

Summary of At-Border Data Collection Results

Economic and Air Quality/Climate Impacts of
Delays at the Border

San Diego, CA
December 8, 2017



Contents

Introduction	4
Overview of the Study Area	4
Overview of Data Collection Efforts.....	5
Summary Statistics for Key Economic Survey Variables	9
Trip Purpose	9
Average Border-Crossing Trip Spending.....	14
Average Expenditures of Border-Crossing Travelers by Expenditure Category.....	16
Alternate Average Spending in Home Country.....	18
Average Expenditures by Expenditure Category If Trip is Not Taken	20
Average Wages	22
Elasticities of Travel Demand with respect to Border Delay	23
Summary Statistics for Key Air Quality Variables.....	25
Model Year	25
Odometer Reading and Units.....	26
Fuel Type.....	27
Share of Fuel Purchased in Mexico.....	28
Smog Check Program.....	29
Switch to Non-Motorized Crossing Mode	30
Summary Statistics for Key CBX Variables.....	32
Trip Purpose	32
Expenditure per Trip	32
Crossing Behavior Before CBX.....	33
Summary Statistics for Other Relevant Variables	35
Origin-Destination of Crossborder Trips	35
Productivity Loss.....	36
Summary of Total Border Crossing Time, Baseline Crossing Time and Delays at Crossing ..	38
Summary Statistics for Willingness to Pay Questions from Previous Surveys.....	42
Appendix 1: Weighting Methodology	46
Appendix 2: Median Statistics for Key Variables.....	49
Median Border-Crossing Trip Spending	49
Median Expenditures of Border-Crossing Travelers by Expenditure Category	49
Alternate Median Spending in Home Country	51



Median Expenditures by Expenditure Category If Trip is Not Taken.....	52
Median Wages.....	54
Appendix 3: Origins and Destinations of Crossborder Trips.....	55
Crossborder Trip Origins.....	55
Crossborder Trip Destinations.....	57
Appendix 4: Graphs of Total Border Crossing Times Collected in the Field.....	59
Passenger Vehicles.....	59
Commercial Vehicles.....	68

Introduction

The California – Baja California border region is one of the most important and dynamic economic zones in North America. However, demand is poised to outstrip supply at the region's border crossings. While the crossings have become a critical element of the bi-national region's economic integration and competitiveness, growing demand has led to increased congestion at border crossings and generated delay and unreliable crossing times for cars, trucks and pedestrians. These delays and travel time unreliability at the border have the potential to reduce the region's economic competitiveness and attractiveness to businesses, resulting in lower levels of economic activity and growth.

In 2006, SANDAG and Caltrans completed a study that showed how border delays cause significant reductions in economic output and employment. The study highlighted the need for improving border crossings and helped make the case for developing a third crossing between San Diego and Tijuana (the planned Otay Mesa East-Mesa de Otay II border crossing). Similarly, in 2007, the former Imperial Valley Association of Governments (IVAG) and Caltrans conducted an economic delay study for Imperial County border crossings. Much has changed since these earlier studies – the regional economy has rebounded from the Great Recession and there are new emerging industry clusters that depend on cross-border trade.

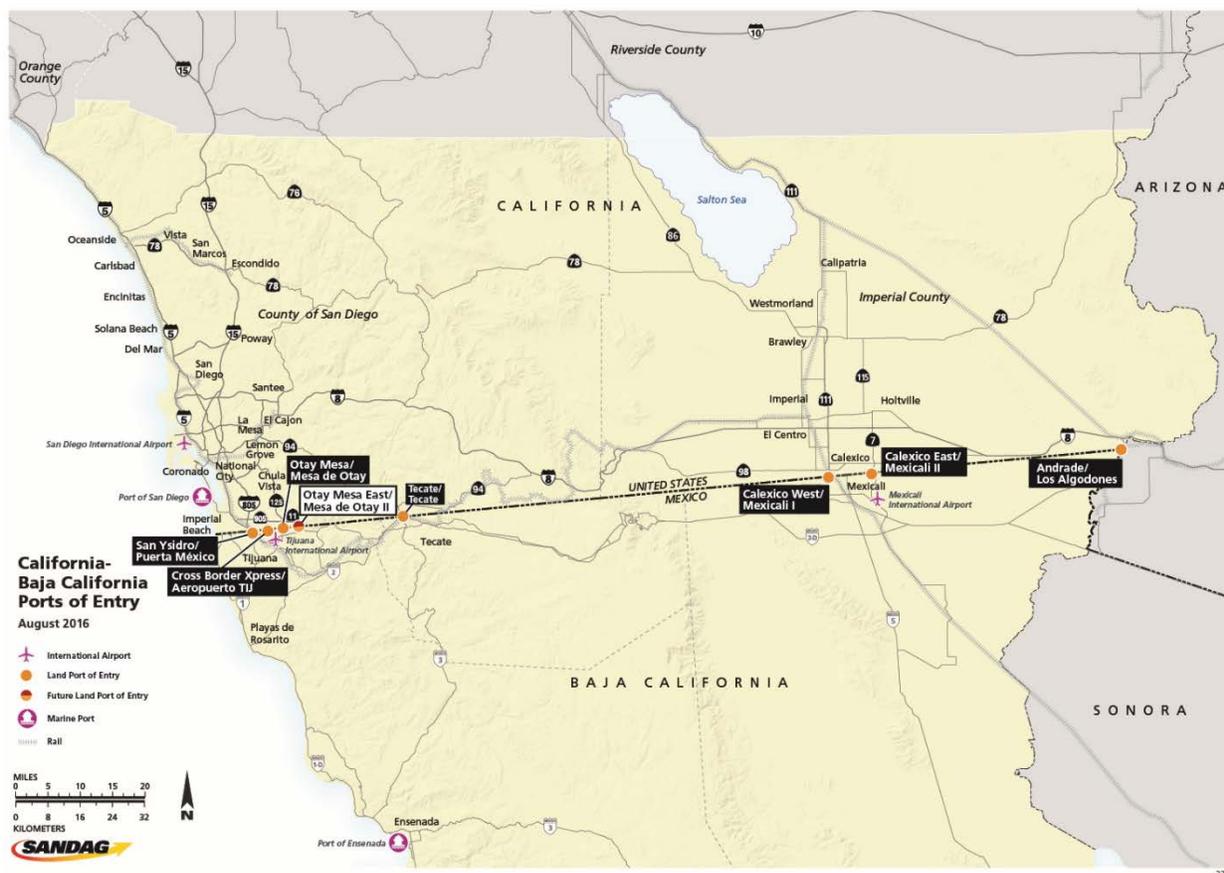
As a result, and coupled with the need to identify cross border wait time impacts on the region's air quality, SANDAG has commissioned the HDR team (led by HDR Inc., and supported by T. Kear Transportation Planning and Management, Inc., Crossborder Group and Sutra Research) to conduct the study on Economic and Air Quality/Climate Impacts of Delays at the Border.

The current report was developed by HDR to report the results of the field data collection efforts. In particular, this document summarizes five kinds of data collected in the field related to this study: 1) data collected through at-border surveys at the six main POEs that will be used as inputs into the economic analysis; 2) data collected through at-border surveys at the six main POEs that will be used as inputs into the air quality analysis; 3) data collected on-site for users of the CBX facility; 4) data on total border crossing times collected through at-border observations at the six main POEs that will be used as inputs into both the economic and air quality analyses; 5) data from an earlier (and separate) study collected through at-border surveys at the Calexico West POEs related to the willingness to pay for a faster border crossing lane at that site. The data summarized includes surveys of pedestrians, individuals crossing in private vehicles, individuals crossing in commercial vehicles as well as border crossing time data.

Overview of the Study Area

Figure 1 below shows a map of the cross-border region, including the ports of entry in the study area and where surveys and data collection were conducted as part of this study.

Figure 1: Map of the Cross-Border Region



Source: SANDAG.

Overview of Data Collection Efforts

AT-BORDER SURVEYS

The HDR team collected more than 10,000 survey responses from border crossers at all six land POEs along the California – Baja California border from August through December of 2016 and at the Cross Border Xpress facility¹ in April 2017. Collectively, these responses are identified as the SANDAG Border Survey. After removing observations for outliers and missing information, the dataset comprises 11,326 observations. Of those, 10,897 observations correspond to the responses collected at the six land POEs in the region, with the remaining 429 corresponding to responses collected at CBX. About two thirds of these were collected from respondents crossing through San Diego County, and the rest were from people crossing through Imperial County. About three quarters of the total dataset captures people crossing from Mexico to the United States, and the remaining observations capture people traveling south from the U.S. to Mexico.

