



Cross-Border Trade and Travel Study

Final Report and Analysis Results

prepared by

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in association with

TSi Consultants

prepared for

**Whatcom County Council of Governments
International Mobility and Trade Corridor**

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Introduction

This report presents analysis of data collected during intercept surveys conducted for the IMTC Cross Border Travel Survey. Other reports prepared for the project describe existing data sources and their utility for cross border travel studies; the intercept survey design and procedures; the survey database contents; results of the survey (basic tabulations of all the survey responses); the results of logistics process interviews conducted with shippers, carriers, and customs brokers in the region; and a report on traffic forecasting.

Report Format

This report has been prepared as a PowerPoint slide presentation with explanatory text. The report can be printed with text sides to provide a report document or its contents can be used as presentation slides.

Analysis Topics

The analyses contained in this report address some of the major cross border transportation issues facing planners on both sides of the border. These analyses are illustrative of uses for the data collected in the Cross Border Travel Survey. The data will also support the development of more sophisticated analysis tools, such as a cross border travel demand model, that will allow more comprehensive analysis of transportation alternatives for the Cascade Gateway region.

Topics covered in the analysis include:

- **Who crosses the border and what drives demand?**
- **Are the time of day characteristics of cross border travel?**
- **What is the potential to divert traffic to alternative crossings?**
- **What is the potential for greater use of HOV lanes?**
- **What is the potential to divert traffic to alternative modes?**
- **What are the markets for pre-approval programs?**

Data Presentation and Terms

Data collected in the cross border intercept surveys were collected and weighted to represent an 11-hour period (7am - 6pm) during which peak traffic occurs. All data presented in this report represent patterns observed for this period of time. Data were collected in summer and in fall and the general presentation in this report presents separate observations for these two seasons. Data were also collected on weekdays and weekends. Unless noted specifically, data presented in this report aggregate results across both weekdays and weekends.

Data were collected at each Port of Entry (POE) and in each direction. However, unless otherwise noted, the data are aggregated across POEs and across both directions. Where day of the week, POE, or direction patterns are significant, they are presented.

Origin-Destination Data

For ease of presentation and to illustrate general trends, origin-destination (O-D) data in this report are generally presented for super zones. The definition of these super zones is generally self-explanatory. Super zones listed below were defined as follows:

- East Lower Mainland - east of Highway 15
- West Lower Mainland - west of Highway 15
- Puget Sound Region - Pierce, King, Kitsap, Snohomish, and Skagit counties
- Western U.S. - California and Oregon
- Eastern Washington - east of Yakima
- Western Washington - west of Yakima excluding Puget Sound Region and Whatcom County

In most cases, additional detail on O-D cities is available in the project database. For O-D within the Lower Mainland and Whatcom County, street address was also collected whenever possible.

Commodity Data

As in the case of O-D data, commodity data is presented in this report in terms of aggregate groupings. The database files for the project contain more detailed commodity categories. The aggregate groupings used in this report are defined as follows:

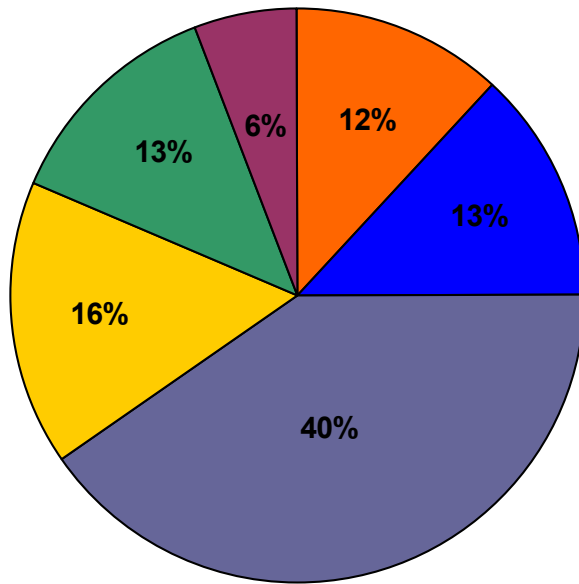
- Farm Products - raw agricultural commodities
- Food Products - processed food and kindred products
- Wood Products - forest products, lumber and wood products (excluding furniture)
- Bulk Products - minerals, fuels (raw and processed), stone and gravel, clay, concrete, and glass
- Manufactured Products
- Other Miscellaneous Freight - waste and scrap, mail, small packages, mixed freight

Who Crosses the Border?

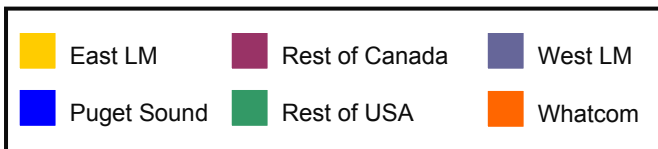
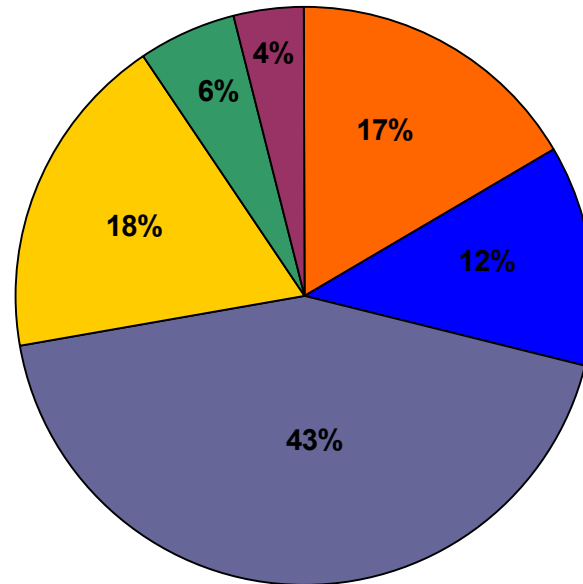
Who Crosses the Border?

Auto Demographics: Residence

Summer: Place of Auto Residence
(All Border Crossings)



Fall: Place of Auto Residence
(All Border Crossings)



In most analysis of travel demand, travel behavior is forecast as a function of the socioeconomic/demographic characteristics of the travelers. For groups of travelers, these characteristics are generally tabulated at the place of residence. Thus, understanding where cross border travelers come from is important.

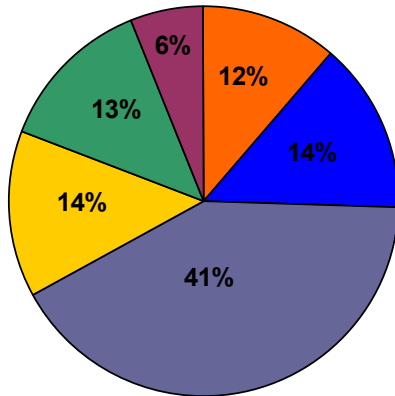
This slide shows that more Canadians than U.S. residents use the Cascade Gateway crossings. It also shows that while Canadians who use these crossings generally live close to the border, U.S. residents are more likely to live in the Puget Sound region or other parts of the U.S.

Places of residence also vary from summer to winter. In summer, with the large volume of recreational and vacation travel, U.S. residents come from farther away, while in fall the fraction and volume of travelers from parts of the U.S. outside the study area are substantially reduced.

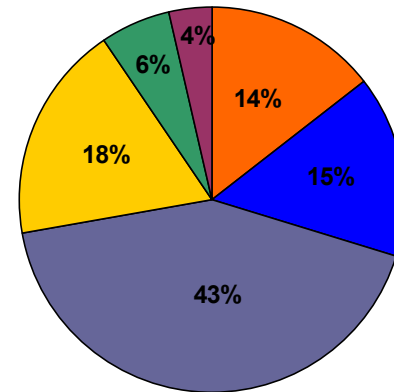
Who Crosses the Border?

Auto Demographics: Residence

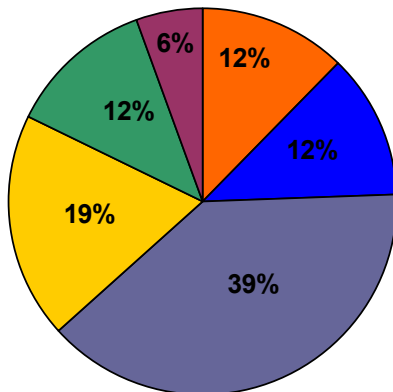
Summer Weekend: Place of Auto Residence



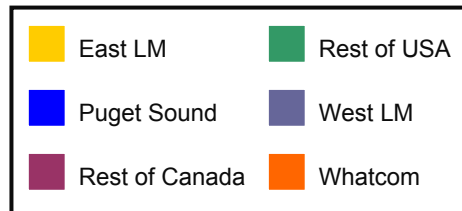
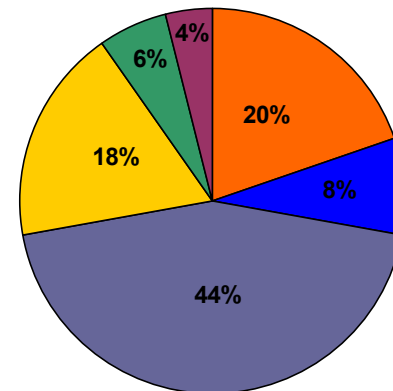
Fall Weekend: Place of Auto Residence



Summer Weekday: Place of Auto Residence



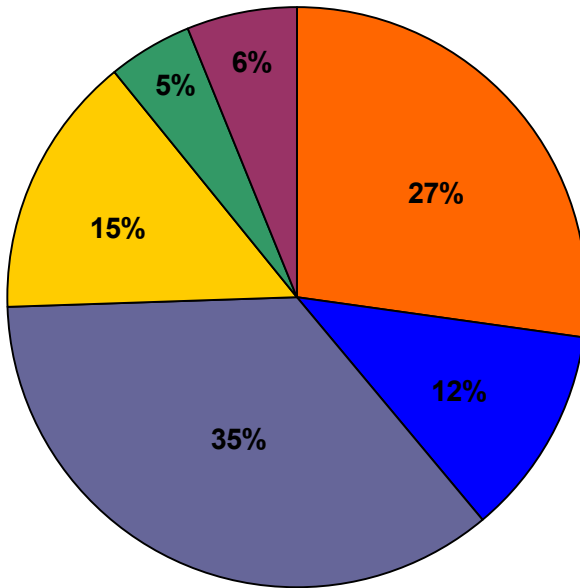
Fall Weekday: Place of Auto Residence



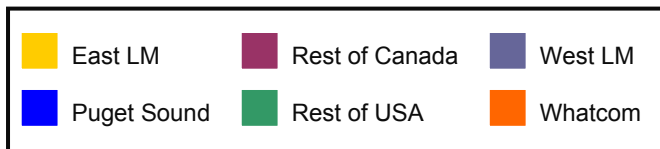
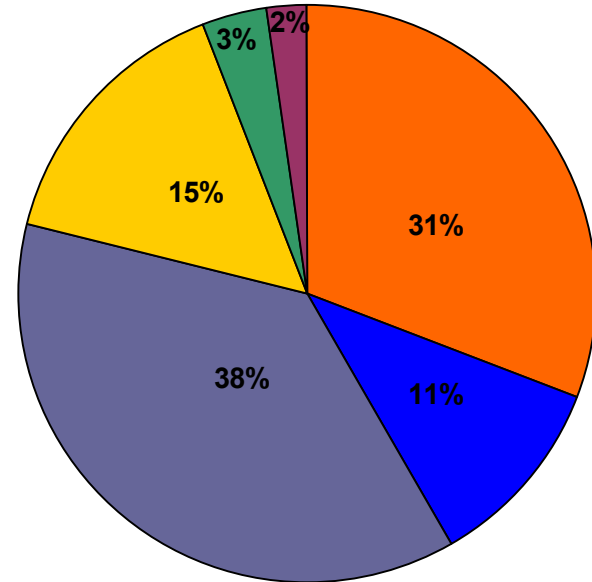
Similar patterns are exhibited when looking at breakdowns of weekend vs. weekday travel. However, there are some distinct differences between summer and fall traveler distributions when looking at weekend/weekday breakdowns. While the place of residence distribution in the summer is similar on weekends and weekdays, in the fall the volume and share of travelers from the Puget Sound region is substantially lower on weekdays than on weekends. This is probably due to the fact that Puget Sound travelers across the border tend to be taking recreational and vacation trips which are less likely to be taken during the week in seasons other than summer.

Who Crosses the Border? Auto Places of Origin

Summer



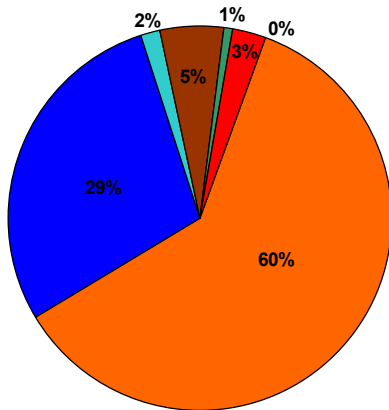
Fall



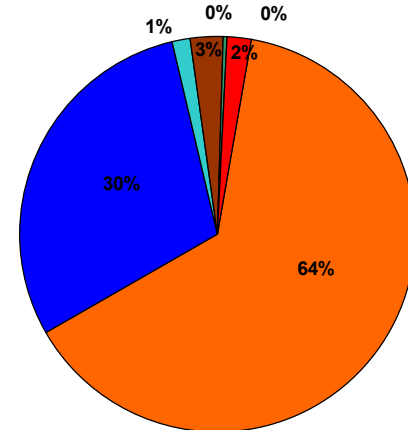
This slide shows some patterns similar to those shown in the place of residence analysis. However, one pronounced difference is the much higher percentage of trips originating in Whatcom County. To some extent this can reflect the fact that many trips from Canada are to Whatcom County for work, shopping, and recreation (in the Mt. Baker area) and some of the trips captured are return trips to Canada. The much lower fraction of trips from the Rest of the U.S. could also indicate that many vacation travelers who cross the border do so with trips originating at some more local place (either in the Puget Sound region or in Whatcom County). This analysis begins to suggest the importance of looking at demographics by place of residence rather than trip origin when analyzing drivers of travel demand.

Who Crosses the Border? Auto Places of Origin

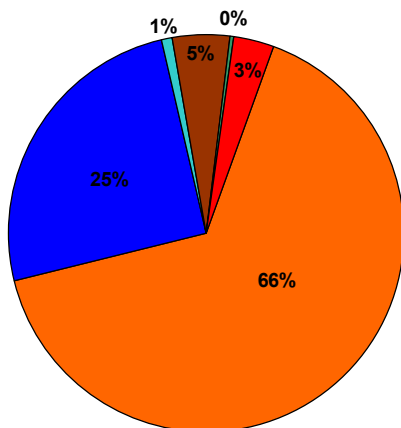
Summer Weekend (Northbound)



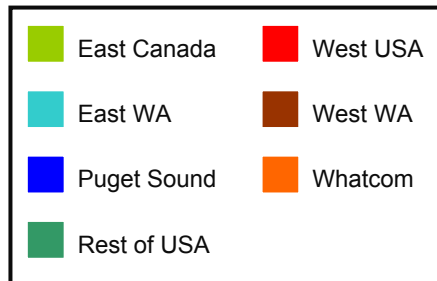
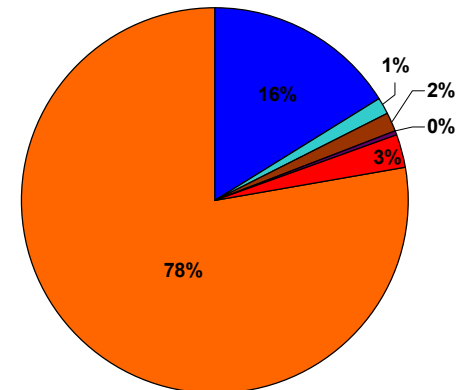
Fall Weekend (Northbound)



Summer Weekday (Northbound)



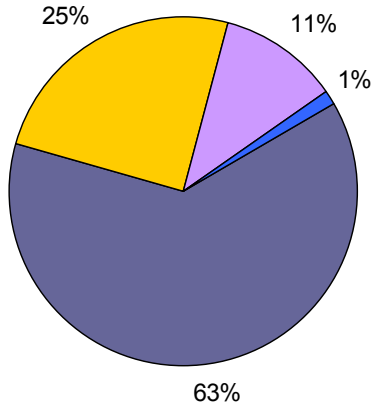
Fall Weekday (Northbound)



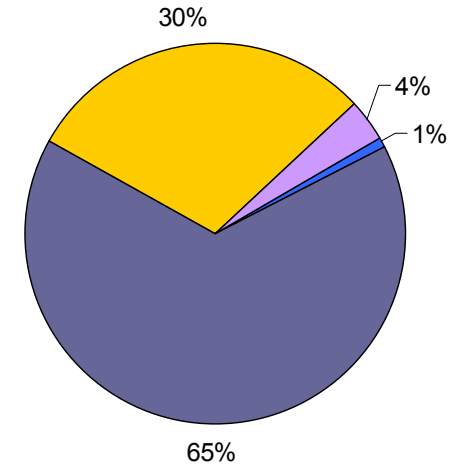
Looking at northbound travel only, the significance of Whatcom County as a place of trip origins is even more apparent. In summer, the distribution of northbound trip origins is relatively constant between weekends and weekdays, with a slightly higher share of trips originating in Whatcom County on weekdays. Again, this is a result of the large volume of recreational and vacation travel in summer coming from outside the immediate border area. In the fall, the share of northbound trips originating in Whatcom County is much higher on weekdays than weekends, primarily because of the drop in trips originating in the Puget Sound region on weekdays, again reflecting the importance of weekend recreational travel.

Who Crosses the Border? Auto Places of Origin

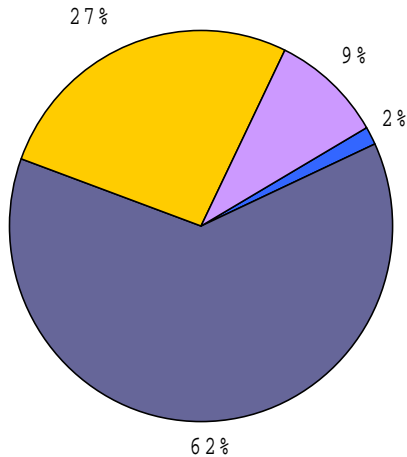
Summer Weekend (Southbound)



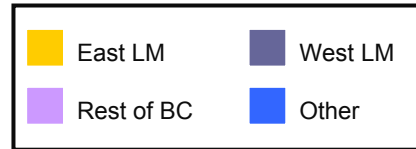
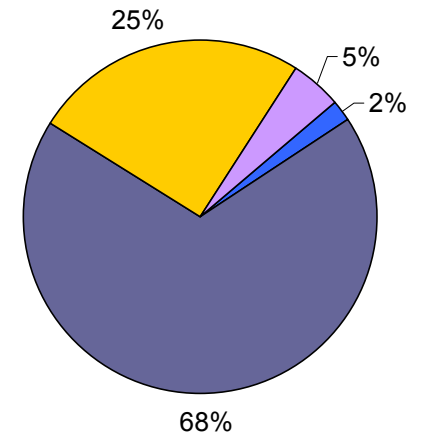
Fall Weekend (Southbound)



Summer Weekday (Southbound)



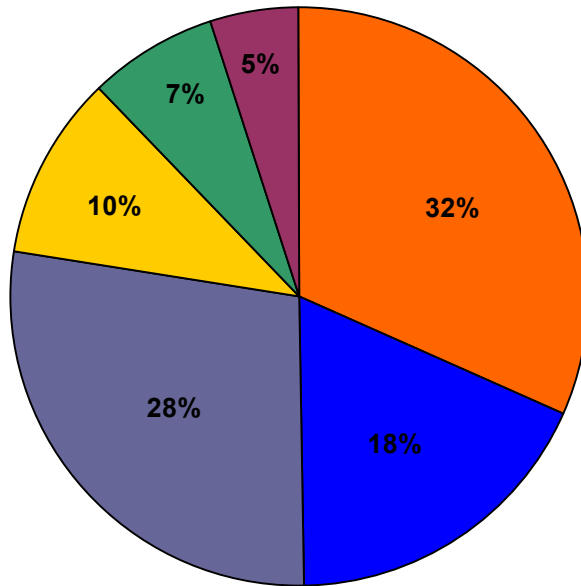
Fall Weekday (Southbound)



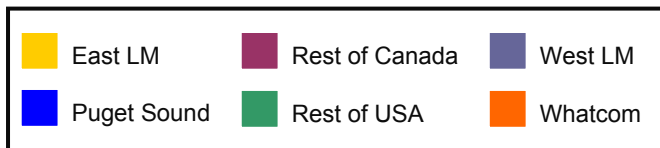
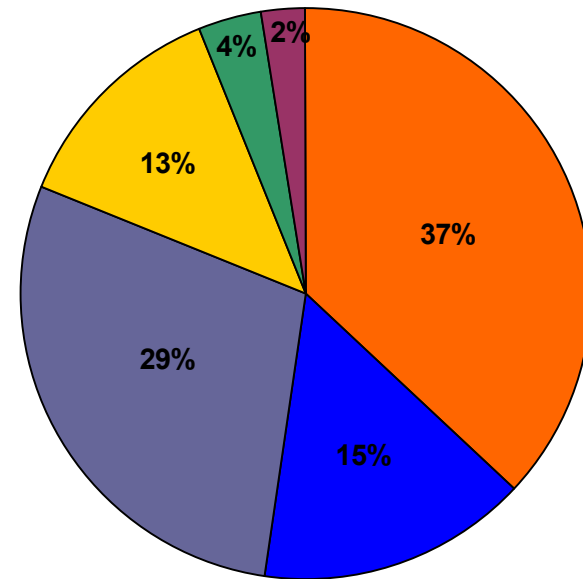
Southbound trips show less variation between weekday and weekend trip origins. The most noticeable difference in Southbound trip origin patterns is between summer and fall, with far fewer fall trips originating in the recreation/vacation areas in the rest of British Columbia than in the summer.

Who Crosses the Border? Auto Places of Destination

Summer



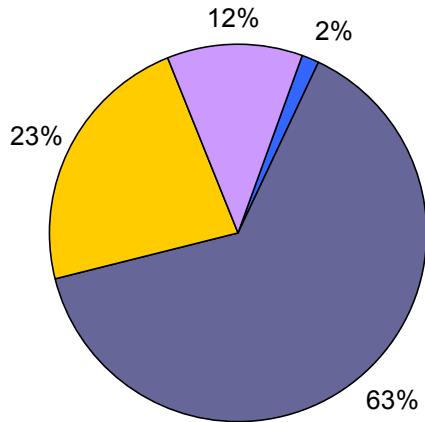
Fall



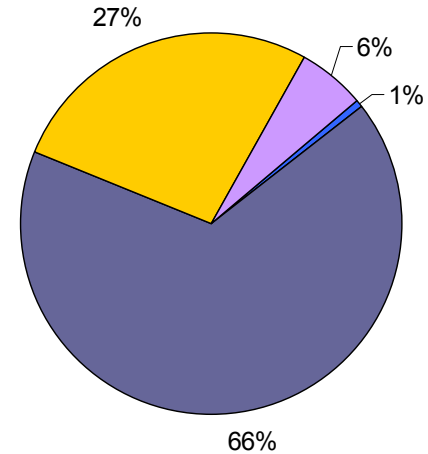
During the survey period, they tended to be a larger share of total trips destined for Whatcom County and the Puget Sound region than trips originating there in both summer and fall. This may reflect the time of day distribution of trips indicating that some of the trips originating in Canada had not yet had their return trip by 5 pm or 6 pm.

Who Crosses the Border? Auto Places of Destination (Northbound)

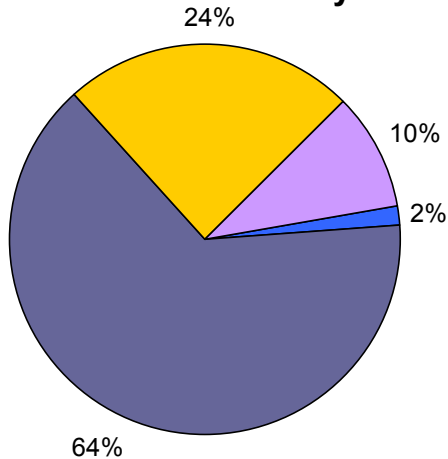
Summer Weekend



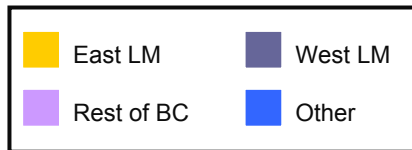
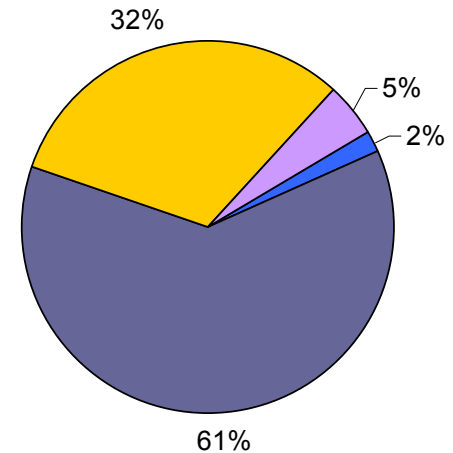
Fall Weekend



Summer Weekday

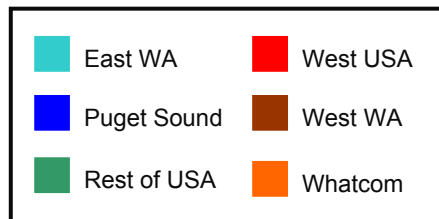
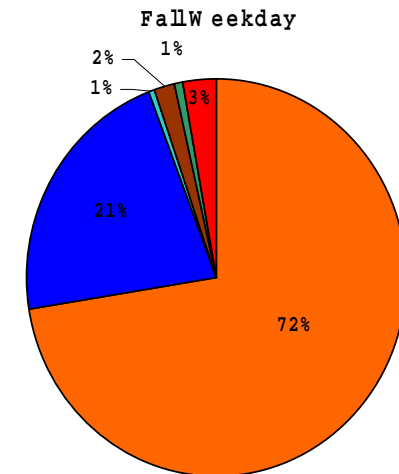
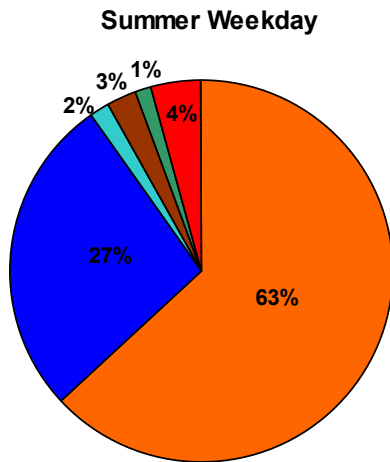
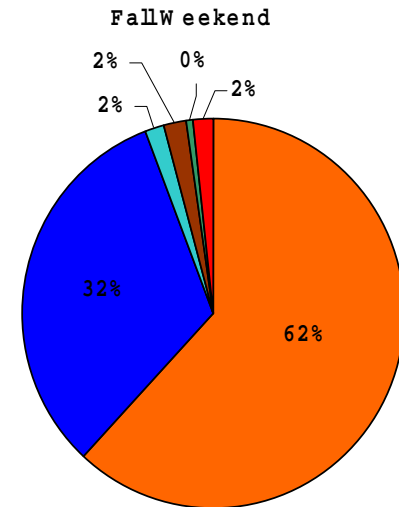
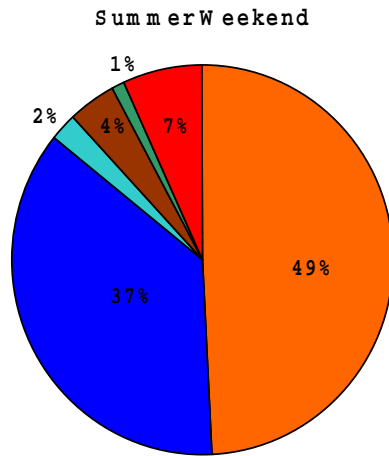


Fall Weekday



With respect to Northbound trips, similar patterns are observed in the destinations of trips as are observed in the origins of Southbound trips. During the summer, there is very little difference in the weekday/weekend distribution of destinations. In the fall, however, a larger share of Northbound trips have destinations in the East Lower Mainland on weekdays and weekends. This may reflect a higher volume of shopping and work/work-related trips that have destinations in this location.

Who Crosses the Border? Auto Places of Destination (Southbound)

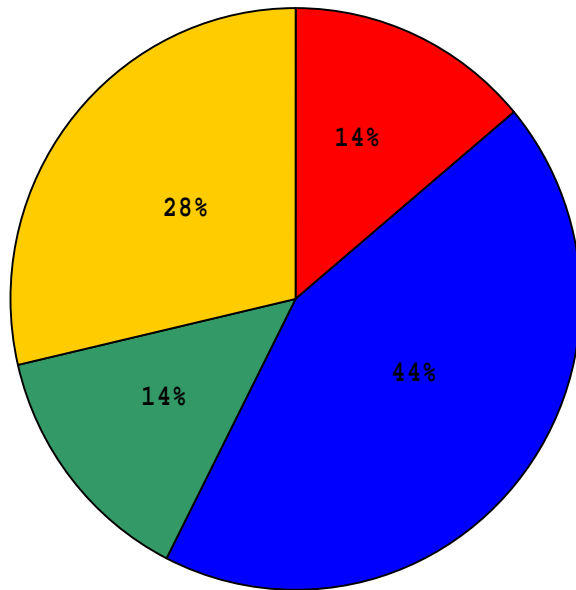


In the Southbound direction, there is a fairly significant difference in the share of trips by destination when comparing weekday and weekend travel. On the weekends, a much larger share of trips have destinations in the Puget Sound region than on weekdays. This holds true for both summer and fall. This may reflect the weekend propensity towards recreational travel. The destination pattern for these trips may include return trips by Puget Sound residents who take many recreation trips to the Lower Mainland as well travelers to the Puget Sound region because of its importance as a weekend recreation destination for Canadian citizens.

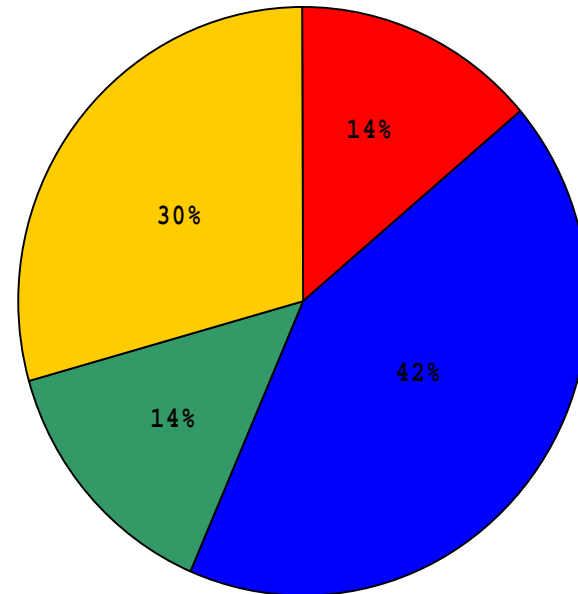
Who Crosses the Border?

Auto Demographics: Household Size

Summer



Fall

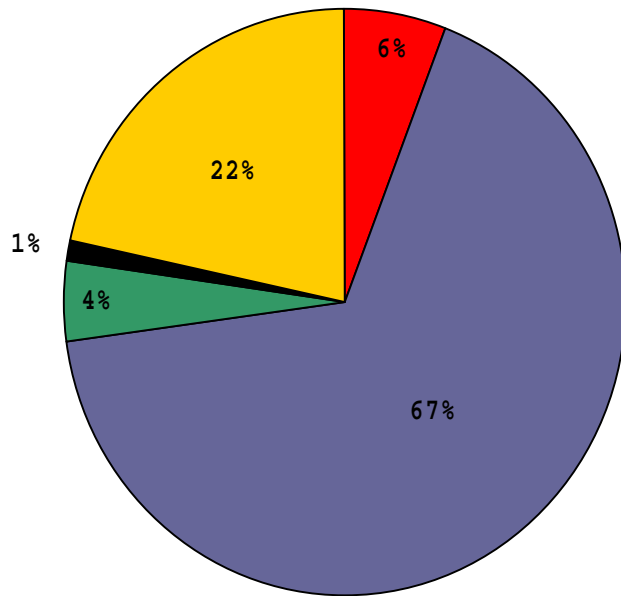


The majority of travelers using the Cascade Gateway POEs have small family units (one or two person households). This demographic may be linked with age of travelers, although information on age of travelers was not collected. The link between household demographics and trip purpose was not fully explored in this analysis report but may provide important market information for specialized transportation services aiming at recreation and vacation travelers.

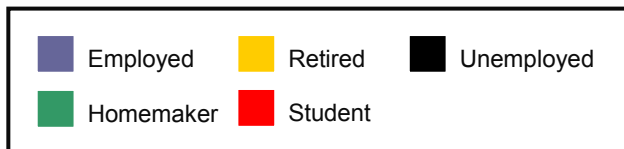
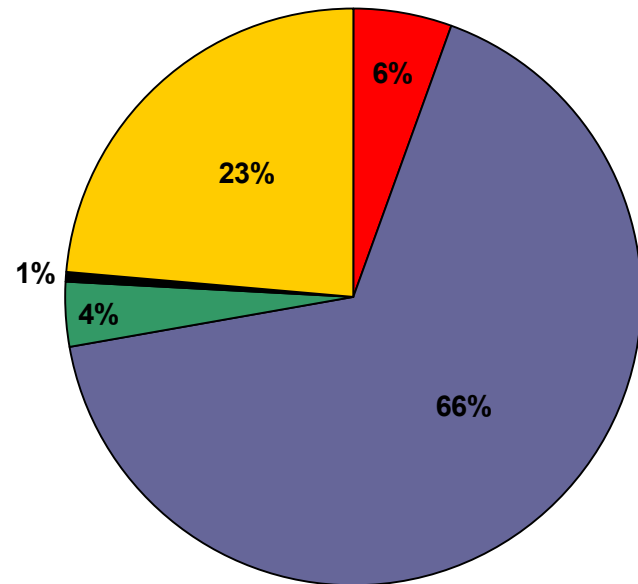
Who Crosses the Border?

Auto Demographics: Employment Status

Summer



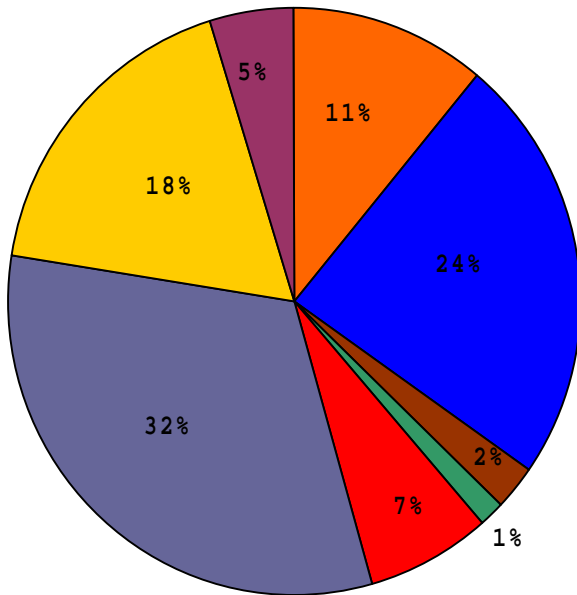
Fall



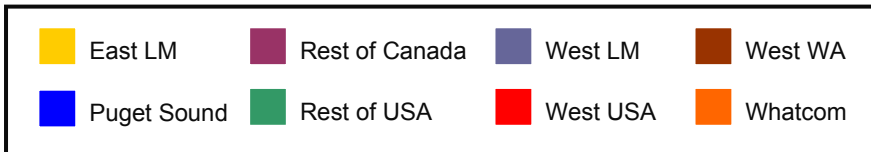
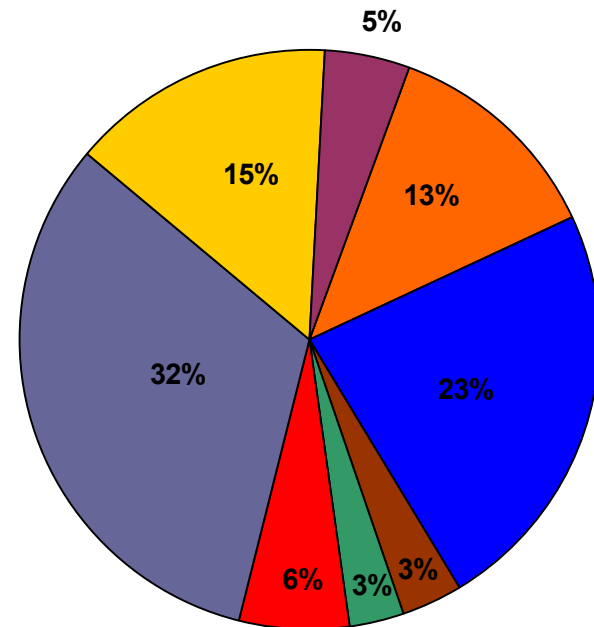
There is very little difference in the employment status of travelers across the border when comparing summer and fall travel. There is a fairly significant fraction of travelers who are retired crossing the border in both the summer and the fall.

Who Crosses the Border? Truck Place of Origin

Summer Weekday



Fall Weekday

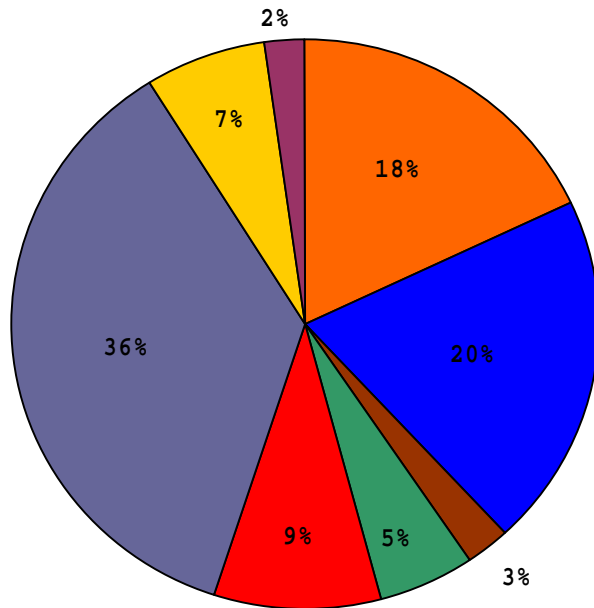


Truck traffic shows a fairly consistent pattern of origins and destinations in both the summer and the fall on weekdays, when the bulk of truck traffic occurs. Most of the southbound truck trips originate in the Lower Mainland, primarily in the major population centers of the West Lower Mainland. Trips moving north, on the other hand originate farther away from the border, with the majority originating in the Puget Sound Region. Trips originating outside of Washington are nearly as significant in number as those originating in Whatcom County, reflecting the lack of a strong manufacturing base in Whatcom County relative to the rest of the U.S.

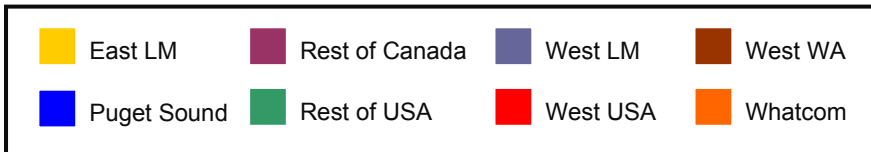
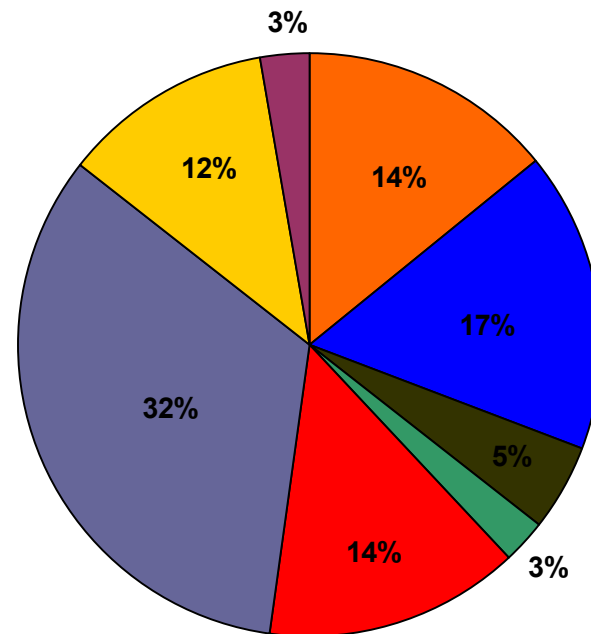
Who Crosses the Border?

Truck Place of Destination

Summer Weekday



Fall Weekday

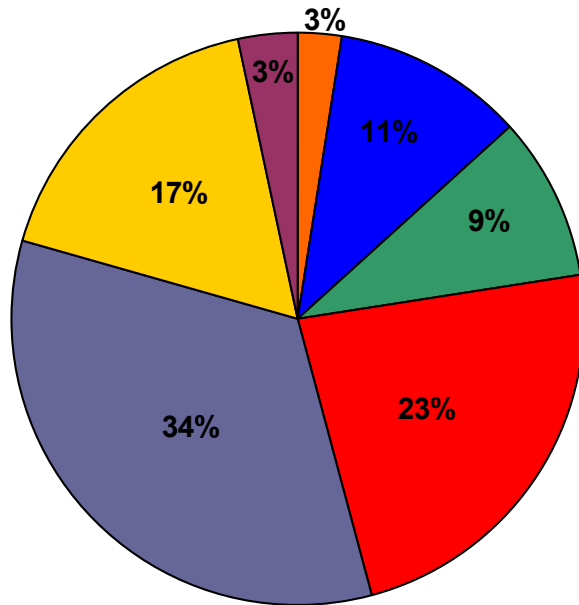


Destination patterns for weekday truck travel are also similar in summer and fall. Again, the northbound trips are primarily destined for the West Lower Mainland as this is the primary population center in the region. There is a higher percentage of southbound trips destined for Whatcom County than trips originating there. This may be a result of Whatcom County being more of a consumption point than production point in the regional economy, but it may also reflect the tendency of Canadian exporters to locate intermediate distribution points in the U.S. close to the border. The Puget Sound Region is also a significant destination for southbound truck trips as is the Western U.S., particularly with the major consumption centers in California.

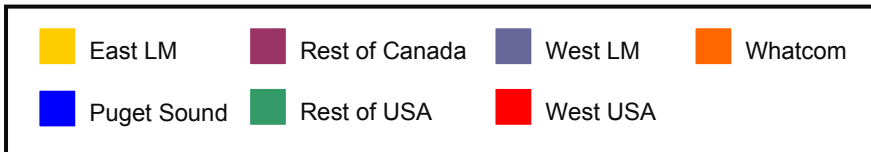
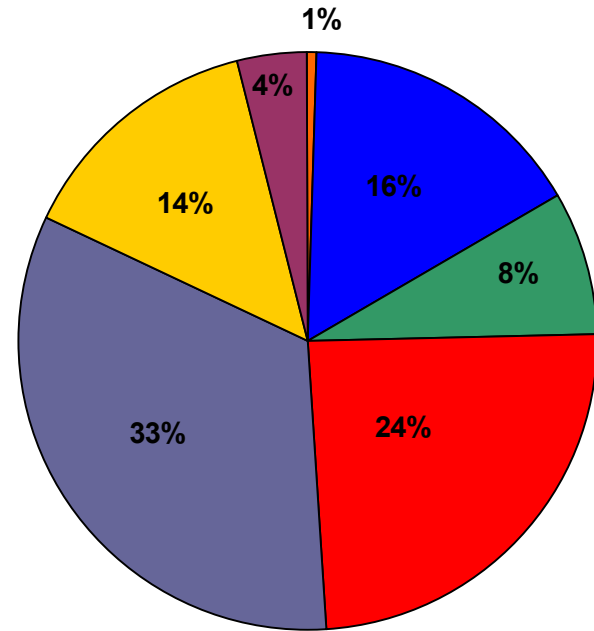
Who Crosses the Border?

