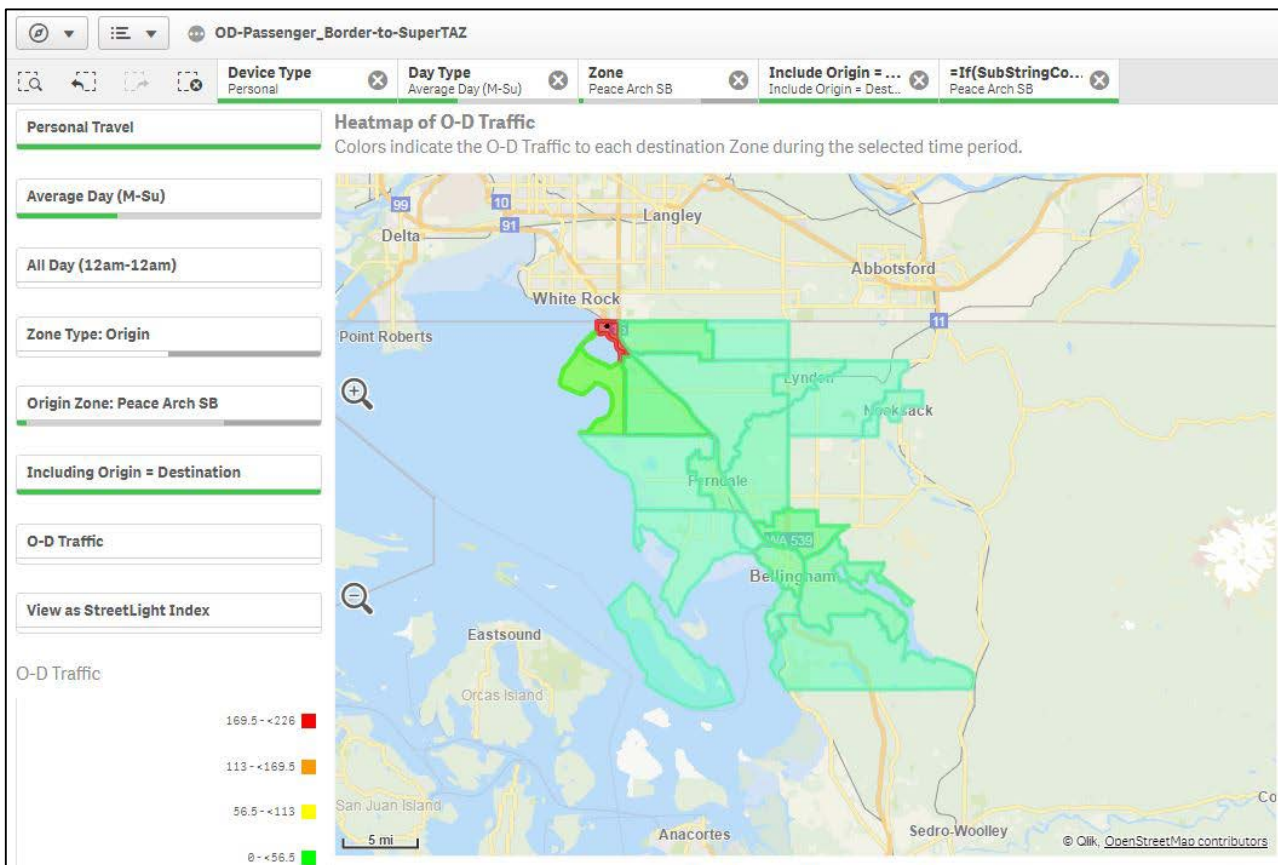
Observations regarding LBS external-trip data originating at the Canada-U.S. border

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?

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

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
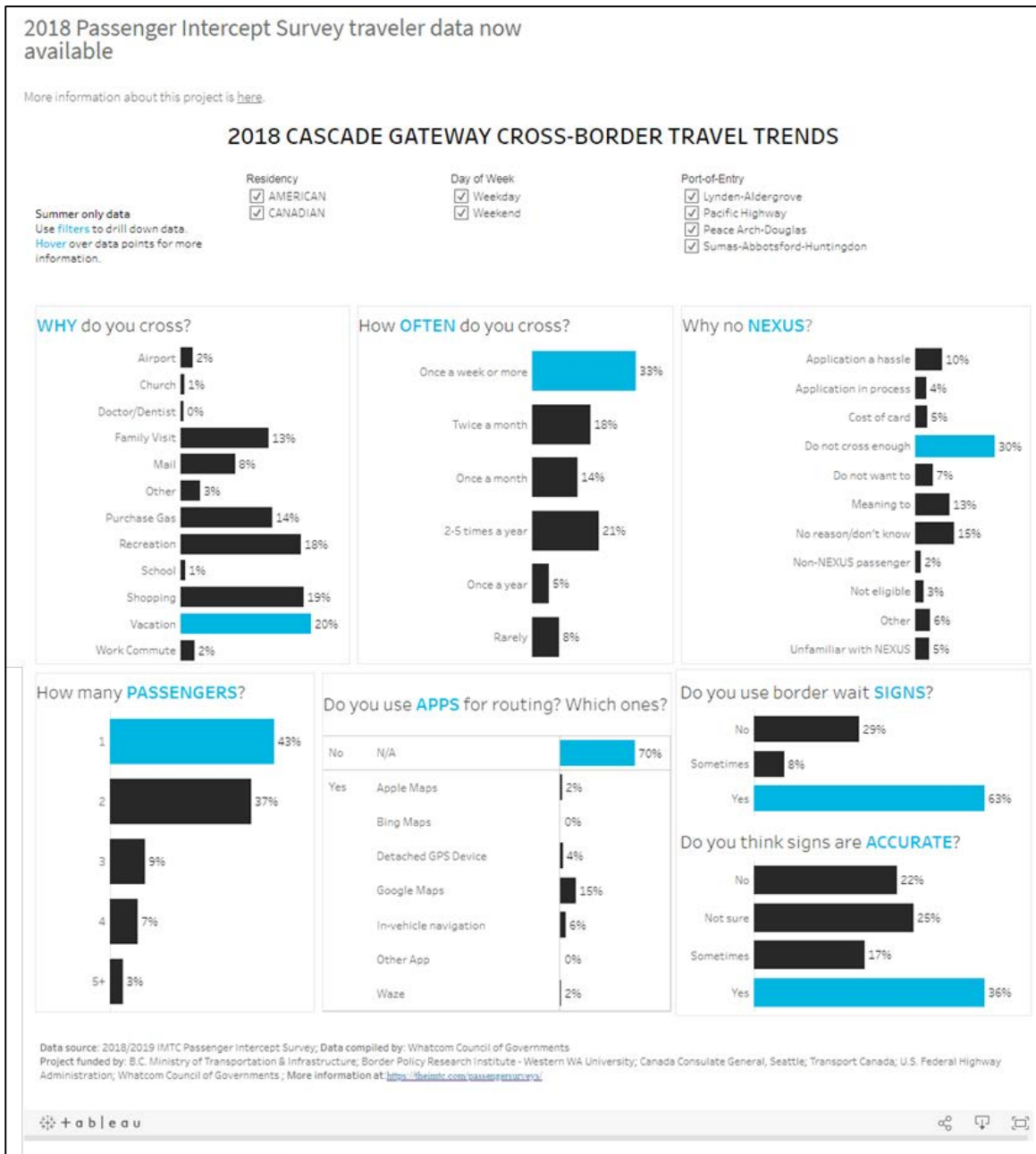
Initial assessment of operational opportunities at Aldergrove-Lynden

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