¹ Cross Border Xpress (CBX) is an enclosed pedestrian skywalk bridge used by Tijuana International Airport ticketed passengers who pay a fee.



All participants were surveyed on the Mexican side of the border, so people who lived in Mexico were questioned about their trip on their way to the United States. People who lived in the U.S. were surveyed on their return trip home, with the questions concerning the trip they had already taken to Mexico. Note that in the survey responses, we assume that country of residence indicates the direction of crossing, so respondents stating they live in Mexico are considered taking a northbound trip, and vice versa for southbound trips from the United States.

The surveys conducted at the six land POEs (excluding CBX) had two components: an economic component and an emissions component. The economic component was geared primarily to understand the expenditure behavior of border crossers that cross either by foot or on privately-owned vehicles (POVs) while the emissions component was geared to collect characteristics of the privately owned and commercial vehicle fleets that impact the amount of air pollution generated in the region from border crossing activities. Normally each participant was asked to provide answers for only one component (the specific component being asked was predetermined for specific days and times of data collection), but surveyors in the field had the discretion to ask POV users for both components if the queue length conditions allowed it. As a result, some participants responded to both components of the survey.

The number of economic component survey responses broken down by country of residence (as reported by the respondents) as well as by the county used to cross the border is provided in Table 1.

Table 1. Number of Economic Surveys Collected, by Country Where Respondent Lives and County of Border-Crossing

Sample size by Self-Reported Country Where Respondent Lives	Imperial County POEs	San Diego County POEs
Mexico	2,361	5,062
United States and Other	925	1,388
Total	3,286	6,450

The sample size can also be broken down by the number of surveys collected across counties and travel modes. Table 2 below presents that information.

Table 2. Number of Economic Surveys Collected, by Travel Mode and County of Border-Crossing

Sample size by Travel Mode	Imperial County POEs	San Diego County POEs
Pedestrians	1,056	1,764
Privately-owned vehicles	2,230	4,686
Total	3,286	6,450



The SANDAG Border Survey also collected 4,026 emission component responses from privately-owned and commercial vehicles.² The breakdown by vehicle type as well as by the county used to cross the border is provided in the following table.

Table 3. Number of Emissions Surveys Collected, by Vehicle Type and County of Border-Crossing

Sample Size by Vehicle Type recorded	Imperial County POEs	San Diego County POEs
Commercial Vehicles	319	843
Passenger Vehicles	1,070	1,794
Total	1,389	2,637

The numbers shown in Table 2 and Table 3 are not additive, since a significant number of participants who drove POVs answered both components of the survey. Additionally, for people crossing in a POV, one person per car was interviewed for the survey, and we assume that their answer was applicable to all the persons in the car.

In the case of the CBX surveys, they focused primarily on collecting variables such as trip purpose, expenditure during the trip and behavior related to air transportation before the existence of CBX. The number of responses broken down by country of residence (as reported by the respondents) is provided in Table 4.

Table 4. Number of Surveys Collected at CBX, by Country Where Respondent Lives

Sample size by Self-Reported Country Where Respondent Lives	Number of Responses	% of Total
Mexico	186	43%
United States	243	57%
Totals	429	100%

EXPANDING THE AT-BORDER SURVEY SAMPLE

To appropriately represent the economic behavior of the underlying border crossing populations in each county, the sample of economic component responses collected through the SANDAG Border Survey was expanded using factors calculated from annual border crossing traffic volumes reported by the Bureau of Transportation Statistics (BTS).³ These expansion factors allow the sample collected in the field to be statistically comparable to the underlying population

² Besides the data collected as part of the SANDAG Border Survey, the study will use information from comparable, recently-collected GHG/air emission surveys from 2014 at the San Ysidro and Calexico West POEs for POVs (over 2,100 surveys total; almost 1,100 at San Ysidro and more than 1,000 at Calexico West), and at the Calexico East POE for trucks (over 200 surveys total). The characteristics of this additional survey data are described in the “Assessment of Existing Data Gaps” memo of this study.

³ The number of economic component observations collected through the survey at the POE and lane-type level was scaled-up using the appropriate factors to represent the numbers in the true population. The true population numbers are presented in Appendix 1 by travel mode (i.e., pedestrians or passenger vehicles).

of border crossers by adjusting for the differences in volumes across lane types and ports of entry in each county.⁴ The results obtained using this scaling process are identified as “weighted statistics” of the corresponding variable. For survey questions that only applied to a certain subset of the respondents (like people crossing for work purposes), the expansion process used was slightly different: we applied proportions estimated from the survey to data reported by BTS to obtain the corresponding expanded samples that were then used in the estimation of weighted statistics.⁵ All the summary statistics in this report correspond to weighted statistics, unless explicitly stated otherwise.

OVERVIEW OF BORDER CROSSING TIME MEASUREMENTS

The HDR team recorded data on the total border-crossing time for both passenger vehicles and commercial vehicles at all six POEs in the study area. For passenger vehicles, measurements were conducted at all POEs during the following days: July 1, 4 and 5 and October 16 and 17, 2016, or five days at each POE in total. For commercial vehicles, the measurements were conducted also during five days at each POE on the following days: October 12, 13 and 14 (Tecate POE), October 19, 20 and 21, 2016 (Calexico East POE) and February 10, 13 and 14, 2017 (Otay Mesa POE), March 1-2, 2017 (Calexico East and Tecate POEs), March 8-9, 2017 (Otay Mesa POE).

⁴ See Appendix 1 for a description of how the expansion factors were used to generate the weighted indicators presented in this document.

⁵ This is due to the fact that the true underlying population from which the sample was taken is unknown.

Summary Statistics for Key Economic Survey Variables

There are a handful of variables considered as key inputs into the Economic Impact model that is being developed as part of the Economic and Air Quality/Climate Impacts of Delays at the Border study. In general, these key variables are related to trip purpose, measures of expenditure per border-crossing trip and type of goods/services bought during that trip, and an indicator of the attitude of crossers with respect to higher wait times at the border, and were collected through the SANDAG Border Survey.

The (weighted) summary statistics for the key variables identified in this study are presented in this section. In particular, the summary statistics for the following variables are reported in this document:^{6,7}

- Primary and Secondary Trip Purpose
- Average Border-Crossing Trip Spending
- Average Border-Crossing Trip Spending by Category
- Alternate Average Spending in Home Country
- Alternate Average Spending in Home Country by Category
- Average Wage
- Elasticity of Travel Demand with respect to Border Delay

Since the SANDAG Border Survey was applied to different “modes” of transportation used to cross the border (i.e., passenger vehicles and pedestrians), the summary statistics for each variable in this section are presented separately for POVs and pedestrians.