Truck Place of Origin

Summer Weekend (Pacific Highway)



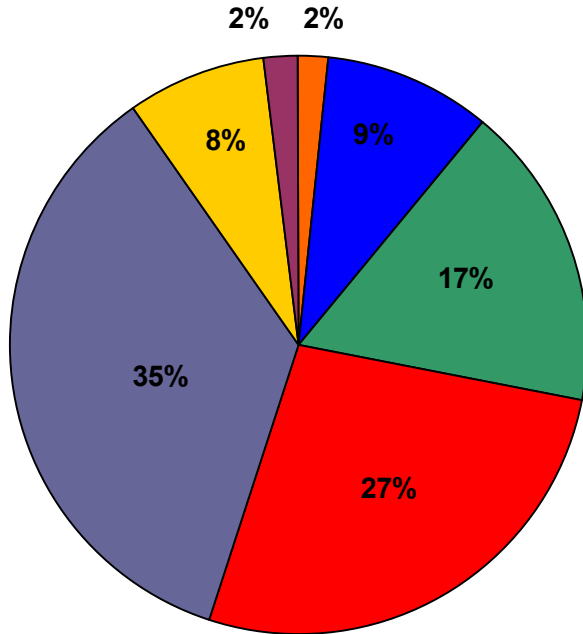
Fall Weekend (Pacific Highway)



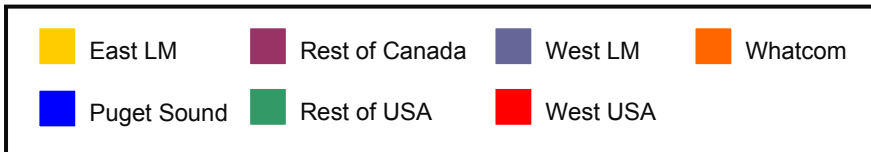
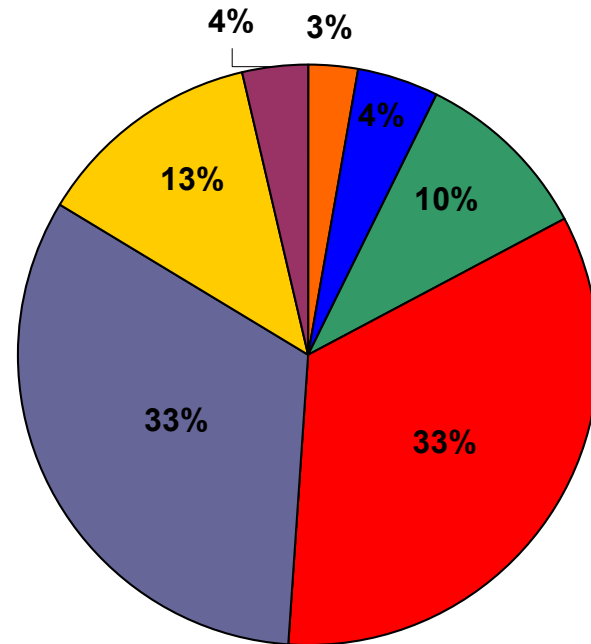
As shown in this slide and the next slide, weekend truck travel, which is really only significant at Pacific Highway, tends to have a similar origin-destination pattern within Canada as does weekday truck travel. On the U.S. side of the border, however, weekend trips tend to be coming from or going to places farther away. These trips are most likely multi-day trips with deliveries scheduled for early in the week.

Who Crosses the Border? Truck Place of Origin

Summer Weekend (Pacific Highway)



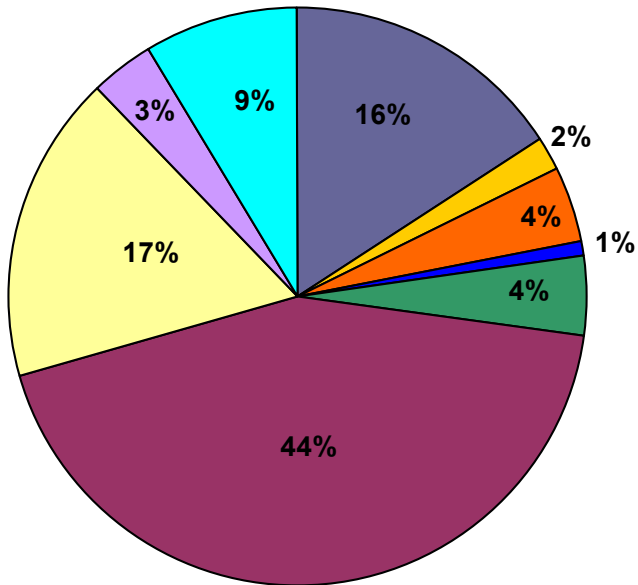
Fall Weekend (Pacific Highway)



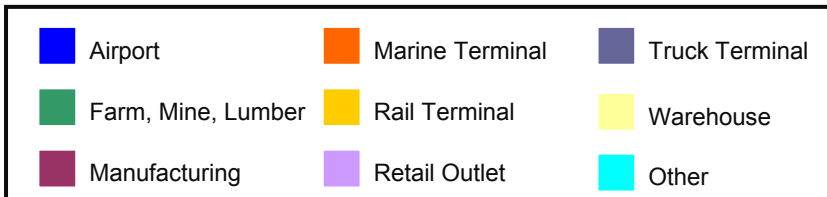
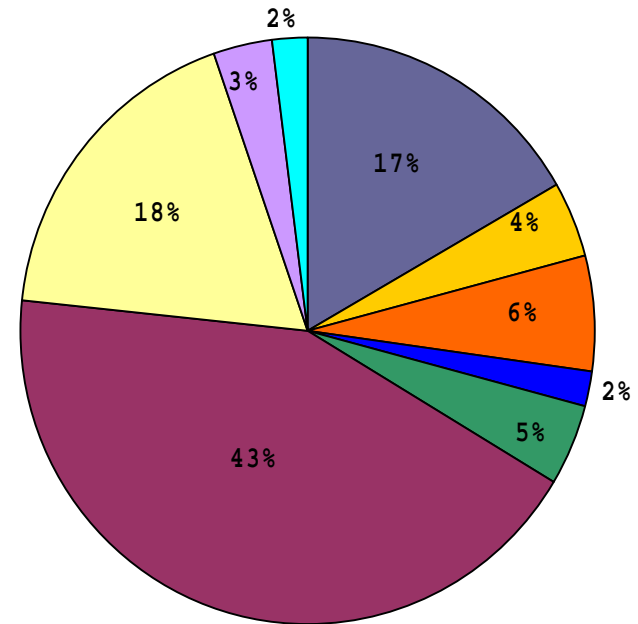
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Who Crosses the border? Type of Business at Truck Origin

Summer



Fall

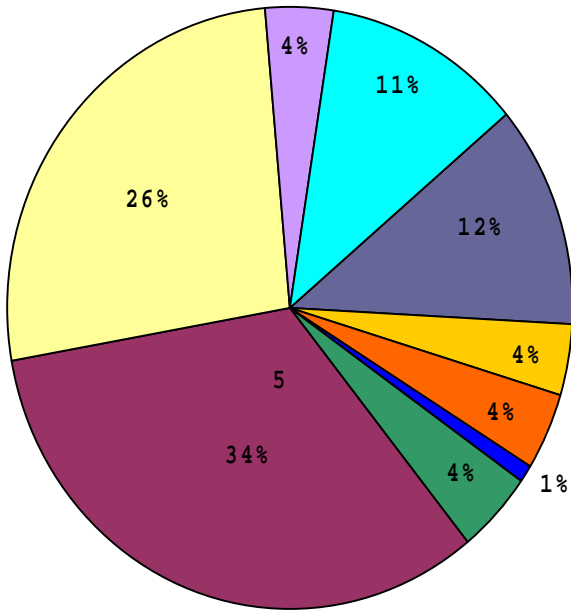


Almost half of the truck trips across the border originate at production locations, primarily at manufacturing facilities. This most likely reflects a logistics pattern whereby distribution centers are located in the country to which the goods are being shipped. In further analysis of the data it may be useful to determine how many of the trips originating in truck terminals are LTL movements through consolidation sites as opposed to empty trucks moving to a pickup location. Other data collected in the study indicate that most of the trips originating at marine terminals are northbound trips originating at the Seattle-Tacoma ports with less moving south from the Vancouver ports.

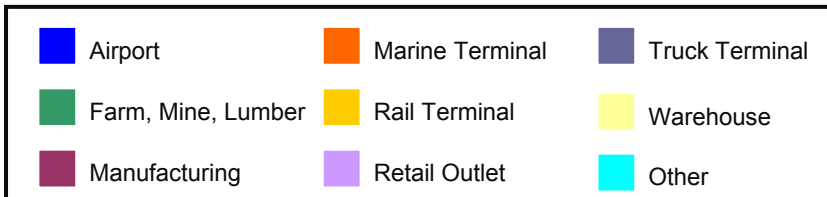
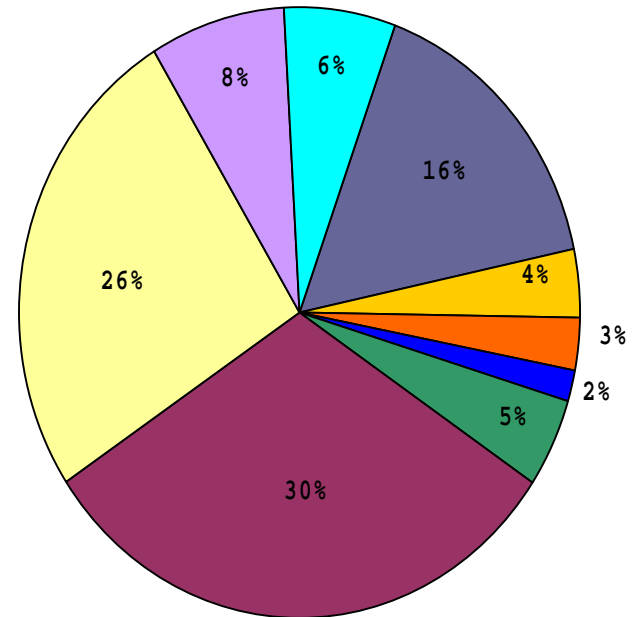
Who Crosses the Border?

Type of Business at Truck Destination

Summer

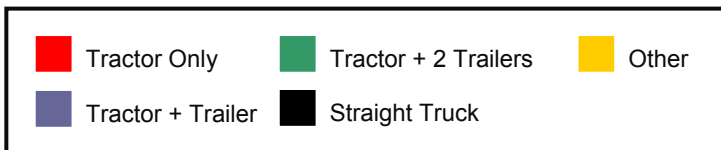
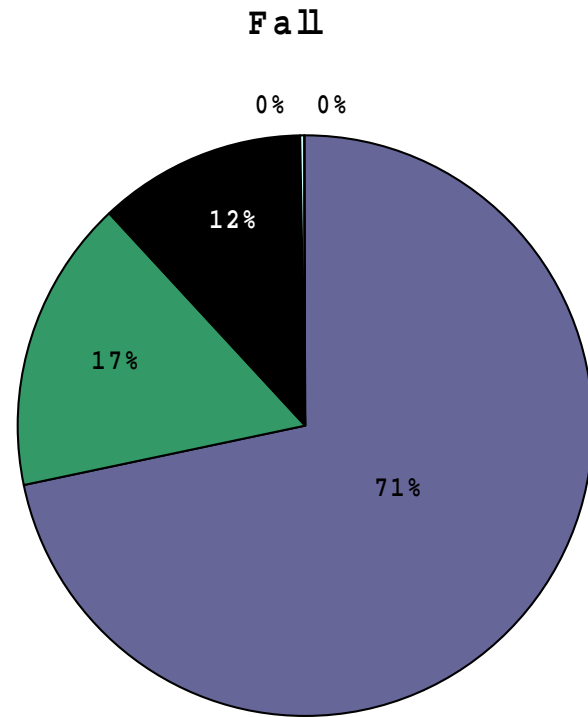
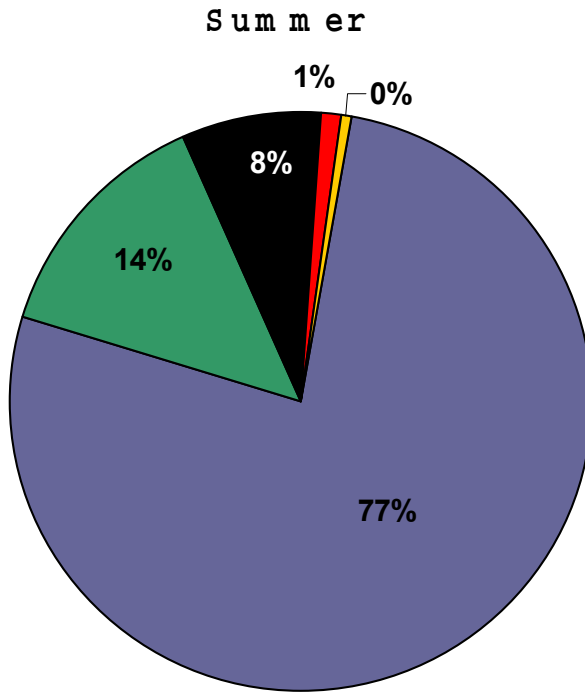


Fall



This slide showing business types at place of destination for truck trips further emphasizes the point illustrated in the previous slide about cross-border logistics. Note the increase in the percentage of trips destined for warehouses relative to production locations. Still, more trips are destined for production sites than any other type of business indicating a substantial amount of the cross-border shipping involves inter-industry transactions as opposed to products directly catering to consumer demand.

Who Crosses the Border? Truck Configuration



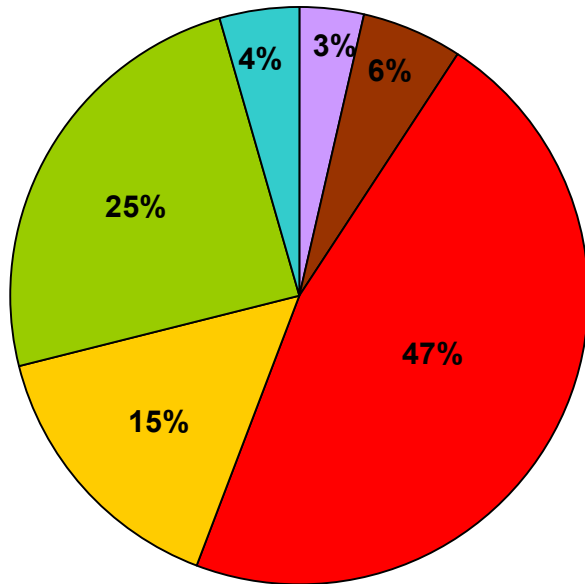
As would be expected, most of the trucks crossing the border are large Class 8 tractor trailers with single and double trailer combinations. This pattern holds true in both summer and fall.

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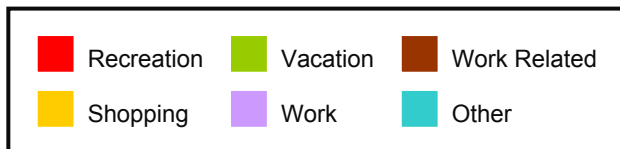
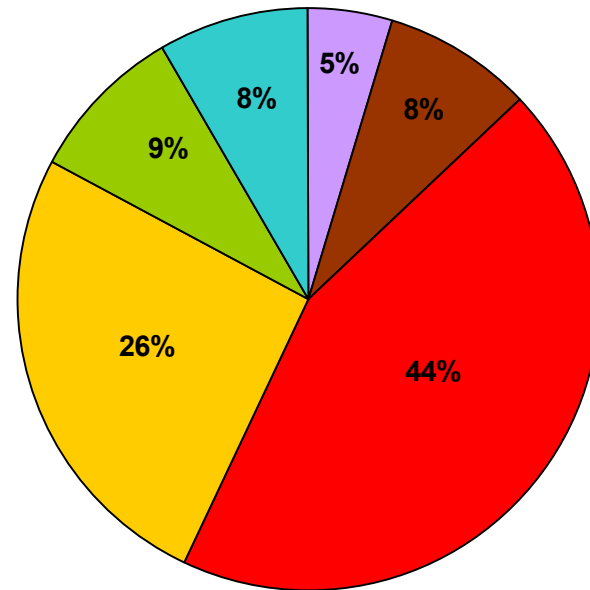
What Drives Demand?

What Drives Demand? Auto Trip Purposes

Summer



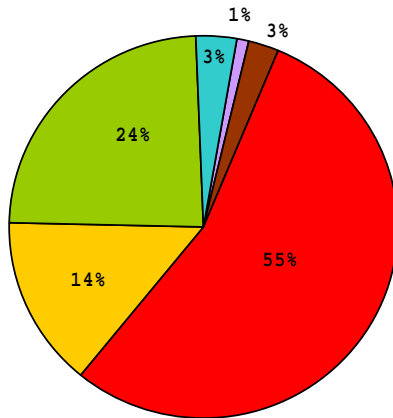
Fall



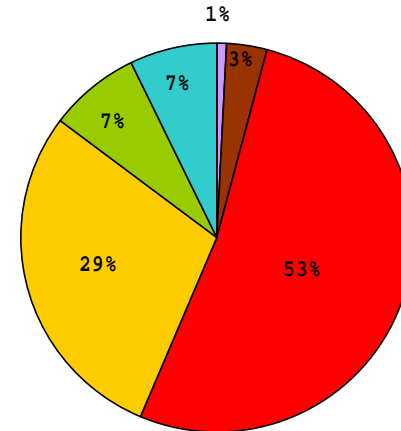
A critical consideration in determining travel demand is the reason why people travel. Different trip purposes are driven by different traveler characteristics. At the Cascade Gateway POEs, the largest category of trips are recreational trips in both the summer and fall. In the summer, there is a significant fraction of trips that are vacation trips and as would be expected, this drops off considerably in the fall. Shopping trips tend to increase in the fall both in terms of total volume of trips and share of total trips. It might be useful to explore whether congestion at the border discourages shopping trips in summer as compared to the fall. Work and work-related trips show consistent volumes across both summer and fall.

What Drives Demand? Auto Trip Purposes

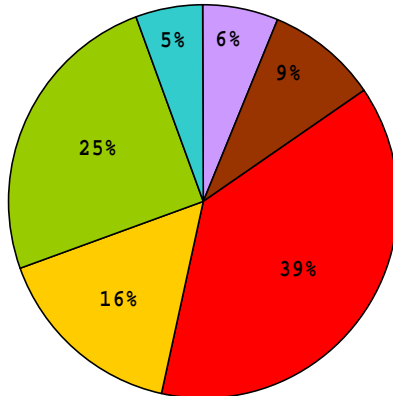
Weekend: Summer



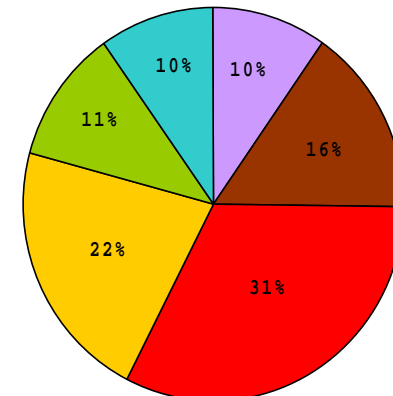
Weekend: Fall



Weekday: Summer



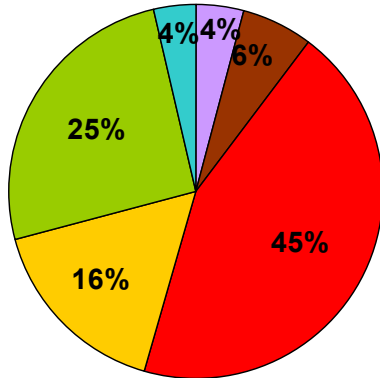
Weekday: Fall



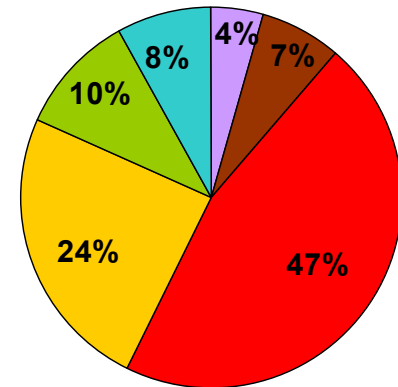
The comparison between weekend and weekday travel patterns shows some similarities between summer and fall but also some distinct differences. In both summer and fall, recreation trips are over half of the weekend trips but drop off considerably on the weekdays. As would be expected, in both seasons work/work-related trips increase on the weekdays. Shopping trips show distinctly different patterns weekday/weekend between summer and fall. Shopping trips are fairly constant between weekdays and weekends in the summer. In the fall, however, shopping trips are much greater on weekends than on weekdays. Weekend shopping is responsible for the overall increase in this trip purpose between summer and fall.

What Drives Demand? Auto Trip Purposes

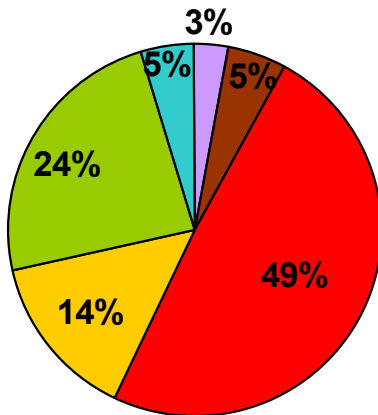
Summer: Northbound



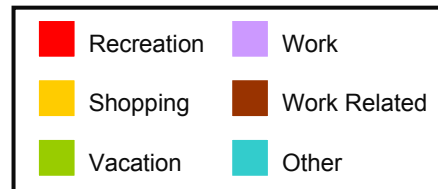
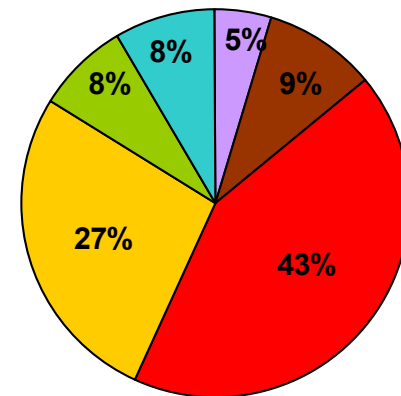
Fall: Northbound



Summer: Southbound



Fall: Southbound

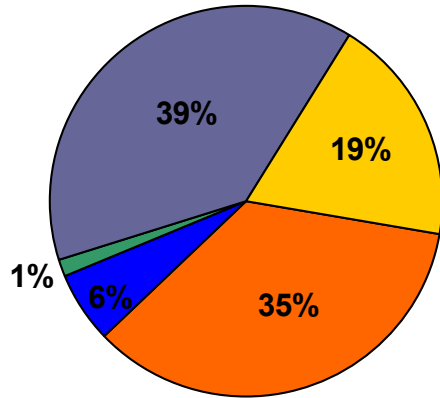


Trip purpose patterns by direction show similar patterns to overall trip purpose patterns. In the Northbound direction, both summer and fall trips are dominated by recreation travel. As would be expected vacation trips are the next largest fraction of trips in summer but they drop off in the fall. Shopping trips remain fairly constant across the seasons although, shopping grows in share between summer and fall, due mainly to the drop in vacation travel. This suggests that the growth in shopping trips in the fall is more likely to involve Canadians traveling to the U.S. to shop.

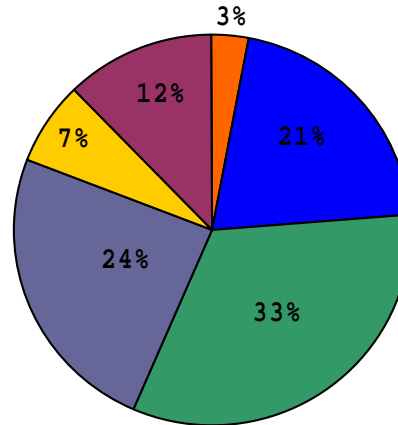
What Drives Demand?

Auto Trip Purposes by Residence

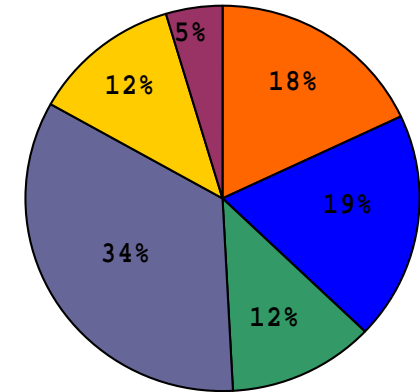
Summer Work Trips



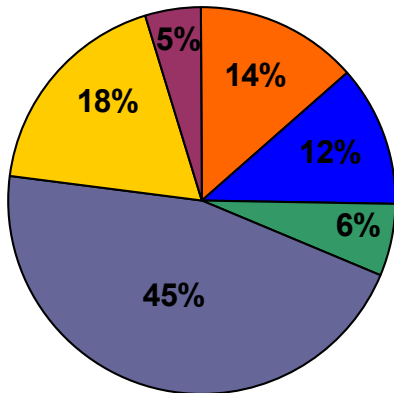
Summer Vacation Trips



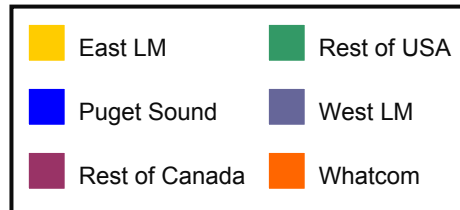
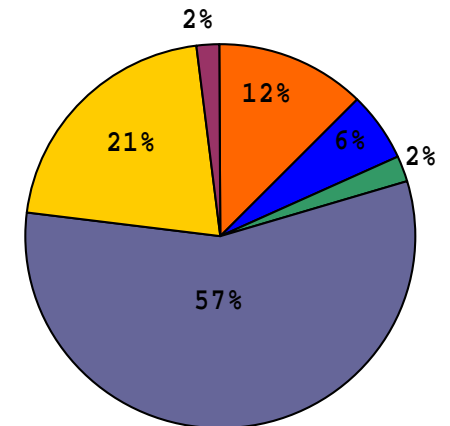
Summer Work Related Trips



Summer Recreation Trips



Summer Shopping Trips

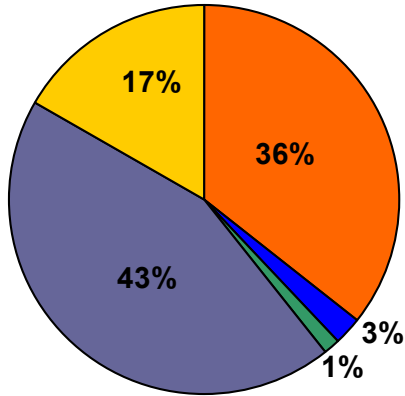


In order to forecast travel demand, it is necessary to know who takes each different type of trip so that the socioeconomic/demographic characteristics of travelers are properly related to the types of trips they take. Summer recreational trips are taken mostly by people living in the Lower Mainland. U.S. residents taking recreational trips are split mostly between Whatcom County and the Puget Sound region. Summer vacation trips, on the other hand, are taken primarily by U.S. residents, with most coming from parts of the U.S. outside the study area. A significant number of summer vacationers also come from the Puget Sound Region. The vast majority of summer shoppers reside in Canada with most coming from the West Lower Mainland. Very few U.S. residents are using the border to shop in Canada during the summer.

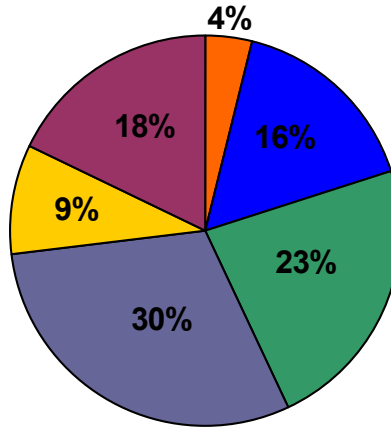
What Drives Demand?

Auto Trip Purposes by Residence

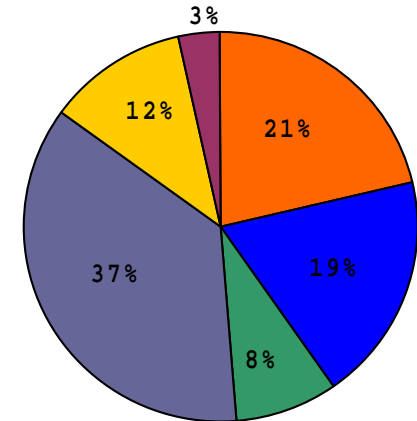
Fall Work Trips



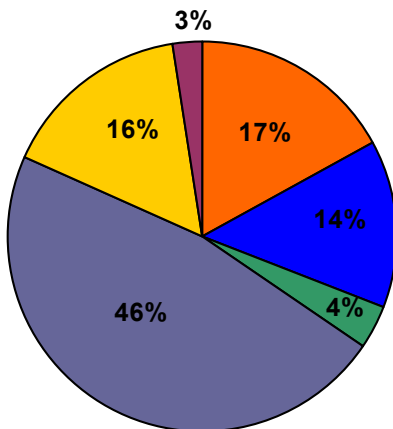
Fall Vacation Trips



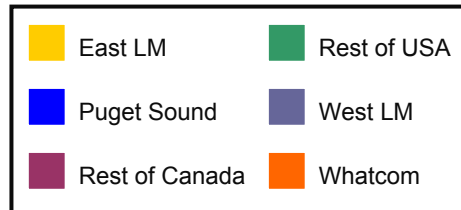
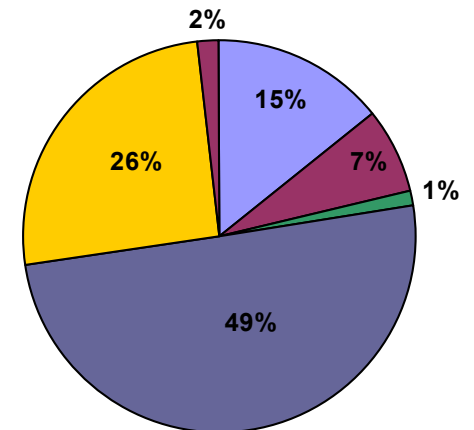
Fall Work Related Trips



Fall Recreation Trips



Fall Shopping Trips

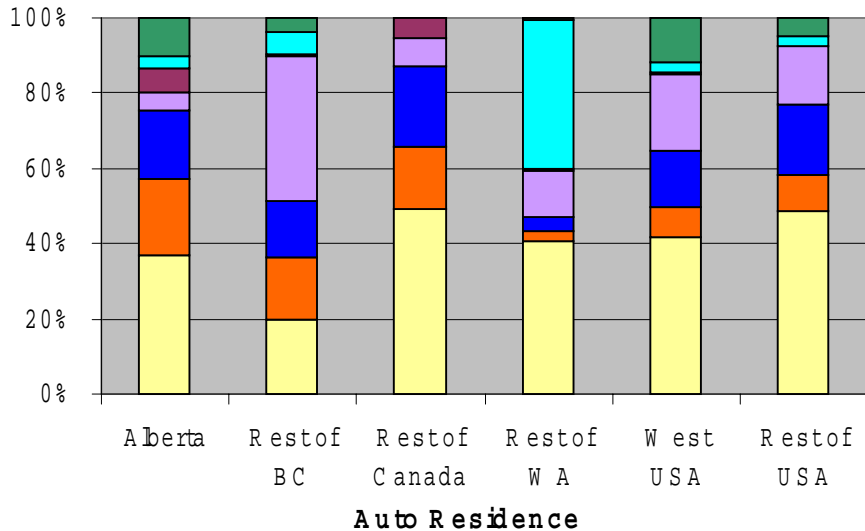


Similar patterns for recreation trips are seen in the fall as in the summer; that is, most of the travelers reside in the Lower Mainland with similar shares of travelers residing in Whatcom County and the Puget Sound region as in the summer. In the fall, when overall vacation travel is down, more Canadians cross the border on vacation travel than do U.S. residents. The pattern for shopping trips in the fall is similar to the summer, with a larger fraction of Canadian shoppers coming from the East Lower Mainland. It should be noted that most of the U.S. residents who cross the border to shop live close to the border (Whatcom County). More Canadians cross the border for work trips but more U.S. residents cross on work-related trips.

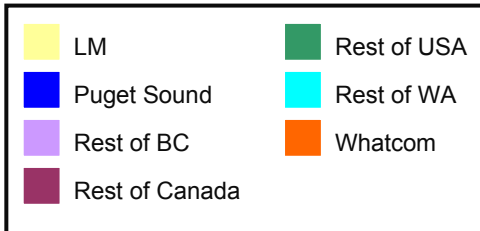
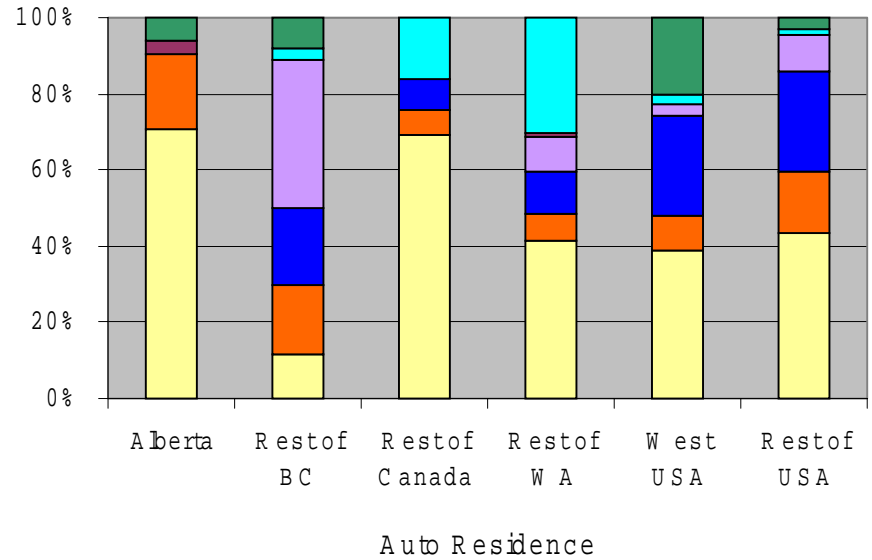
What Drives Demand?

Auto Residence by Trip Origin

Summer



Fall

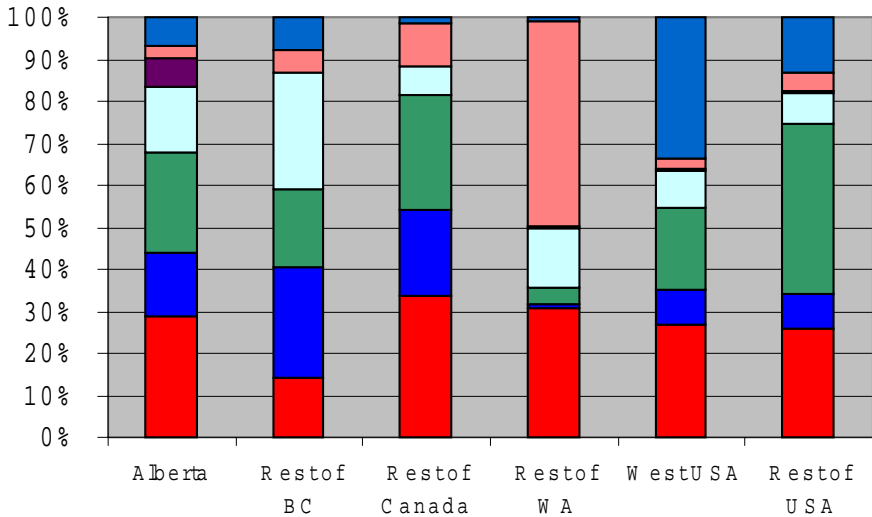


The bars in these charts show the trip origin for travelers who reside outside of the Lower Mainland, Whatcom County, and the Puget Sound region. The charts show that many of these travelers begin their trips across the border in places other than those in which they live. Given the distribution of place of residence of travelers, the most interesting observation from these charts is the number of U.S. residents who originate their cross border trips north from the Puget Sound region. This suggests that there may be a major opportunity for diversion of travelers to other long distance modes or modes that provide connections to long distance modes (e.g., rail shuttles from the airport).

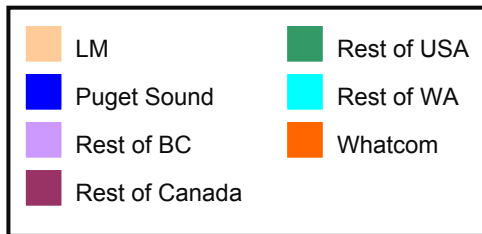
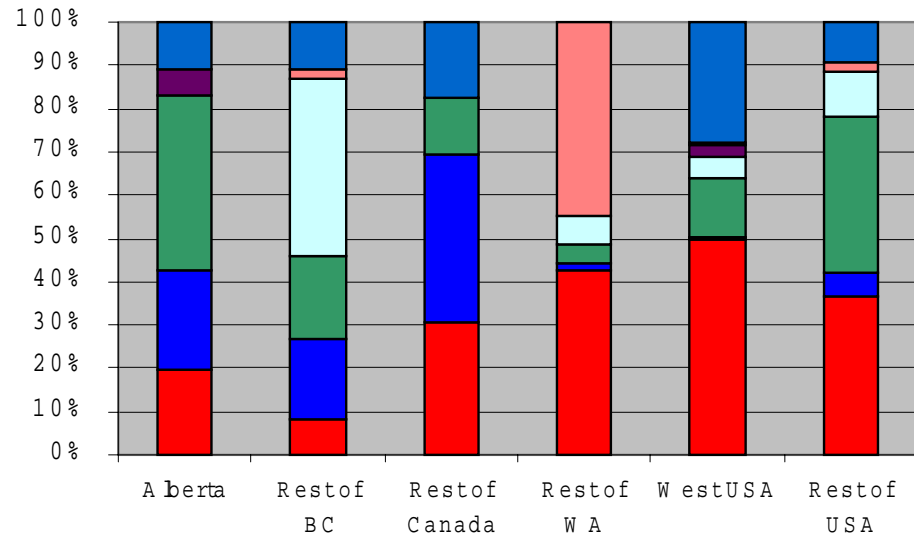
What Drives Demand?

Auto Residence by Trip Destination

Summer



Fall

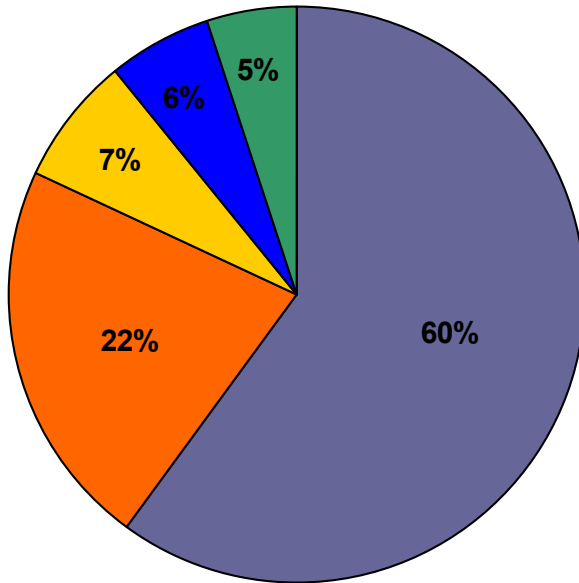


This chart reinforces the conclusions of the previous chart by capturing return trips for which the outbound leg was not captured in the previous chart. Again, notice the large number U.S. residents destined for the Puget Sound region or Whatcom County in both summer and fall.

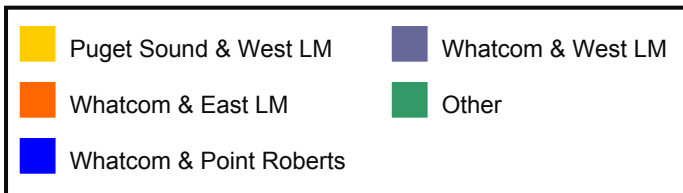
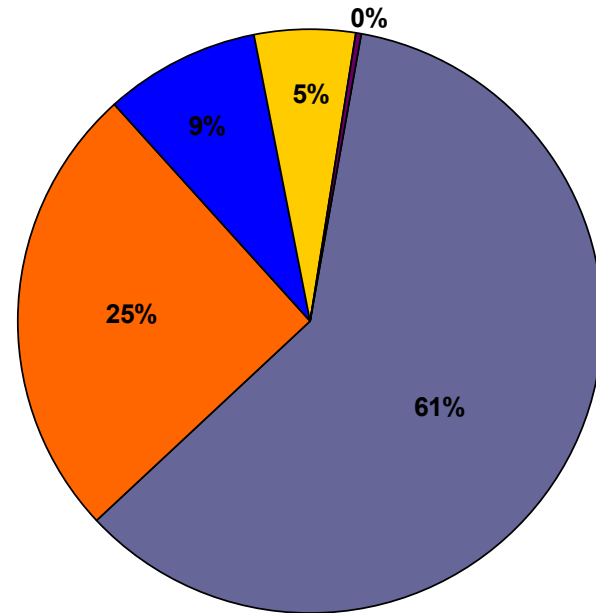
What Drives Demand?

Major Origins and Destinations

Summer Work Commute Trips



Fall Work Commute Trips

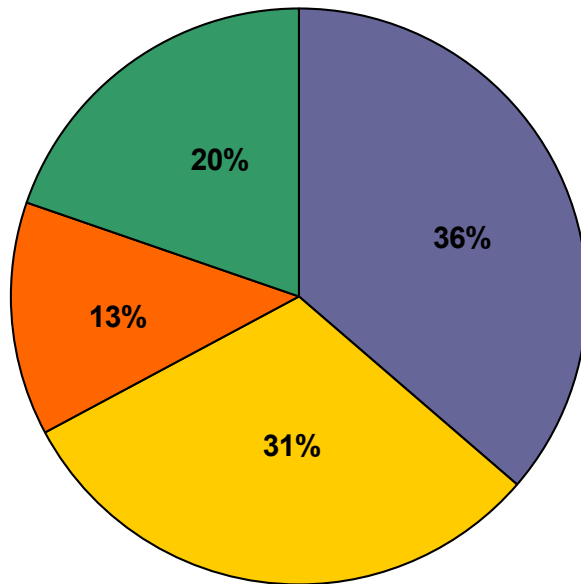


Major trip purposes crossing the border have distinct origin-destination patterns. O-D patterns for commute trips are similar in summer and fall and, as expected, are fairly localized. The predominant O-D pattern is between Whatcom County and the West Lower Mainland. A slightly, smaller fraction of trips are between Whatcom County and the East Lower Mainland. Very few commute trips fall outside of this area.

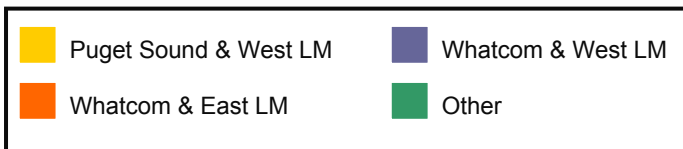
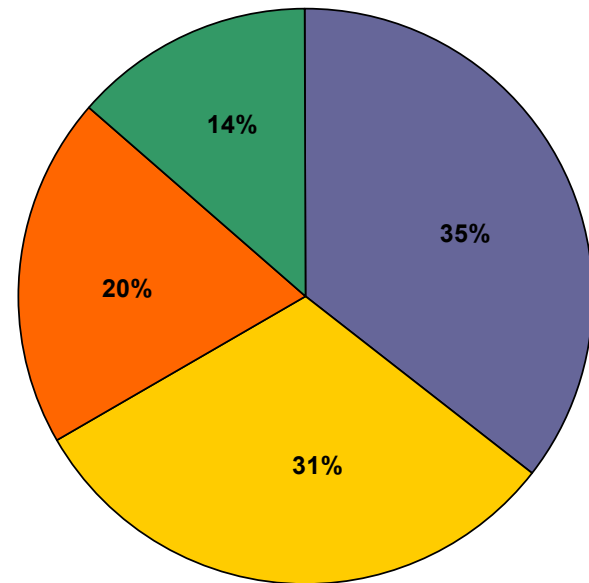
What Drives Demand?

Major Origins and Destinations

Summer Business Related Trips



Fall Business Related Trips

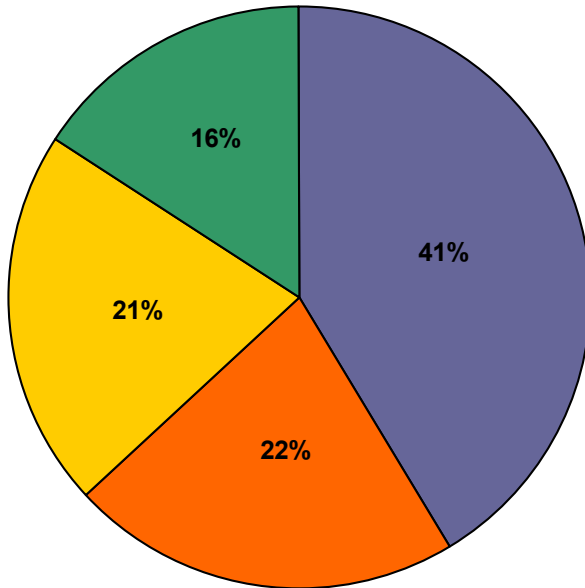


Business trips extend to a wider area than do commute trips. Trips between Whatcom County and the West Lower Mainland are still the leading O-D pair, but trips between the Puget Sound Region and West Lower Mainland are nearly as significant. Business trips between Whatcom County and the East Lower Mainland are less significant than are commute trips between these locations. Again, travel patterns for business trips are similar in summer and fall.

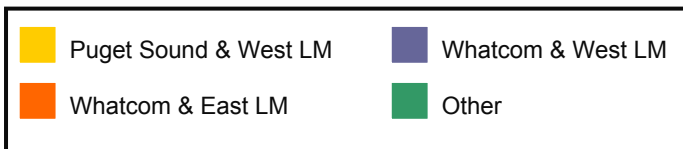
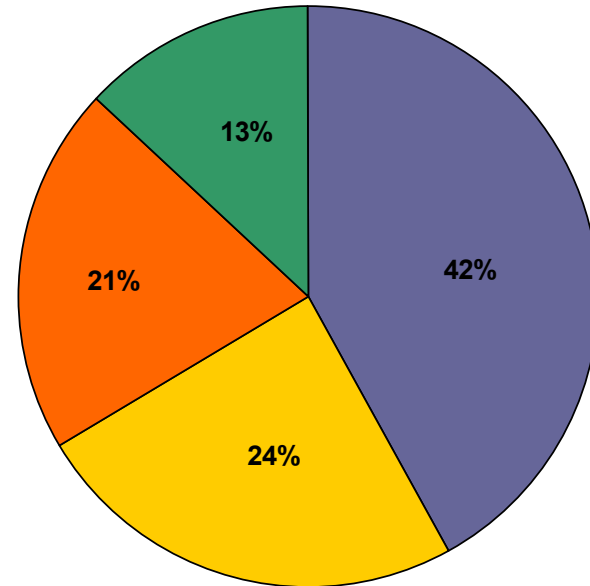
What Drives Demand?