Trip Purpose

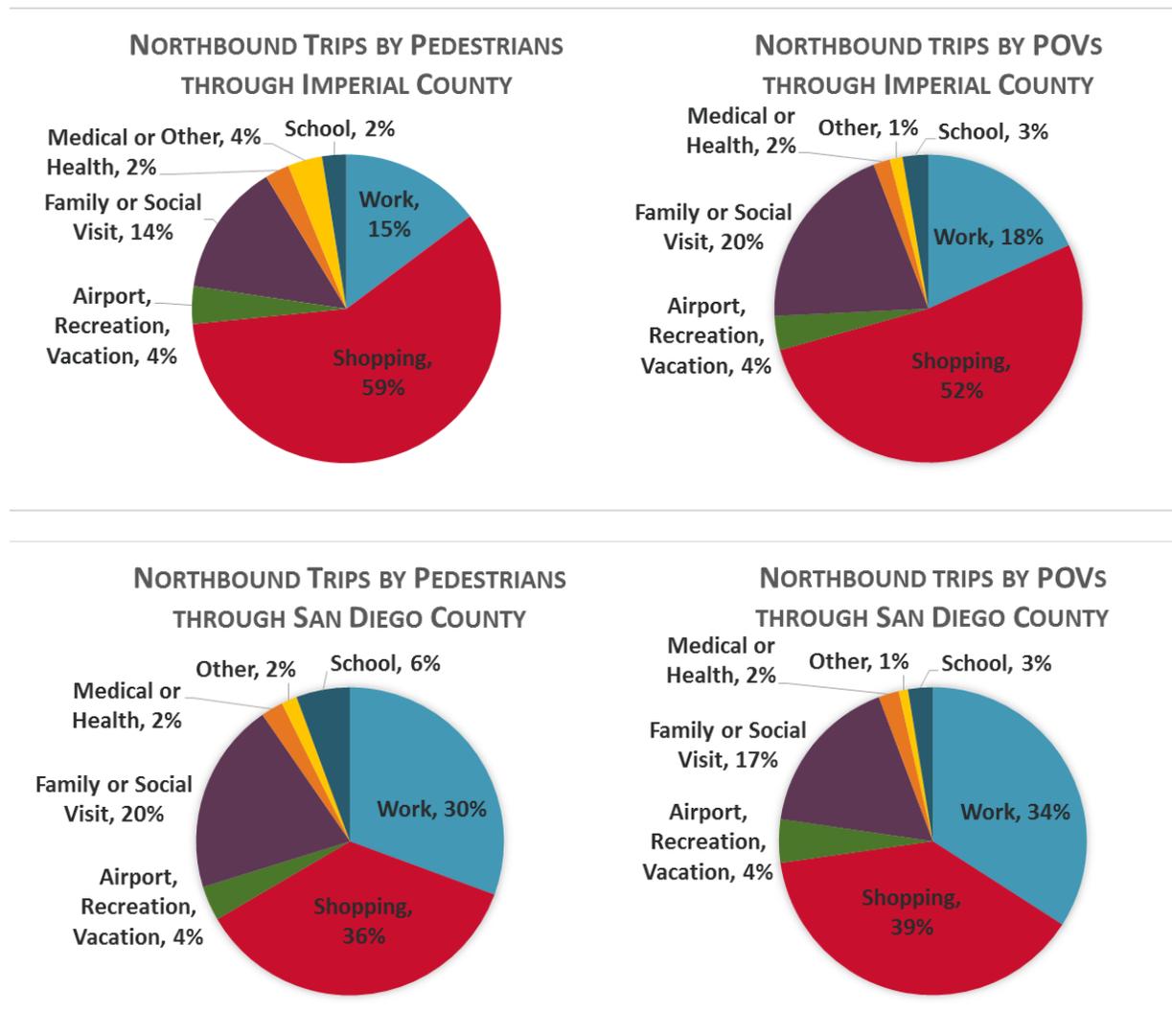
The survey respondents were asked about the primary and secondary purposes for their crossborder trip and we received answers from all respondents.

Primary trip purpose varies depending on country of residence, travel mode, and to a lesser degree, the county used to cross. A majority of northbound trips are taken for work, shopping, or social and family visiting purposes; together these make up 75 to 90 percent of all primary trip purposes listed across POE counties and travel modes (see Figure 2). About one third of pedestrians and one third of POVs crossing north into San Diego County are crossing for work. For Imperial County, the survey shows that 15 to 18 percent of northbound trips are work-related for both POVs and pedestrians, whereas the shopping portion is more than half. Family and social visits are the next most frequently listed primary reason for crossing northbound, comprising 14 to 20 percent of trip purposes across pedestrians, POVs, both in San Diego County and Imperial County.

⁶ The variables listed correspond to those variables for which the SANDAG Border Survey was the source of the statistics. These variables were discussed during the Risk Analysis Session of the Economic Peer-Review.

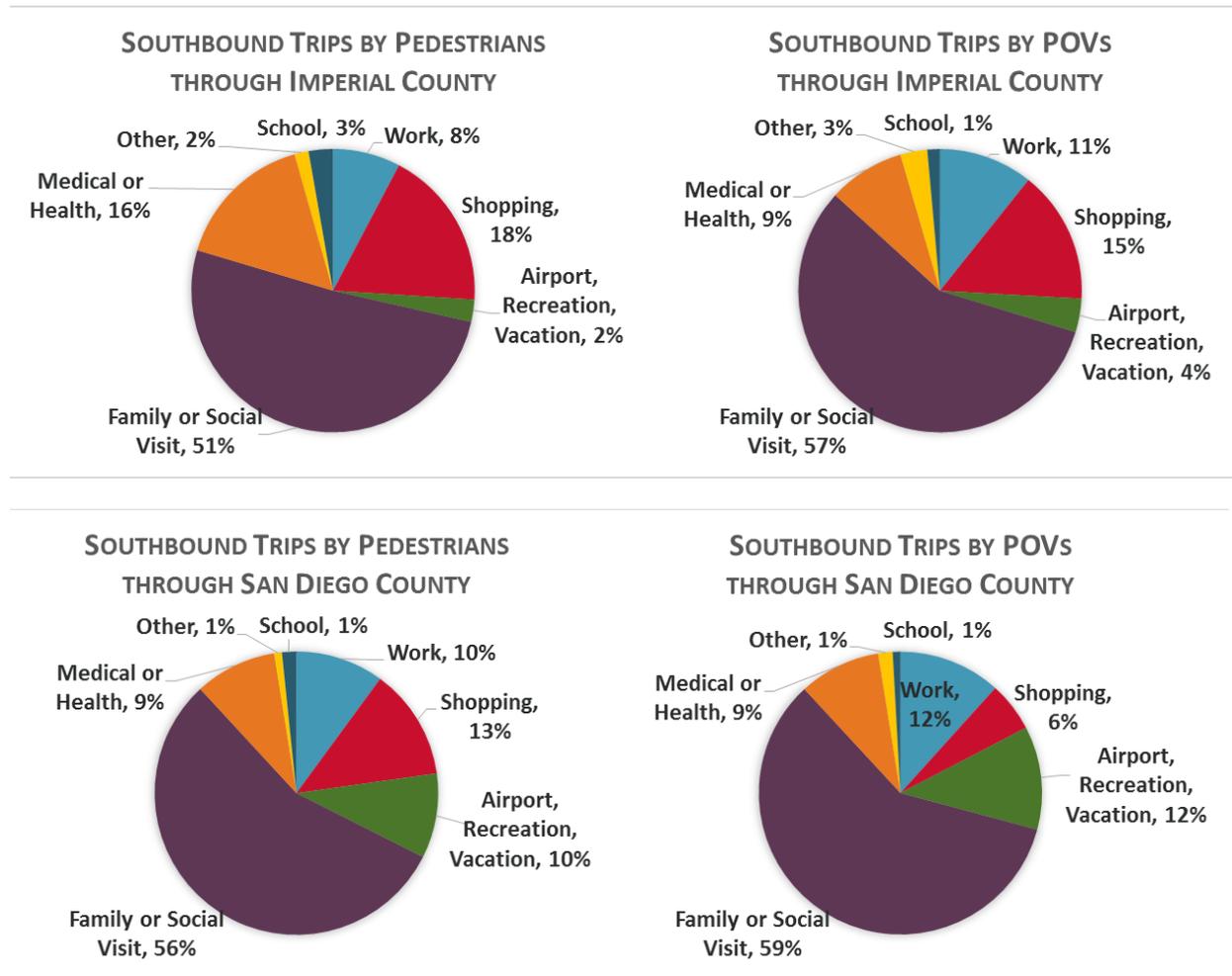
⁷ The median results for border-crossing trip expenditure, border-crossing trip expenditure by category, alternate spending in home country, alternate spending in home country by category and wage were also calculated and are presented in the Appendix of this document.

Figure 2. Primary Trip Purposes for Northbound Trips by Mode and County of Crossing



For people crossing into Mexico southbound, family and/or social visits comprise over half of the primary purposes for trips taken for both counties and travel modes, and work or business trips comprise closer to 10 percent of southbound trips. Additionally, for trips in vehicles through Imperial and San Diego County, 10 percent of trips are taken for medical or health reasons. For pedestrians the proportion is similar, but relatively more trips through Imperial County are taken for medical reasons (16 percent), as can be seen in Figure 3.

Figure 3. Primary Trip Purposes for Southbound Trips by Mode and County of Crossing

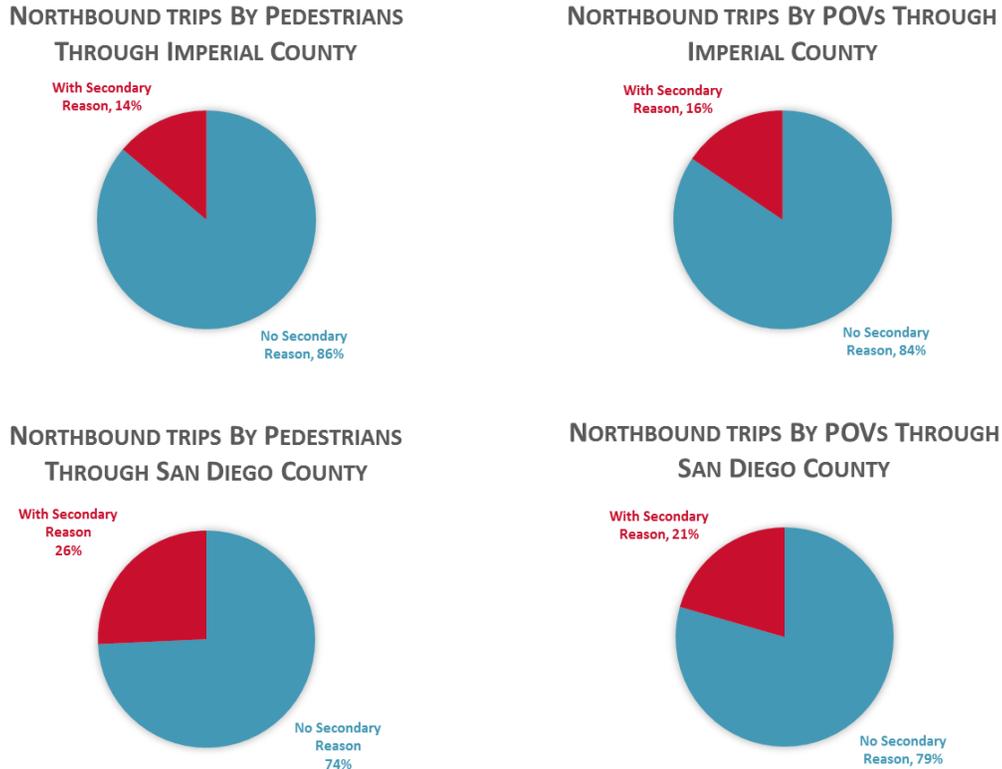


Overall, the survey indicates that relatively more cross-border trips for shopping as a primary purpose are taken through Imperial County than San Diego County, and conversely more work-related cross-border trips are taken through San Diego County than Imperial County.⁸

A majority of respondents (about 80 percent overall) listed that they had no secondary purpose for taking their trip. For northbound trips, this proportion is slightly higher for both pedestrians and POVs at the POEs in Imperial County compared to the POEs in San Diego County.

⁸ This is in relative terms because in absolute terms cross-border traffic is much higher through POEs in San Diego County compared to POEs in Imperial County.

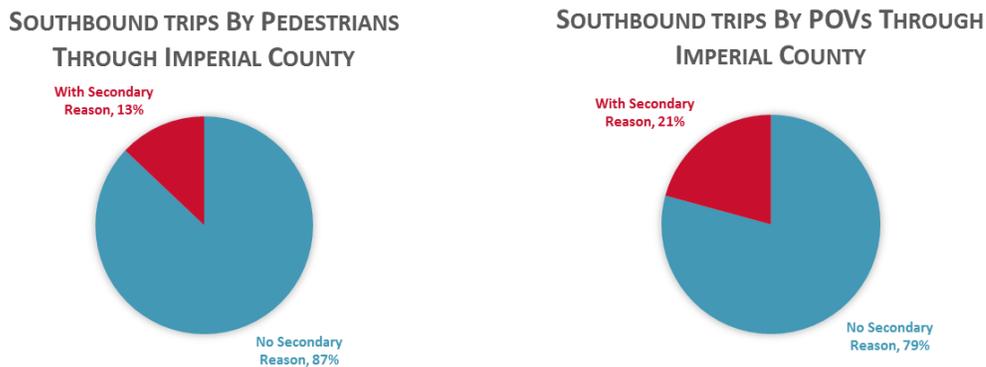
Figure 4. Secondary Trip Purposes for Northbound Trips by Mode and County of Crossing



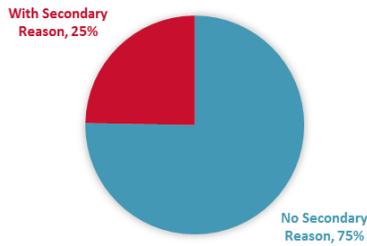
For those northbound crossers that reported having a secondary purpose, family or social visit and shopping were important across the county of crossing and the crossing mode. Table 5 presents the complete breakdown of the answers to the secondary purpose for northbound trips.

For southbound crossings, the highest percentage of trips without a secondary purpose corresponded to those of pedestrians crossing through Imperial County (87 percent), while the lowest percent corresponded to pedestrians crossing through San Diego County (75 percent).

Figure 5. Secondary Trip Purposes for Southbound Trips by Mode and County of Crossing



SOUTHBOUND TRIPS BY PEDESTRIANS THROUGH SAN DIEGO COUNTY



SOUTHBOUND TRIPS BY POVs THROUGH SAN DIEGO COUNTY

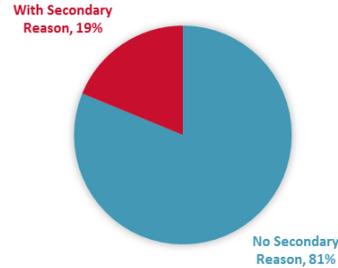


Table 5. Secondary Trip Purposes for Northbound Trips, by Crossing Mode and County

Secondary Trip Purpose, Northbound Trips	Imperial County POEs	San Diego County POEs
Pedestrians		
No Secondary Reason	86%	74%
Airport	0%	0%
Family or Social Visit	5%	8%
Medical or Health	1%	1%
Other	0%	0%
Recreation/Vacation	2%	3%
School	0%	1%
Shopping	4%	11%
Work or business	1%	3%
Private Vehicle Crossers		
No Secondary Reason	84%	79%
Airport	0%	0%
Family or Social Visit	5%	6%
Medical or Health	1%	1%
Other	0%	0%
Recreation/Vacation	2%	2%
School	0%	1%
Shopping	7%	9%
Work or business	1%	1%

Those southbound crossers that reported a secondary trip purpose mentioned family or social visit, shopping, medical or health and recreation / vacation were important across the county and crossing modes. Table 6 presents the complete breakdown of the answers to the secondary purpose for southbound trips.



Table 6. Secondary Trip Purposes for Southbound Trips, by Crossing Mode and County

Secondary Trip Purpose, Southbound Trips	Imperial County POEs	San Diego County POEs
Pedestrians		
No Secondary Reason	87%	75%
Airport	0%	0%
Family or Social Visit	4%	9%
Medical or Health	1%	5%
Other	1%	0%
Recreation/Vacation	1%	5%
School	0%	0%
Shopping	6%	6%
Work or business	1%	1%
Private Vehicle Crossers		
No Secondary Reason	79%	81%
Airport	0%	0%
Family or Social Visit	8%	6%
Medical or Health	2%	2%
Other	0%	0%
Recreation/Vacation	3%	5%
School	0%	0%
Shopping	6%	4%
Work or business	2%	1%

Average Border-Crossing Trip Spending

The SANDAG Border Survey also collected information on expenditure patterns by border crossers. In particular, it elicited information on the amount of expenditure during border crossing trips and the categories of expenditure. Furthermore, it also asked interviewees about their expenditure behavior in case a border crossing trip had to be cancelled (i.e., the degree by which the expenditure would be deferred or substituted in the home country) in order to better understand the impact of foregone trips to the economy on either side of the border.

All respondents were asked how much they spent or will spend on their border-crossing trip to Mexico or the United States. They were also asked to describe how they would spend the money, by listing amounts of expense in several spending categories, such as shopping, gas, groceries, and entertainment. The data was validated by reconciling responses in the overall expenditure question with responses in the expenditure breakdown, disregarding outliers with expenditures of over \$10,000.⁹ The expenditure data are particularly skewed right (i.e., not

⁹ We also excluded observations with corresponding wage/salary responses above \$40,000 per month.

normally distributed), meaning that though many respondents listed expenses from \$0 to \$100, a significant number of respondents also listed more than \$500 in expenses, some listing up to thousands of dollars in expenditure. About 80% of the data is contained within the range of \$7 to \$350. Some but not all of the large expenses may be explained by vacations on either side of the border.