Major Origins and Destinations

Summer Recreation Trips



Fall Recreation Trips

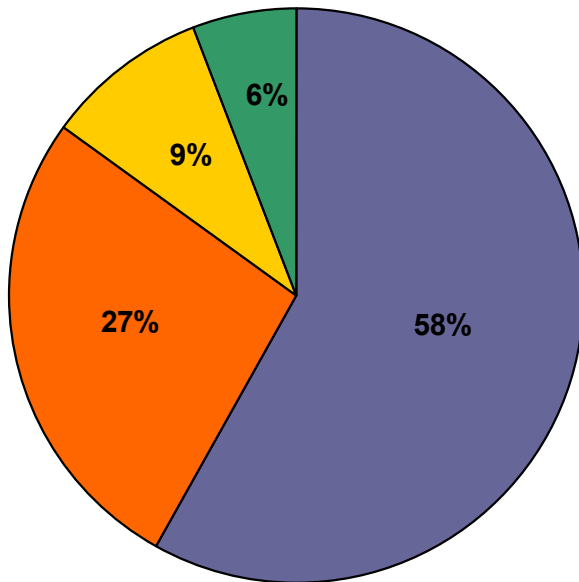


Recreation trips also occur in an area that includes the Lower Mainland to the Puget Sound Region. The largest fraction of trips occur between Whatcom County and the Lower Mainland, with most of these trips between Whatcom County and the West Lower Mainland. But nearly one-quarter of recreation trips occur between the Puget Sound Region and the West Lower Mainland.

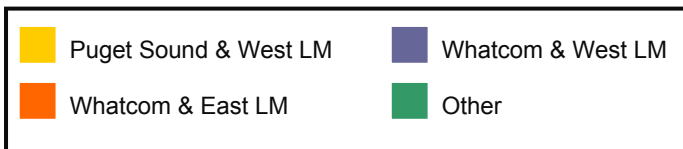
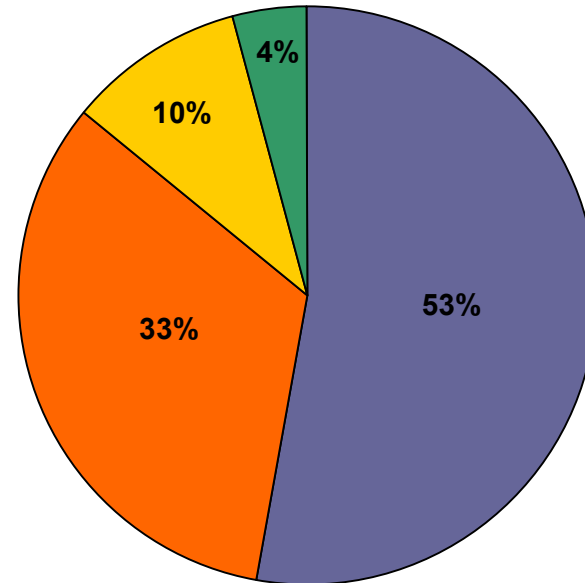
What Drives Demand?

Major Origins and Destinations

Summer Shopping Trips



Fall Shopping Trips

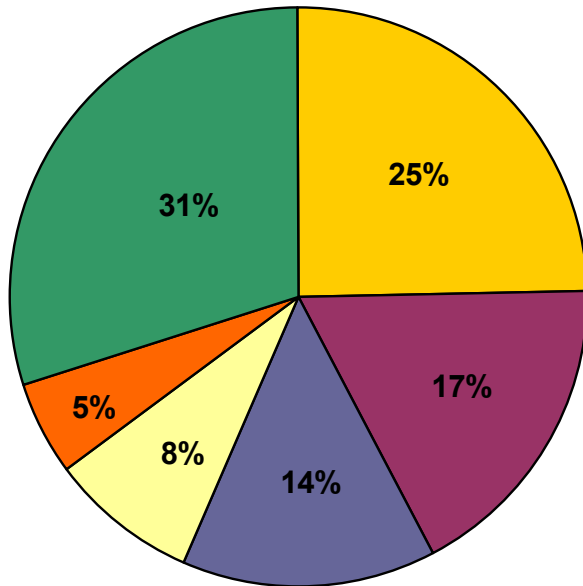


Almost all shopping trips occur between Whatcom County and the Lower Mainland. The majority of trips occur between Whatcom County and the West Lower Mainland, but a significant share occur between Whatcom County and the East Lower Mainland. This share increases in the fall with the general increase in shopping trips.

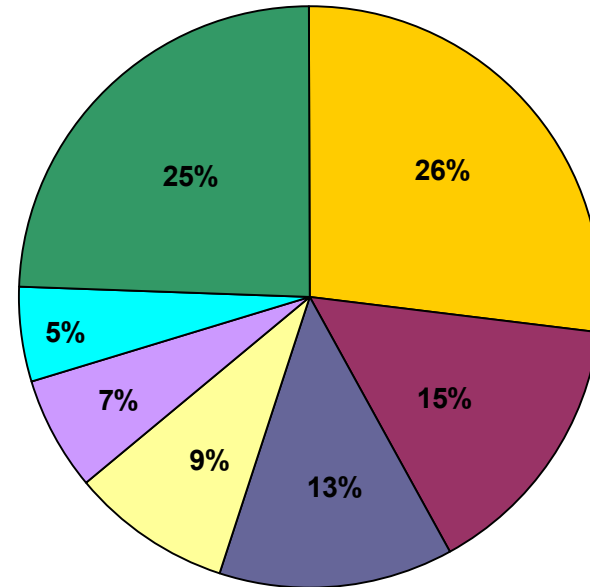
What Drives Demand?

Major Origins and Destinations

Summer Vacation Trips



Fall Vacation Trips



Vacation origin-destination patterns encompass a much broader area than any other trip purpose, with very few of the trips being local. Roughly one-quarter of vacation trips are made between the Puget Sound Region and the West Lower Mainland, one of the larger vacation O-D pairs. Trips between the Puget Sound Region and the rest of British Columbia also account for a large share of trips. In both summer and fall approximately 40% of vacation trips had either an origin or destination outside the area from Puget Sound to the Lower Mainland.

What Drives Demand?

Recreation Trips to Canada (U.S. Residents)

| Major Destination City | Summer Trips | Percentage |
|------------------------|--------------|--------------|
| Vancouver | 1,882 | 30.7 |
| Abbotsford | 797 | 13.0 |
| White Rock | 579 | 9.4 |
| Surrey | 561 | 9.1 |
| Langley | 329 | 5.4 |
| Richmond | 287 | 4.7 |
| Chilliwack | 264 | 4.3 |
| Burnaby | 161 | 2.6 |
| Whistler | 142 | 2.3 |
| North Vancouver | 138 | 2.3 |
| Aldergrove | 111 | 1.8 |
| Delta | 94 | 1.5 |
| Mission | 89 | 1.5 |
| Victoria | 67 | 1.1 |
| Coquitlam | 63 | 1.0 |
| Harrison | 62 | 1.0 |
| New Westminster | 56 | 0.9 |
| Maple Ridge | 55 | 0.9 |
| Hope | 54 | 0.9 |
| Other | 342 | 5.6 |
| Total | 6,133 | 100.0 |

| Major Destination City | Fall Trips | Percentage |
|------------------------|--------------|--------------|
| Vancouver | 1,507 | 33.5 |
| Langley | 444 | 9.9 |
| Abbotsford | 432 | 9.6 |
| White Rock | 344 | 7.6 |
| Surrey | 326 | 7.2 |
| Richmond | 279 | 6.2 |
| Burnaby | 193 | 4.3 |
| Chilliwack | 130 | 2.9 |
| Cloverdale | 103 | 2.3 |
| New Westminster | 84 | 1.9 |
| Delta | 84 | 1.9 |
| Mission | 75 | 1.7 |
| Whistler | 70 | 1.6 |
| North Vancouver | 51 | 1.1 |
| Other | 381 | 8.5 |
| Total | 4,503 | 100.0 |

In order to identify more clearly where different types of trips are concentrated, the consultant team looked at trip destinations at the city level. Recreation trips to Canada by U.S. residents have Vancouver as the largest single destination in both summer and fall (roughly one-third of trips). Other major recreation destinations include Abbotsford (more so in the summer), Langley, White Rock, and Surrey.

What Drives Demand?

Vacation Trips to Canada (U.S. Residents)

| Major Destination City | Summer Trips | Percentage |
|------------------------|--------------|--------------|
| Vancouver | 1,796 | 30.9 |
| Whistler | 743 | 12.8 |
| Victoria | 393 | 6.8 |
| Richmond | 293 | 5.0 |
| Surrey | 164 | 2.8 |
| Hope | 152 | 2.6 |
| Chilliwack | 131 | 2.3 |
| Burnaby | 125 | 2.2 |
| White Rock | 103 | 1.8 |
| Abbotsford | 93 | 1.6 |
| Kelowna | 86 | 1.5 |
| Kamloops | 83 | 1.4 |
| North Vancouver | 83 | 1.4 |
| Coquitlam | 68 | 1.2 |
| Cache Creek | 67 | 1.2 |
| Langley | 64 | 1.1 |
| Tofino | 62 | 1.1 |
| Campbell River | 61 | 1.1 |
| Other | 1,236 | 21.3 |
| Total | 5,803 | 100.0 |

| Major Destination City | Fall Trips | Percentage |
|------------------------|--------------|--------------|
| Vancouver | 275 | 23.8 |
| Abbotsford | 119 | 10.3 |
| Whistler | 147 | 12.7 |
| Richmond | 55 | 4.8 |
| Surrey | 94 | 8.1 |
| Other | 464 | 40.2 |
| Total | 1,154 | 100.0 |

Vacation trips to Canada by U.S. residents are more concentrated in summer than fall. Over 50% of the summer vacation trips are to Vancouver, Whistler, or Victoria. In fall, Vancouver and Whistler remain major vacation destination. Abbotsford also attracts a relatively large share of fall vacation trips.

What Drives Demand?

Shopping Trips to Canada (U.S. Residents)

| Major Destination City | Summer Trips | Percentage |
|------------------------|--------------|--------------|
| Abbotsford | 308 | 25.5 |
| Vancouver | 202 | 16.7 |
| Surrey | 196 | 16.3 |
| Richmond | 158 | 13.1 |
| White Rock | 140 | 11.6 |
| Langley | 80 | 6.6 |
| Other | 122 | 10.1 |
| Total | 1,206 | 100.0 |

| Major Destination City | Fall Trips | Percentage |
|------------------------|--------------|--------------|
| Vancouver | 541 | 31.3 |
| Abbotsford | 424 | 24.5 |
| Surrey | 163 | 9.4 |
| Richmond | 157 | 9.1 |
| Langley | 148 | 8.5 |
| White Rock | 131 | 7.6 |
| Aldergrove | 114 | 6.6 |
| Other | 53 | 3.1 |
| Total | 1,731 | 100.0 |

Shopping trips to Canada by U.S. residents occur in a relatively small number of cities. Vancouver and Abbotsford account for the largest share with trips to Surrey, Langley, Richmond, White Rock, and Aldergrove accounting for most of the remainder.

What Drives Demand?

Recreation Trips to the U.S. (Canadian Residents)

| Major Destination City | Summer Trips | Percentage |
|------------------------|---------------|--------------|
| Bellingham | 2,101 | 15.3 |
| Lynden | 2,056 | 14.9 |
| Seattle | 1,971 | 14.3 |
| Birch Bay | 1,809 | 13.1 |
| Blaine | 1,798 | 13.1 |
| Other | 992 | 7.2 |
| Sumas | 786 | 5.7 |
| Mt Baker | 444 | 3.2 |
| Ferndale | 216 | 1.6 |
| Maple Falls | 163 | 1.2 |
| Mt Vernon | 144 | 1.0 |
| Custer | 140 | 1.0 |
| Everett | 135 | 1.0 |
| Tacoma | 131 | 1.0 |
| Nooksack | 123 | 0.9 |
| Whidbey Island | 110 | 0.8 |
| Deming | 100 | 0.7 |
| Kendall | 83 | 0.6 |
| George | 73 | 0.5 |
| La Conner | 64 | 0.5 |
| Skagit | 60 | 0.4 |
| Renton | 58 | 0.4 |
| Portland | 54 | 0.4 |
| Kent | 54 | 0.4 |
| Whatcom | 53 | 0.4 |
| Semiahmoo | 50 | 0.4 |
| Total | 13,768 | 100.0 |

| Major Destination City | Fall Trips | Percentage |
|------------------------|--------------|--------------|
| Blaine | 1,665 | 18.9 |
| Bellingham | 1,403 | 15.9 |
| Seattle | 1,200 | 13.6 |
| Birch Bay | 1,195 | 13.6 |
| Lynden | 427 | 4.8 |
| Sumas | 352 | 4.0 |
| Ferndale | 306 | 3.5 |
| Mt Baker | 201 | 2.3 |
| Deming | 198 | 2.2 |
| Maple Falls | 187 | 2.1 |
| Nooksack | 117 | 1.3 |
| Semiahmoo | 103 | 1.2 |
| Skagit | 90 | 1.0 |
| Everett | 85 | 1.0 |
| Tacoma | 79 | 0.9 |
| Portland | 67 | 0.8 |
| Anacortes | 56 | 0.6 |
| Paradise Lake | 52 | 0.6 |
| Lummi Island | 51 | 0.6 |
| Other | 971 | 11.0 |
| Total | 8,805 | 100.0 |

Recreation trips to the U.S. by Canadian residents are concentrated in a relatively small number of destinations. In both summer and fall, over 70% of these trips are to five cities: Bellingham, Lynden, Seattle, Birch Bay and Blaine.

What Drives Demand?

Vacation Trips to the U.S. (Canadian Residents)

| Major Destination City | Summer Trips | Percentage |
|------------------------|--------------|--------------|
| Seattle | 881 | 20.1 |
| Birch Bay | 775 | 17.7 |
| Bellingham | 362 | 8.2 |
| Portland | 257 | 5.9 |
| Sumas | 130 | 3.0 |
| Blaine | 120 | 2.7 |
| Mt Baker | 116 | 2.6 |
| Tacoma | 91 | 2.1 |
| Lynden | 90 | 2.1 |
| Maple Falls | 74 | 1.7 |
| Other | 1,494 | 34.0 |
| Total | 4,390 | 100.0 |

| Major Destination City | Fall Trips | Percentage |
|------------------------|--------------|--------------|
| Seattle | 407 | 27.2 |
| Birch Bay | 187 | 12.5 |
| Bellingham | 120 | 8.0 |
| Portland | 88 | 5.9 |
| Eugene | 53 | 3.5 |
| Other | 641 | 42.8 |
| Total | 1,496 | 100.0 |

Vacation trips by Canadians to the U.S. are far less concentrated by destination than are recreation trips. Four cities account for over 50% of trips in both cases (Seattle, Birch Bay, Bellingham, and Portland), with Seattle being the most significant vacation destination in both seasons.

What Drives Demand?

Shopping Trips to the U.S. (Canadian Residents)

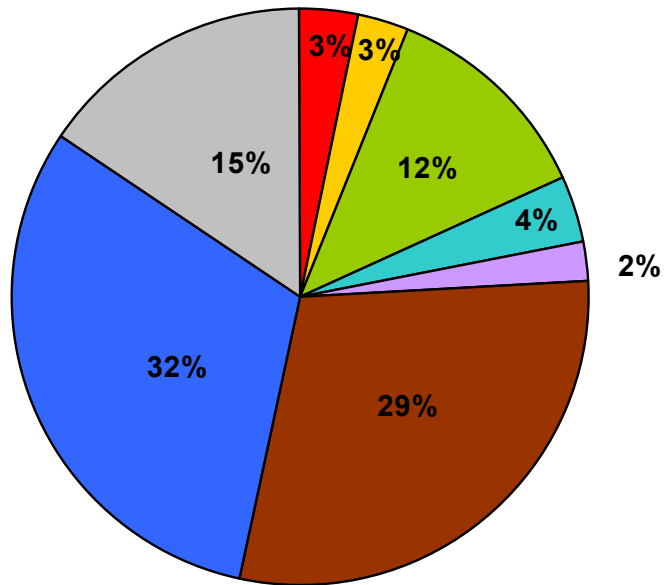
| Major Destination City | Summer Trips | Percentage |
|------------------------|--------------|--------------|
| Bellingham | 2,164 | 42.4 |
| Blaine | 1,465 | 28.7 |
| Sumas | 551 | 10.8 |
| Lynden | 472 | 9.3 |
| Other | 246 | 4.8 |
| Seattle | 201 | 3.9 |
| Total | 5,099 | 100.0 |

| Major Destination City | Fall Trips | Percentage |
|------------------------|--------------|--------------|
| Bellingham | 2,480 | 40.3 |
| Blaine | 1,801 | 29.2 |
| Lynden | 780 | 12.7 |
| Sumas | 605 | 9.8 |
| Seattle | 294 | 4.8 |
| Ferndale | 72 | 1.2 |
| Other | 128 | 2.1 |
| Total | 6,160 | 100.0 |

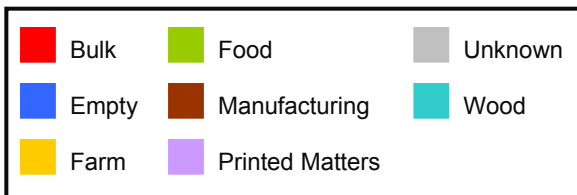
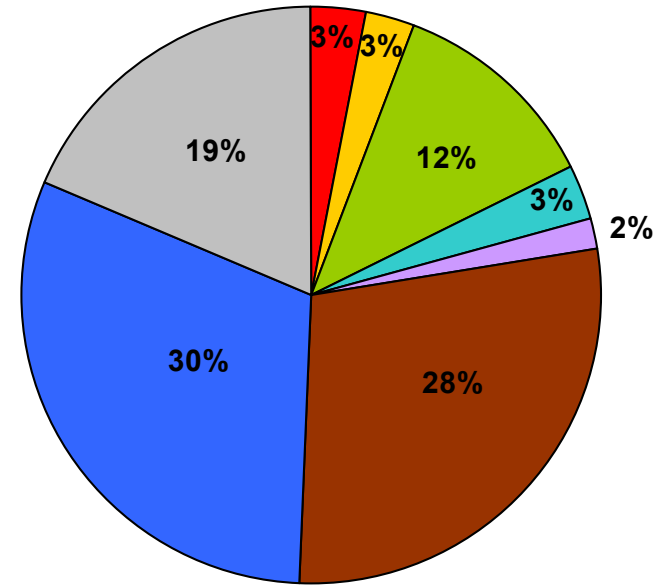
Roughly half of the shopping trips by Canadian residents to the U.S. are destined for the border cities in which the POEs are located (Blaine, Lynden, and Sumas). Nonetheless, more of the shopping trips are destined for Bellingham than any single destination in the U.S. Very few shopping trips by Canadian residents go to any other destination in the U.S.

What Drives Demand? Commodities Transported

Summer (Northbound)



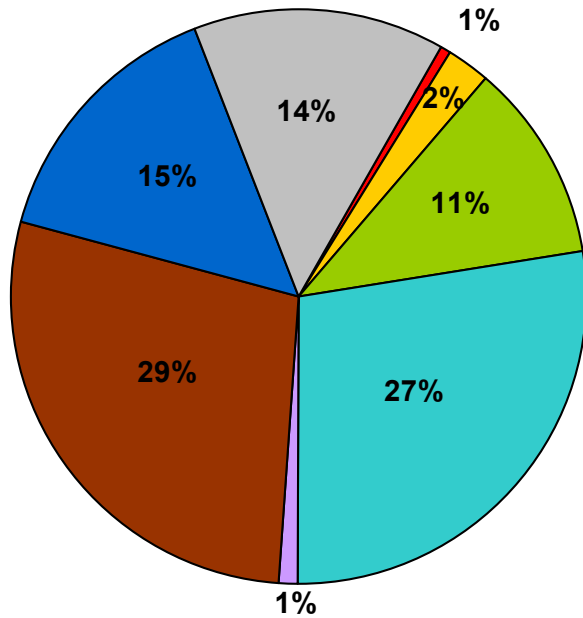
Fall (Northbound)



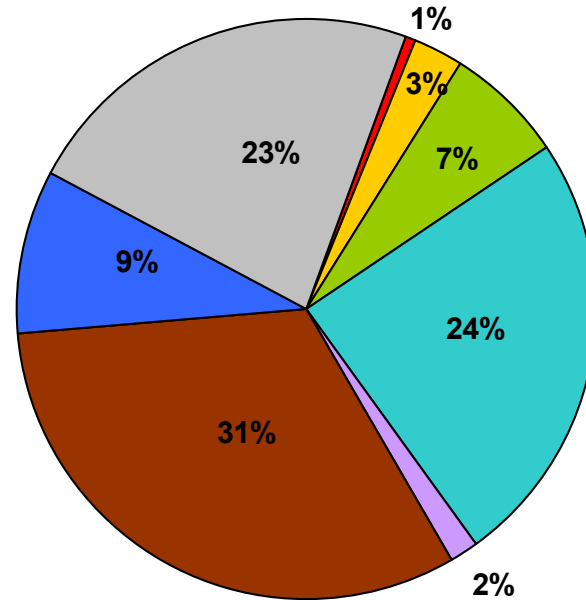
Commodity flows that reflect economic production, consumption, and distribution patterns drive demand for truck movement. There are some distinct directional patterns in commodity movements by truck across the border. It is sometimes jokingly said that the most significant commodity moved by trucks is air. This is certainly true of northbound truck movements, where empties predominate. This may reflect current exchange rates that favor Canadian exports. Manufactured products represent the largest commodity group moving north by truck followed by processed food products. This reflects the diversified manufacturing base of the U.S. and the consumer demand of the Vancouver metropolitan area.

What Drives Demand? Commodities Transported

Summer (Southbound)



Fall (Southbound)

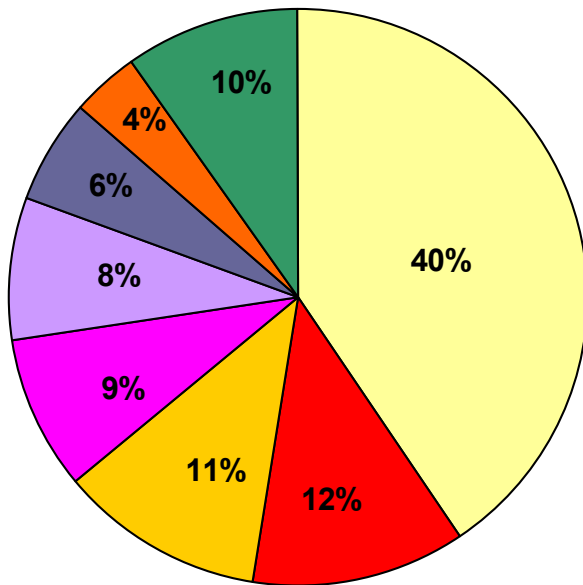


Southbound, empties are a much less significant share of truck movements. Again, manufactured products are the most significant commodity moved by truck. Processed food products are also important but represent a smaller share of southbound movements than of northbound movements. Aside from the reduction in the amount of empties, the large volume of wood products is the biggest difference in southbound movements as compared to northbound movements. These charts as well as the previous charts show that there is no significant difference between summer and fall commodity movements by truck.

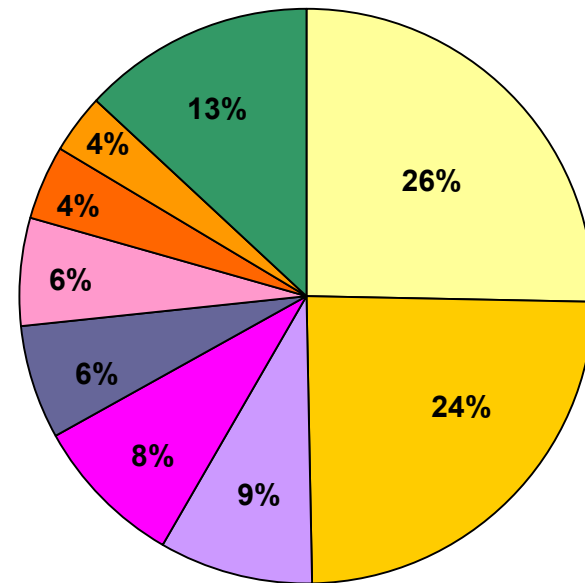
What Drives Demand?

Major Origins and Destinations

Summer: Food



Fall: Food

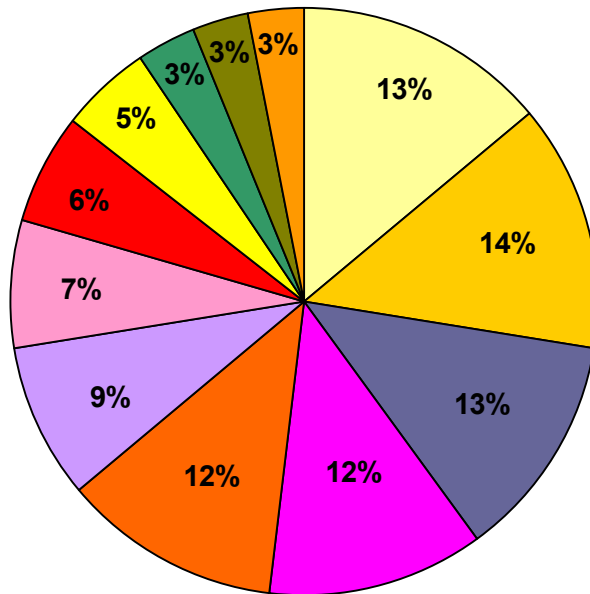


Food products crossing the border in the summer months are moving largely between the Western U.S. states of California and Oregon, and the West Lower Mainland. Trucks moving between the rest of the U.S., Puget Sound Region and the West Lower Mainland also represent significant truck flows of food products in the summer. In the Fall, movements between the Western U.S. and the West Lower Mainland remain a significant share of total food truck movements; but movements between the Puget Sound Region and the West Lower Mainland represent a much more significant share of food truck flows in the fall than they do in the summer.

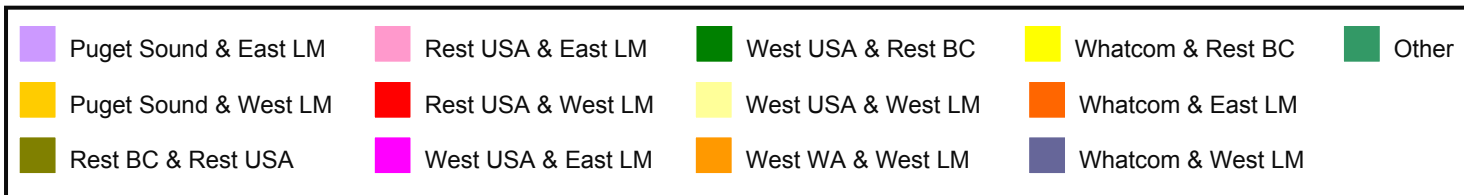
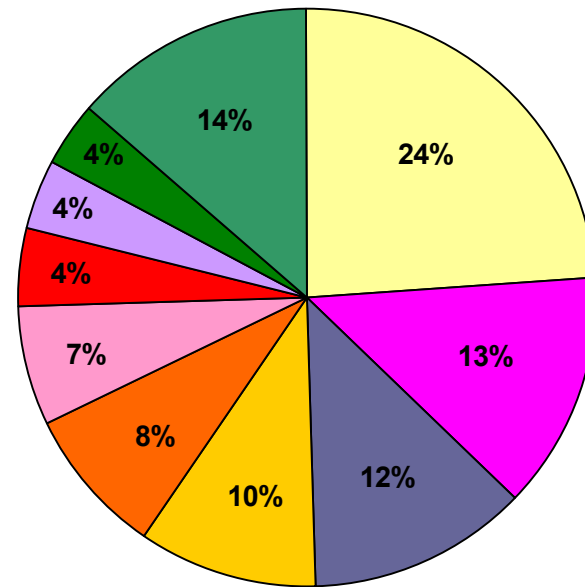
What Drives Demand?

Major Origins and Destinations

Summer Wood



Fall: Wood

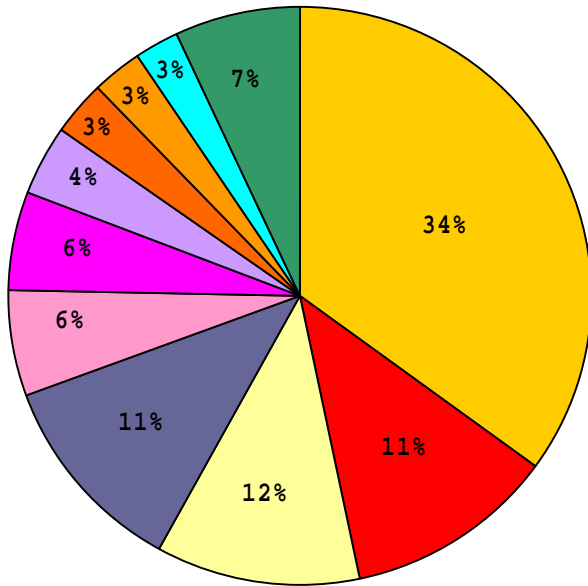


Wood products moved by truck show a distinctly different pattern of origins and destinations in the summer than in the fall. In the summer, movements between the East Lower Mainland and the U.S. represent the largest share of wood product shipments by truck. But in the Fall, this is not the case. In both the summer and fall, the largest share of wood products move between the Western U.S. and the West Lower Mainland. Wood products movements by truck show a generally dispersed pattern of origins and destinations in the U.S., reflecting the widespread market for these products.

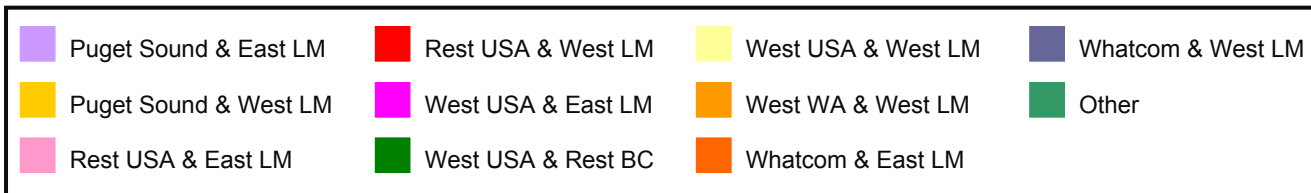
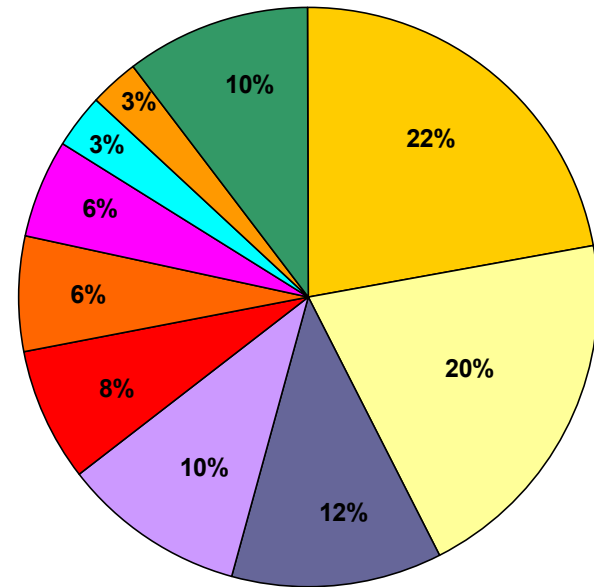
What Drives Demand?

Major Origins and Destinations

Summer: Manufactured Products



Fall: Manufactured Products



Manufactured products moving by truck across the border move largely between the West Lower Mainland and the U.S. reflecting both the product infrastructure and demand center in the Vancouver metropolitan area. Movements between the Puget Sound Region and the West Lower Mainland represent the most significant origin-destination pattern, but in general, the distribution of origins and destinations in the U.S. is fairly dispersed.

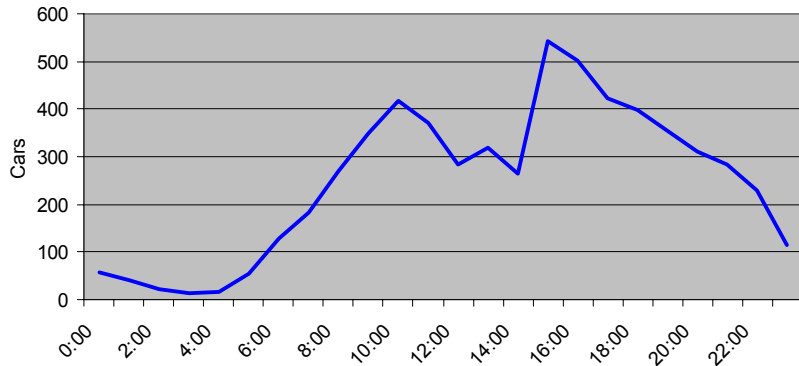
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What Are the Time-of-Day Traffic Patterns?

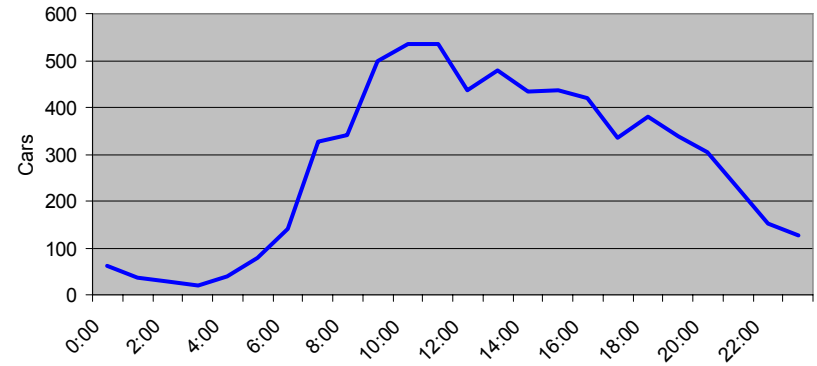
What Are the Time-of-Day Traffic Patterns?

Peace Arch: Summer

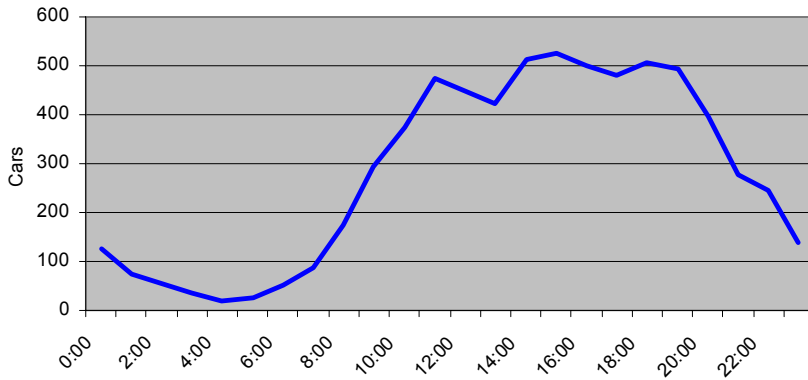
Summer Weekday: Northbound



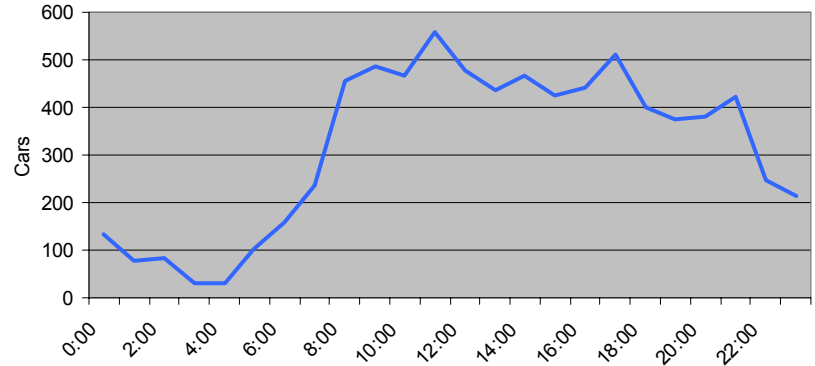
Summer Weekday: Southbound



Summer Weekend: Northbound



Summer Weekend: Southbound

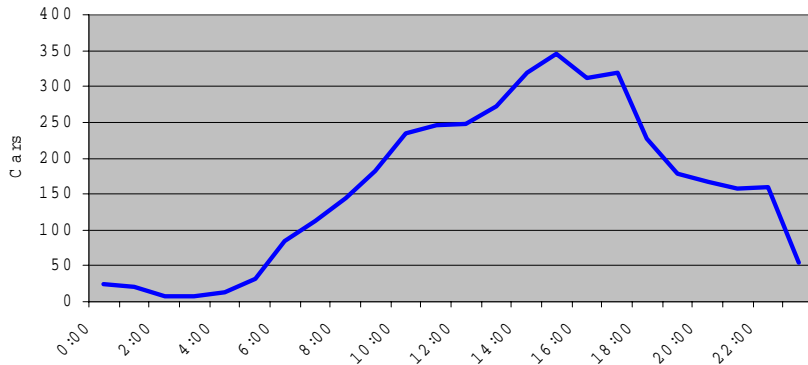


Examining time of day traffic patterns is important in understanding traffic congestion. Ultimately, by looking across POEs, it may be possible to identify opportunities to spread peak traffic and make better use of existing capacity. Summer is the peak season for auto traffic. In the Northbound direction, peak periods are similar on weekdays and weekends with a small peak in late morning and peak conditions that tend to last from mid-afternoon to early evening. The same is true in the Southbound direction with a peak in mid-morning, but with relatively flat traffic volumes from 9-4 on weekdays and 8-5 on weekends. Peak volumes in both directions are experienced on the weekend.

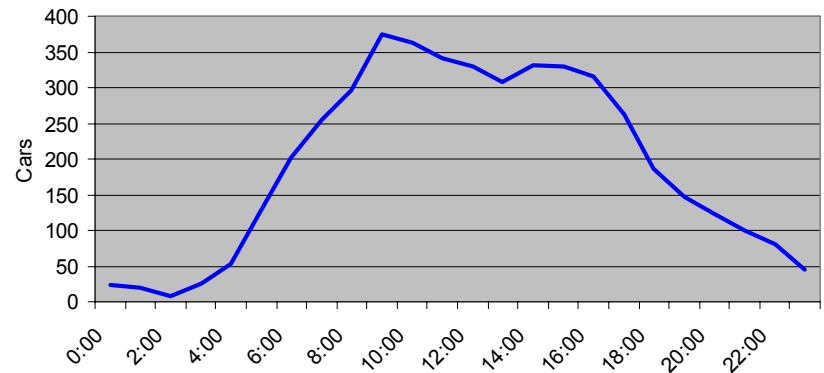
What Are the Time-of-Day Traffic Patterns?

Peace Arch: Fall

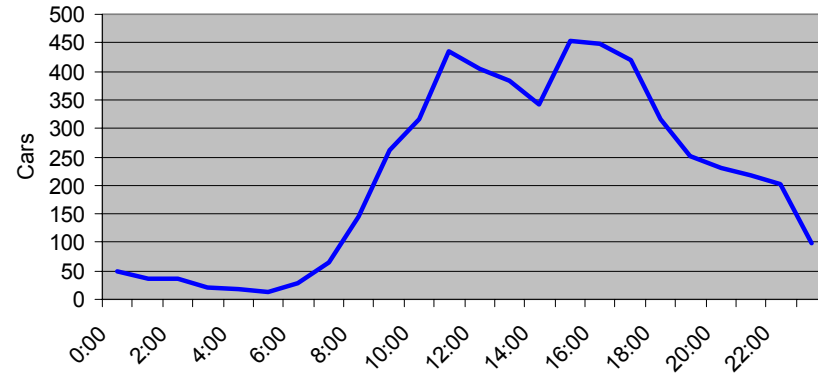
Fall Weekday: Northbound



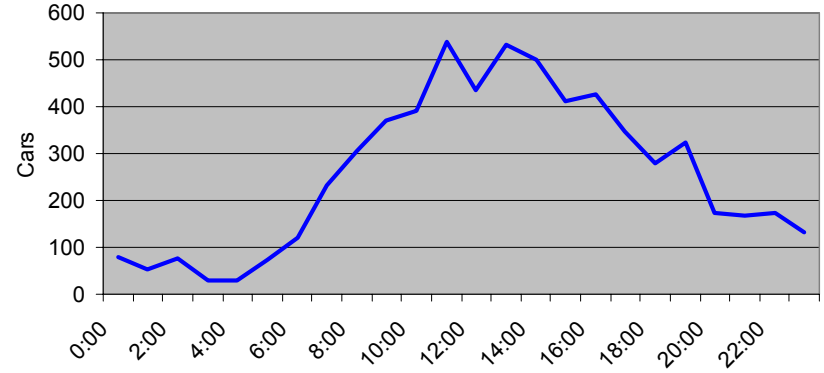
Fall Weekday: Southbound



Fall Weekend: Northbound



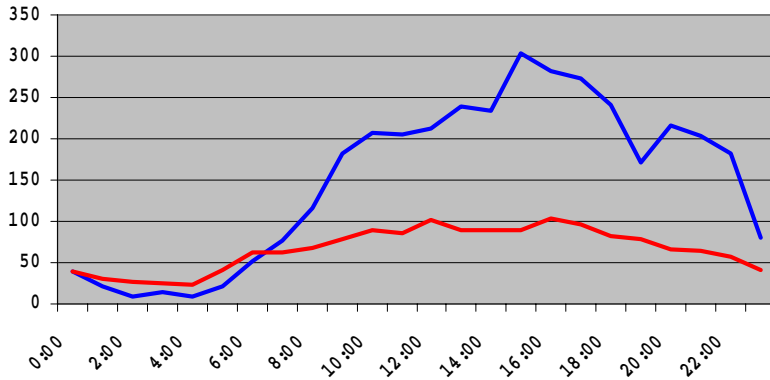
Fall Weekend: Southbound



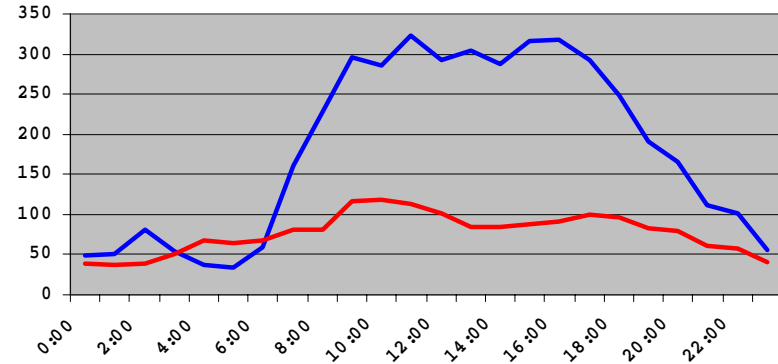
The peak periods in the fall are shorter than they are in the summer. In the Northbound direction, there is an afternoon peak on the weekdays, as in the summer, but it is earlier in the afternoon. The weekend afternoon peak is also shorter in duration. In the Southbound direction, there is a peak at around 9 a.m. on weekdays but traffic volumes are relatively flat until 5 p.m. On the weekends, there is a more pronounced peak than in the summer and peak conditions last only from 10-4.

What Are the Time-of-Day Traffic Patterns? Pacific Highway: Summer

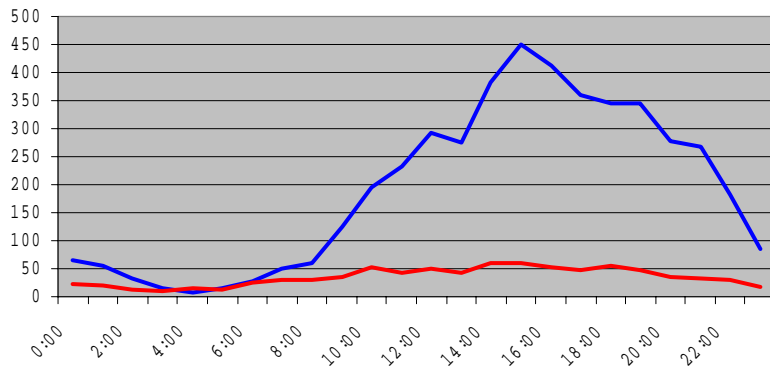
SummerWeekday: Northbound



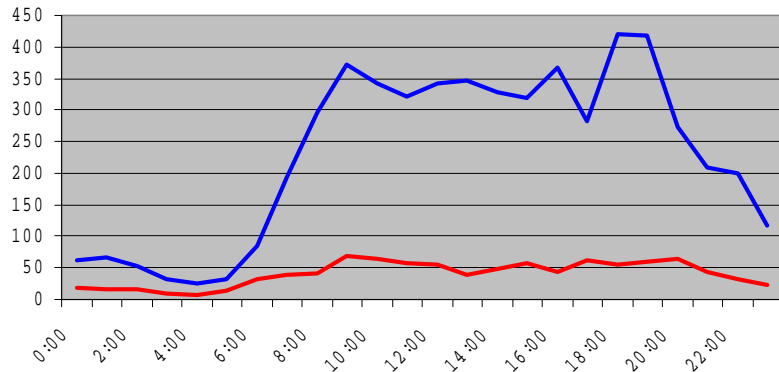
SummerWeekday: Southbound



SummerWeekend: Northbound



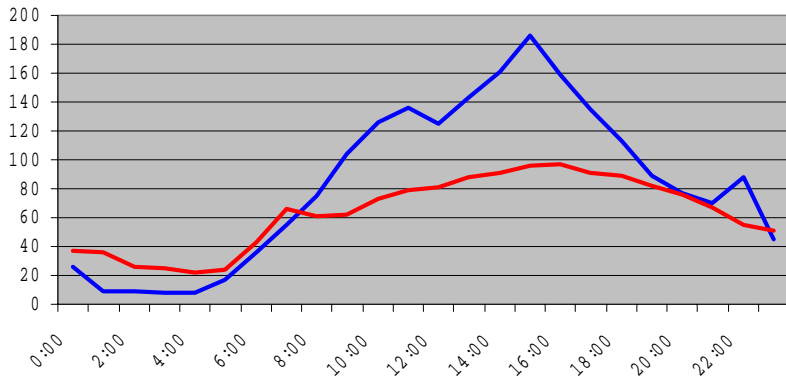
SummerWeekend: Southbound



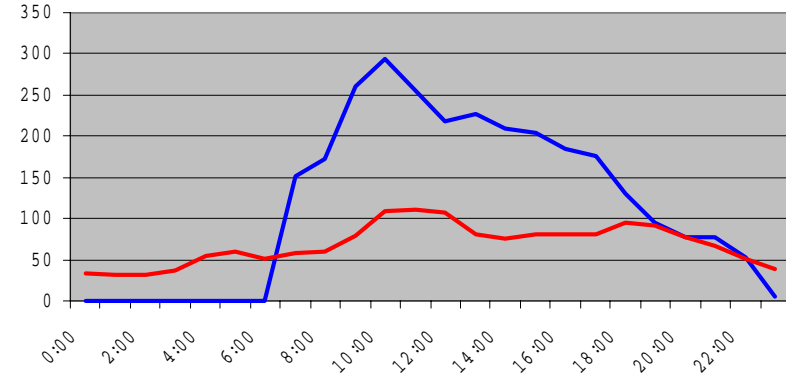
Northbound summer auto traffic at Pacific Highway experiences similar peak periods as does traffic at Peace Arch suggesting there may be more limited opportunities to use Pacific as a relief valve in this direction. The difference between peak volumes Northbound on the weekend are also more pronounced, suggesting the motorists are already shifting between the two crossings. In the Southbound direction, Pacific Highway has a late peak in the early evening on the weekend, which it may be possible to shift to another crossing. Truck traffic, which is substantially higher on weekdays, has a relatively flat distribution throughout the day. In the Southbound direction there is a slight peak between 10 and noon.

What Are the Time-of-Day Traffic Patterns? Pacific Highway: Fall

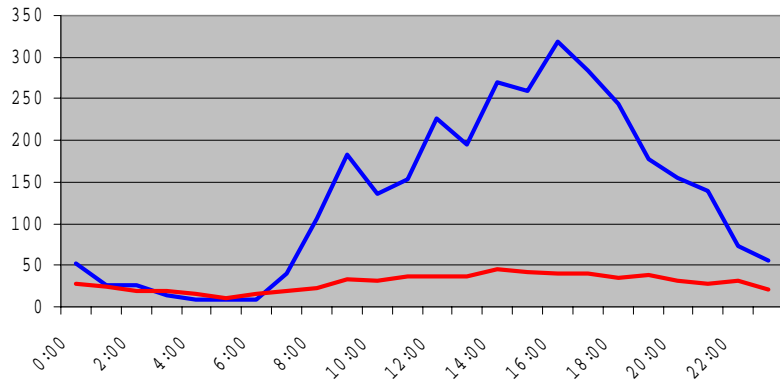
Fall weekday: Northbound



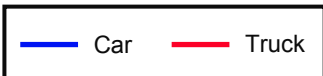
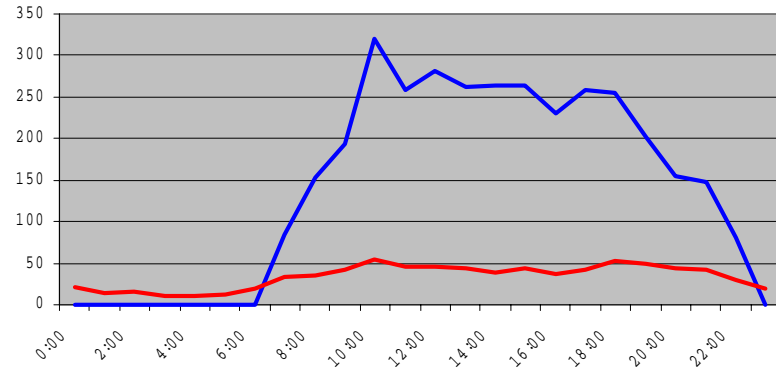
Fall weekday: Southbound



Fall weekend: Northbound



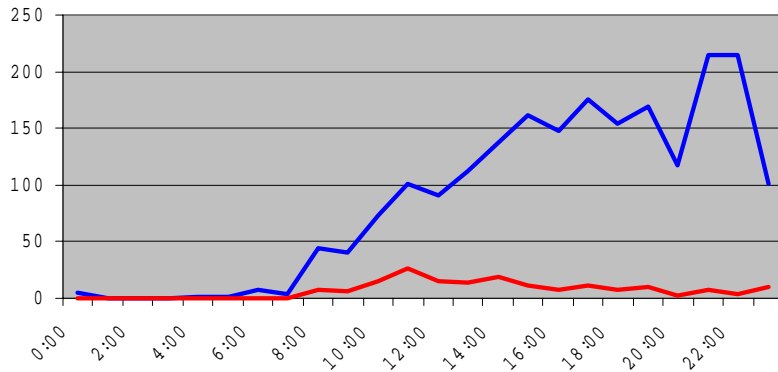
Fall weekend: Southbound



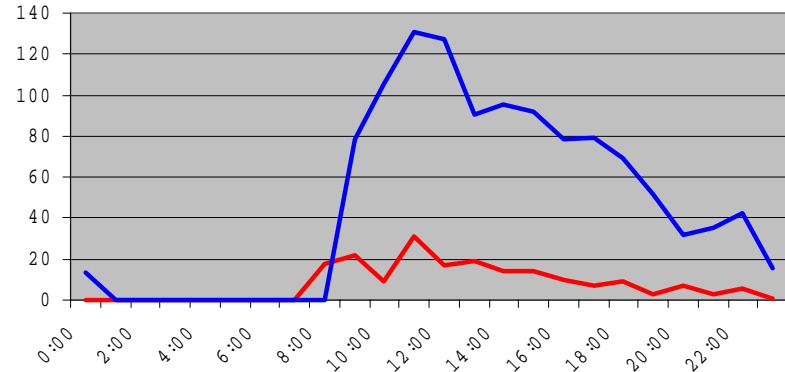
Fall auto traffic at Pacific Highway shows similar time-of-day patterns as summer. Northbound traffic peaks in the afternoon with the daily peak at around 4 p.m. (consistent with return trips by Canadian residents). Southbound trips show relatively flat traffic volumes from 10-4 on weekdays and 10-7 on weekends. The peak is at 11 am mirroring the afternoon peak in the Northbound direction. Truck traffic volumes remain relatively flat throughout the day with peak activity on weekdays. Northbound truck traffic has a slight peak around 5 p.m., while Southbound traffic has a peak around 11 a.m.-noon and another slight peak around 7 p.m.

What Are the Time-of-Day Traffic Patterns? Aldergrove: Summer

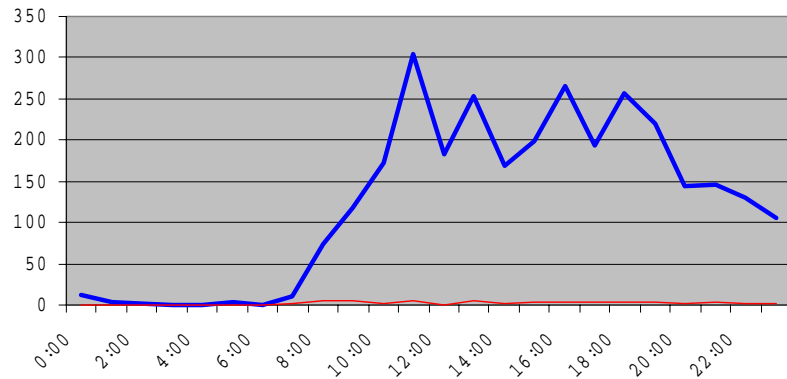
SummerWeekday: Northbound



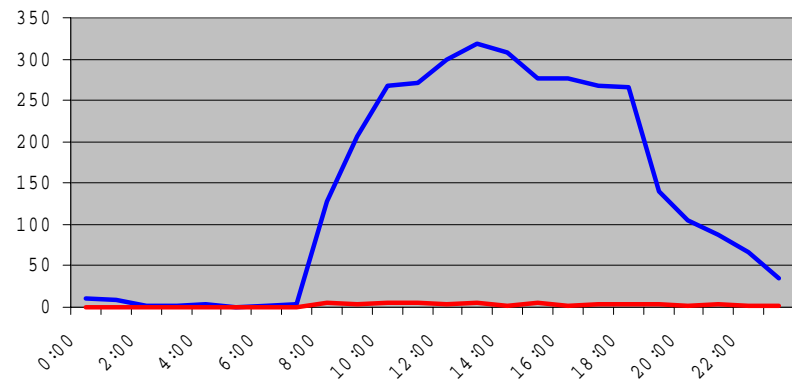
SummerWeekday: Southbound



SummerWeekend: Northbound



SummerWeekend: Southbound

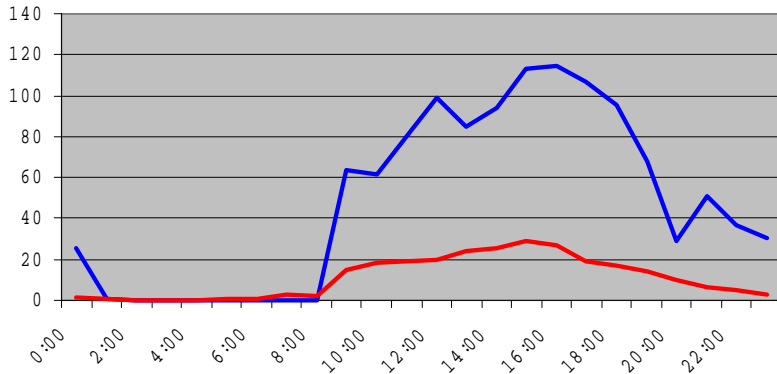


Summer Northbound auto traffic at Lynden/Aldergrove experiences an afternoon peak on weekdays with a flatter distribution on weekends. These peak periods significantly overlap the peaks of the other crossings. However, the lower volumes at this location suggests a potential opportunity to use the crossing as a relief facility. On weekends, Southbound auto traffic volumes are more constant from 11-7, again overlapping the peaks at other crossings. For truck traffic, Northbound volumes are very low (suggesting underutilized capacity) even though the timing of the peak in the late morning is similar to that of other crossings. In the Southbound direction, truck volumes peak around noon, with a secondary peak around 9.

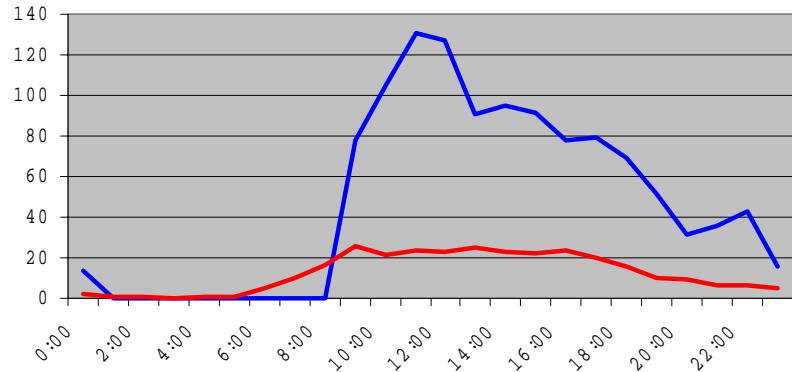
What Are the Time-of-Day Traffic Patterns?

Aldergrove: Fall

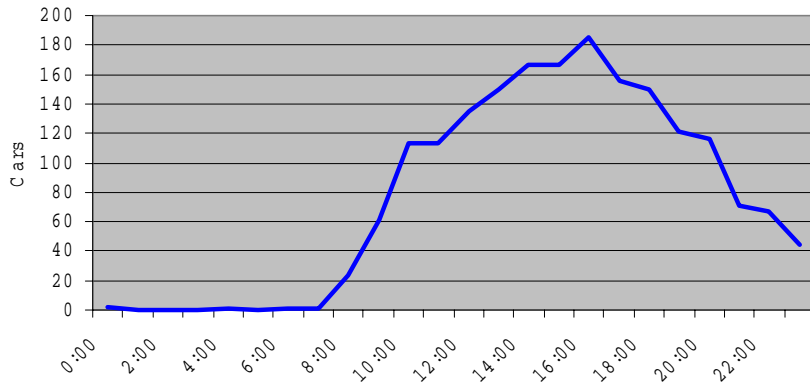
Fall weekday: Northbound



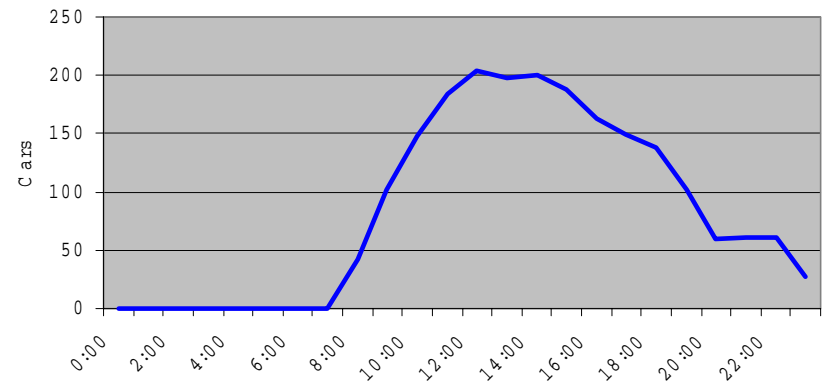
Fall weekday: Southbound



Fall weekend: Northbound



Fall weekend: Southbound



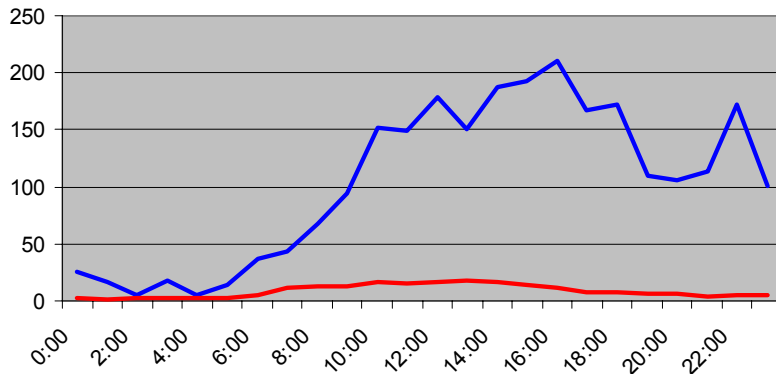
— Car — Truck

Fall weekday auto trip patterns at Lynden/Aldergrove Northbound are similar to summer except there is no late evening peak in the fall. The weekend peak shifts to later in the day. Weekday truck trip patterns show some differences between the summer and fall in the Southbound direction. The time-of-day distribution is flatter in the fall and the peak shifts from the noon hour to later in the afternoon (around 4).

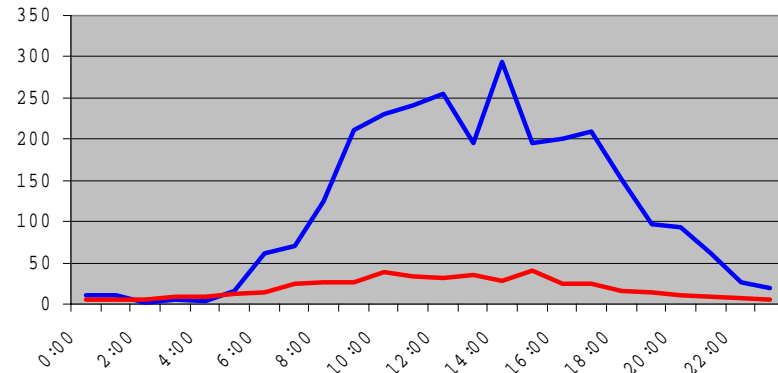
What Are the Time-of-Day Traffic Patterns?

Sumas: Summer

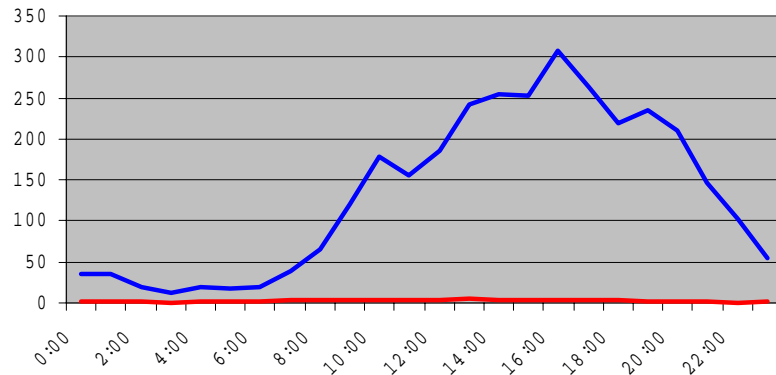
Summer Weekday: Northbound



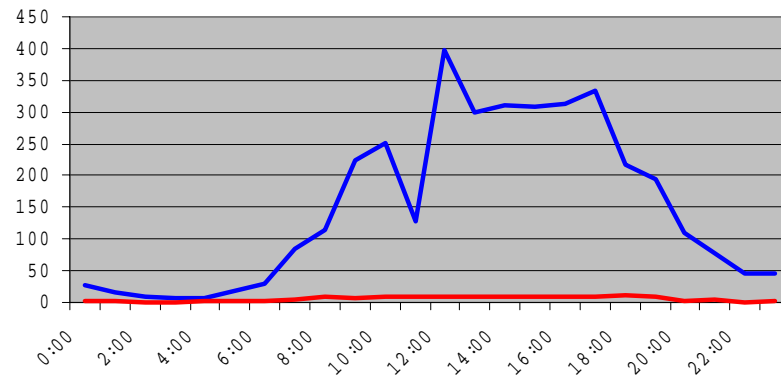
Summer Weekday: Southbound



Summer Weekend: Northbound



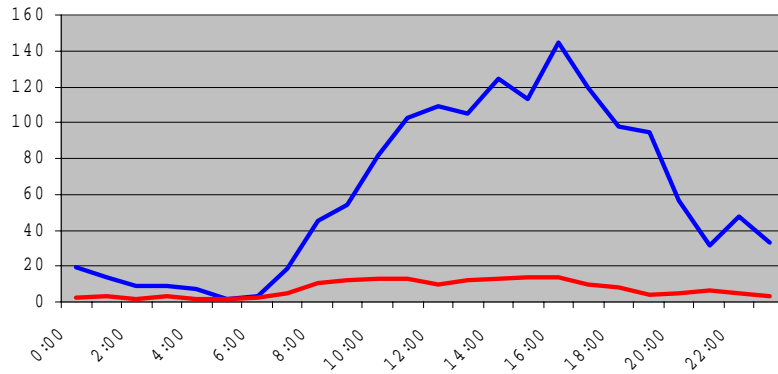
Summer Weekend: Southbound



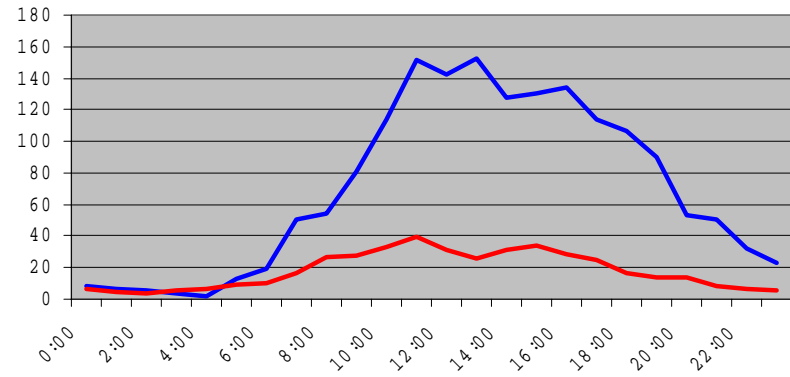
At Sumas/Huntingdon, summer Northbound auto traffic peaks in the afternoon just like most other crossings in the Cascade Gateway system. While handling relatively high volumes of traffic during this period, there may still be opportunities for diversion of traffic from more heavily traveled crossings. In addition, when the secondary morning peak occurs Northbound at Peace Arch and Pacific Highway, Sumas could help spread this peak. In the Southbound direction, the afternoon peaking behavior on both weekends and weekdays is similar to most of the other crossings, although there may be some available capacity in the morning. Again, truck traffic volumes are generally constant throughout the mid-day.

What are the Time-of-Day Traffic Patterns? Sumas: Fall

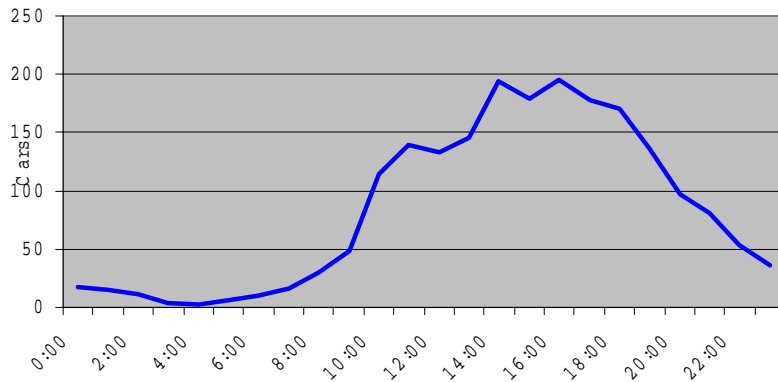
Fall weekday: Northbound



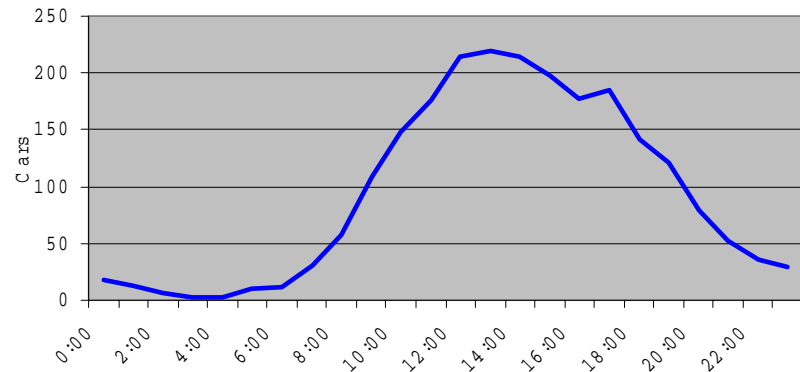
Fall weekday: Southbound



Fall weekend: Northbound



Fall weekend: Southbound



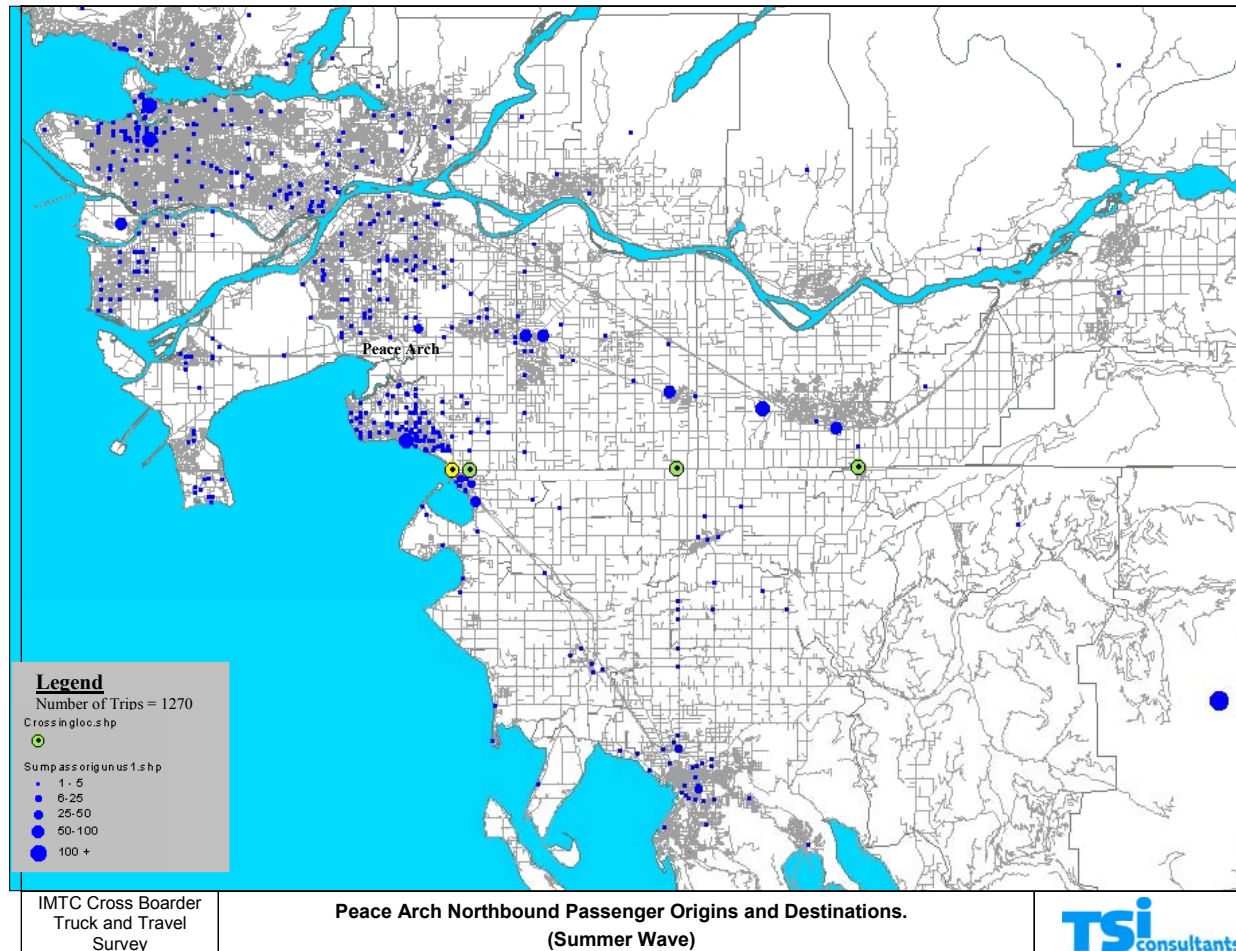
In the fall, the Northbound time of day distribution for autos on the weekdays is somewhat flatter than during the summer but weekend distributions are similar. In the Southbound direction, the weekday peak travel time occurs earlier in the day and the weekend distribution is flatter. Truck patterns are similar to the fall.

Without a comprehensive travel demand model and a better understanding of actual physical and operational capacities at each POE it is difficult to determine in detail the opportunities for shifting traffic to alternative crossings. While peak periods do overlap across all POEs, the relatively low volumes of auto and truck traffic at Lynden/Aldergrove and Sumas/Huntingdon suggest that opportunities may exist. Congested travel times for specific O-D combinations need to be better understood.

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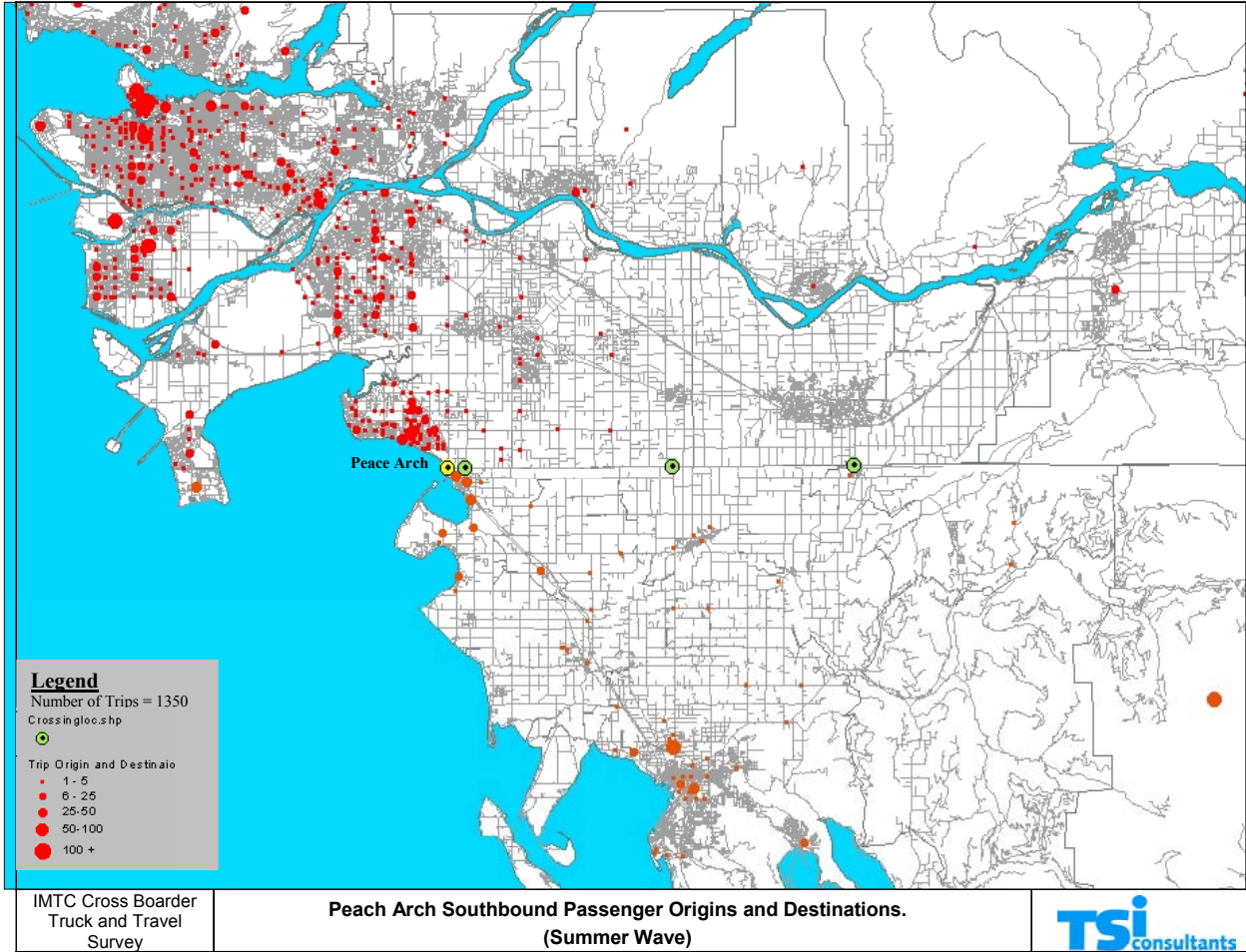
What is the Potential to Divert Traffic to Alternative Crossings?

The Potential to Divert Traffic to Alternative Crossings



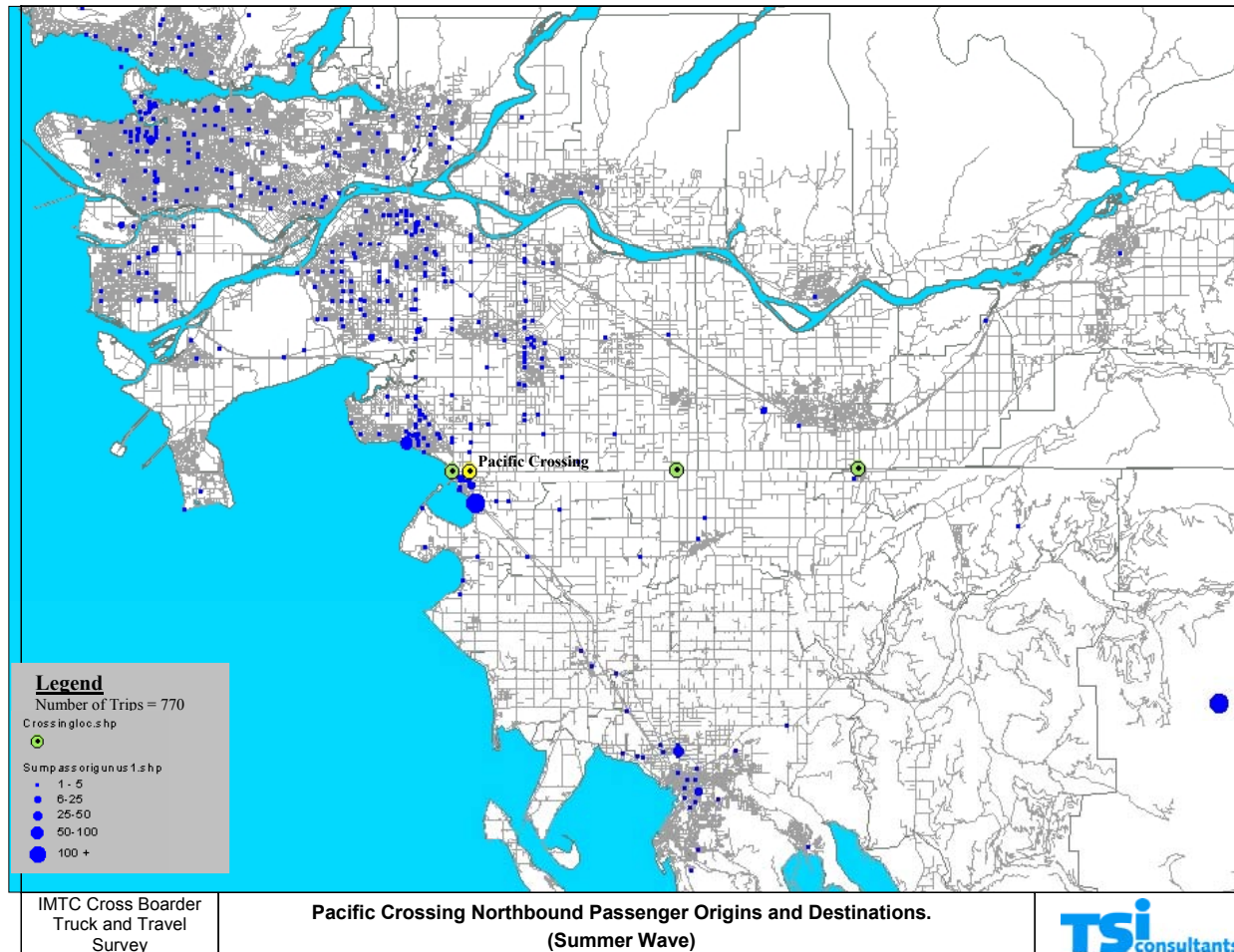
This map shows origins and destinations for northbound auto trips during the summer at Peace Arch. The map shows that there are clearly trips destined for locations east of Pacific Highway that might be served by the Lynden or Sumas POEs. Using Advanced Traveler Information Systems (ATIS) and upgraded connector routes, this traffic would most likely need to be diverted closer to the Puget Sound region, indicating the need for cooperative planning among the MPOs south of the border and WSDOT.

The Potential to Divert Traffic to Alternative Crossings



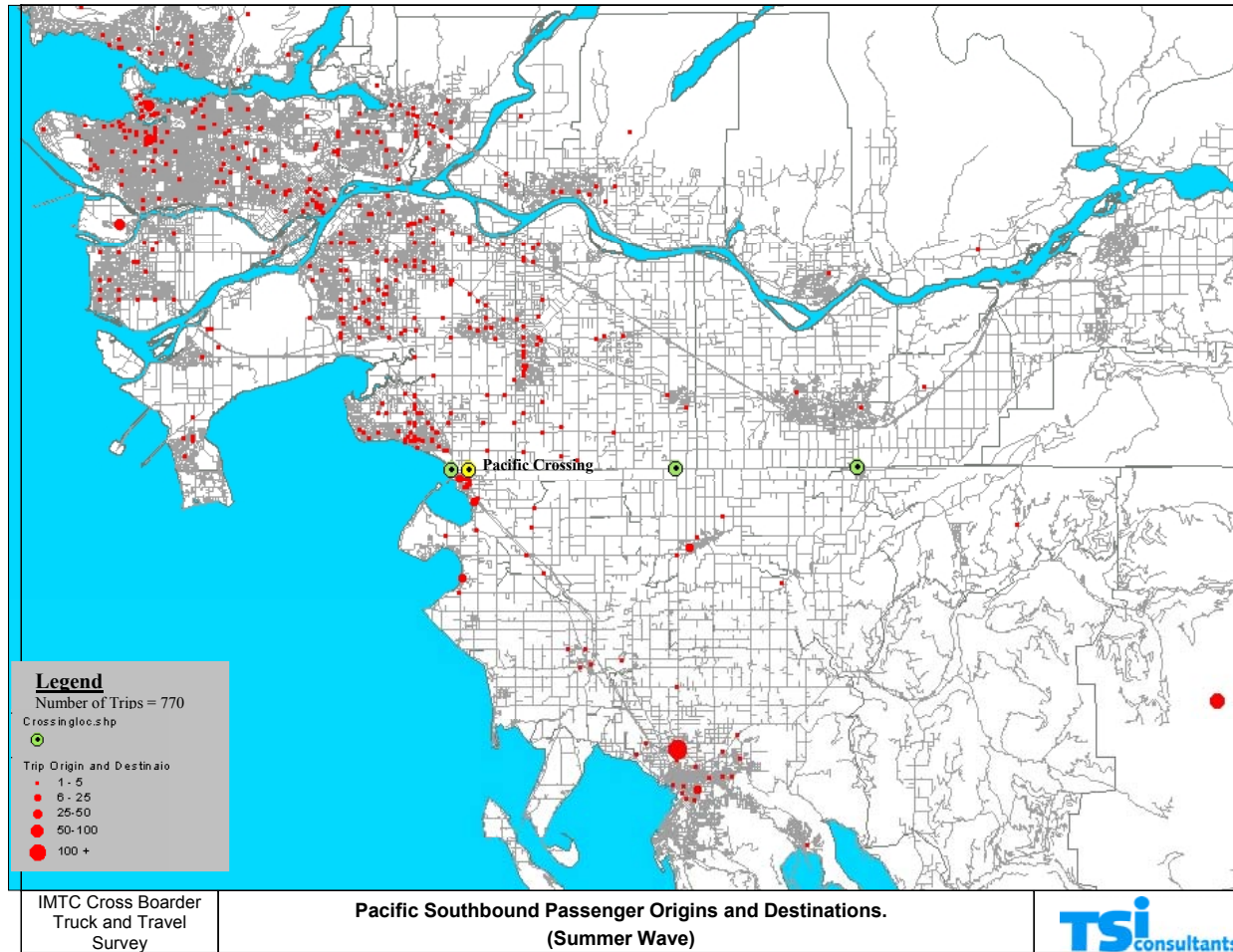
This map shows the summer Southbound origins and destinations at Peace Arch. There appear to be fewer opportunities for shifting traffic to the Aldergrove and Huntingdon crossings than in the reverse direction. This lack of mirroring of trips is most likely because the return trips to Canada are occurring outside the survey (peak period). Thus, investment in connectors and ATIS may be less likely to have an impact on peak congestion at Peace Arch Southbound.

The Potential to Divert Traffic to Alternative Crossings



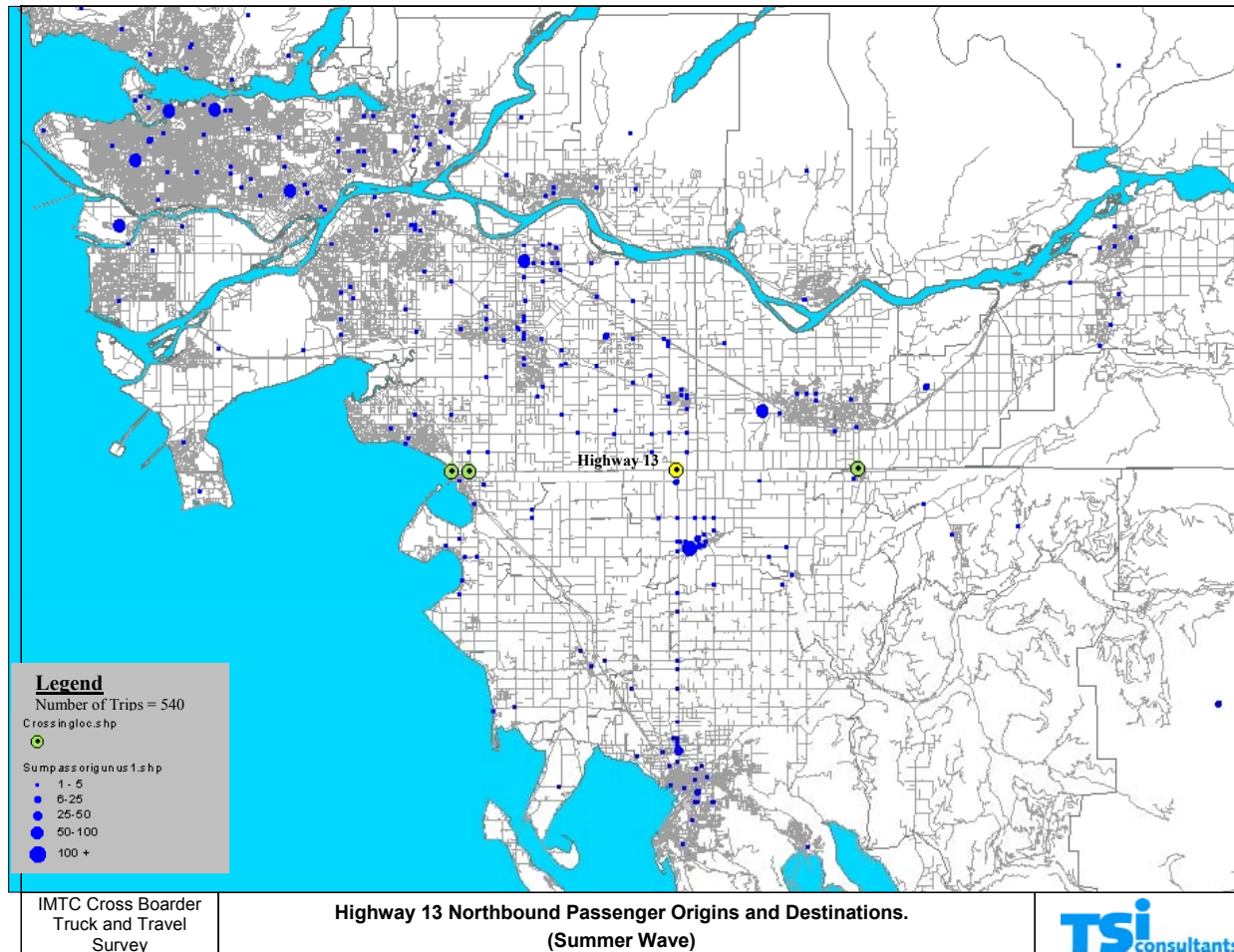
Northbound origins and destinations at Pacific Highway also provide some opportunities for shifts to the Lynden crossing, although the concentrations of destinations between the Pacific Highway and Lynden are less than those for the Peace Arch crossing. Again, the traffic should be intercepted coming out of the Puget Sound region and up I-5 north of Seattle.

The Potential to Divert Traffic to Alternative Crossings



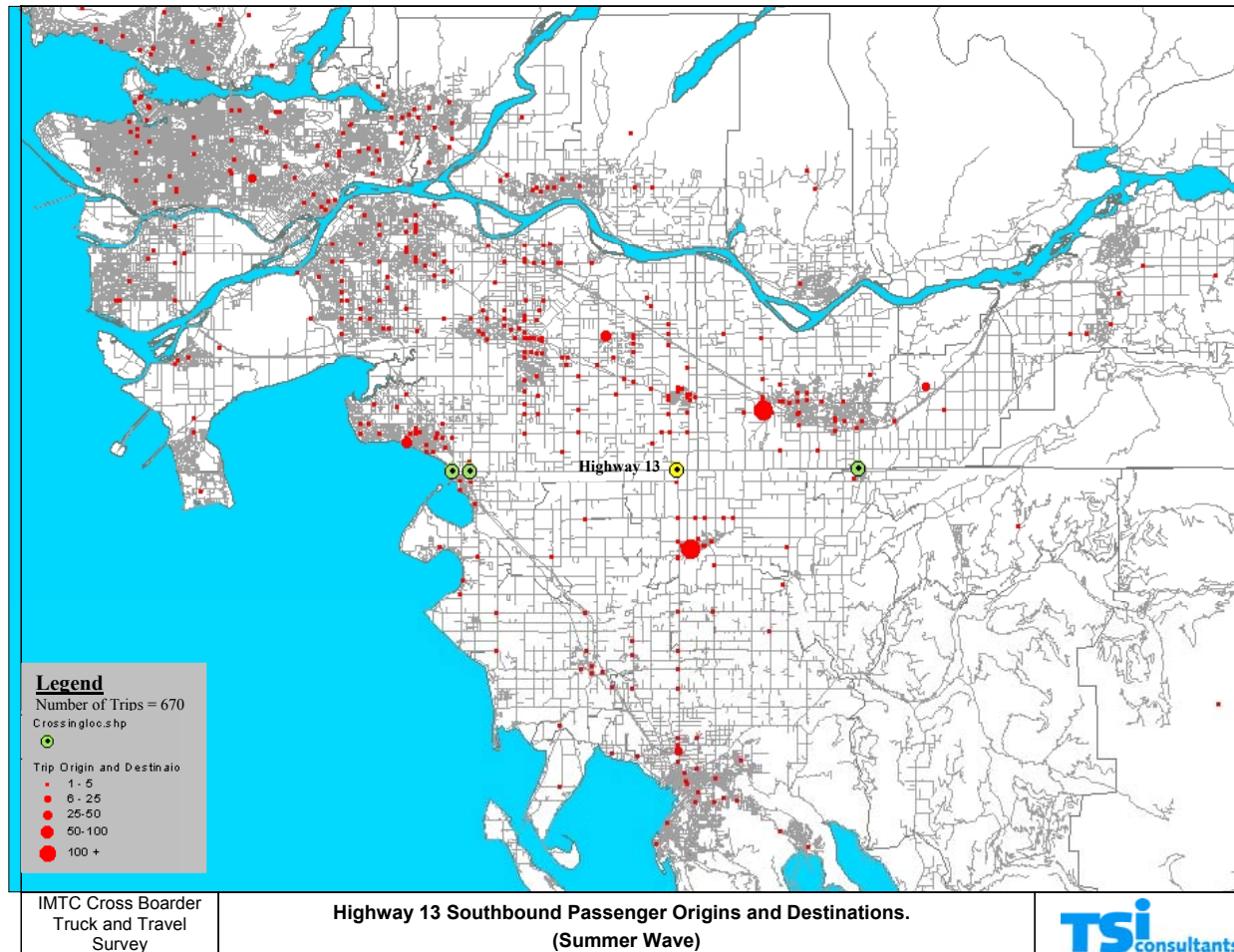
Summer Southbound auto traffic at Pacific Highway shows a similar origin-destination pattern as does the Northbound traffic indicating that connectors linking Langley on the north side of the border with the Puget Sound region and points south on I-5 through the Lynden crossing could be a feasible option for reducing peak congestion at Pacific Highway.