Figure 6 shows the skewedness of the expenditure of southbound trips crossing in a vehicle through Imperial County POEs. This category of crossers features almost 70 percent of their reported border crossing expenditures between \$0 and \$100 but also shows that approximately 10 percent of their expenditures were reported to be above \$500.¹⁰

Figure 6. Distribution of Expenditures from Imperial County Southbound Vehicles Subsample

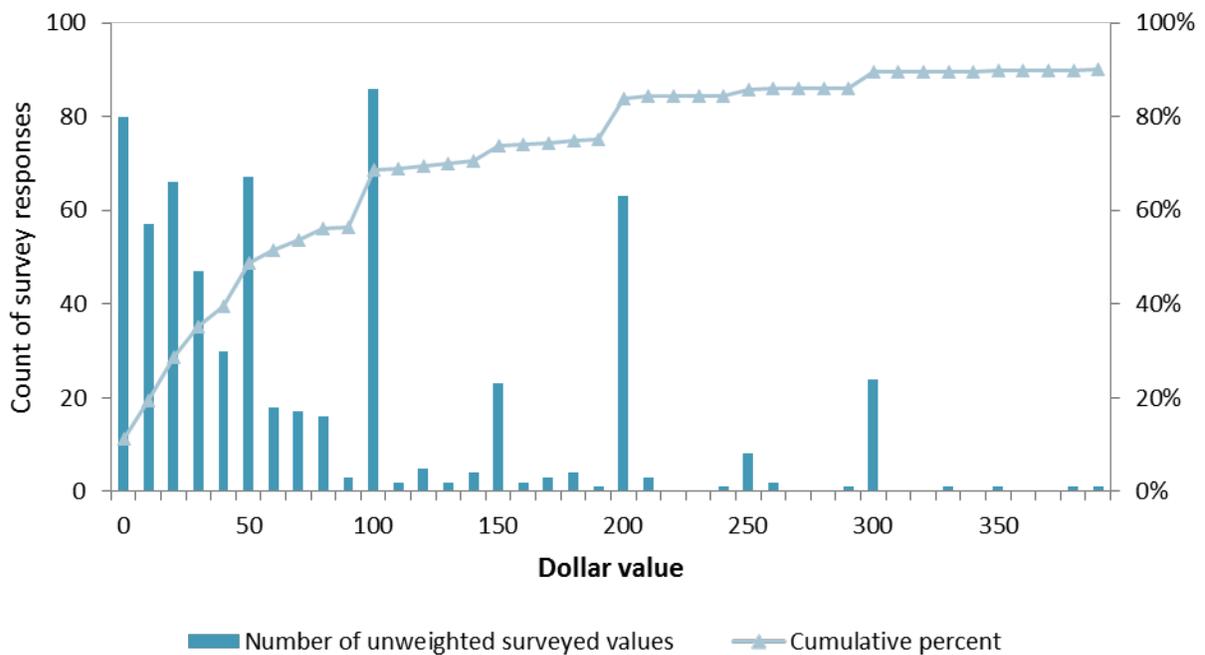


Chart displays only 90 percent of the survey results; the remaining values range from \$400 to \$10,000.

In general, the survey data indicates that average spending per trip ranges from \$112 to \$220, across travel modes, border counties, and north and southbound trips. On average, crossers living in Mexico spend less per trip than people living in the U.S., except for vehicle drivers who cross through San Diego County, where spending appears similar for north and southbound trips. People crossing in Imperial County spend less per trip than people crossing in San Diego County, except for people who live in the United States and cross in a vehicle. For border crossers through Imperial County, the average pedestrian spends less than the average person driving across the border, whereas spending patterns across travel mode for crossers in San Diego County display the opposite relationship. Weighted average expenditure per trip is displayed in Table 7.

¹⁰ The median will be used to introduce risk analysis to this variable, since it represents the behavior of the individual at the center of the distribution of possible expenditure levels.



Table 7. Average Spending per Border Crossing Trip

Average Spending per Border Crossing Trip, Dollars	Imperial County	San Diego County
Pedestrians		
Crossers Living in Mexico	\$112	\$182
Crossers Living in the U.S.	\$142	\$220
Vehicles		
Crossers Living in Mexico	\$147	\$166
Crossers Living in the U.S.	\$165	\$165

Average Expenditures of Border-Crossing Travelers by Expenditure Category

The SANDAG Border Survey asked border-crossing travelers to break down their trip-related expenditures by broad expenditure categories. The categories considered included entertainment, gas, groceries, hotel, public transportation, restaurants, shopping and a category called “other” to capture expenditures not listed in the survey.

The data collected was analyzed using the place where the respondent reported to live, the county where the POE used to cross is located and the type of crossing (i.e., pedestrians and vehicles). An analysis of the survey data shows that the average crosser living in Mexico has different expenditure habits compared to the average crosser living in the U.S. regardless of the mode and the POE used to cross. Crossers living in Mexico have a high concentration of expenditures on shopping, while crossers living in the U.S. diversify their expenditures more across categories such as groceries, restaurants and shopping.

The average pedestrian living in Mexico has similar expenditure patterns regardless of the location of the POE used to cross. The average (weighted) expenditures and the percentage share of each category of expenditure by pedestrians during a single border-crossing trip is presented in Table 8.¹¹

¹¹ Notice that the sum of expenditures across all categories is equal to the average expenditure



Table 8. Average Spending by Pedestrians per Border Crossing Trip by Category

	Imperial		San Diego	
Crossers living in Mexico	% share	\$	% share	\$
Entertainment	5.5%	\$6	4.0%	\$7
Gas	2.7%	\$3	2.3%	\$4
Groceries	17.1%	\$19	14.6%	\$27
Hotel	0.0%	\$0	3.8%	\$7
Other ¹²	1.0%	\$1	2.7%	\$5
Public Transportation	0.3%	\$0	4.3%	\$8
Restaurants	8.7%	\$10	10.7%	\$19
Shopping	64.8%	\$73	57.6%	\$105
Total, all categories	100.0%	\$112	100.0%	\$182
Crossers living in the U.S.				
Entertainment	2.2%	\$3	12.5%	\$27
Gas	2.9%	\$4	4.0%	\$9
Groceries	31.3%	\$44	18.9%	\$42
Hotel	0.0%	\$0	8.9%	\$19
Other	7.1%	\$10	8.9%	\$20
Public Transportation	0.2%	\$0	7.2%	\$16
Restaurants	25.4%	\$36	18.9%	\$42
Shopping	31.0%	\$44	20.7%	\$46
Total, all categories	100.0%	\$142	100.0%	\$220

The average (weighted) expenditures and the percentage share of each category of expenditure by vehicle users during a single border-crossing trip is presented in Table 9.

¹² Some of the POV and pedestrian respondents provided an explanation for the “Other” category. Common answers included: gym, church, paperwork, betting, postal services, and parking.

Table 9. Average Spending by Vehicle Users per Border Crossing Trip by Category

	Imperial		San Diego	
	% share	\$	% share	\$
Crossers living in Mexico				
Entertainment	6.4%	\$9	3.9%	\$7
Gas	9.7%	\$14	10.3%	\$17
Groceries	19.2%	\$28	13.4%	\$22
Hotel	0.6%	\$1	2.1%	\$3
Other	3.2%	\$5	2.1%	\$3
Public Transportation	0.0%	\$0	0.0%	\$0
Restaurants	10.1%	\$15	7.3%	\$12
Shopping	50.9%	\$75	60.9%	\$101
Total, all categories	100.0%	\$147	100.0%	\$166
Crossers living in the U.S.				
Entertainment	12.7%	\$21	6.0%	\$10
Gas	9.3%	\$15	9.0%	\$15
Groceries	16.3%	\$27	17.2%	\$28
Hotel	2.9%	\$5	5.8%	\$10
Other	15.2%	\$25	13.0%	\$22
Public Transportation	0.0%	\$0	0.2%	\$0
Restaurants	14.1%	\$23	21.6%	\$36
Shopping	29.4%	\$49	27.3%	\$45
Total, all categories	100.0%	\$165	100.0%	\$165

Alternate Average Spending in Home Country

The SANDAG Border Survey asks questions concerning the respondents’ spending patterns in case they were to cancel their current trip (in other words, if they decided not to take the trip due to, for example, border wait times being too long). In particular, interviewees were asked to consider a situation in which their current border-crossing trip would not take place and were asked to choose between spending the amount they were anticipating spending on the trip either at their home country or to defer the expenditure until they performed a future border-crossing trip.