The Potential to Divert Traffic to Alternative Crossings

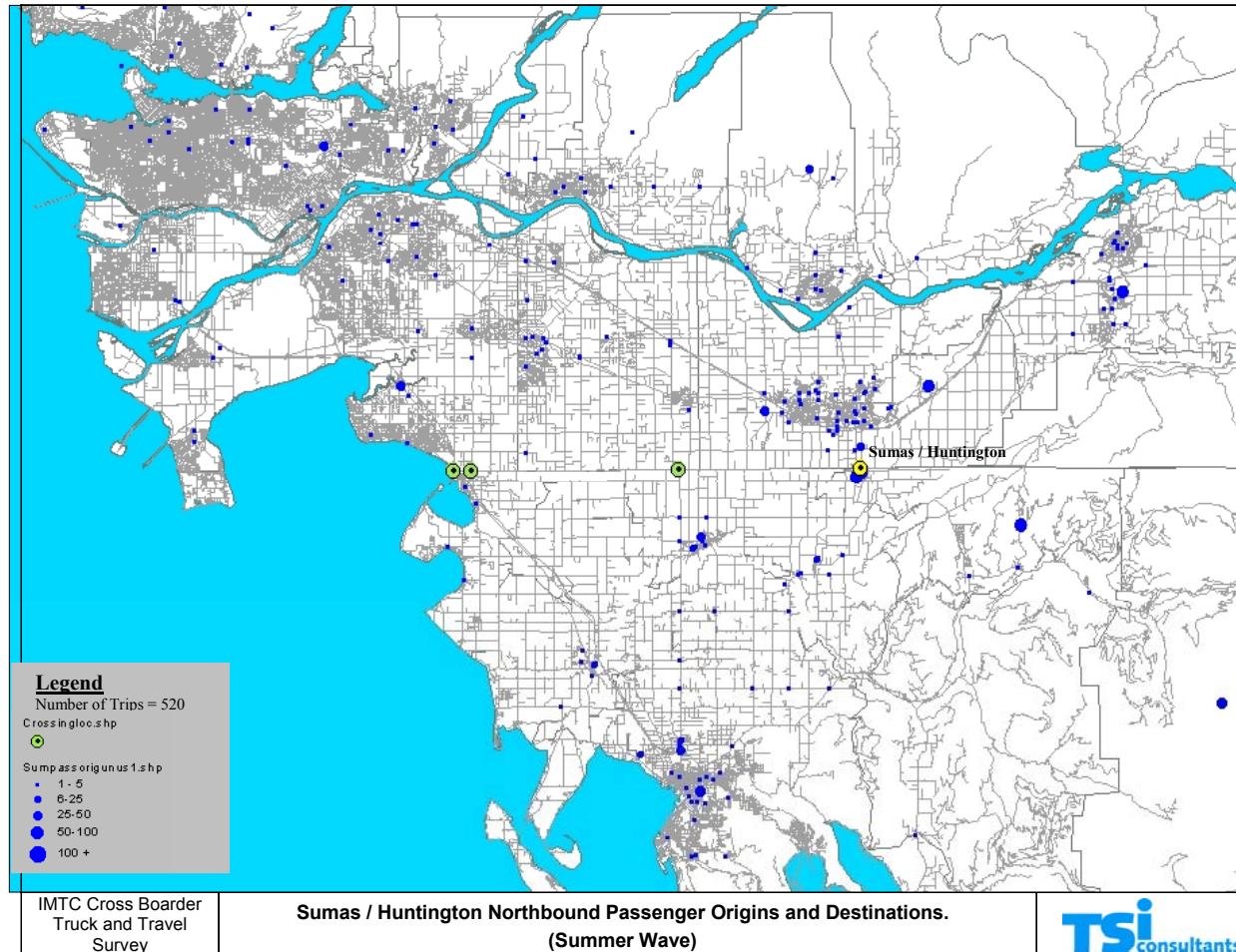


This map and the remaining maps in this series of slides shows the origin and destination patterns for Lynden/Aldergrove and Sumas/Huntingdon. These maps show that traffic through these two crossings tends to be more localized than is the case at Peace Arch and Pacific Highway. However, at least in the case of Lynden/Aldergrove there are some O-D combinations in common with Pacific Highway, suggesting that there are opportunities to manage the Peace Arch, Pacific Highway, and Lynden/Aldergrove POEs as a system with ATIS and a well designed system of connectors (especially south of the border) to facilitate more efficient use of existing capacity. More in-depth studies of these options should be conducted when a cross border travel demand model is developed.

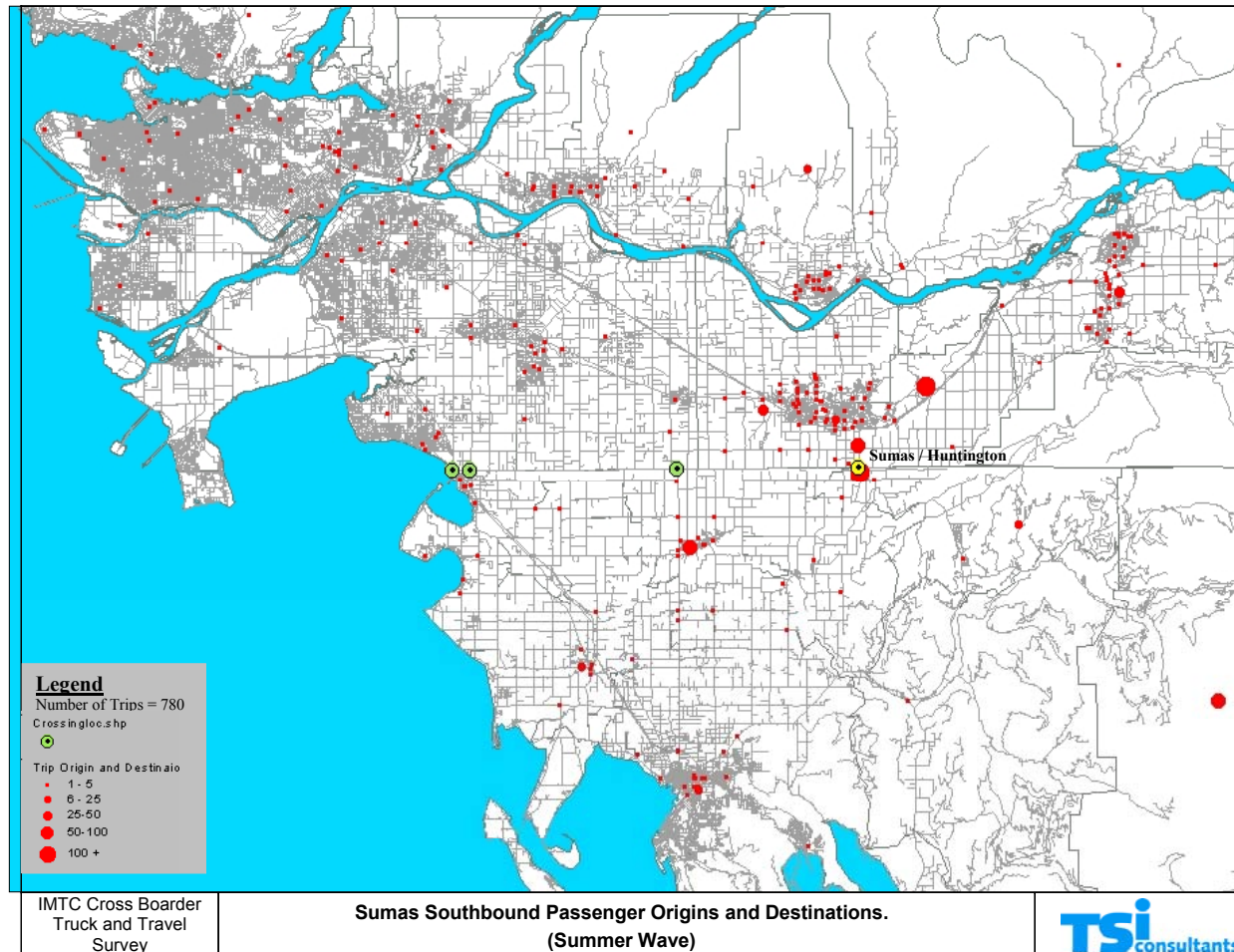
The Potential to Divert Traffic to Alternative Crossings



The Potential to Divert Traffic to Alternative Crossings

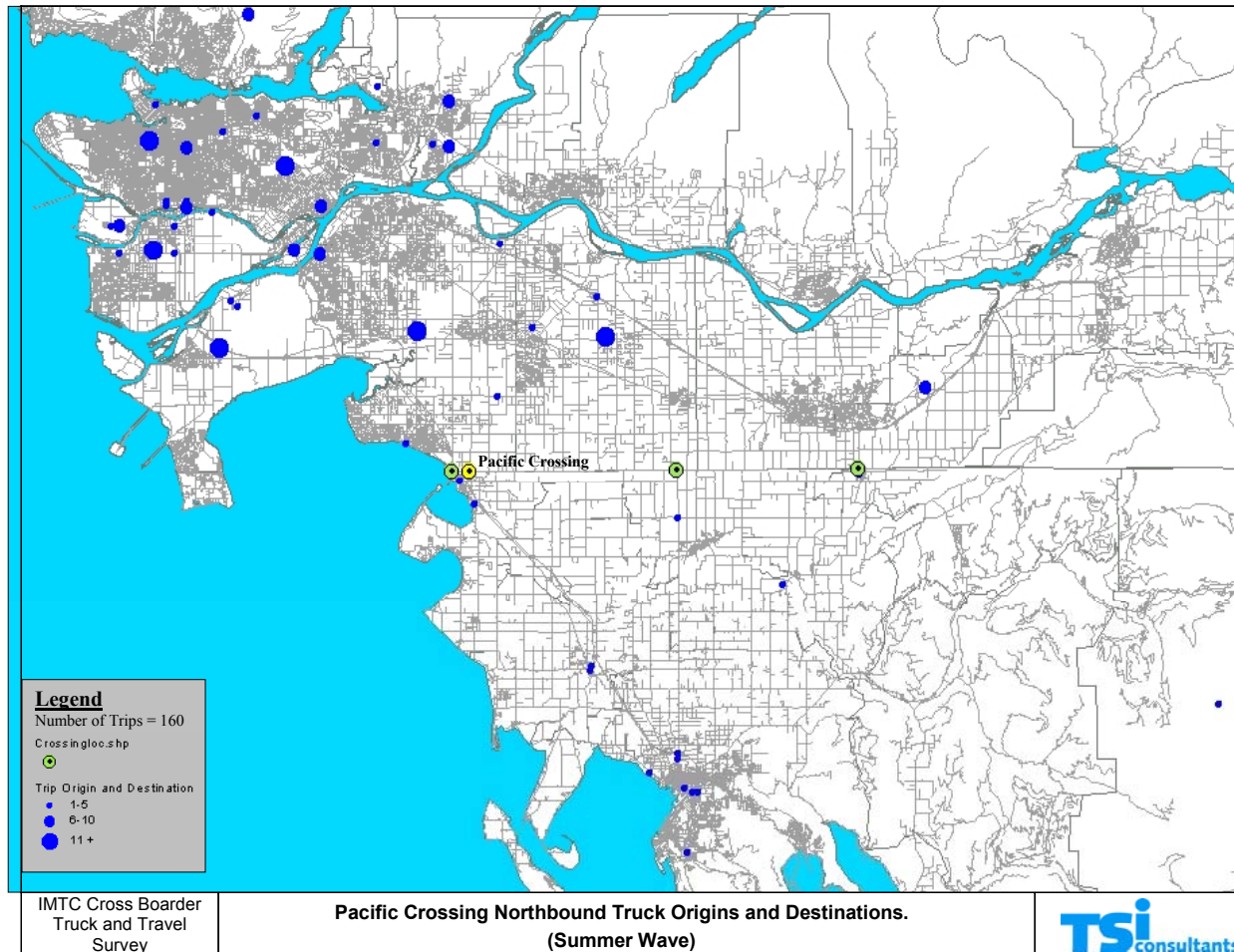


The Potential to Divert Traffic to Alternative Crossings



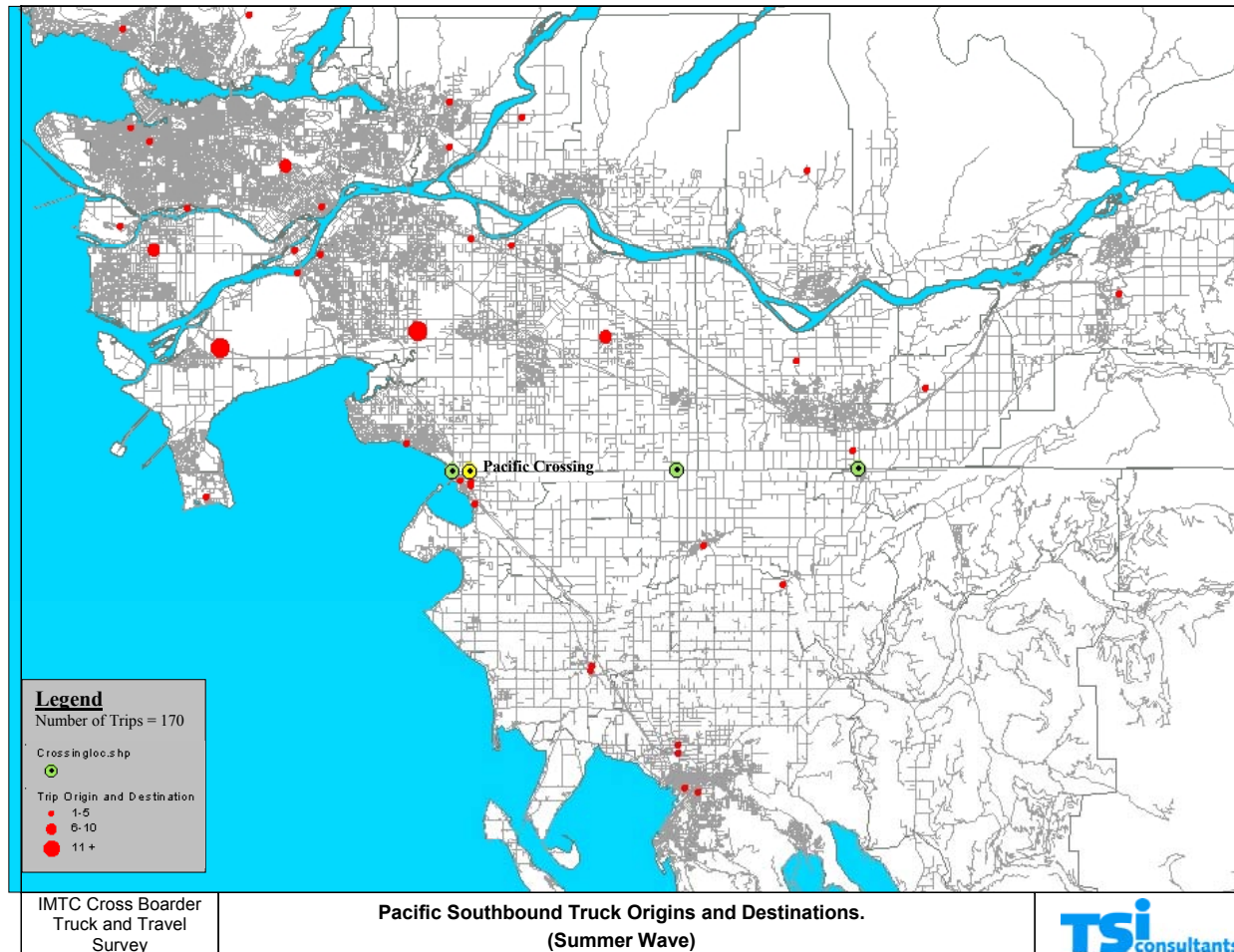
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The Potential to Divert Traffic to Alternative Crossings



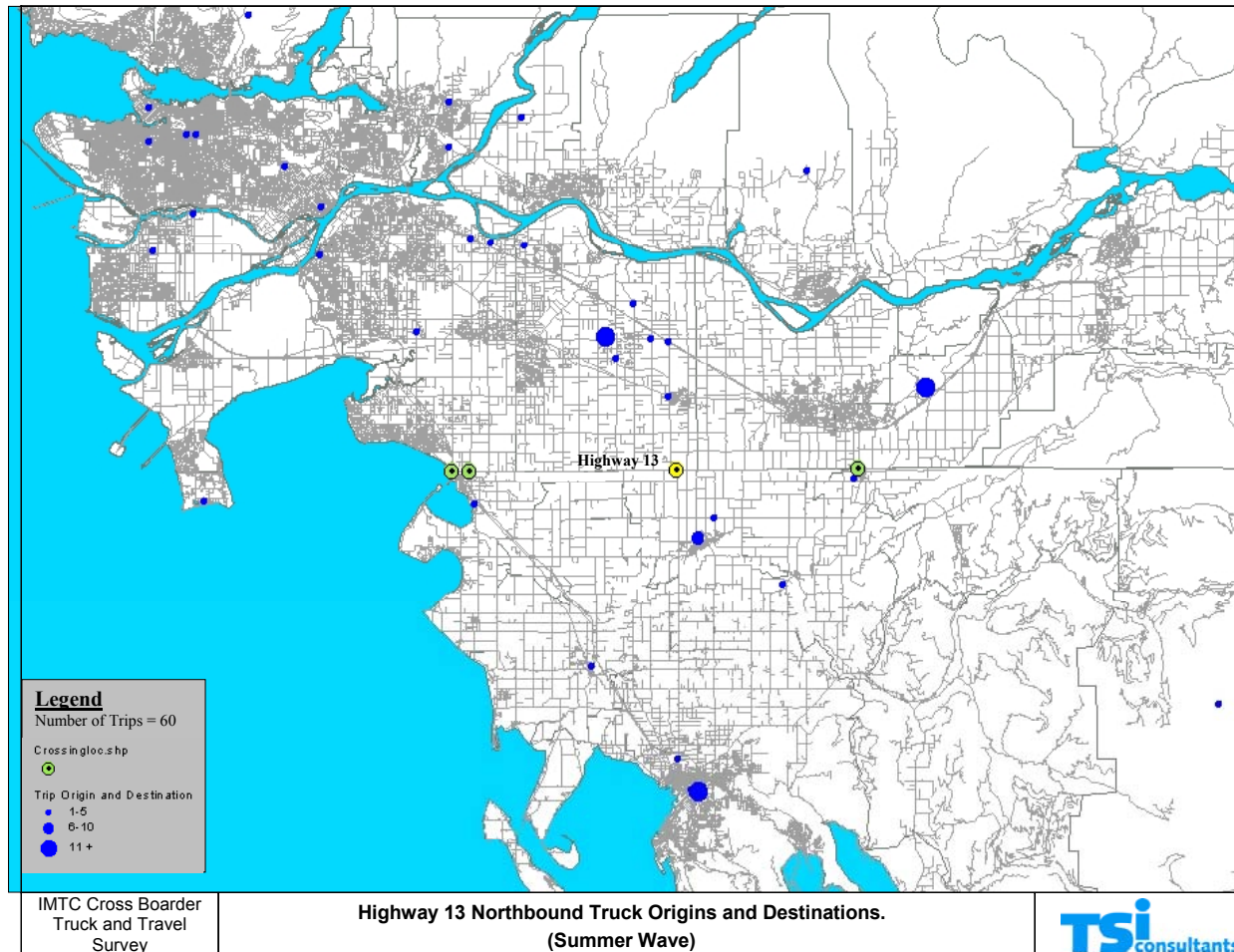
This map and the next map show summer truck origins and destinations at Pacific Highway for Northbound and Southbound trips respectively. Recall from earlier charts that truck origins and destinations in the U.S. tend to be more spread out away from the border outside of Washington. The maps show a few small concentrations of trips east of Pacific Highway that could potentially be shifted to the Lynden/Aldergrove and Sumas/Huntingdon crossings. The impact these shifts are likely to have on peak period truck congestion is hard to gauge without conducting more in-depth analysis with a travel demand model. The maps also show the potential impact that opening Aldergrove as a full service Northbound crossing may have on the need for connectors on the Canadian side of the border.

The Potential to Divert Traffic to Alternative Crossings



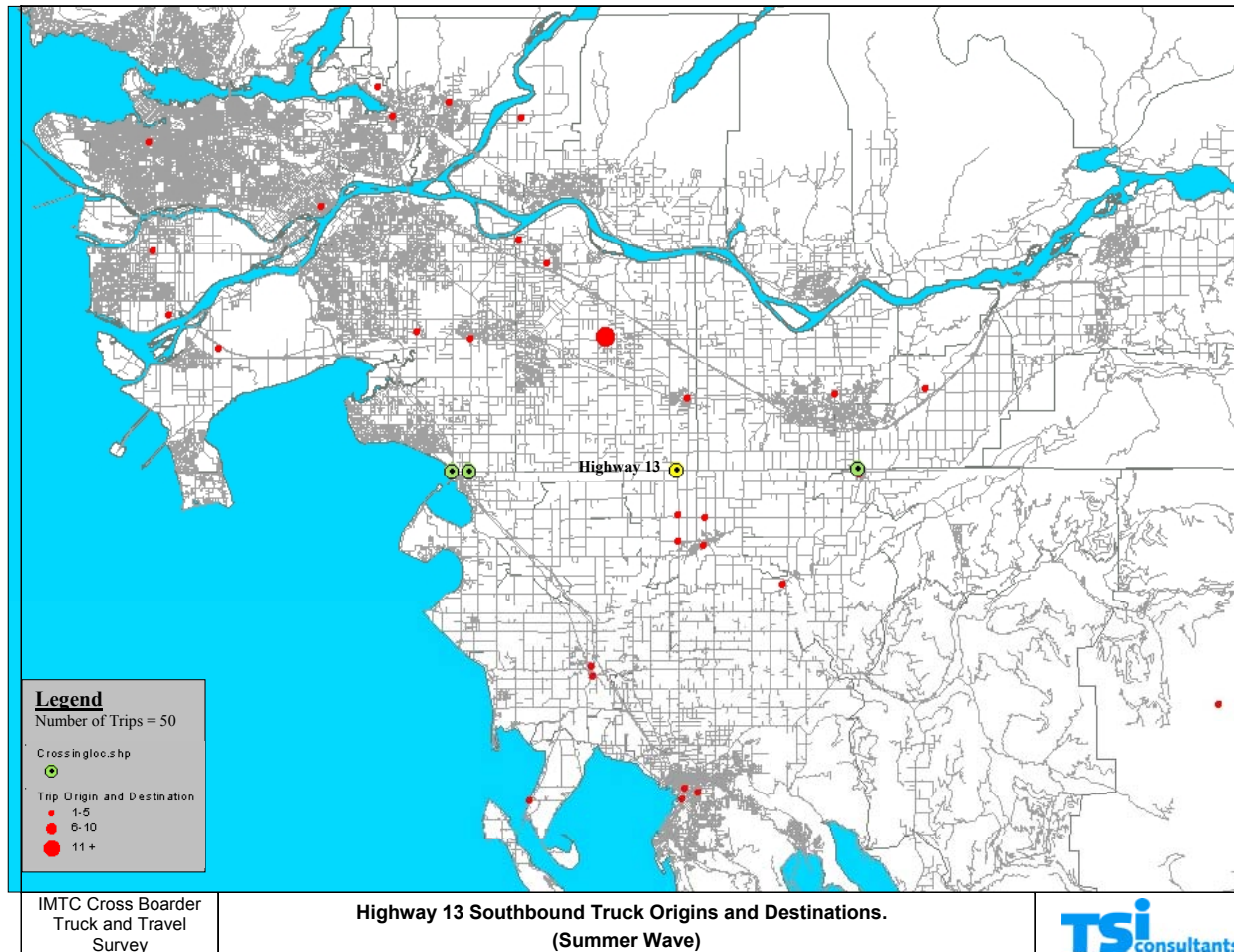
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The Potential to Divert Traffic to Alternative Crossings

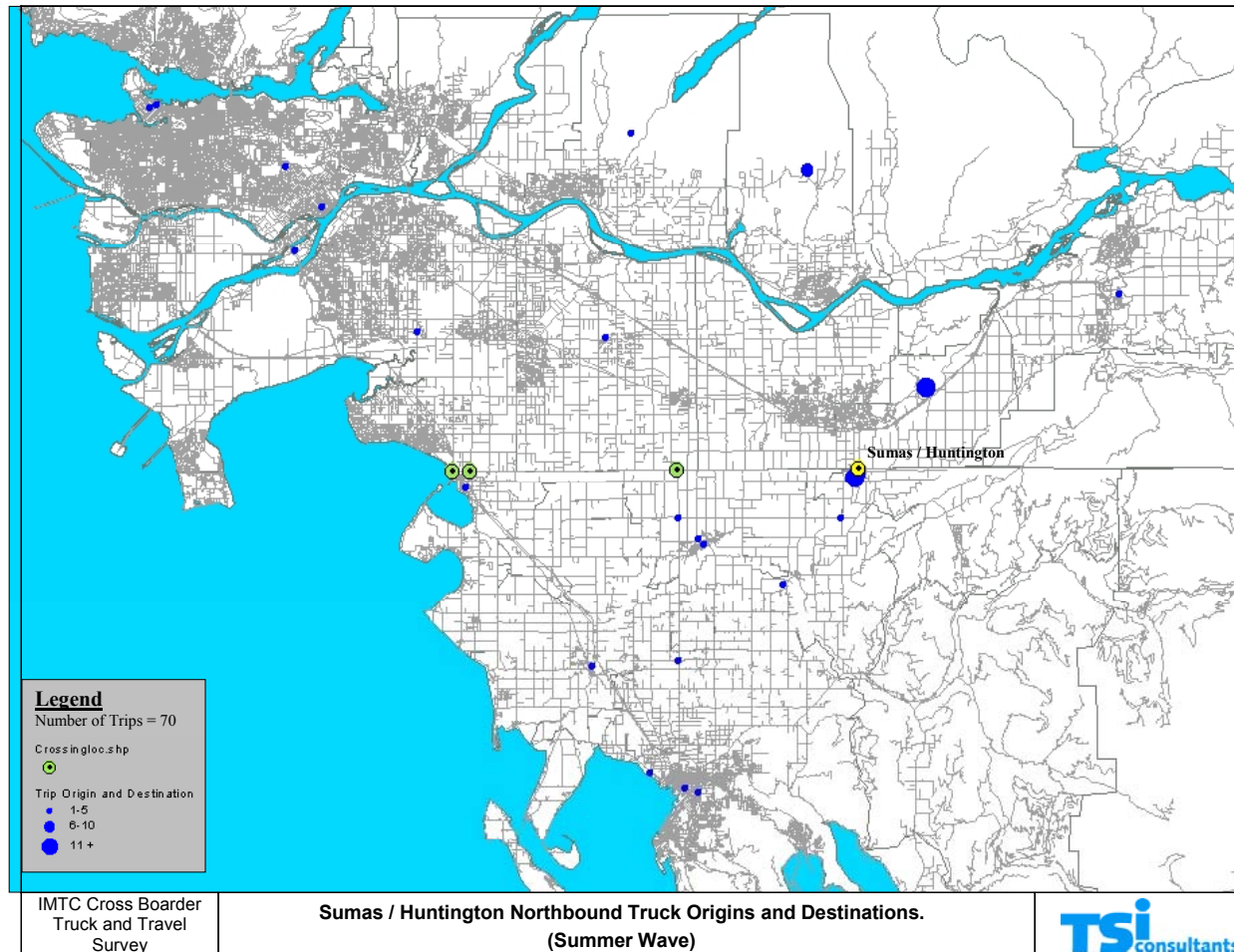


As in the case of auto traffic, this map and the remaining maps show that truck trips using the Lynden/Aldergrove and Sumas/Huntingdon crossings tend to have more local origins and destinations in the Eastern Lower Mainland and within the study area.

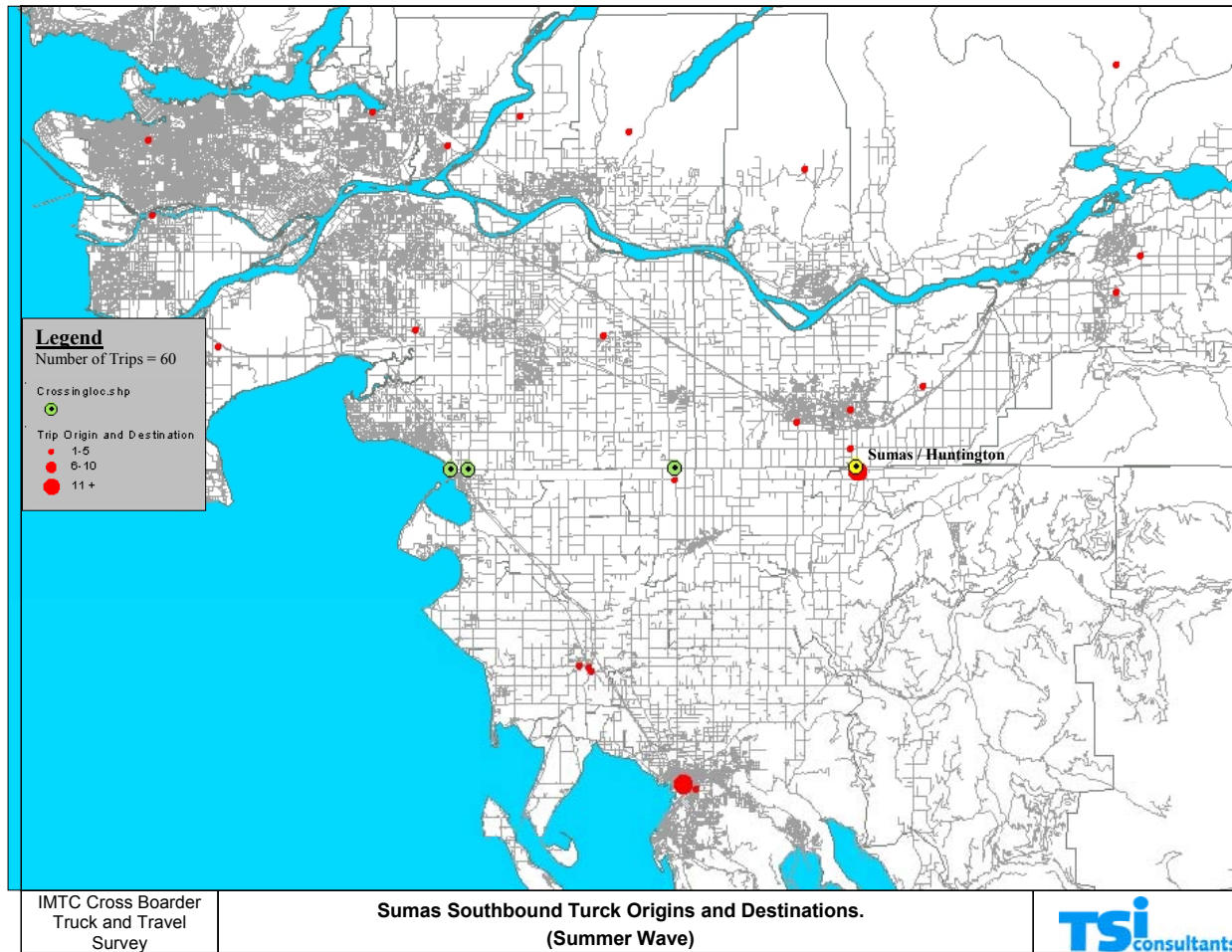
The Potential to Divert Traffic to Alternative Crossings



The Potential to Divert Traffic to Alternative Crossings



The Potential to Divert Traffic to Alternative Crossings

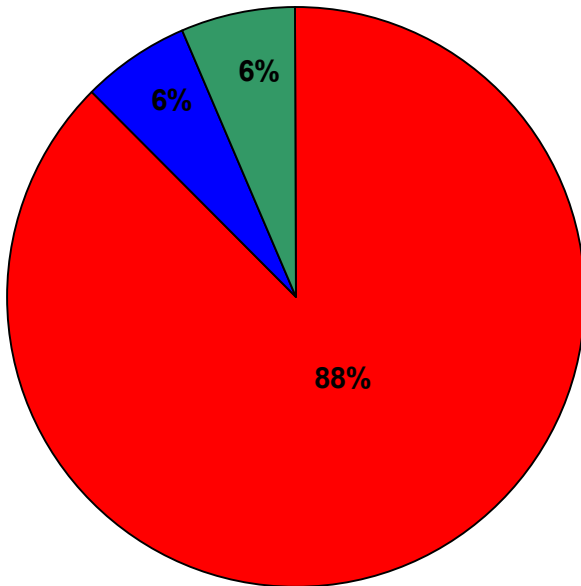


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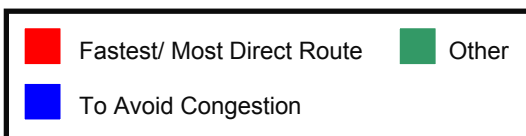
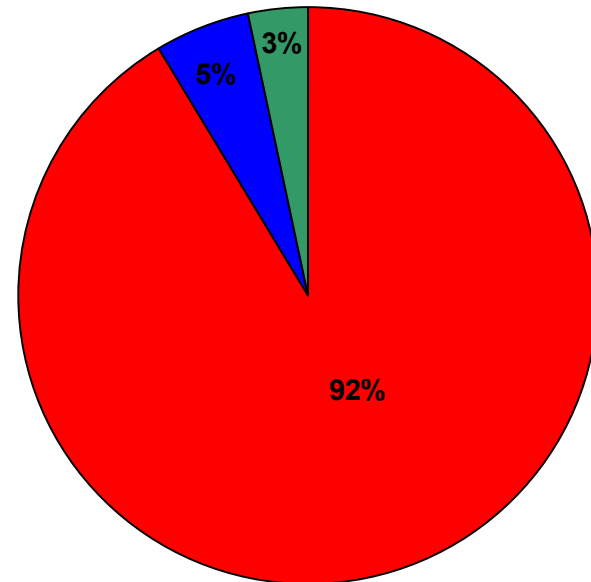
The Potential to Divert Traffic to Alternative Crossings

Auto Reasons for Using Specific Crossing

Summer



Fall

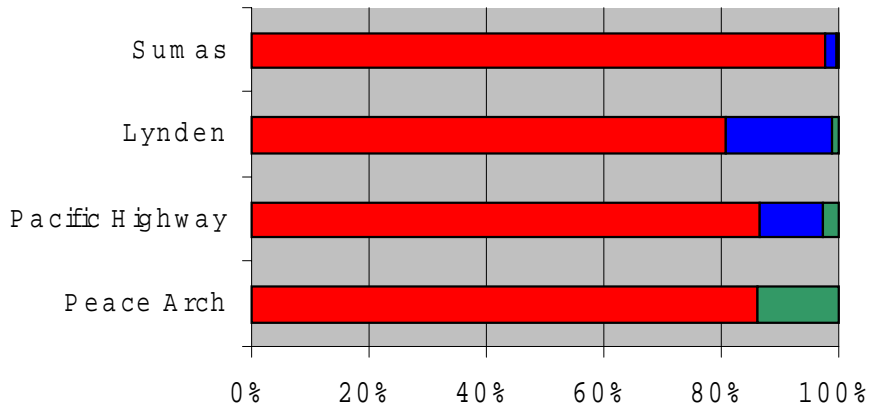


As would be expected, this slide shows that most passenger vehicles choose their route across the border because they believe it is the fastest, most direct route. As indicated in the earlier maps, better information about congestion and travel times, and good connector routes could potentially divert traffic away from Peace Arch and Pacific Highway during congested periods.

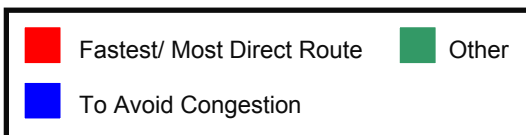
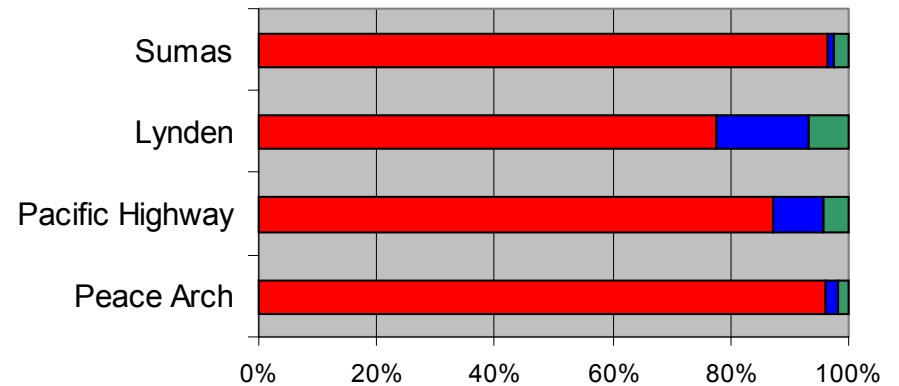
The Potential to Divert Traffic to Alternative Crossings

Auto Reasons for Using Specific Crossing

Summer Auto Reason by Border Crossing



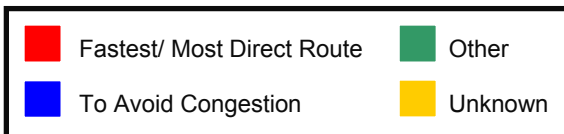
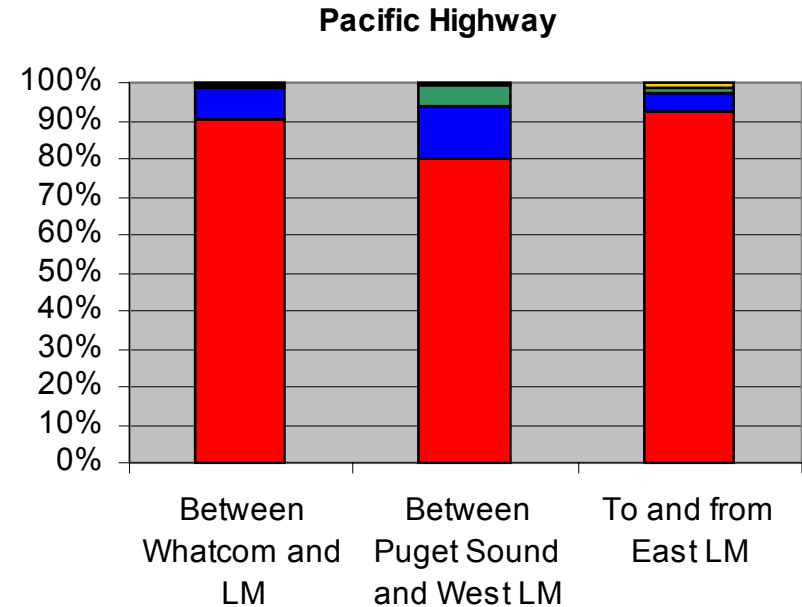
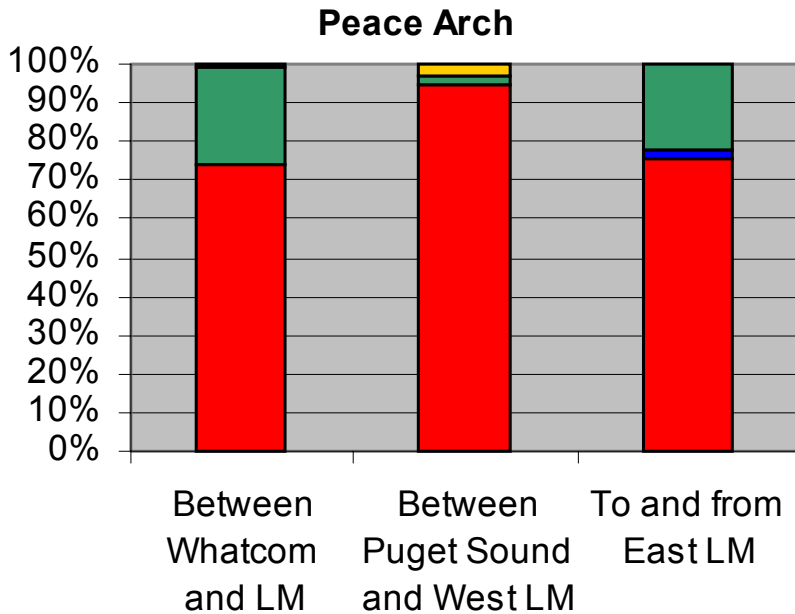
Fall Auto Reason by Border Crossing



Those travelers who are already choosing a route to avoid congestion tend to do so at Pacific Highway or Lynden/Aldergrove. The analysis of the geography of origins and destinations suggests the particular O-D pairs for which this choice is already occurring. To the extent that other trips with these O-D patterns are not yet being diverted, there does appear to be an opportunity to encourage a more integrated approach to using the Peace Arch, Pacific Highway, and Lynden/Aldergrove crossings as a system. The charts on the following two pages further explore the relationship between choice of route and origin-destination patterns.

The Potential to Divert Traffic to Alternative Crossings

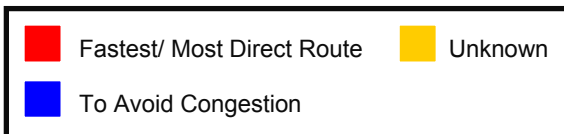
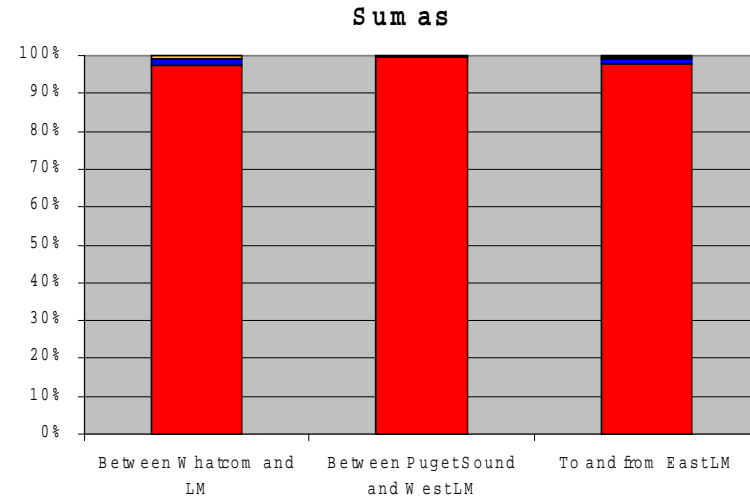
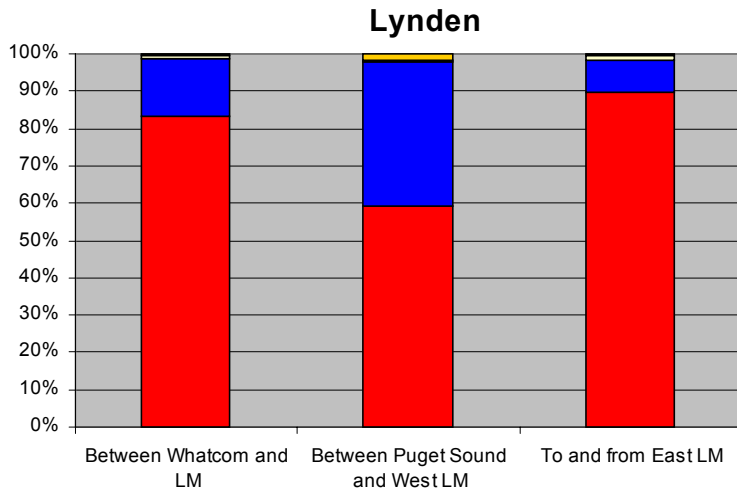
Summer Auto Reasons for Using Specific Crossing



This chart and the next chart show that in the summer, trips between the Puget Sound region and the West Lower Mainland are those most likely to select an alternate crossing to avoid congestion and that the alternate crossing used is either Pacific Highway or Lynden (presumably to avoid congestion at Peace Arch). This suggests that there may be even greater potential to utilize these three crossings as a system for this significant auto O-D flow. Additional research into the city pairs for these trips should determine the amount of other trips with similar O-D patterns that are not being diverted but that could be with better traveler information.