Based on the survey responses, people are generally more likely to defer their spending rather than spend it at their home county, but this varies. Crossers who live in the U.S. are more likely to spend in their home country when a border-crossing trip is not taken. The exception to this are pedestrians in Imperial County, for which crossers living in Mexico are slightly more prone than crossers living in the U.S. to spend in their home country if the trip is not taken.

About half of pedestrians through Imperial County and one third of pedestrians through San Diego stated that they would spend their money at their home country versus deferring their spending for another trip. About one third of vehicle crossers through both counties stated they



would spend at their home country instead, except for the one half of vehicle crossers living in the U.S. crossing through San Diego that stated they would defer spending instead. The percent of respondents that would spend at their home country if the border crossing trip was not taken is presented in Table 10.

Table 10. Respondents that Would Spend at Home Country if Border Crossing Trip was Not Taken

Respondents that would spend at home country if border trip is not taken, percent	Imperial County	San Diego County
Pedestrians		
Crossers Living in Mexico	51.4%	27.7%
Crossers Living in the U.S.	50.6%	38.5%
Vehicles		
Crossers Living in Mexico	31.4%	36.1%
Crossers Living in the U.S.	38.3%	50.4%

The survey also asked those individuals that would not defer their expenditure due to a border crossing trip not taken to report the amount of money they would spend at their home country.¹³

The average expenditure ranges from \$79 for pedestrians living in the U.S. and crossing through San Diego County POEs to \$167 for vehicle occupants living in Mexico and crossing through POEs in Imperial County.¹⁴ In general, crossers living in Mexico have higher average expenditures in their home country than crossers living in the U.S. across modes when a border crossing trip is not taken. The exception are pedestrian crossers using Imperial County POEs, since crossers living in the U.S. average \$111 dollars of home country expenditure when a border trip is not taken compared to \$99 for crossers living in Mexico. A possible explanation for this is that the expenditure categories include groceries, shopping and restaurants, which are more expensive in the U.S.

The average spending at home if a border trip is not taken is reported in Table 11.

¹³ As in the case of the border-crossing trip expenditures variable, the statistic that will be used to introduce risk analysis to this variable is the median, since expenditure values when a trip is not taken tend to be skewed (in a statistical sense) and the median captures the behavior of the individual at the center of the distribution of possible expenditure levels.

¹⁴ It is worth noting that the behavior of home-country expenditure differs by mode and POE location of the forgone crossing. The percentage of respondents that reported that they would spend at their home country in case a border trip is not taken (by travel mode) is presented in the Appendix for each specific expenditure category.



Table 11. Average Spending at Home if a Border Trip is Not Taken

Average Spending at Home if Border Trip is not taken, per Trip, Dollars	Imperial County	San Diego County
Pedestrians		
Crossers Living in Mexico	\$99	\$128
Crossers Living in the U.S.	\$111	\$79
Vehicles		
Crossers Living in Mexico	\$167	\$130
Crossers Living in the U.S.	\$102	\$95

Notice that in the majority of the cases the average expenditure at home if a border trip is not taken is smaller than the average spending for border crossing trips made. The exception is vehicle crossers that live in Mexico and cross through Imperial County POEs, whose at-home average spending if a trip is not taken is higher than their average spending while on a cross-border trip. There could be several explanations to this result, including price differences between goods and services that belong to expenditures categories that are less likely to be deferred by this group of border-crossers when a border trip is not taken.

Average Expenditures by Expenditure Category If Trip is Not Taken

As in the case of expenditure for border-crossing trips made, the survey collected information on expenditures at home by category in case a trip was not taken. The same categories of expenditure as those described for border-crossing trips are used for this question. As in the case of a trip taken, the data collected was analyzed using the place where the respondent reported to live, the county where the POE used to cross is located and the mode for crossing (i.e., pedestrian or vehicles).

An analysis of the survey data shows that, in general, the average pedestrian crosser that decides not to take a border-crossing trip has a tendency to spend at home primarily on groceries and shopping, regardless of where the crosser lives or the county of crossing. For crossers living in the U.S. and crossing through San Diego County, a category of home expenditure that is also significant is restaurants. The average (weighted) expenditures and the percentage share of each category of expenditure at home by pedestrians in case a border-crossing trip is not taken are presented in Table 12.



Table 12. Average Spending at Home by Pedestrians, by Category if a Border Trip is Not Taken

	Imperial		San Diego	
Crossers living in Mexico				
Entertainment	3.9%	\$4	1.6%	\$2
Gas	4.7%	\$5	1.6%	\$2
Groceries	15.0%	\$15	26.3%	\$34
Hotel	0.0%	\$0	6.9%	\$9
Other	3.1%	\$3	13.0%	\$17
Public Transportation	0.0%	\$0	10.3%	\$13
Restaurants	5.2%	\$5	9.8%	\$13
Shopping	68.0%	\$68	30.5%	\$39
Total, all categories	100.0%	\$99	100.0%	\$128
Crossers living in the U.S.				
Entertainment	0.3%	\$0	10.9%	\$9
Gas	0.1%	\$0	5.0%	\$4
Groceries	35.6%	\$40	29.6%	\$23
Hotel	0.0%	\$0	0.0%	\$0
Other	7.8%	\$9	0.0%	\$0
Public Transportation	0.0%	\$0	2.2%	\$2
Restaurants	7.4%	\$8	35.1%	\$28
Shopping	48.9%	\$54	17.2%	\$14
Total, all categories	100.0%	\$111	100.0%	\$79

As in the case of the average pedestrian, the average vehicle crosser that decides not to take a border-crossing trip has a tendency to spend at home primarily on groceries and shopping, regardless of where the crosser lives or the county of crossing. However, other categories that also represent significant home expenditure regardless of where the crosser lives or the POE used are gas and restaurants. The average (weighted) expenditures and the percentage share of each category of expenditure at home by vehicle crossers in case a border-crossing trip is not taken are presented in Table 13.¹⁵

¹⁵ It is worth noting that the shares of expenditures in the categories of “Entertainment” for crossers living in Mexico and “Other” for crossers living in the U.S. show a significant difference between the San Diego and Imperial County border regions.



Table 13. Average Spending at Home by Vehicle Users, by Category if a Border Trip is Not Taken

	Imperial		San Diego	
Crossers living in Mexico				
Entertainment	13.8%	\$23	4.7%	\$6
Gas	11.2%	\$19	11.9%	\$15
Groceries	21.9%	\$37	15.9%	\$21
Hotel	0.7%	\$1	1.2%	\$2
Other	4.0%	\$7	0.5%	\$1
Public Transportation	0.0%	\$0	0.0%	\$0
Restaurants	12.1%	\$20	12.0%	\$16
Shopping	36.3%	\$61	53.8%	\$70
Total, all categories	100.0%	\$167	100.0%	\$130
Crossers living in the U.S.				
Entertainment	4.4%	\$4	5.5%	\$5
Gas	8.3%	\$8	14.1%	\$13
Groceries	17.4%	\$18	25.4%	\$24
Hotel	0.5%	\$1	1.7%	\$2
Other	18.1%	\$19	2.5%	\$2
Public Transportation	0.0%	\$0	0.0%	\$0
Restaurants	17.2%	\$18	22.8%	\$22
Shopping	34.0%	\$35	28.0%	\$27
Total, all categories	100.0%	\$102	100.0%	\$95

Average Wages

Respondents who indicated their trip was work related were also asked for their monthly wage. Across all travel modes, counties, and trip directions, we received 677 useful wage responses, 177 from crossers at Imperial County POEs, and the rest from San Diego POEs. This data was validated by transforming numeric responses given for a different time period (i.e., daily wage or yearly salary) to monthly wages and identified two outliers that were greater than \$40,000 a month.¹⁶

The average monthly wage for a pedestrian crossing the border for work is \$1,114 in San Diego County and \$872 in Imperial County. For people driving across the border, the weighted averages for both counties are around \$1,700.

¹⁶ For the purposes of risk analysis, we will be using the median for this variable, since wages tend to have non-symmetric distributions and therefore the median captures the wage of the individual at the center of the distribution of possible salary levels.

Table 14. Average Monthly Wages

Weighted Average Monthly Wage/Salary, Dollars	Imperial County POEs	San Diego County POEs
Pedestrians crossing for work	\$872	\$1,114
People crossing in vehicles for work	\$1,705	\$1,685

Elasticities of Travel Demand with respect to Border Delay

A key question of the survey asked respondents to report how much longer (compared to their perception of currently-anticipated wait time) they would be willing to wait before deciding to cancel a cross border trip they had already planned. Respondents were given a series of time intervals representing additional wait times (ranging from 5 minutes to more than 4 hours) that they could choose from. Using this information, an estimate of the elasticity of travel demand with respect to border delays was derived using a standard formula for the estimation of elasticities. In particular, for every time interval included in the survey, the percentage change in the number of respondents that reported would cancel the trip was estimated and compared to the percentage change that the additional wait time represents over the current wait time.

The estimated elasticities show that pedestrians are less sensitive to additional wait times than occupants of vehicles and that crossers motivated by work purposes are less sensitive to additional wait times (i.e., they have higher tolerance to border crossing wait times than those crossing for non-working purposes). Similarly, the estimates show that vehicle crossers in San Diego County are less sensitive to additional border crossing wait times than crossers in Imperial County but the opposite is true for pedestrian crossers (i.e., pedestrian crossers are less sensitive to wait times in Imperial County).¹⁷

Since this variable represents the percentage change in border crossings associated with a one percent increase in wait time at the border, an elasticity of -0.03 (reported for pedestrians crossing for work or business purposes in Imperial County) means that a 1 percent increase in current wait times at the pedestrian crossings in Imperial would represent a reduction of 0.03 percent in the number of pedestrian crossings through these POEs for this type of crossing purpose.

The estimates of the elasticities derived from the SANDAG Border Survey are presented in Table 15 for different types of crossers, trip purposes and counties where the crossings occur.¹⁸ These elasticities will be combined in the economic model with the average delays estimated in this study (see section Summary of Total Border Crossing Time, Baseline Crossing Time and Delays at Crossing in this document) and the future delays calculated through the Binational Travel Demand Model to assess the impact of delays on future volumes through the POEs.

¹⁷ Since border crossers travel in both directions during any particular border crossing trip, the elasticity is assumed to be equal for crossers living in the U.S. and Mexico.

¹⁸ Since the survey asked about a range of potential additional wait times, several sets of elasticities were estimated based on their answers (one for each potential range). The elasticities listed in the table correspond to the median elasticity, since that represents the most-likely response.



Table 15. Elasticity of Travel Demand With Respect to Border Delays

Elasticity of Travel Demand With Respect to Border Delays	Imperial County	San Diego County
Pedestrians		
Crossing for work or business	-0.03	-0.07
Crossing for a non-work purpose	-0.05	-0.09
Vehicles		
Crossing for work or business	-0.09	-0.08
Crossing for a non-work purpose	-0.12	-0.11

Table 15 shows that the response of border crossers to increased wait times is fairly inelastic across all crossing types and across counties where the POEs are located. For example, a one percent increase in wait times for pedestrians crossing for work or business through Imperial County POEs will translate in a reduction in the number of pedestrians crossing the border through that region of only 0.03 percent. In other words, the increased wait time has a very small impact on the number of border-crossing trips, suggesting that crossers have high tolerance to wait times throughout the area (i.e., the volume of crossings is inelastic with respect to wait times).

Furthermore, when the maximum ranges for this elasticity estimate are analyzed, it shows that the sensitivity of travelers to wait times is slightly higher, but still shows that the responses of travelers at the California-Baja California border are inelastic. The minimum and maximum elasticity estimates are presented in Table 16.

Table 16. Minimum and Maximum Elasticities of Travel Demand With Respect to Border Delays

Elasticity of Travel Demand With Respect to Border Delays	Imperial County		San Diego County	
	MIN	MAX	MIN	MAX
Pedestrians				
Crossing for work or business	-0.02	-0.09	-0.05	-0.15
Crossing for a non-work purpose	-0.03	-0.08	-0.03	-0.08
Vehicles				
Crossing for work or business	-0.05	-0.23	-0.04	-0.11
Crossing for a non-work purpose	-0.08	-0.26	-0.04	-0.15

Summary Statistics for Key Air Quality Variables

There are a few variables considered as key inputs into the Air Quality (Emissions) Impact model that are being developed as part of the study. In general, these key variables are related to the year when the vehicle used to cross the border was manufactured, the condition of the engines for those vehicles as measured by the mileage, the fuel type used by them, the country where fuel is purchased and the adherence to a smog check program. Answers to these questions were collected through the SANDAG Border Survey.

The summary statistics for the key air quality variables identified in this study are presented in this section. In particular, the summary statistics for the following variables are reported in this document:

- Model Year
- Odometer Reading (indicator for condition of engine) and Units of Odometer Measurement (indicator for where vehicle was built)
- Fuel Type
- Share of Fuel Purchased in Mexico
- Adherence to a Smog Check Program
- Willingness to Switch to Non-Motorized Border Crossing Mode

The units for reporting each one of these variables may differ, but are clearly indicated in each one of the corresponding variable descriptions.

Model Year

The relevant statistics related to model year for the commercial and passenger vehicle fleets surveyed, by county where the border crossing occurred, are reported in Table 17.

Table 17. Relevant Statistics on Model Year by County

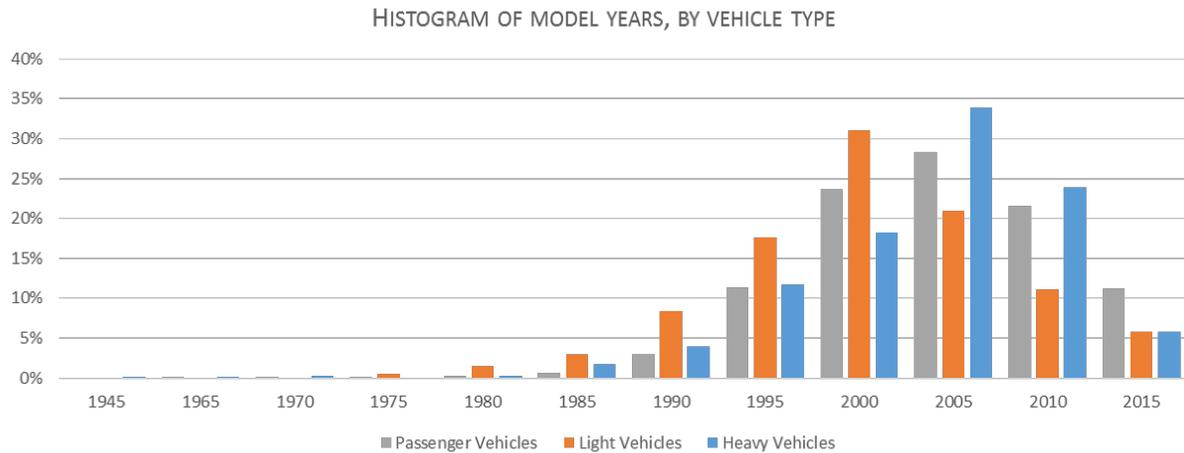
	Imperial County	San Diego County
Commercial Vehicles		
Newest Model Year	2018	2017
Median Model year	2006	2005
Oldest Model year	1945	1965
Average Model year	2005	2004
Passenger Vehicles		
Newest Model Year	2017	2018
Median Model year	2007	2005
Oldest Model year	1976	1965
Average Model year	2007	2006

In general, median and average model years for commercial and passenger vehicles are very similar, indicating that their distributions are relatively symmetric. For commercial vehicles, however, Imperial County seems to have a slightly newer fleet (both newest, median and average model year are more recent than those in San Diego), however, this county also has

the oldest model year in the survey. For passenger vehicles, the situation is similar as that of commercial vehicles (i.e., Imperial has a slightly newer fleet based on median and average model year indicators).

A histogram depicting the shares of 5-year groupings of the model year variable for each one of the different vehicle types considered (i.e., passenger vehicles, light vehicles and heavy vehicles) is presented in Figure 7.

Figure 7. Histogram of Model Year by Vehicle Type



The figure above shows that light vehicles have their largest share in the 2000-2005 model year bin or category, while passenger vehicles and heavy vehicles have their largest share in the 2005-2010 bin.