The Potential to Divert Traffic to Alternative Crossings

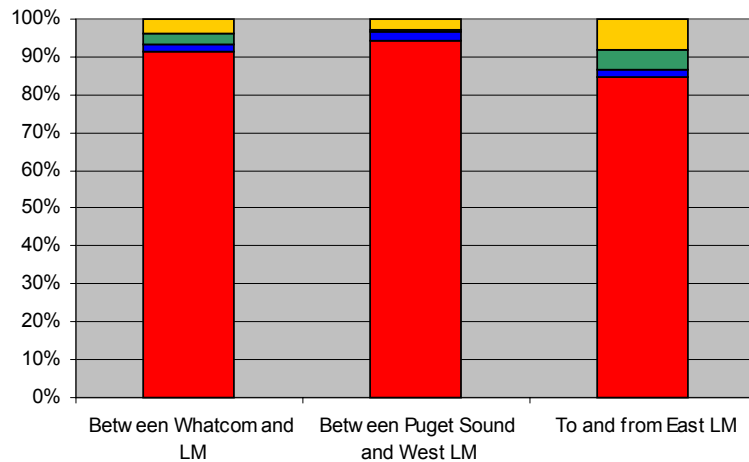
Summer Auto Reasons for Using Specific Crossing



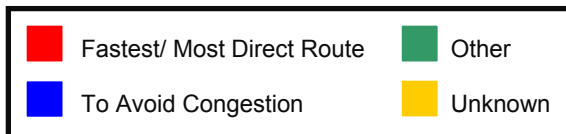
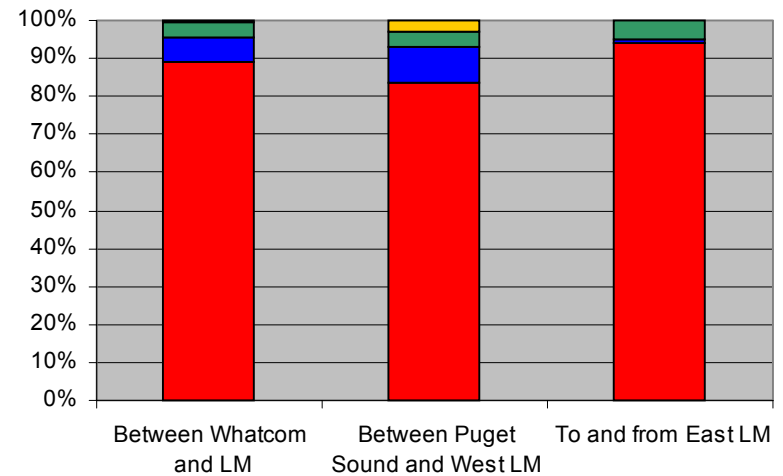
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The Potential to Divert Traffic to Alternative Crossings Fall Auto Reasons for Using Specific Crossing

Peace Arch



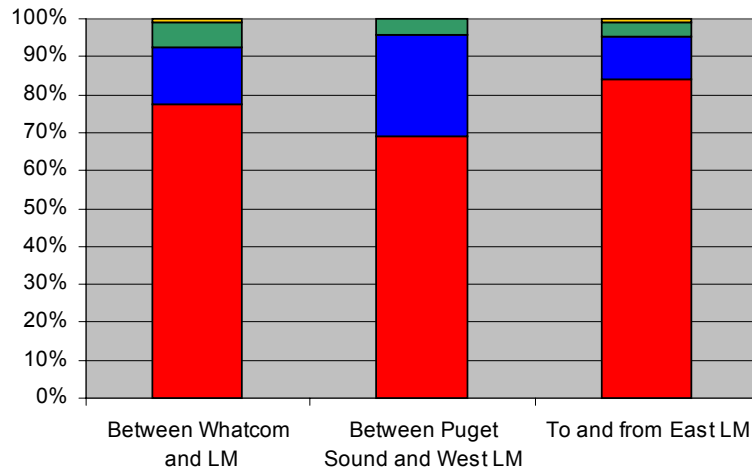
Pacific Highway



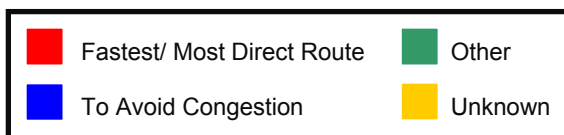
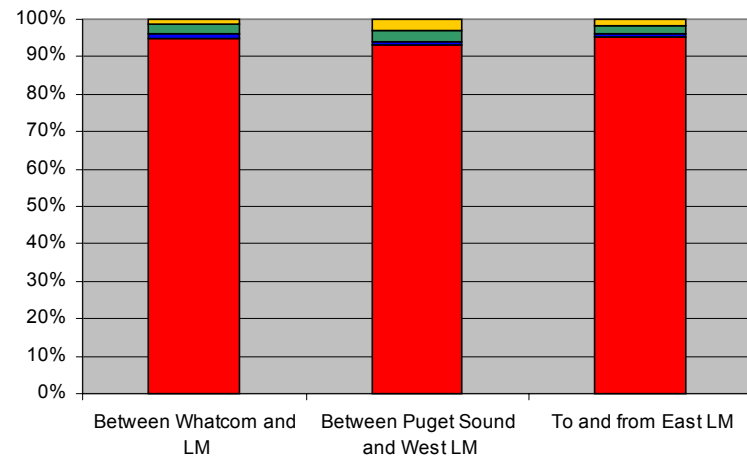
The patterns previously discussed for the summer are also apparent in the fall although, as might be expected, a particular crossing is less likely to be selected to avoid congestion in the fall regardless of the O-D of the trip.

The Potential to Divert Traffic to Alternative Crossings Fall Auto Reasons for Using Specific Crossing

Lynden



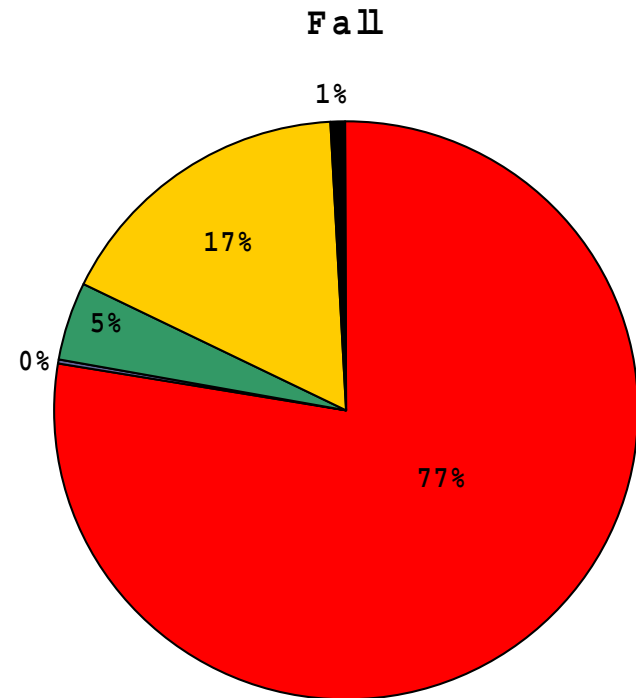
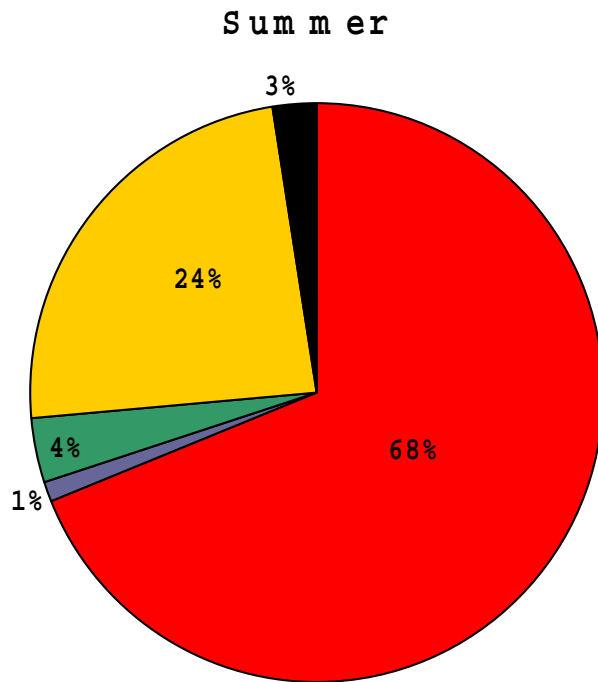
Sumas



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The Potential to Divert Traffic to Alternative Crossings

Truck Reason for Using Specific Crossing

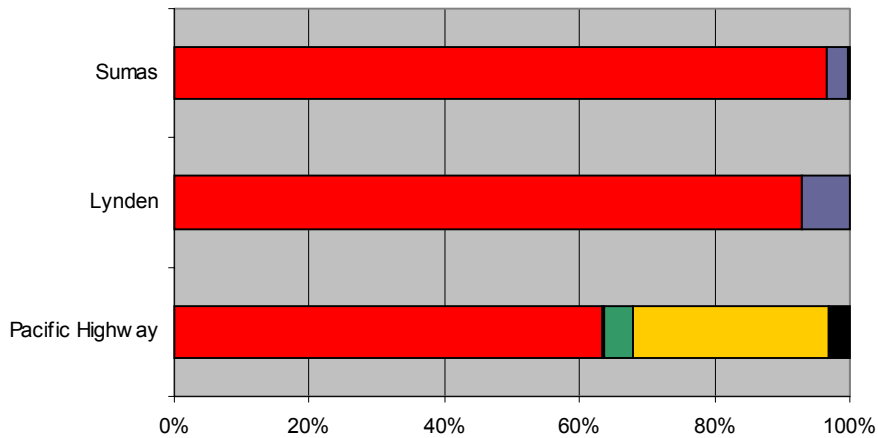


Like drivers of passenger vehicles, truck drivers overwhelmingly report that they choose their crossing because it is the fastest, most direct route. However, a larger percentage of truck drivers report some other reason for choosing their crossing. A significant percentage choose a crossing because of the location of their customs broker. Since most customs brokers have offices at multiple crossings, this response may reflect a decision by a higher level decision-maker to use a particular crossing because it is on the most direct route. However, once that decision is made and paperwork is forwarded to the customs broker, a decision to re-route at the last minute is no longer an option. This is an important factor to consider in assessing the viability of traveler information in order to provide alternative crossing options to commercial vehicles.

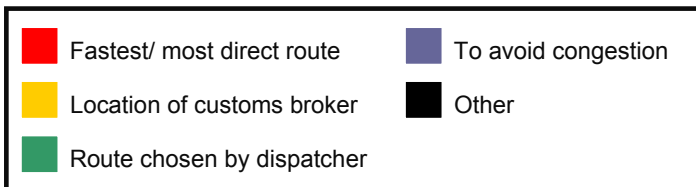
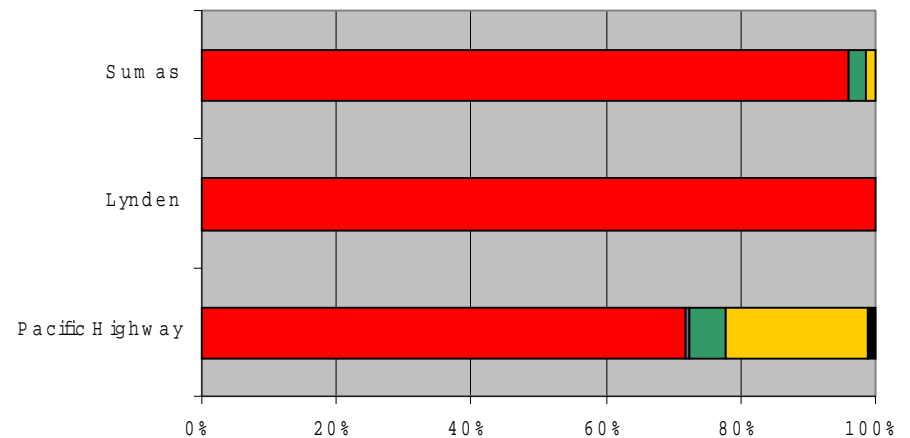
The Potential to Divert Traffic to Alternative Crossings

Truck Reason for Using Specific Crossing

By Border Crossing: Summer



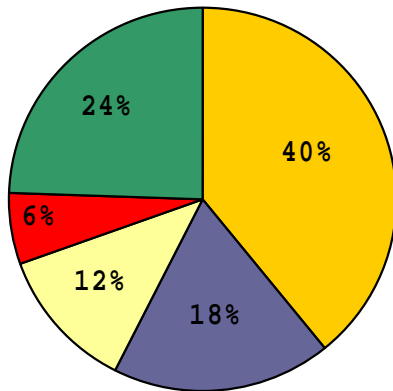
By Border Crossing: Fall



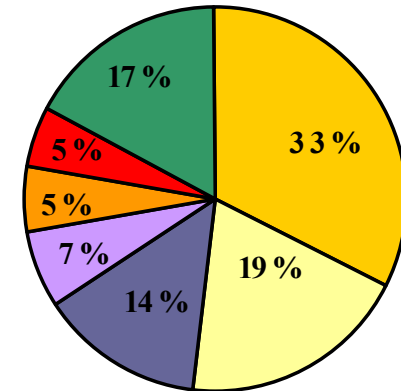
The reasons truck drivers use a particular crossing varies considerably by crossing. Lynden/Aldergrove is used more often than any other crossing to avoid congestion, but this is true primarily in the summer and is only reported by about 10% of drivers. On the other hand, at Pacific Highway drivers frequently report that they use the crossing because this is the location of their customs broker. This is reasonably consistent in both summer and fall. It bears further investigation of the O-D patterns of these drivers to see if building up the institutional and commercial infrastructure at Lynden/Aldergrove and changing permitting regulations could provide more flexibility and system-wide operational efficiency.

The Potential to Divert Traffic to Alternative Crossings Pacific Highway: Major Origins and Destinations

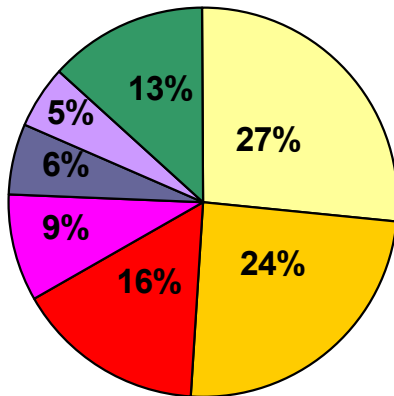
Summer: On Fastest or Most Direct Route



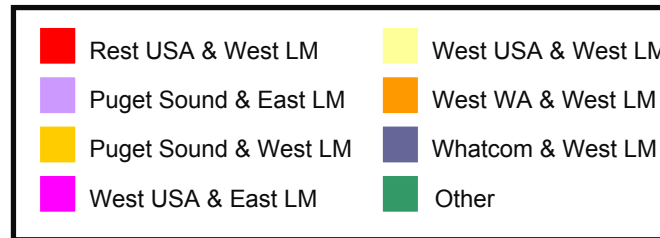
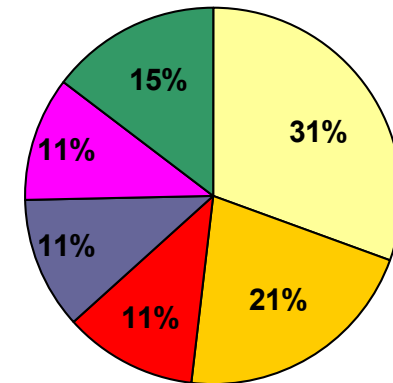
Fall: On Fastest or Most Direct Route



Summer: Location of Customs Broker



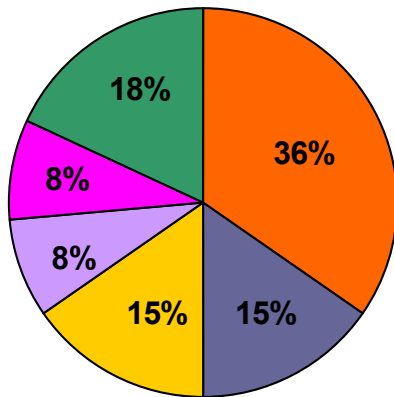
Fall: Location of Customs Broker



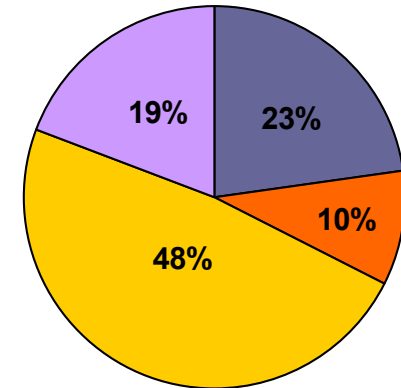
The origin-destination patterns of trucks reporting that they use Pacific Highway because it is the fastest/most direct route are somewhat different than those who report that they use the crossing because it is the location of their customs brokers. In both summer and fall, over 50% of drivers who report this is the fastest/most direct route are traveling within the area from the Puget Sound Region to the Lower Mainland. Drivers who use this crossing because it is the location of their customs broker are more likely to have origins/destinations elsewhere in the U.S. This suggests that for many drivers who travel outside the study area, the decision about which crossing to use may be made long before it is possible to react to information about border congestion.

The Potential to Divert Traffic to Alternative Crossings Lynden: Major Origins and Destinations

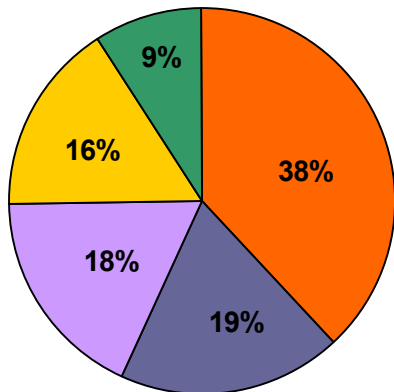
Summer: On Fastest or Most Direct Route



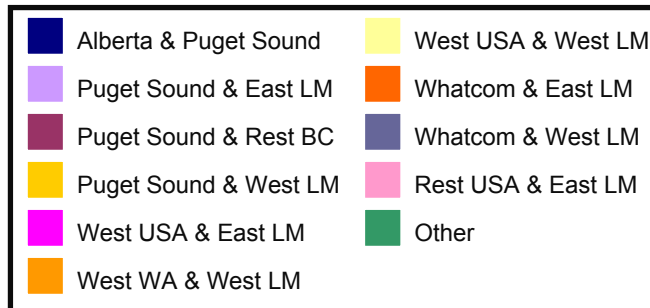
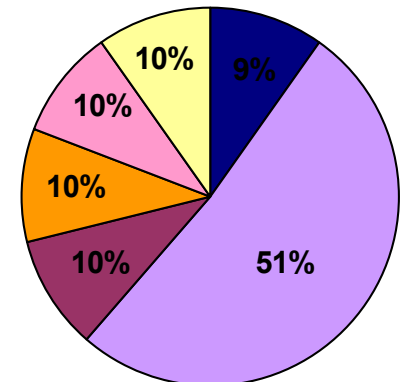
Summer: To Avoid Congestion at Another Crossing



Fall: On Fastest or Most Direct Route



Fall: To Avoid Congestion At Another Crossing

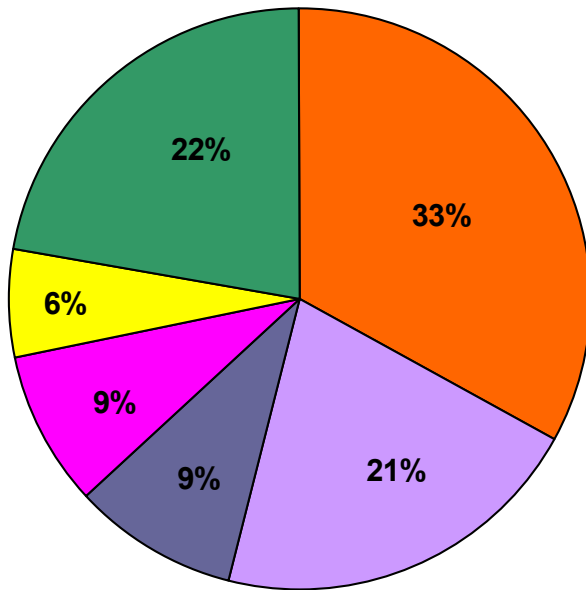


While over half the trucks who report choosing Lynden/Aldergrove because it is the fastest/most direct route have origins-destinations in the West Lower Mainland, a substantial fraction have origins and destinations in the same general area as those who report using Pacific Highway because it is the fastest/most direct route. This O-D travel pattern needs to be further investigated looking at city pairs because it suggests that Lynden/Aldergrove may be a logical “relief valve” for truck congestion at Pacific Highway.

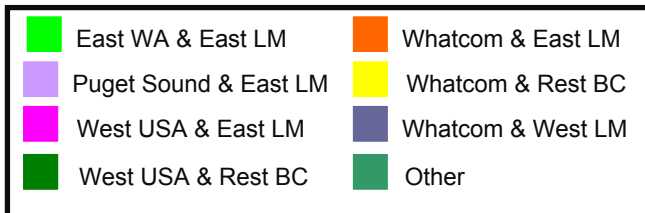
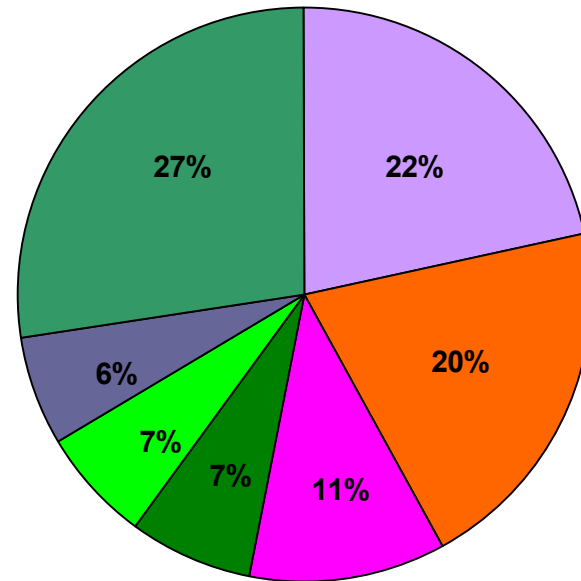
This slide also shows that truck drivers who use Lynden/Aldergrove to avoid congestion in the summer have different O-D patterns.

The Potential to Divert Traffic to Alternative Crossings Sumas: Major Origins and Destinations

Summer: On Fastest or Most Direct Route



Fall: On Fastest or Most Direct Route

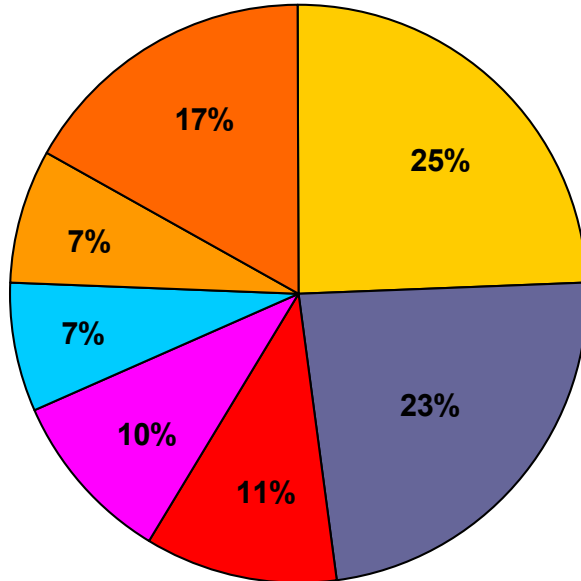


On the other hand, those drivers who say they use Sumas/Huntingdon because it is the fastest/most direct route most often have an origin-destination in the East Lower Mainland. This distinctly different O-D pattern suggests very little opportunity for Sumas/Huntingdon to act as an alternative crossing to Pacific Highway.

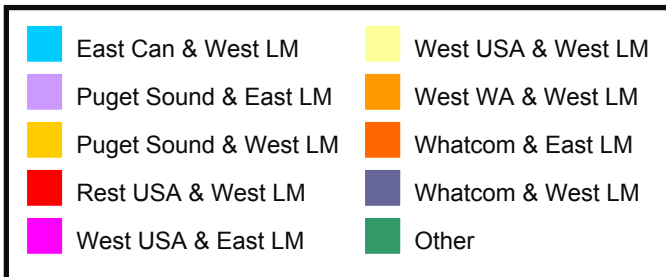
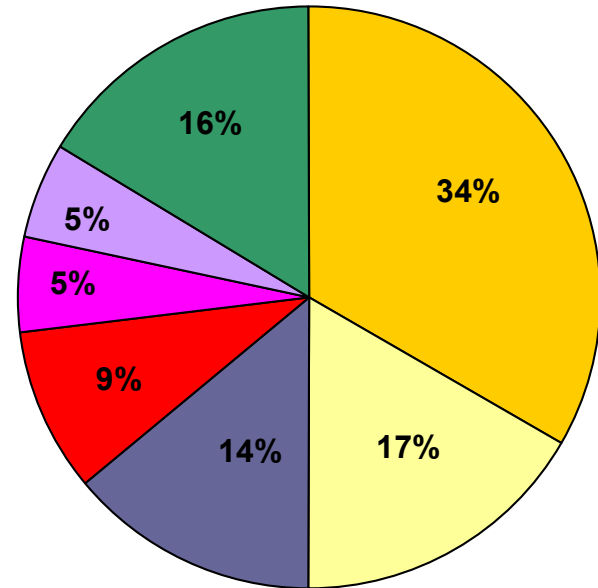
The Potential to Divert Traffic to Alternative Crossings

Major Truck Origins and Destinations

Pacific Highway: Alternative Crossing Available (Summer)



Pacific Highway: No Alternative Crossing Perceived (Summer)

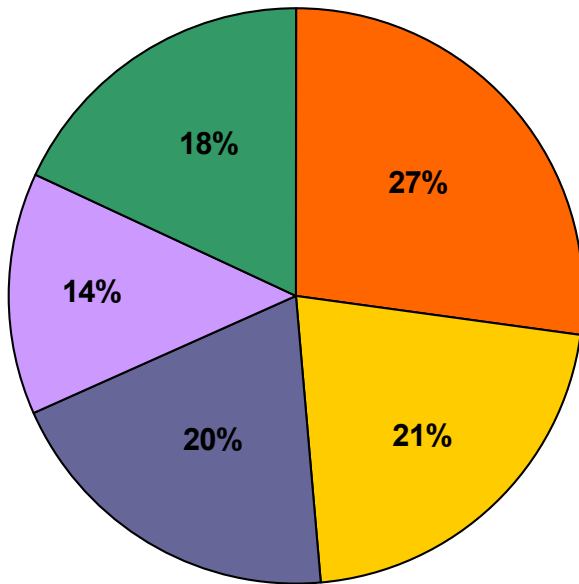


Most truck drivers using Pacific Highway in the summer do not believe that they have an appropriate alternative crossing. A much higher percentage of those who do than those who don't are traveling between Whatcom County and the Lower Mainland.

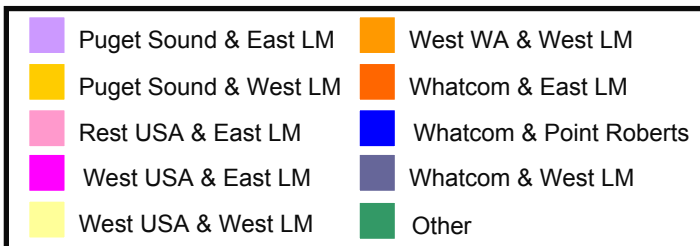
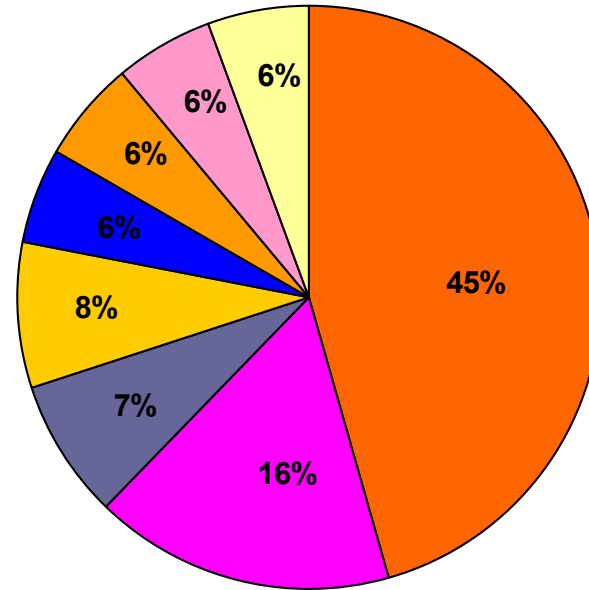
The Potential to Divert Traffic to Alternative Crossings

Major Truck Origins and Destinations

Lynden: Alternative Crossing Available (Summer)



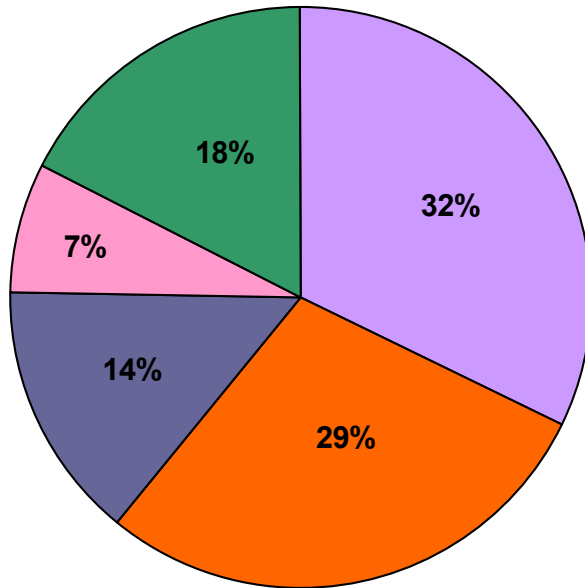
Lynden: No Alternative Crossing Perceived (Summer)



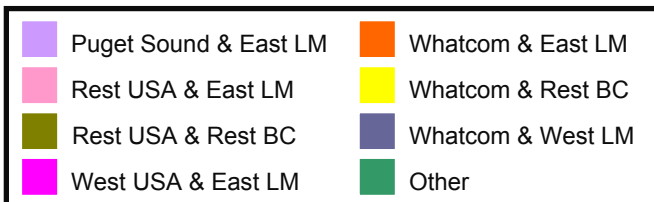
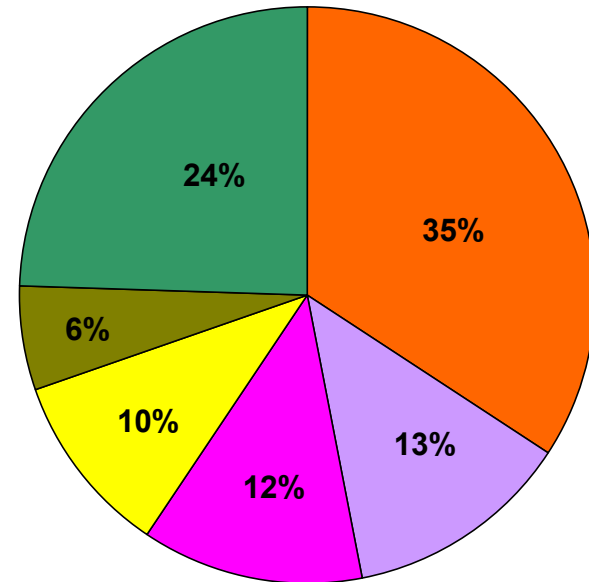
Roughly an equal percentage of truck drivers who cross at Lynden and believe they have an alternative crossing are traveling to or from the East Lower Mainland or the West Lower Mainland. There does appear to be a significant percentage of truck drivers traveling to or from the East Lower Mainland who do not believe they have an alternative crossing. This most likely reflects drivers serving businesses close to this crossing.

The Potential to Divert Traffic to Alternative Crossings Major Truck Origins and Destinations

**Sumas: Alternative Crossing Available
(Summer)**



**Sumas: No Alternative Crossing Perceived
(Summer)**

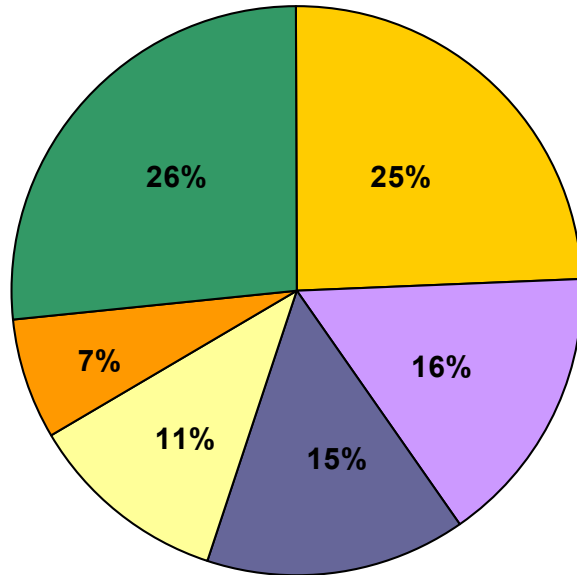


This slide generally reflects the overall origin-destination patterns of truck drivers using the Sumas/Huntingdon crossing, with very few drivers having origins/destinations in Canada other than in the East Lower Mainland. There is little opportunity, or reason to divert this traffic to the only other viable crossing, Lynden/Aldergrove.

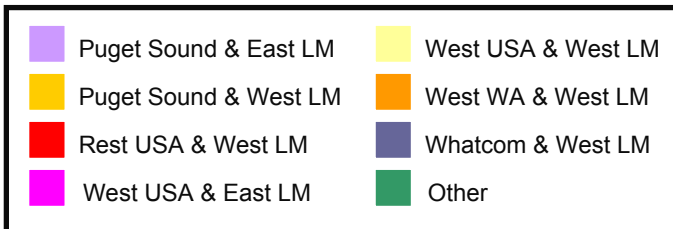
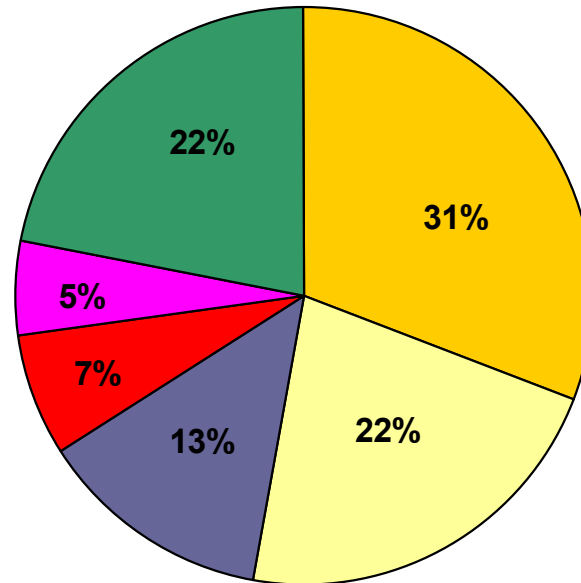
The Potential to Divert Traffic to Alternative Crossings

Major Truck Origins and Destinations

Pacific Highway: Alternative Crossing Available (Fall)



Pacific Highway: No Alternative Crossing Perceived (Fall)

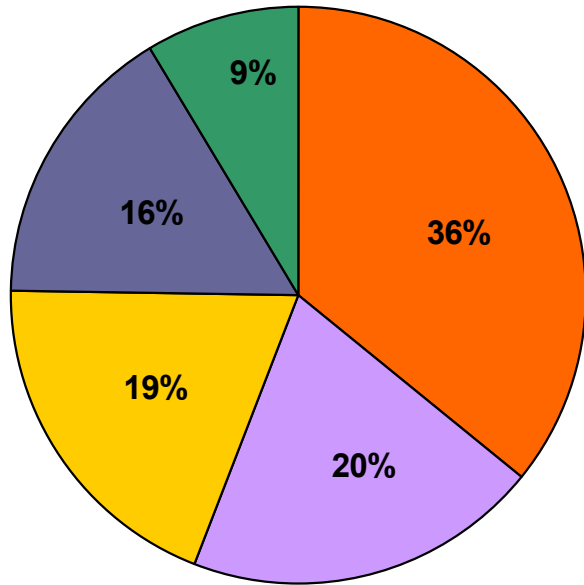


In the fall, different patterns are observed for truck drivers using Pacific Highway who believe they have an alternative crossing. Very few of these are drivers traveling between Whatcom County and the Lower Mainland. A substantial percentage of these drivers have origins and destinations outside of the study area.

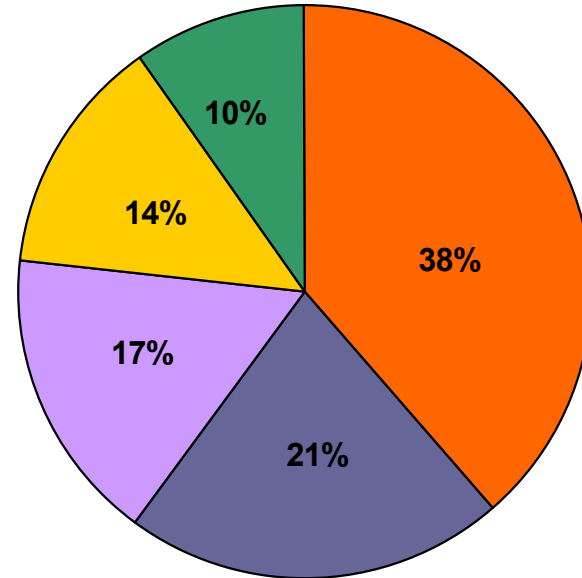
The Potential to Divert Traffic to Alternative Crossings

Major Truck Origins and Destinations

Lynden: Alternative Crossing Available (Fall)



Lynden: No Alternative Crossing Perceived (Fall)

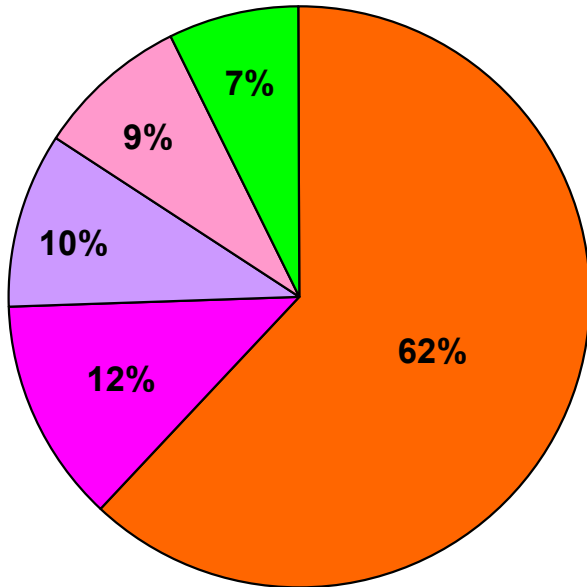


In the fall, most of the truck drivers using the Lynden/Aldergrove crossings are traveling to or from the East Lower Mainland suggesting less of a link with Pacific Highway in the fall. A smaller percentage of truck drivers using this crossing in the fall that come to or from the East Lower Mainland feel that they do not have an alternative crossing than in the summer, but this percentage is still high in the fall (over 50%).

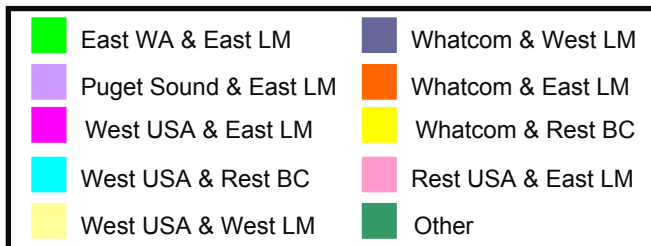
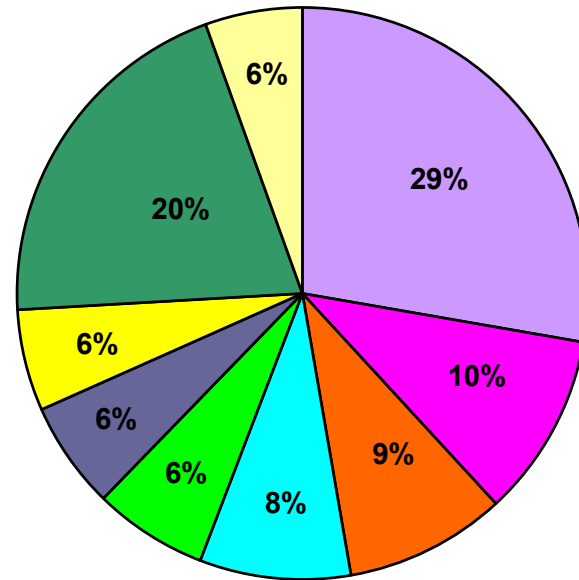
The Potential to Divert Traffic to Alternative Crossings

Major Truck Origins and Destinations

Sumas: Alternative Crossing Available (Fall)



Sumas: No Alternative Crossing Perceived (Fall)



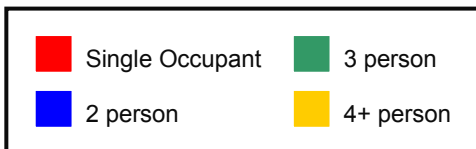
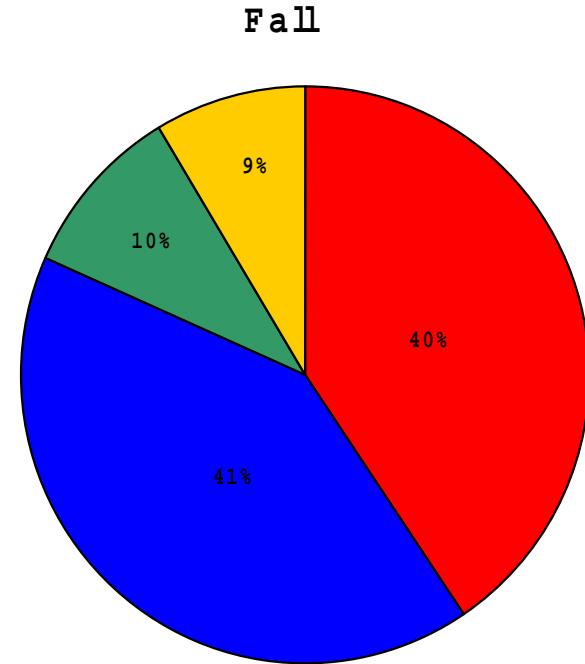
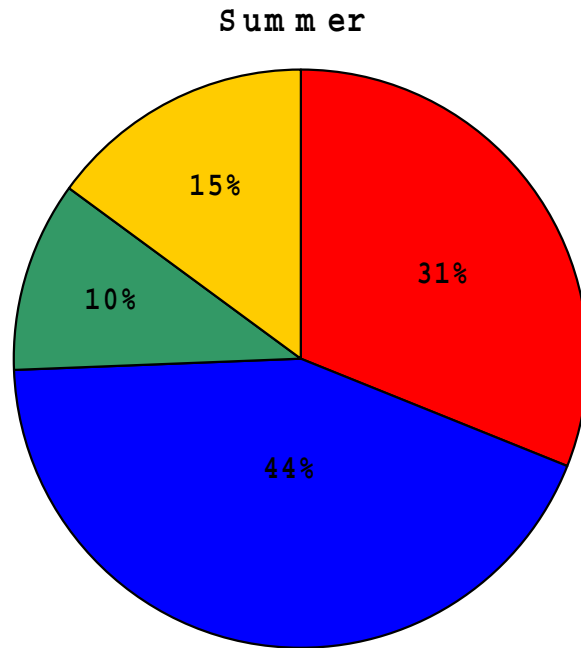
At Sumas/Huntingdon, the overwhelming use of this crossing by drivers with either an origin-or destination in the East Lower Mainland remains apparent in the fall. In both summer and fall, those drivers using this crossing who do not believe they have an appropriate alternative crossing are more likely to have an origin or destination outside the study area than within the study area.

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What is the Potential for HOV Lanes?

What is the Potential for HOV Lanes?

Vehicle Occupancy

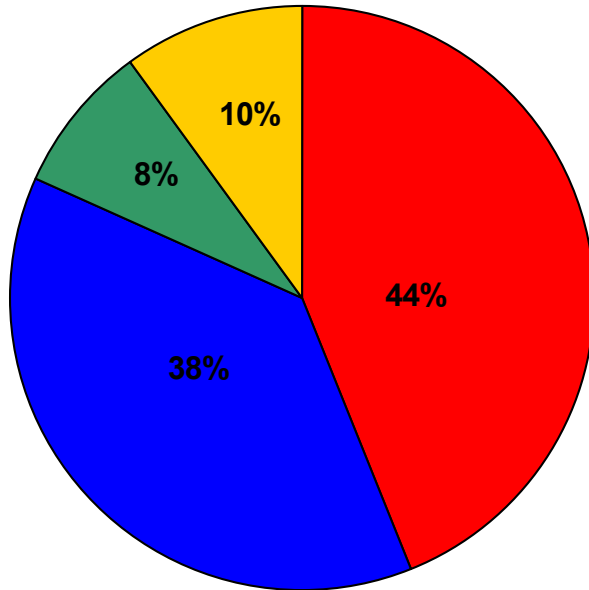


While the unique distribution of trip purposes crossing the border leads to a fairly large number of 3+ person vehicles (a core market for HOV lanes), this chart shows that 1 and 2 person vehicle trips are still the dominant mode of travel. Getting these users of the border to switch to higher occupancy vehicles could significantly enhance capacity utilization. It should also be noted that the existing market for HOV lanes is much smaller in the fall as compared to the summer.

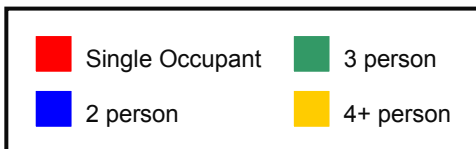
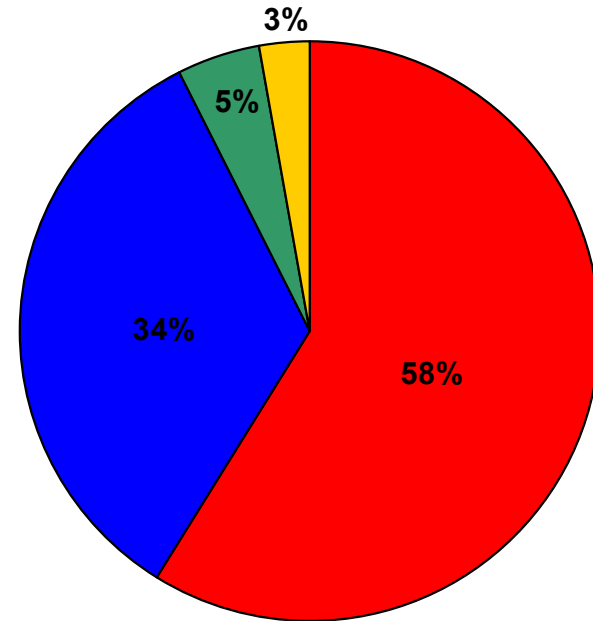
What is the Potential for HOV Lanes?

Vehicle Occupancy

Weekday (Northbound): Summer



Weekday (Northbound): Fall

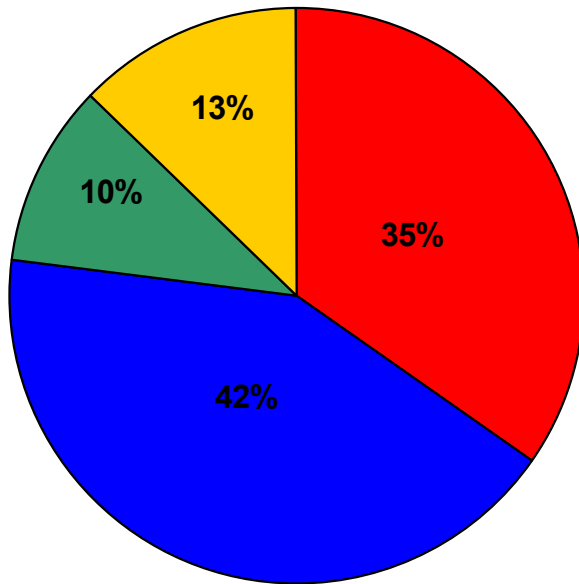


On weekdays in the northbound direction, the share of vehicle trips made in single occupancy or 2-person vehicles is higher than on weekends. SOV trips show a particular increase. This reflects a different distribution of trip purposes (vacation and recreation trips being more likely to occur in HOVs than work and shopping trips). As in the previous slide, fall trips show a much higher percentage of SOVs and 2-person vehicle trips as vacation trips drop off.

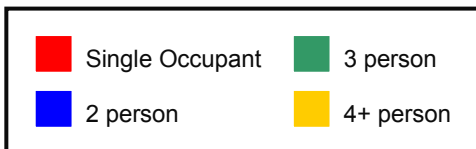
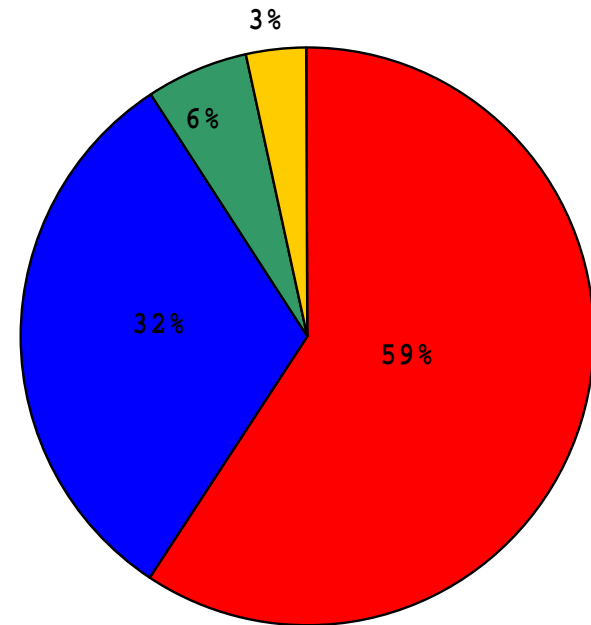
What is the Potential for HOV Lanes?

Vehicle Occupancy

Weekday (Southbound): Summer



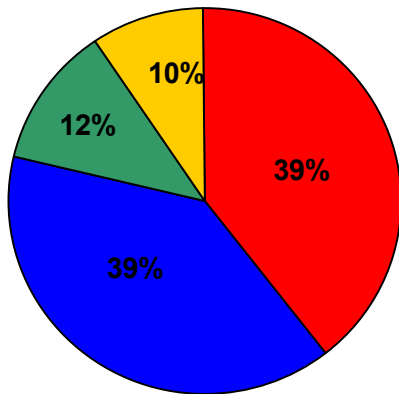
Weekday (Southbound): Fall



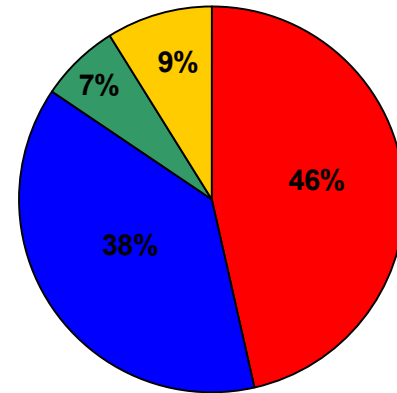
This chart shows that the pattern of vehicle occupancy is virtually identical in both directions across the border during the fall, but that in the summer there appear to be fewer weekday trips southbound that are SOV and 2-person vehicle trips than in the northbound direction. This discrepancy reflects the time-of-day patterns of the trips and likely means that the low occupancy vehicles crossing northbound during the day may be returning later in the evening, outside of the peak period.

What is the Potential for HOV Lanes? Auto Occupants in the Peak Period

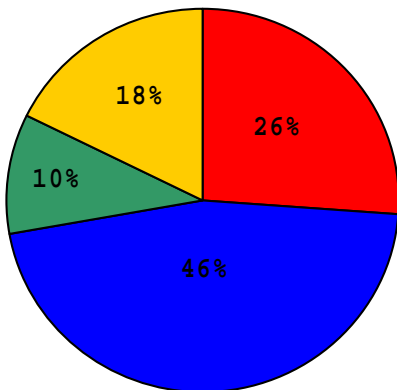
Peace Arch: Summer Northbound



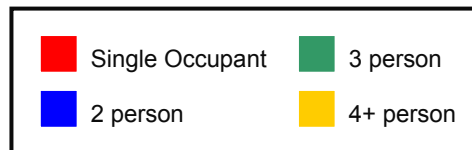
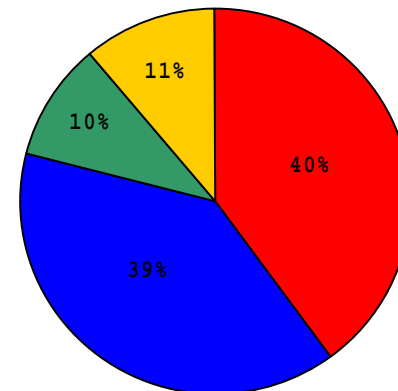
Peace Arch: Fall Northbound



Peace Arch: Summer Southbound



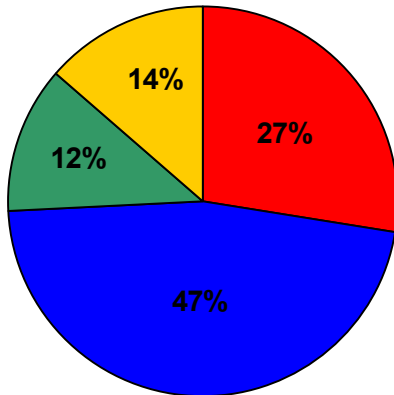
Peace Arch: Fall Southbound



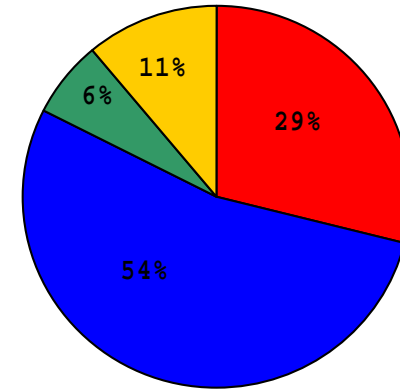
This chart shows the vehicle occupancy patterns at Peace Arch, the most congested passenger crossing, during the hours of peak traffic at this crossing. In the Northbound direction, the peak period SOV share is somewhat lower than the overall weekday SOV share in this direction but slightly higher than the overall SOV share at all border crossings in both directions. In the Southbound direction, the peak hour SOV share is lower than both the overall weekday southbound SOV share and the overall SOV share for both directions. Nonetheless, there does seem to be considerable potential to reduce traffic by encouraging HOV travel in the peak period, particularly in the Northbound direction.

What is the Potential for HOV Lanes? Auto Occupants in the Peak Period

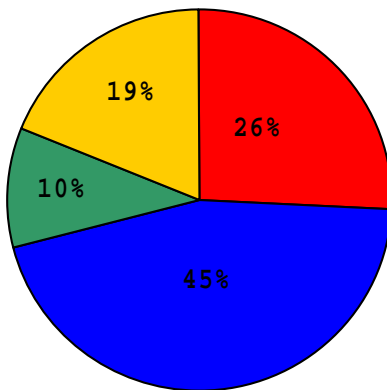
Pacific Highway: Summer Northbound



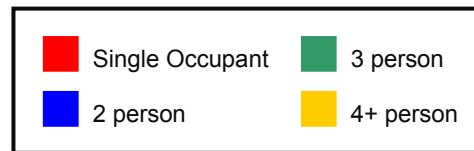
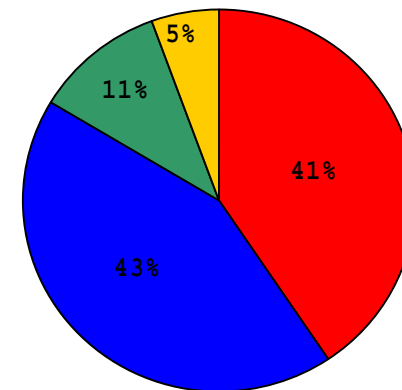
Pacific Highway: Fall Northbound



Pacific Highway: Summer Southbound



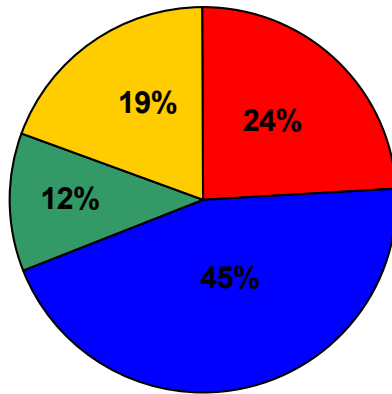
Pacific Highway: Fall Southbound



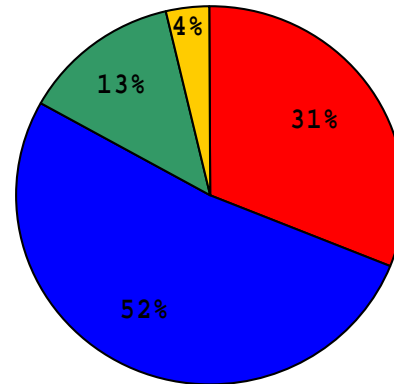
Pacific Highway shows a similar peak hour distribution of HOV traffic to Peace Arch, although the percentage of SOVs is slightly lower. During the summer in particular, there is more limited potential to reduce peak hour congestion through the reduction of SOV trips at Pacific Highway.

What is the Potential for HOV Lanes? Auto Occupants in the Peak Period

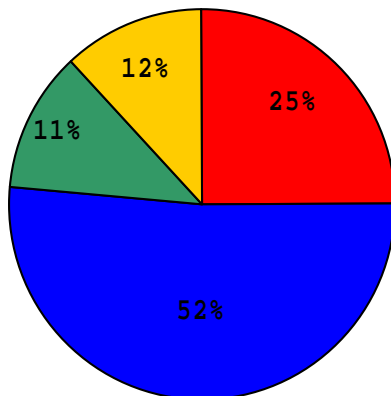
Lynden: Summer Northbound



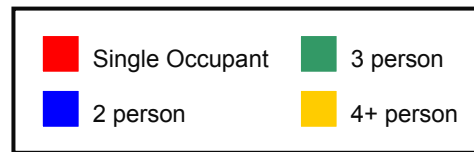
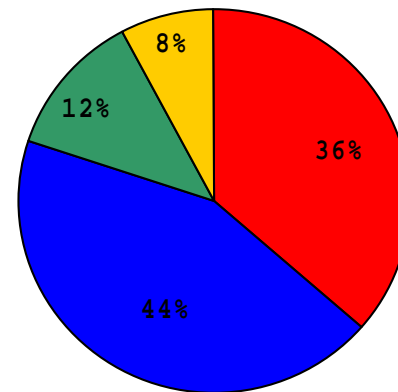
Lynden: Fall Northbound



Lynden: Summer Southbound



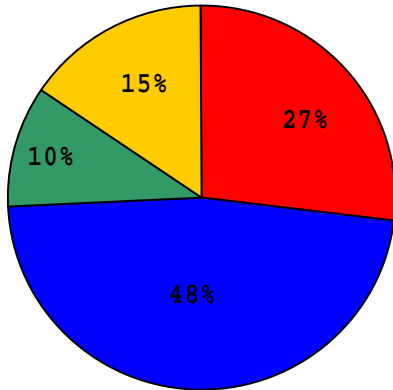
Lynden: Fall Southbound



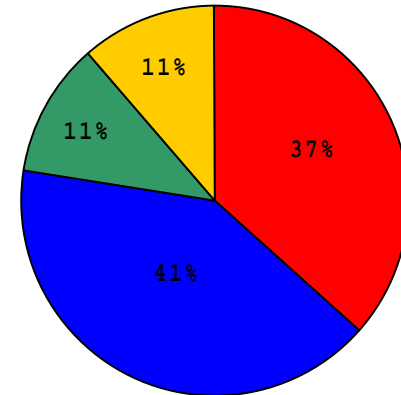
Lynden/Aldergrove also shows similar overall patterns of HOV usage to the other crossings during the peak period. Overall, its peak period SOV usage is the lowest of all four crossings.

What is the Potential for HOV Lanes? Auto Occupants in the Peak Period

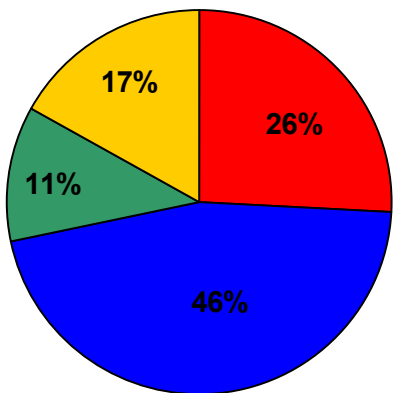
Sumas: Summer Northbound



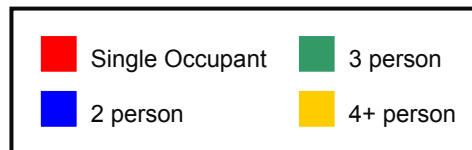
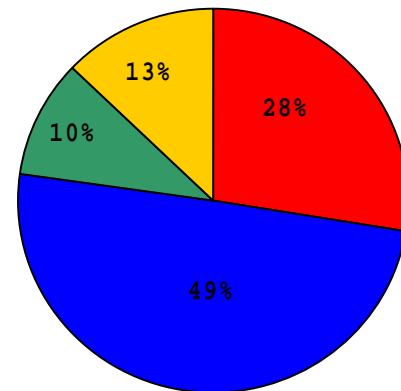
Sumas: Fall Northbound



Sumas: Summer Southbound



Sumas: Fall Southbound

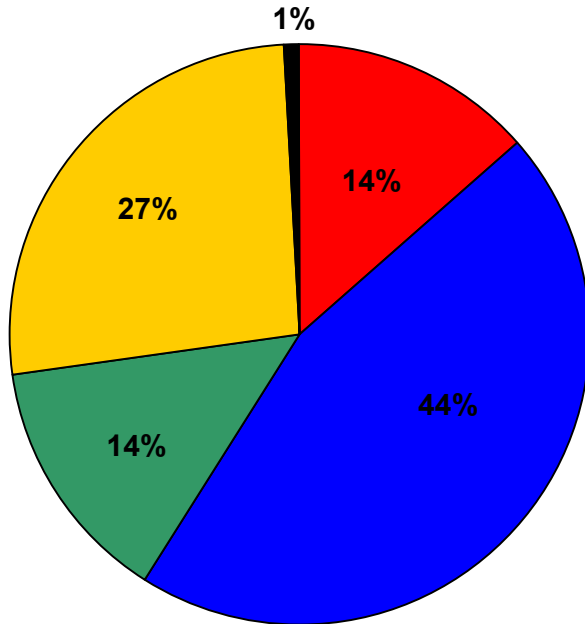


Sumas/Huntingdon shows a similar peak period distribution of HOV trips in the summer to the other crossings. However, in the fall it maintains a higher level of HOV usage than do the other crossings. While not quite as low as Lynden/Aldergrove, Sumas/Huntingdon's SOV trips during the peak period are also relatively low.

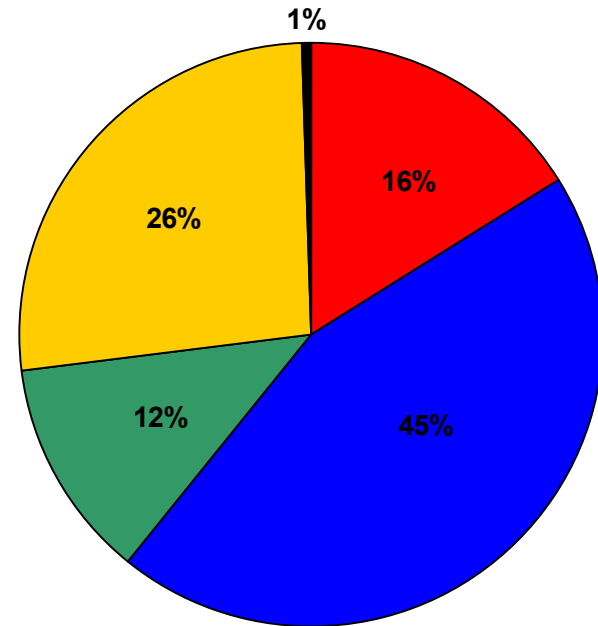
What is the Potential for HOV Lanes?

Auto Trip Purposes by Household Size

Summer: Recreation Trips



Fall: Recreation Trips

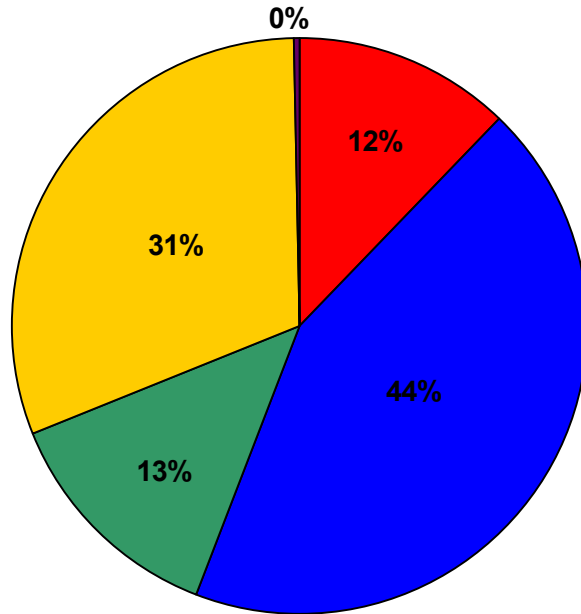


Recreation trips and vacation trips are more likely to be taken as a family/household than most other trip types. The household size distribution of travelers taking recreation trips shows that approximately 60% of recreation trips are taken by people in 1 or 2 person households, which may explain the large number of SOV and 2-person vehicle trips.

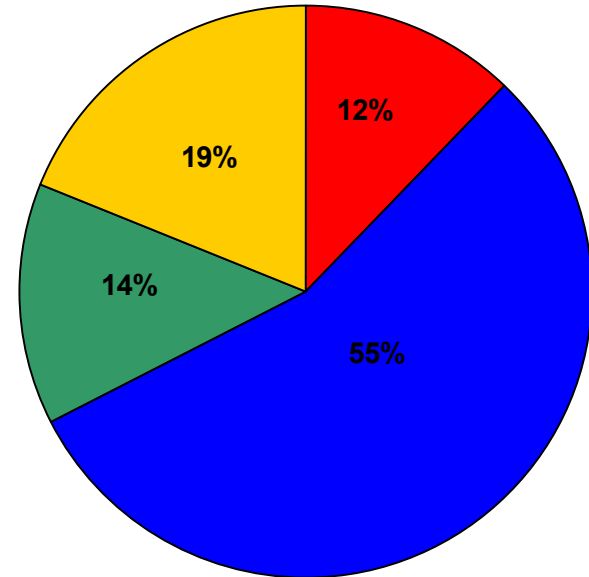
What is the Potential for HOV Lanes?

Auto Trip Purposes by Household Size

Summer: Vacation Trips



Fall: Vacation Trips



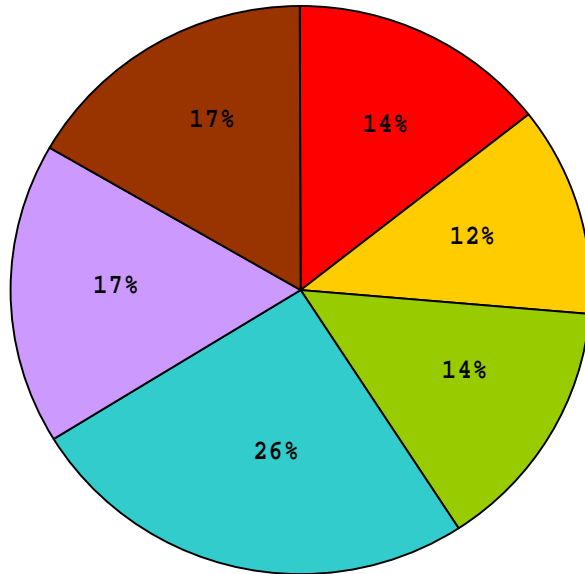
Vacation trips across the border also tend to be taken by a large number of one and two-person households, especially in the fall. This demographic characteristic helps explain the large share of SOV and 2-person vehicle trips in both seasons.

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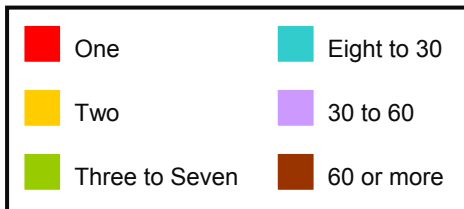
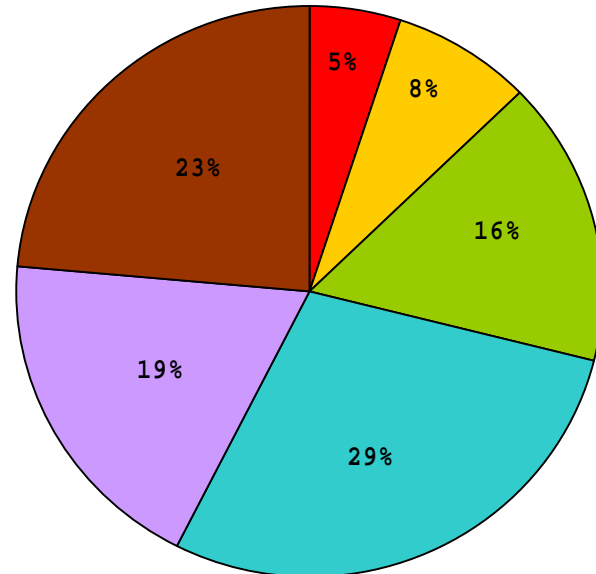
What is the Market for Pre-Approval Programs?

What is the Market for Pre-approval Programs? Number of Auto Trips Per Year

Summer



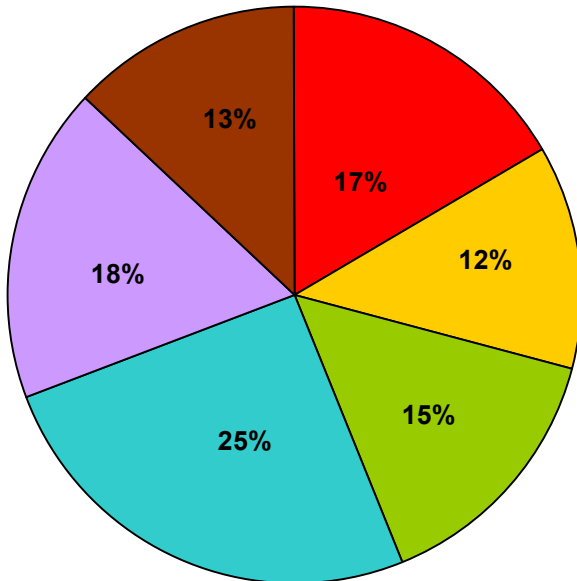
Fall



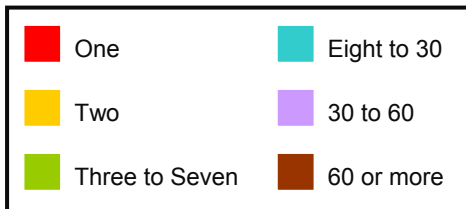
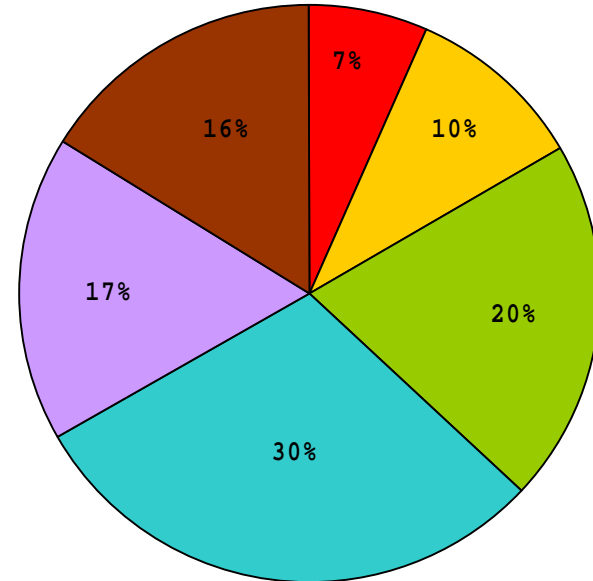
There should be a significant market for pre-approval programs among auto drivers. Roughly the same number of trips across the border in summer and fall are regular travelers (more than 30 trips per year) across the border. These represent about one-third of summer trips and over 40% of fall trips.

What is the Market for Pre-approval Programs? Number of Auto Trips Per Year

Summer Weekend



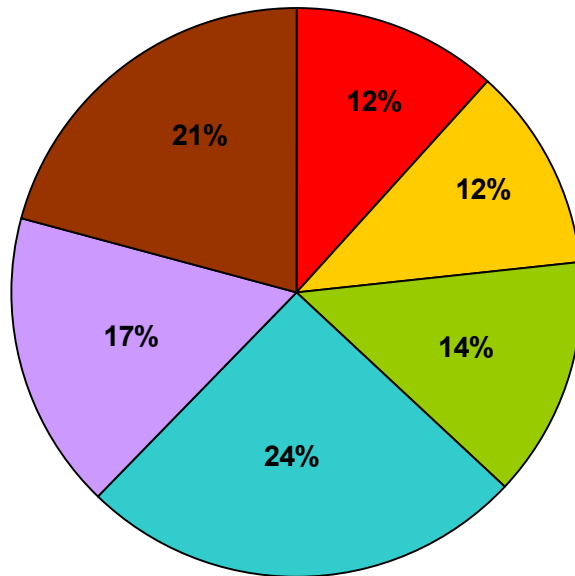
Fall Weekend



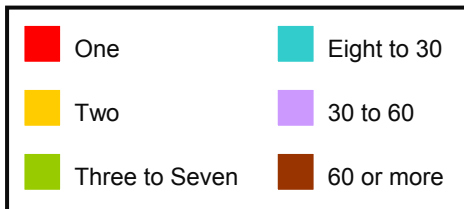
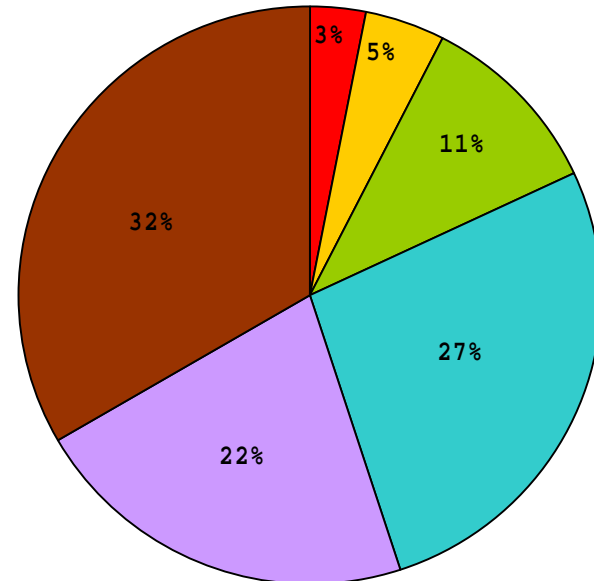
During the peak weekend period, there are still a substantial number of trips taken by regular travelers, although the percentage of total trips is smaller.

What is the Market for Pre-approval Programs? Number of Auto Trips Per Year

Summer Weekday



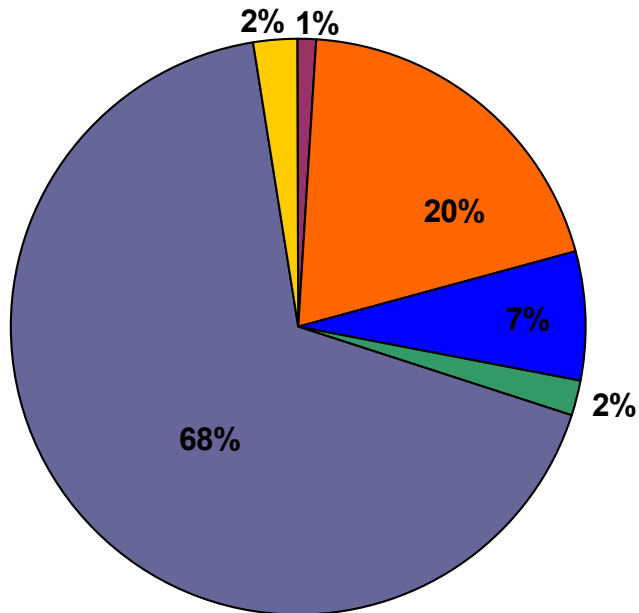
Fall Weekday



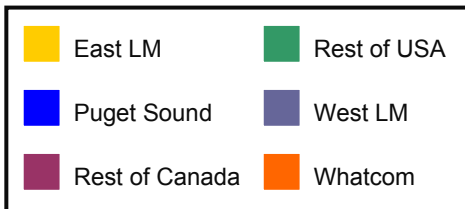
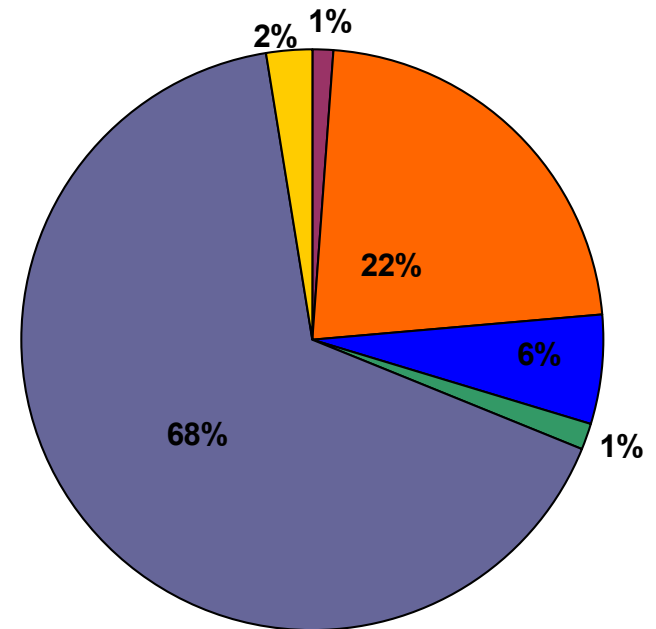
On weekdays, regular travelers represent a substantial share of the total trips taken (over 50% in the fall).

What is the Market for Pre-approval Programs? More Than Eight Auto Crossings Per Year

Peace Arch: Summer Auto Residence



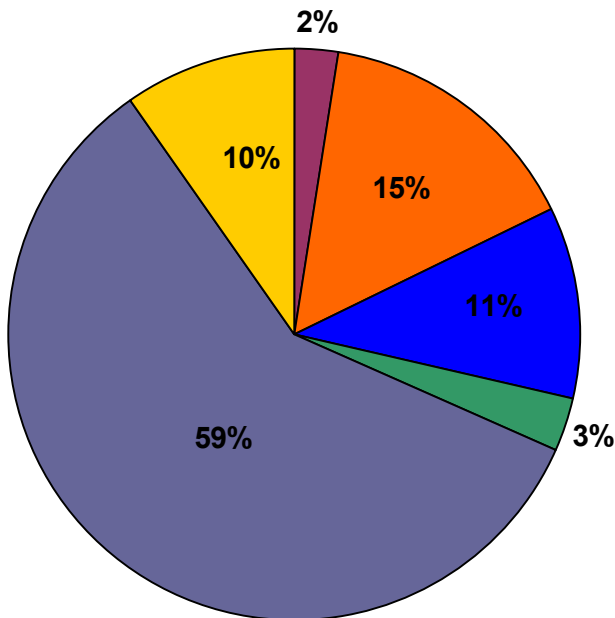
Peace Arch: Fall Auto Residence



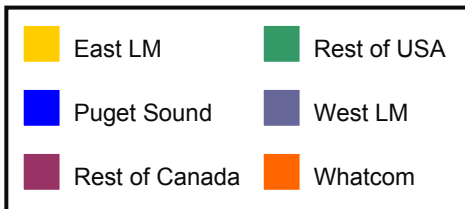
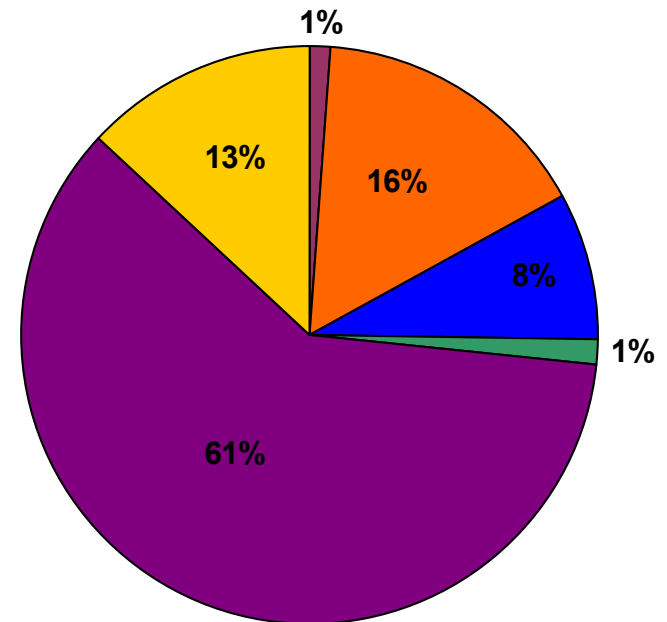
As might be expected, frequent travelers across the border live in close proximity to the border. At Peace Arch, the vast majority of frequent travelers live in the West Lower Mainland (roughly two-thirds of these trips). Most of the remainder of frequent travelers live in Whatcom County (between 20% and 25%).

What is the Market for Pre-approval Programs? More Than Eight Auto Crossings Per Year

Pacific Highway: Summer Auto Residence



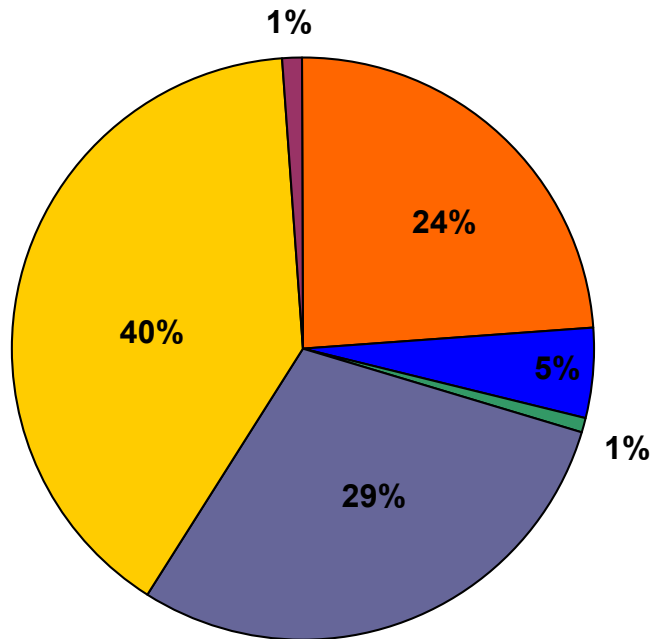
Pacific Highway: Fall Auto Residence



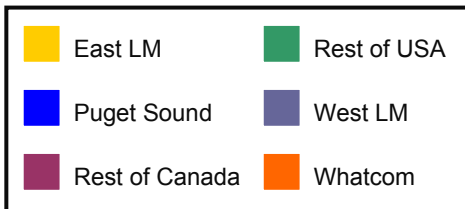
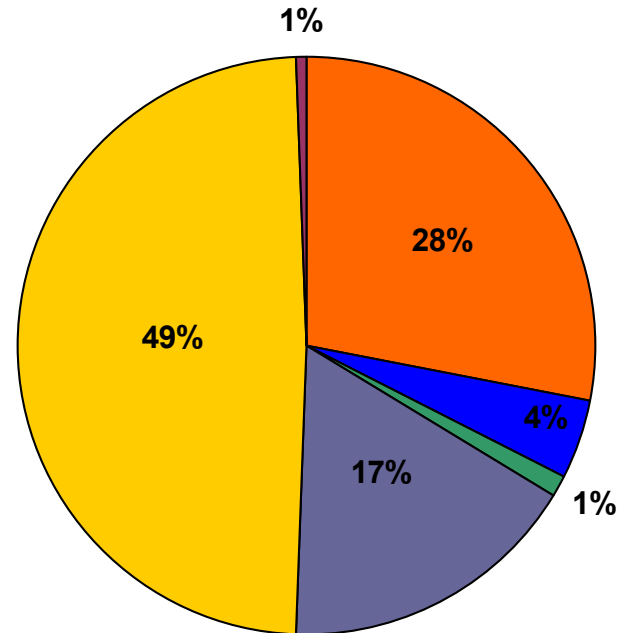
The places of residence of frequent travelers at Pacific Highway are slightly different than at Peace Arch. While the majority of these travelers live in the West Lower Mainland, the percentage of trips made by people living in the West Lower Mainland is smaller at Pacific Highway. Share of frequent traveler trips made by Whatcom County residents is also lower. A major difference between Peace Arch and Pacific Highway is that at Pacific Highway a much higher percentage of frequent traveler trips are made by residents of the East Lower Mainland.

What is the Market for Pre-approval Programs? More Than Eight Auto Crossings Per Year

Lynden: Summer Auto Residence



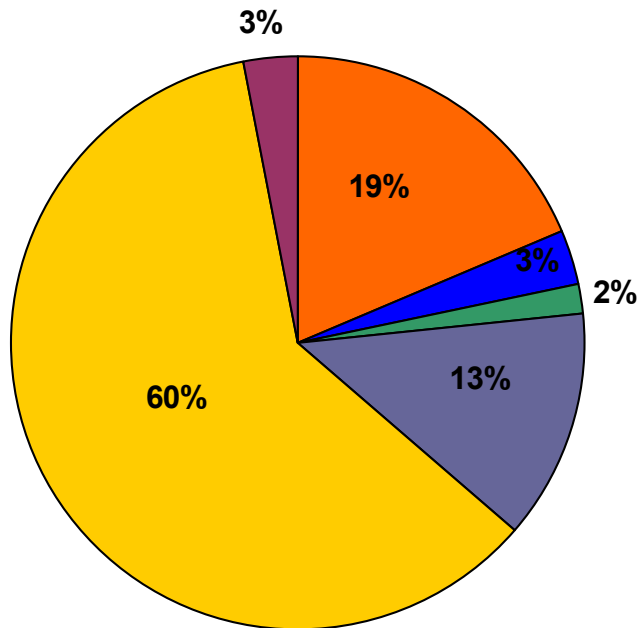
Lynden: Fall Auto Residence



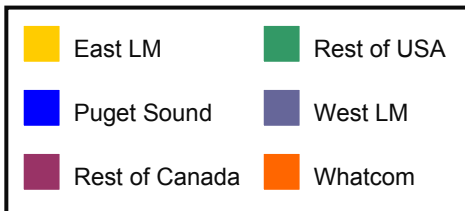
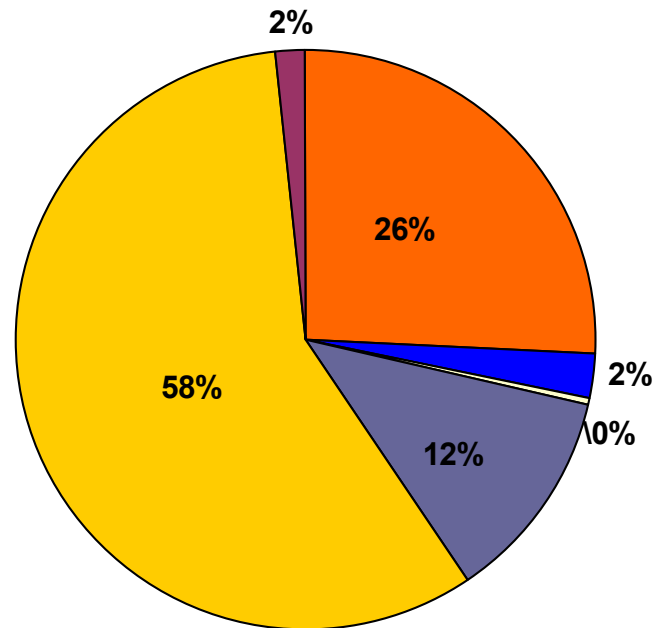
Frequent travelers at Lynden are most likely to live in the East Lower Mainland than anywhere else. A slightly higher percentage of these trips are made by residents of Whatcom County than at Peace Arch.

What is the Market for Pre-approval Programs? More Than Eight Auto Crossings Per Year

Sumas: Summer Auto Residence



Sumas: Fall Auto Residence



At Sumas/Huntingdon, the majority of trips by frequent travelers are made by residents of East Lower Mainland and very few of these trips are made by West Lower Mainland residents. About the same fraction of these trips are made by residents of Whatcom County as make frequent trips at Peace Arch.

What is the Market for Pre-approval Programs? More Than Eight Auto Crossings Per Year

| Summer Resident City (in Lower Mainland and Whatcom County) | Frequency | Percent |
|--|---------------|--------------|
| Abbotsford | 2,186 | 10.4 |
| Aldergrove | 518 | 2.5 |
| Bellingham | 1,487 | 7.1 |
| Birch Bay | 208 | 1.0 |
| Blaine | 836 | 4.0 |
| Burnaby | 716 | 3.4 |
| Chilliwack | 486 | 2.3 |
| Coquitlam | 563 | 2.7 |
| Delta | 765 | 3.7 |
| Ferndale | 456 | 2.2 |
| Langley | 1,348 | 6.4 |
| Lynden | 685 | 3.3 |
| Mission | 334 | 1.6 |
| New Westminster | 359 | 1.7 |
| North Vancouver | 407 | 1.9 |
| Point Roberts | 223 | 1.1 |
| Richmond | 607 | 2.9 |
| Sumas | 238 | 1.1 |
| Surrey | 3,242 | 15.5 |
| Vancouver | 1,833 | 8.8 |
| White Rock | 2,221 | 10.6 |
| Other | 1,215 | 5.8 |
| Total | 20,932 | 100.0 |

This chart provides more detail on residency of frequent travelers across the border. Six cities account for the residency of frequent travelers making 60% of the trips by residents of Whatcom County and the Lower Mainland: Surrey, White Rock, Abbotsford, Vancouver, Bellingham, and Langley.

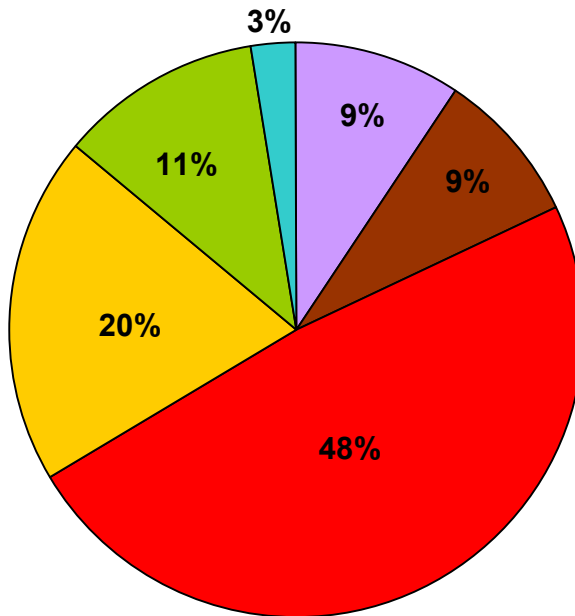
What is the Market for Pre-approval Programs? More Than Eight Auto Crossings Per Year

| Fall Resident City (in Lower Mainland and Whatcom County) | Frequency | Percent |
|--|---------------|--------------|
| Abbotsford | 1,704 | 9.0 |
| Aldergrove | 388 | 2.0 |
| Bellingham | 1,327 | 7.0 |
| Birch Bay | 234 | 1.2 |
| Blaine | 870 | 4.6 |
| Burnaby | 624 | 3.3 |
| Chilliwack | 431 | 2.3 |
| Cloverdale | 261 | 1.4 |
| Coquitlam | 429 | 2.3 |
| Delta | 557 | 2.9 |
| Ferndale | 384 | 2.0 |
| Langley | 1,095 | 5.8 |
| Lynden | 810 | 4.3 |
| Maple Ridge | 236 | 1.2 |
| Mission | 213 | 1.1 |
| New Westminster | 334 | 1.8 |
| North Vancouver | 293 | 1.5 |
| Richmond | 654 | 3.4 |
| Sumas | 326 | 1.7 |
| Surrey | 2,689 | 14.1 |
| Vancouver | 1,495 | 7.9 |
| White Rock | 2,190 | 11.5 |
| Other | 1,457 | 7.7 |
| Total | 19,001 | 100.0 |

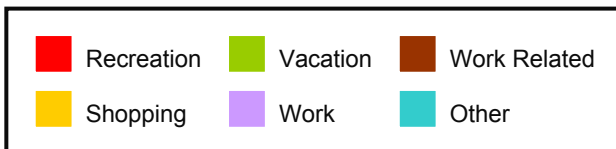
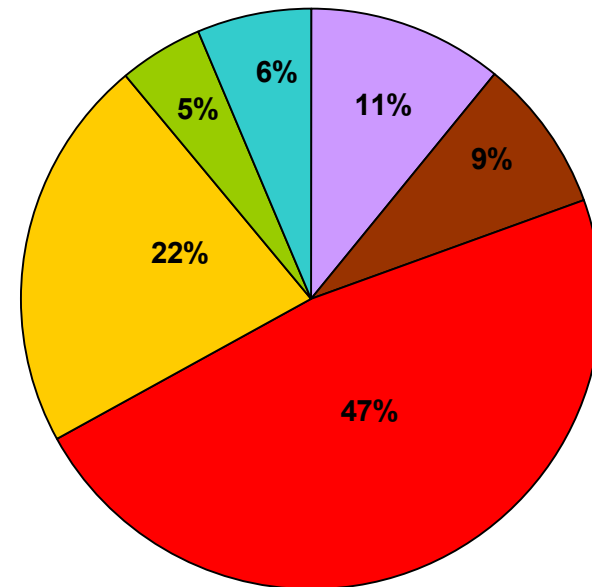
Similar patterns are seen for residency of frequent travelers during the fall.

What is the Market for Pre-approval Programs? More Than Eight Auto Crossings Per Year

Peace Arch: Summer Trip Purposes



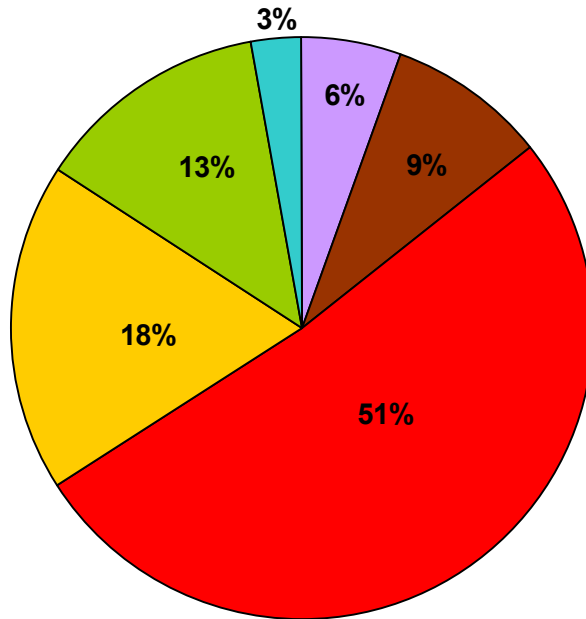
Peace Arch: Fall Trip Purposes



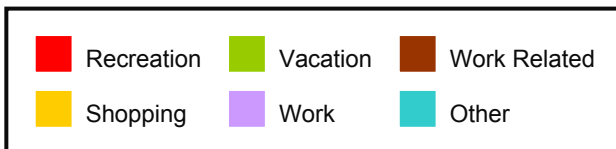
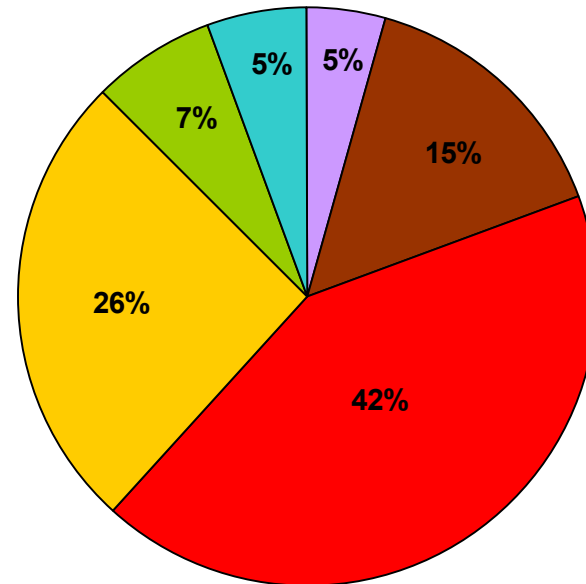
In the next four slides, we show the trip types (auto trip purposes) of people that make more than eight auto crossings per year. A fairly large share of trips by frequent travelers at all four crossings are recreation trips, reflecting the general usage of this system of border crossings. A higher percentage of trips by frequent travelers at all crossings are work or work-related trips than is the case for trips by occasional travelers crossing the border.

What is the Market for Pre-approval Programs? More Than Eight Auto Crossings Per Year

Pacific Highway: Summer Trip Purposes



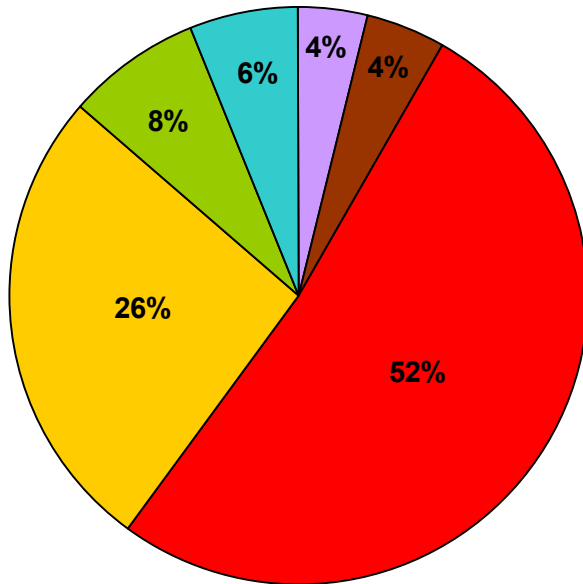
Pacific Highway: Fall Trip Purposes



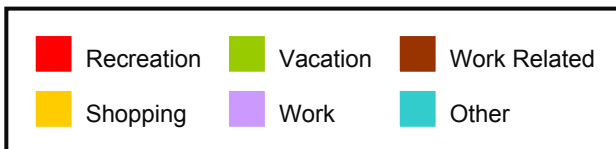
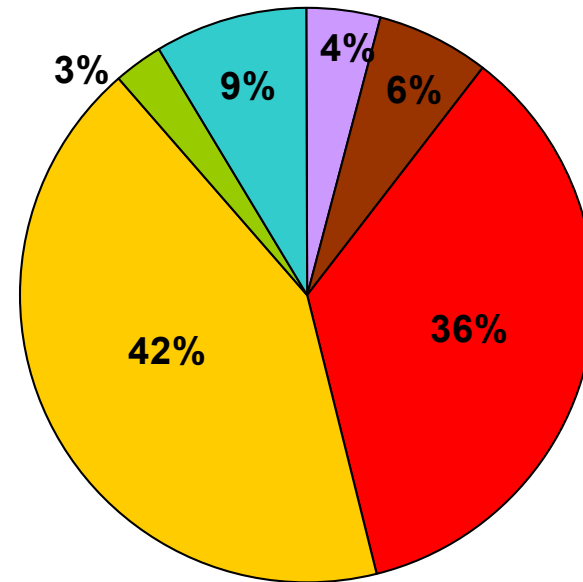
Patterns of trip purposes by frequent travelers at Pacific Highway are similar to those at Peace Arch.

What is the Market for Pre-approval Programs? More Than Eight Auto Crossings Per Year

Lynden: Summer Trip Purposes



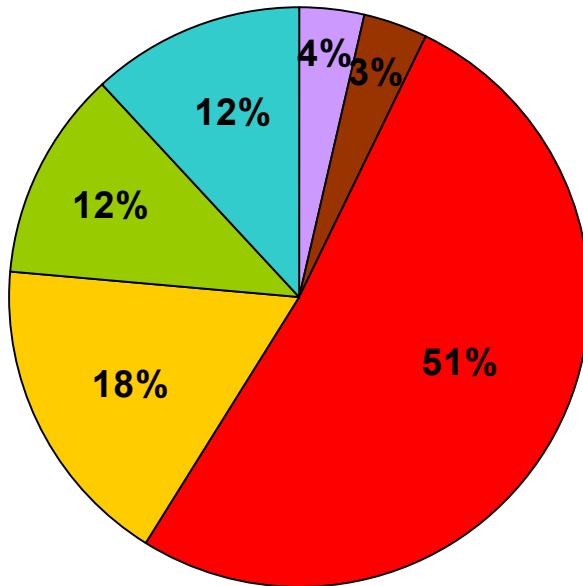
Lynden: Fall Trip Purposes



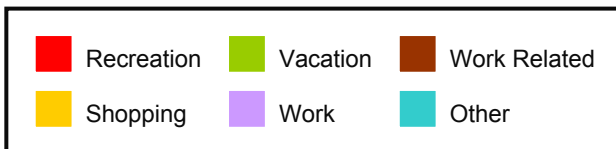
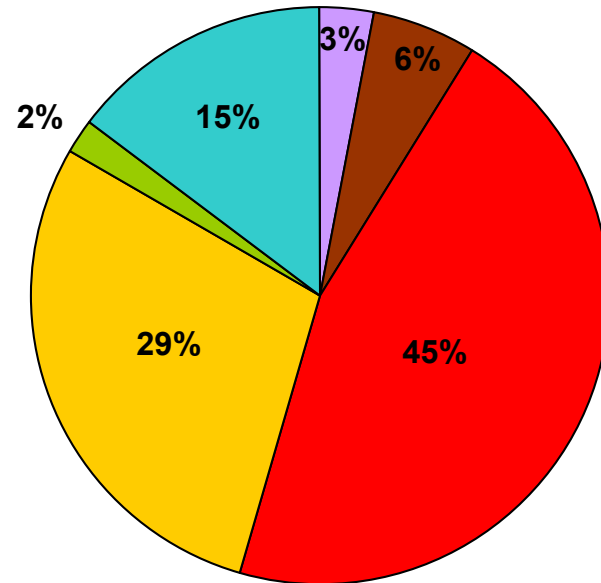
As shown in this slide and the next slide, at both Lynden/Aldergrove and Sumas/Huntingdon, work and work-related trips represent a smaller percentage of trips by frequent travelers than they do at Peace Arch and Pacific Highway. Shopping trips at both crossings are more often made by frequent travelers.

What is the Market for Pre-approval Programs? More Than Eight Auto Crossings Per Year

Sumas: Summer Trip Purposes



Sumas: Fall Trip Purposes

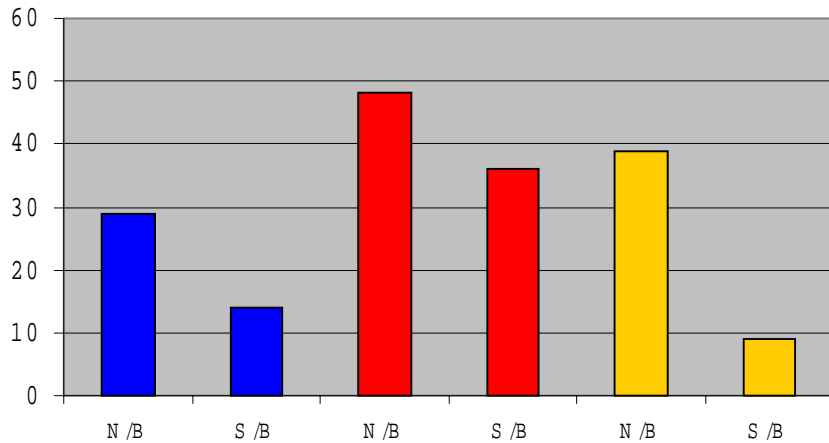


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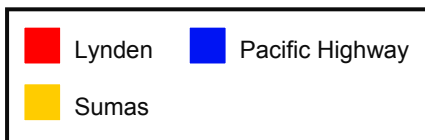
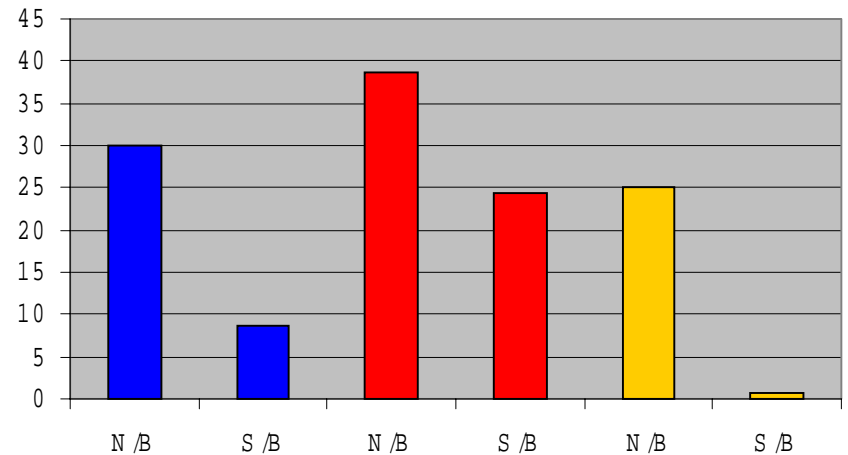
What is the Market for Pre-approval Programs?

Percentage of Empty Trucks

Summer



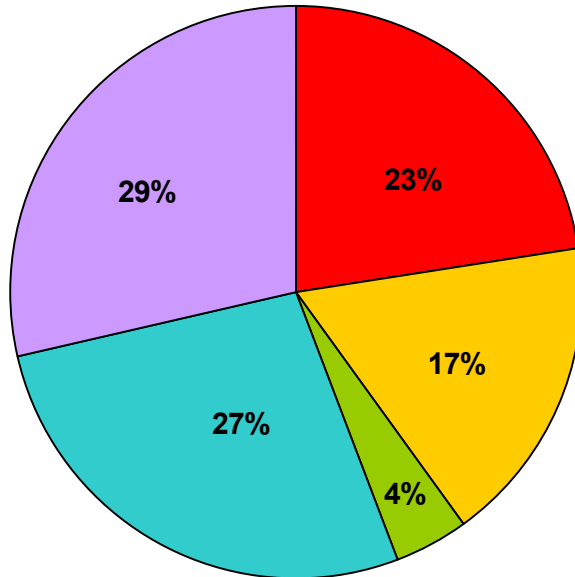
Fall



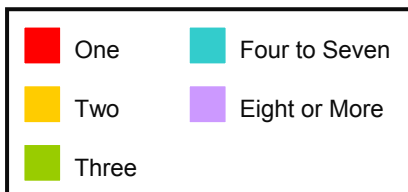
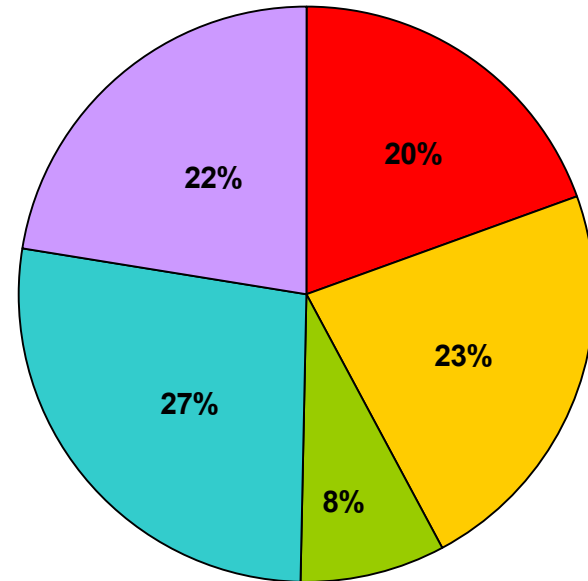
In addition to pre-approval programs, many commercial vehicle operators have recommended special lanes for empty trucks. This chart illustrates the imbalance in empty truck flows across the border at all commercial crossings. The imbalance is greatest at Sumas and least at Lynden.

What is the Market for Pre-approval Programs? Number of Truck Border Crossings

Summer



Fall

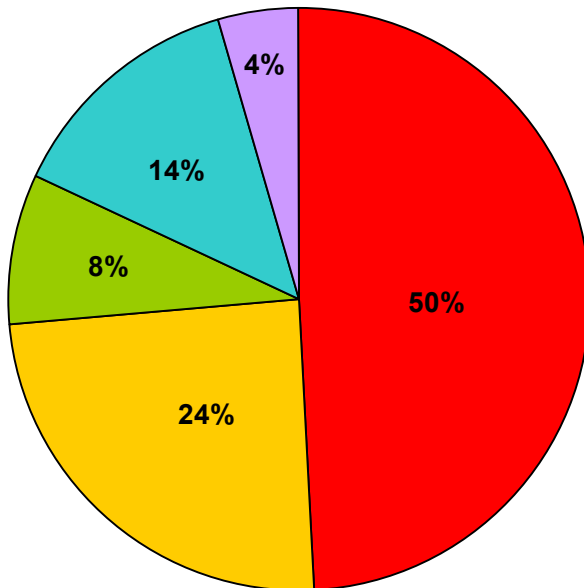


This chart shows the high percentage of truck trips that are made by frequent travelers. About 50% of trips are made by drivers who cross the border more than four times per week.

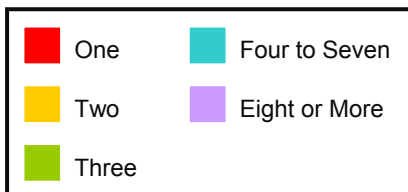
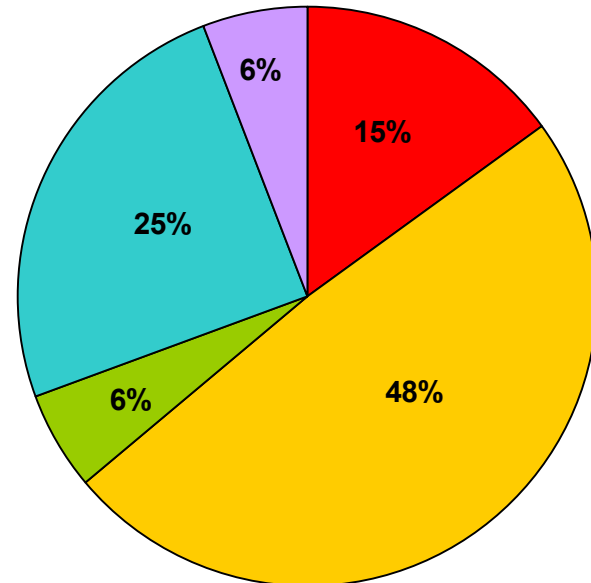
What is the Market for Pre-approval Programs?

Number of Truck Border Crossings

Summer Weekend (Pacific Highway)



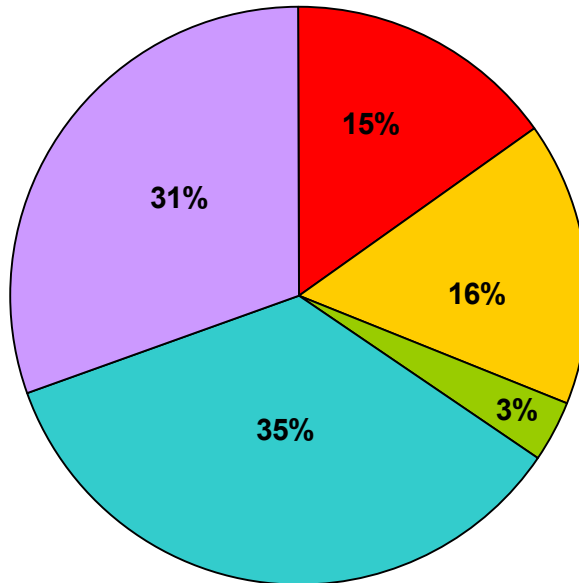
Fall Weekend (Pacific Highway)



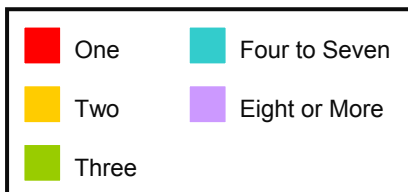
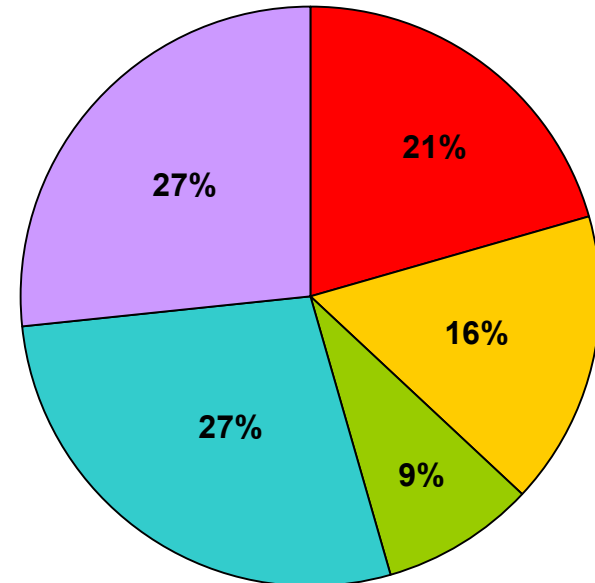
This chart shows that on weekends, most trips are made by trucks that cross only once or twice per week.

What is the Market for Pre-approval Programs? Number of Truck Border Crossings

Summer Weekday



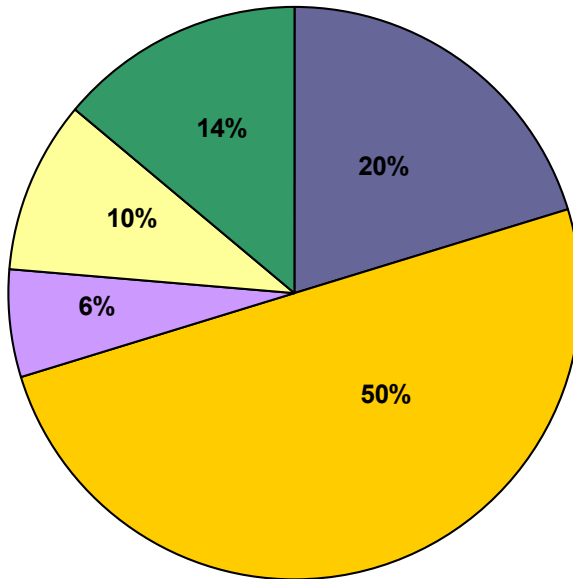
Fall Weekday



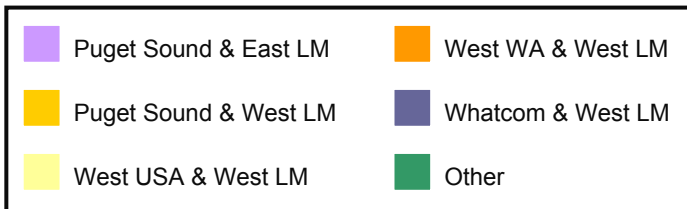
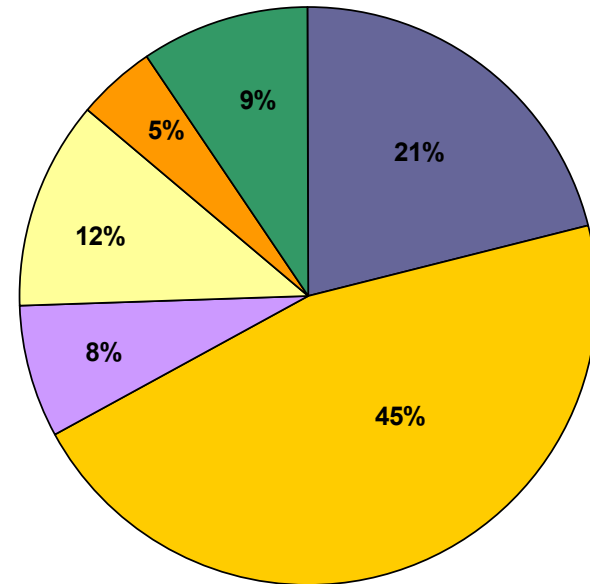
On weekdays over 50% of truck trips are made by drivers who make more than four trips per week.

What is the Market for Pre-approval Programs? More Than Four Truck Crossings Per Week

Pacific Highway: Summer Origin Destination Pairs



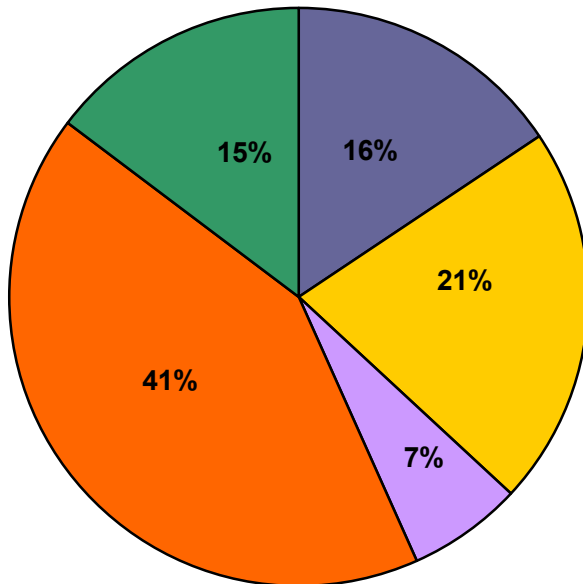
Pacific Highway: Fall Origin Destination Pair



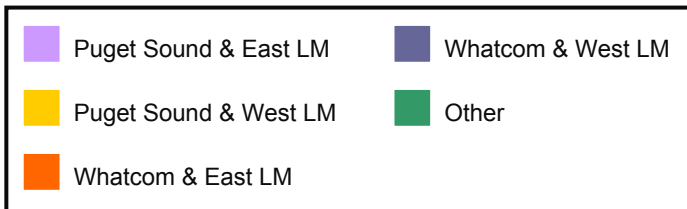
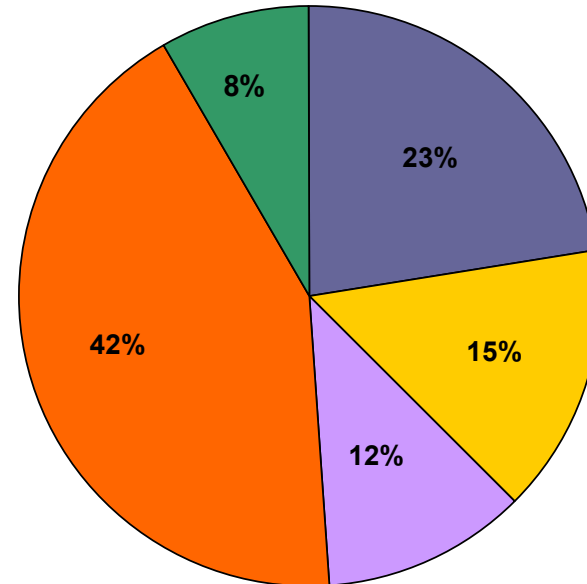
At Pacific Highway, the largest percentage of trips made frequently are trips between Puget Sound and the West Lower Mainland. About 20% of these repetitive trips are made between Whatcom County and the West Lower Mainland.

What is the Market for Pre-approval Programs? More Than Four Truck Crossings Per Week

Lynden: Summer Origin Destination Pairs



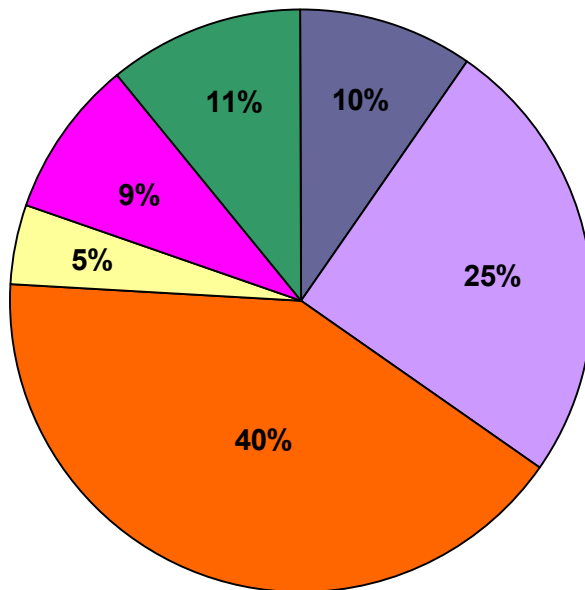
Lynden: Fall Origin Destination Pairs



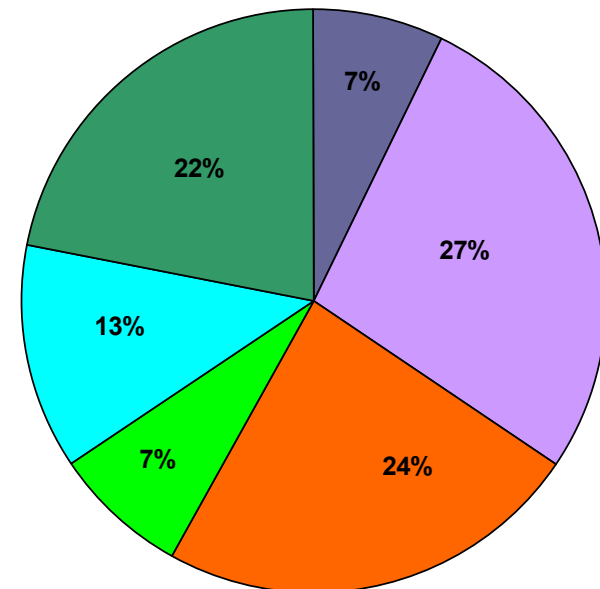
At Lynden, the largest fraction of repetitive trips are made between Whatcom County and the East Lower Mainland. Similar fractions of repetitive trips are made between Whatcom County and the West Lower Mainland and Puget Sound and the West Lower Mainland.

What is the Market for Pre-approval Programs? More Than Four Truck Crossings Per Week

Sumas: Summer Origin Destination Pair



Sumas: Fall Origin Destination Pairs



At Sumas, the largest percentage of repetitive trips are made between Whatcom County and the East Lower Mainland and Puget Sound and the East Lower Mainland. Sumas also has a large number of repetitive trips made by trucks with an origin or destination outside the study area.

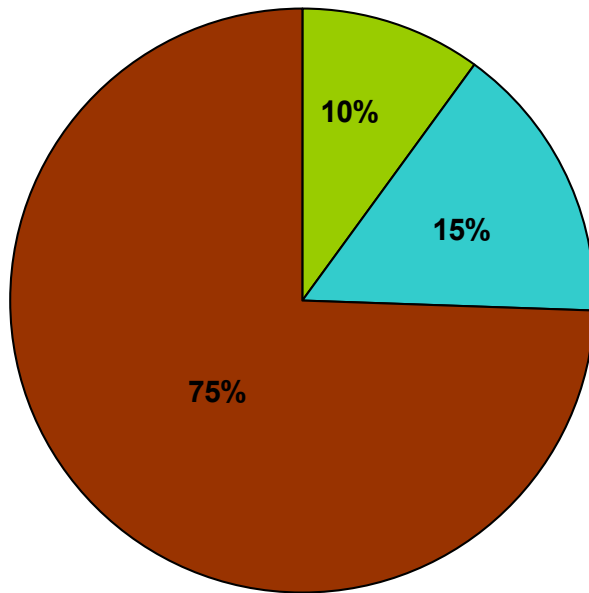
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What is the Potential to Divert Traffic to Alternative Freight Modes?

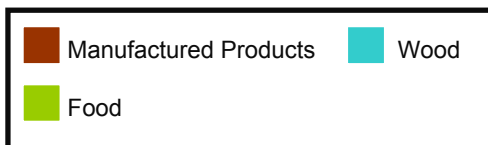
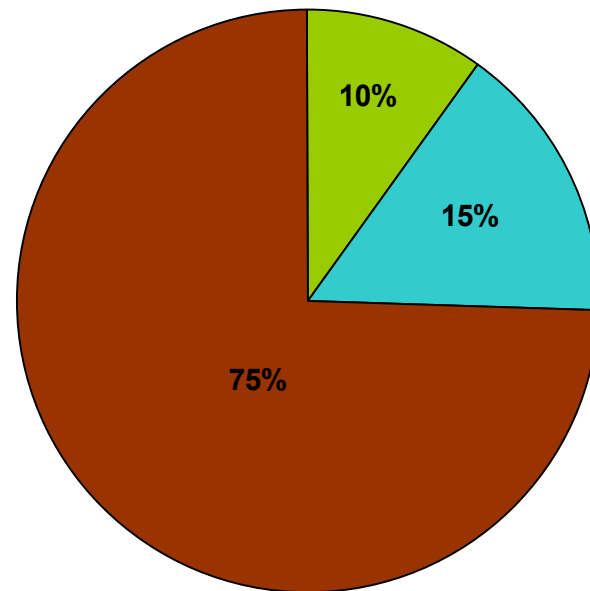
Potential to Divert Traffic to Alternative Modes

Short Haul: Puget Sound and West LM

Summer Commodities



Fall Commodities

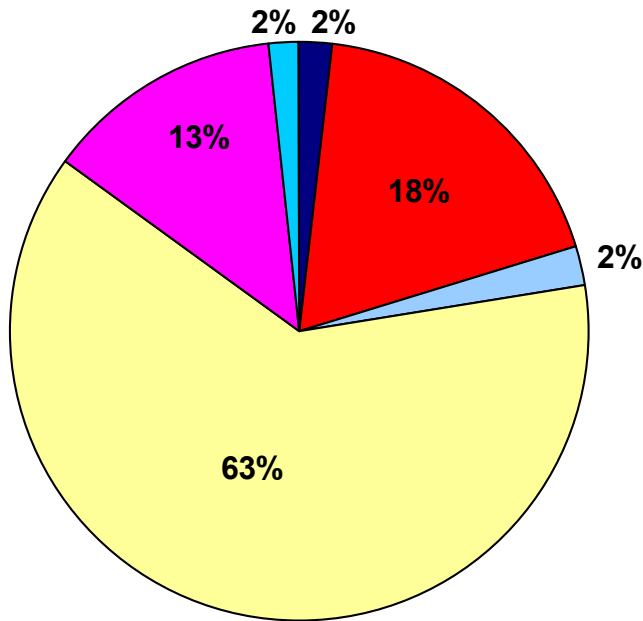


Significant interest has been expressed in the potential for short-haul intermodal services as a mechanism for diverting truck traffic to rail. A hypothetical service running between Seattle and Vancouver has been postulated and the data collected in the cross-border travel study has been used to provide a very crude analysis of market potential. Over 90% of the truck trips between the Puget Sound Region and the West Lower Mainland (a potential dray area for intermodal service) falls into 3 commodity groups that are sometimes carried by intermodal services. In both summer and fall, these commodity movements represent between 15% and 20% of total commodity trips across the border, a market that could have significant impact on truck traffic, particularly at the Pacific Highway crossing.

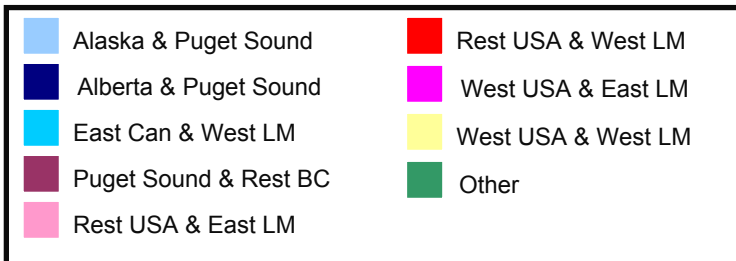
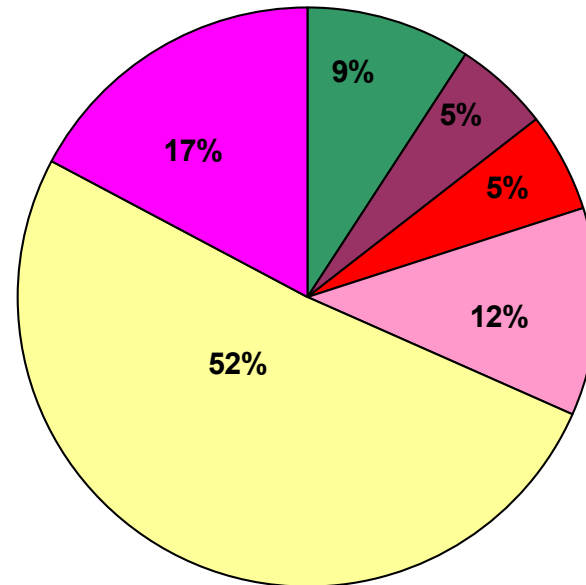
Potential to Divert Traffic to Alternative Modes

Long Haul: Food

Summer Major Origins and Destinations



Fall Major Origins and Destinations

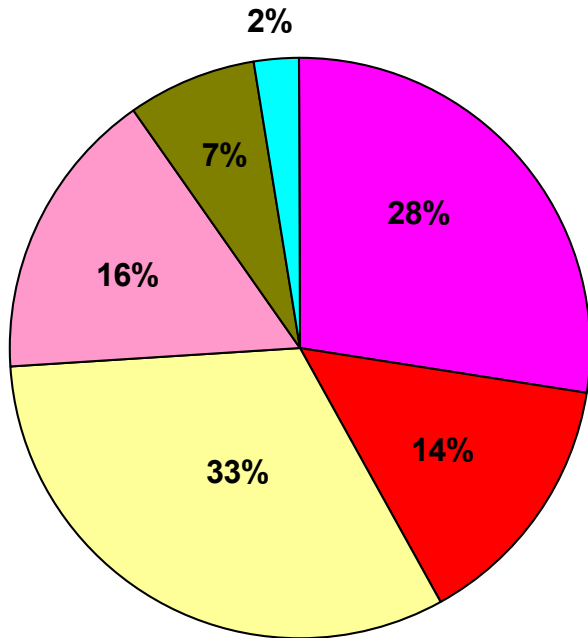


Long haul rail markets are typically feasible in competition with trucking when the products are not time sensitive and the distances shipped exceed 700 miles. The following slides look at the regional origin-destination patterns of long haul movements of major commodity groups. Processed food products, manufactured products, and timber and wood products represent over 90% of the long haul commodity trips. A significant fraction of the food products move between the Western U.S. (California and Oregon) and the West Lower Mainland.

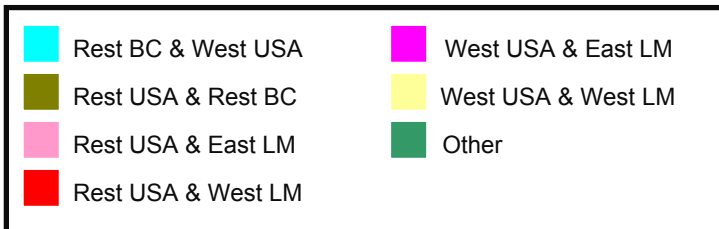
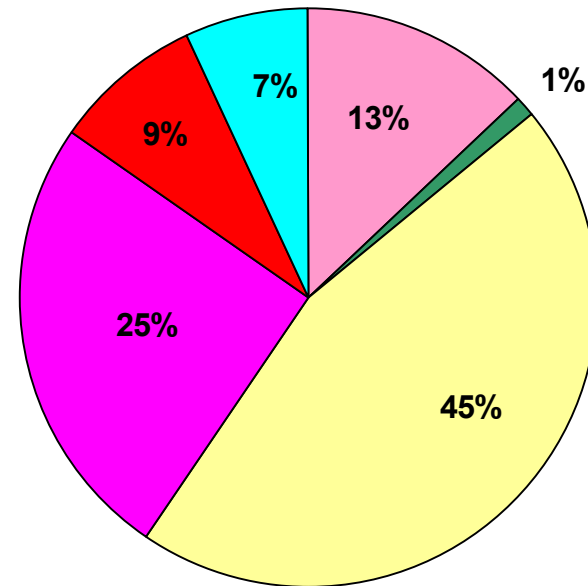
Potential to Divert Traffic to Alternative Modes

Long Haul: Wood

Summer Major Origins and Destinations



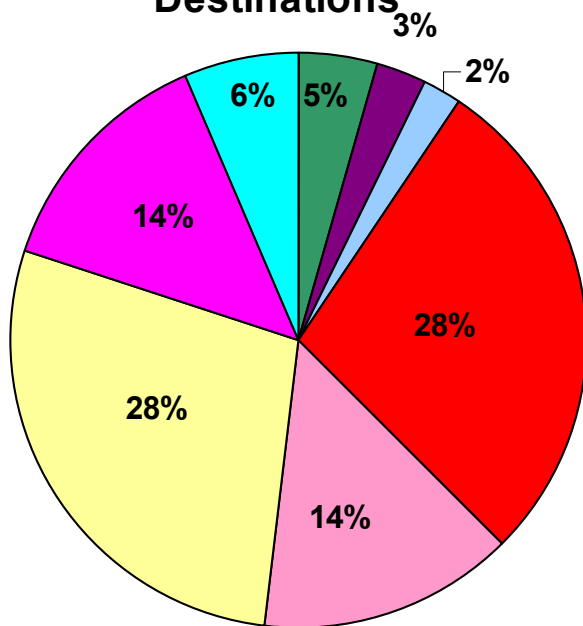
Fall Major Origins and Destinations



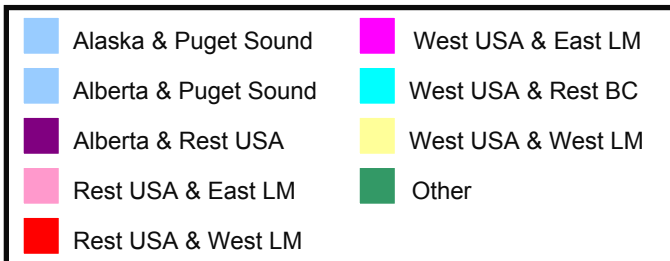
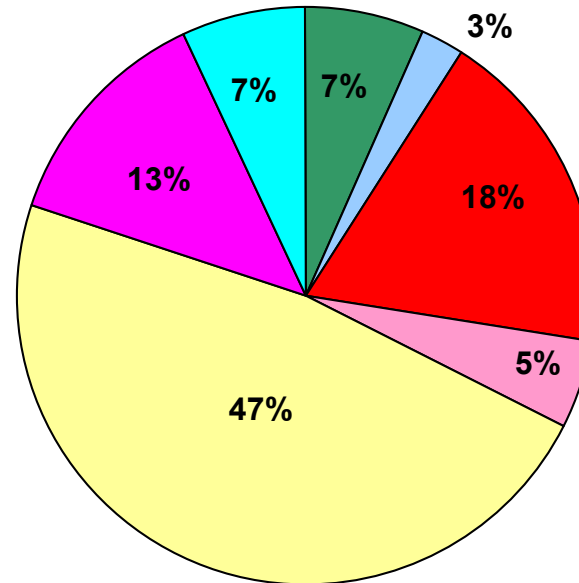
Wood products may not present as concentrated a set of shipping lanes as do food products. Movements with O-Ds in the Lower Mainland are split between the west and the east and destinations in the U.S. are fairly dispersed.

Potential to Divert Traffic to Alternative Modes Long Haul: Manufacturing

Summer Major Origins and Destinations



Fall Major Origins and Destinations



While long haul O-D patterns for manufactured products in the summer are more dispersed than in the fall, there is still a considerable amount of product moving between the Western U.S. and the Lower Mainland in both seasons, representing a potential market for greater rail intermodal shipment.