Odometer Reading and Units

Of the total number of vehicles surveyed, the majority of them have an odometer with units in miles, indicating that a significant share of the vehicles crossing the border was built in the U.S. This is particularly true for commercial vehicles, where more than 90 percent of respondents reported an odometer in miles. The table below summarizes these results. Note that the shares do not differ significantly between geographies, and therefore the results are listed for all POEs in the California-Baja California region.

Table 18. Odometer Units by Vehicle Type

Sample Size by Vehicle Type and Odometer Units	All POEs	
Commercial Vehicles		
Odometer in kilometers	94	8%
Odometer in miles	1,068	92%
Passenger Vehicles		
Odometer in kilometers	448	16%
Odometer in miles	2,416	84%

The actual readings on the odometers were transformed into miles and the average and median odometer reading were calculated for each border region where the crossing took place (i.e., Imperial and San Diego Counties). The results are presented in the table below.¹⁹

Table 19. Relevant Statistical Measures for the Odometer Reading Variable

Odometer Reading (in miles) by Vehicle Type	Imperial County	San Diego County
Commercial Vehicles		
Average	285,834	403,707
Median	154,000	202,162
Passenger Vehicles		
Average	126,753	164,435
Median	105,000	127,500

The statistics on odometer readings show a similar picture to that of the model year, with vehicles that cross through Imperial County showing less use than those that cross through San Diego County. However, in this case the median estimates are lower than the average estimates, suggesting that some vehicles in the sample have a large number of miles traveled.

Fuel Type

The fuel type has a direct impact on the emissions created by vehicles crossing the border. Table 20 shows the share of fuels used by border-crossing vehicles by vehicle type and county of crossing.

¹⁹ Potential outliers (i.e., odometer readings greater than the equivalent of 5.6 million miles, the maximum passenger vehicle odometer reading) were removed from the sample to create the estimates shown in the table.

Table 20. Fuel Type by Vehicle Type and County of Crossing

Fuel Type by Vehicle Type	Imperial County		San Diego County	
Commercial Vehicles				
100% Electric	0	0.0%	2	0.2%
Diesel	111	34.9%	380	45.1%
Gasoline	203	63.8%	446	52.9%
Hybrid electric	0	0.0%	1	0.1%
Natural Gas	4	1.3%	14	1.7%
Total, all categories	318	100.0%	843	100.0%
Passenger Vehicles				
100% Electric	5	0.5%	7	0.4%
Diesel	1	0.1%	4	0.2%
Gasoline	1,041	97.4%	1,707	95.2%
Hybrid electric	9	0.8%	21	1.2%
Natural Gas	13	1.2%	55	3.1%
Total, all categories	1,069	100.0%	1,794	100.0%

In the case of commercial vehicles, the vast majority of crossers use diesel and gasoline. However, the share of crossers that uses gasoline through Imperial County is higher than the share of users of this fuel type through San Diego County. In the case of passenger vehicles, the vast majority of crossers use gasoline as their vehicle’s fuel. For these type of vehicles, crossers through San Diego County reported significantly larger shares of hybrid and natural gas-powered vehicles than crossers through Imperial County, though the absolute shares of these fuels are small.

Share of Fuel Purchased in Mexico

The share of fuel purchased in Mexico also affects the emissions into the atmosphere. The responses to this survey question are concentrated primarily along the extremes (i.e., the majority of responses correspond to border crossers that do not buy fuel in Mexico or that only buy fuel in Mexico) regardless of the vehicle type considered. Table 21 shows the share of fuel bought in Mexico by vehicle type and county where the crossing occurred.

Table 21. Percent of fuel purchased in Mexico, by Vehicle Type

Percent of fuel purchased in Mexico, by Vehicle Type	Imperial County		San Diego County	
Commercial Vehicles				
0%	108	34%	332	39%
1-9%	12	4%	49	6%
10-19%	16	5%	41	5%
20-29%	16	5%	33	4%
30-39%	6	2%	24	3%
40-49%	9	3%	31	4%
50-59%	33	10%	75	9%
60-69%	10	3%	20	2%
70-79%	7	2%	28	3%
80-89%	22	7%	33	4%
90-99%	9	3%	40	5%
100%	69	22%	137	16%
Total, all categories	317	100%	843	100%
Passenger Vehicles				
0%	361	34%	439	24%
1-9%	47	4%	163	9%
10-19%	59	6%	122	7%
20-29%	51	5%	130	7%
30-39%	31	3%	92	5%
40-49%	37	3%	95	5%
50-59%	99	9%	139	8%
60-69%	21	2%	37	2%
70-79%	29	3%	81	5%
80-89%	53	5%	160	9%
90-99%	74	7%	141	8%
100%	208	19%	195	11%
Total, all categories	1,070	100%	1,794	100%

The results show that in the case of commercial vehicles, crossers in San Diego County tend to purchase less fuel in Mexico. In particular, the share of border crossers in San Diego that does not buy fuel in Mexico is higher than the share of border crossers in Imperial County that do not buy fuel in Mexico. Similarly, the share of crossers in San Diego County that buy all their fuel in Mexico is lower in San Diego County. In the case of passenger vehicles, both the share of crossers that does not buy fuel in Mexico and the share of crossers that only buys fuel in Mexico is higher in the case of Imperial County.

Smog Check Program

Participation in a smog check program can reduce the emissions related to border crossing trips. In general, both commercial and passenger vehicles in the border region have a high share of participation in these programs. The share of responses to the question about having a

smog check inspection during the last 12 months is presented in the table below, by vehicle type and county of crossing.

Table 22. Participation in Smog Check Inspection in Last 12 Months, by Vehicle Type

Responses to a Smog-Check in the last 12 months, By Vehicle Type	Imperial County		San Diego County	
Commercial Vehicles				
DK/NA	2	1%	8	2%
No	47	22%	38	8%
Yes	165	77%	408	90%
Total, all categories	214	100%	454	100%
Passenger Vehicles				
DK/NA	22	2%	40	2%
No	192	18%	161	9%
Yes	856	80%	1,593	89%
Total, all categories	1,070	100%	1,794	100%

Based on these results, crossers that use San Diego County POEs reported a higher participation on smog check programs over the last 12 months compared to crossers that use Imperial County POEs. Also, the results suggest that the rate of participation in these programs differs primarily between geographies, and not so much between vehicle types in the same geography.

Switch to Non-Motorized Crossing Mode

The emissions component of the SANDAG Border Survey asked participants to report the wait time at pedestrian crossing that would induce them to switch from a motorized crossing to a non-motorized one (i.e., to cross by foot, bicycle or using public transportation). The shares of responses for different time intervals of pedestrian wait times are provided in Table 23 by county of crossing.



Table 23. Ranges of Border Crossing Wait Times that Would Cause Vehicle User to Switch to Pedestrian Crossing

Ranges of wait time at pedestrian crossing ²⁰	Imperial County		San Diego County	
	Count	Percentage	Count	Percentage
Passenger Vehicles				
0 delay	161	15%	151	8%
1-10 minutes	160	15%	275	15%
11-20 minutes	56	5%	160	9%
21-30 minutes	37	3%	106	6%
31-40 minutes	13	1%	44	2%
41-50 minutes	8	1%	12	1%
51-60 minutes	13	1%	13	1%
60+ minutes	42	4%	49	3%
Wouldn't change from car	580	54%	984	55%
Total, all categories	1,070	100%	1,794	100%

The majority of the respondents for each county of crossing reported they would not switch to a non-motorized mode regardless of how much the wait time is at the pedestrian crossings. Furthermore, crossers in San Diego County are less likely to switch to a non-motorized mode than crossers in Imperial County.

Across geographies, of those respondents that showed a willingness to switch to a non-motorized mode, a significant portion said they would consider the switch only if wait times at pedestrian crossings were 20 minutes or less. The share of those that would switch only if zero delays are experienced at the pedestrian POEs is larger at Imperial County.

²⁰ This question was also posed to commercial vehicle drivers, and even though over 200 responses were gathered at the Imperial Valley POEs and over 400 responses were gathered at the San Diego POEs, these were not reported since it does not seem plausible that truck drivers can switch to a non-motorized mode and move freight across the border.

Summary Statistics for Key CBX Variables

The surveys collected at CBX as part of the SANDAG Border Survey shed light on the recent change in behavior of border crossers that use airplane as their mode of travel due to the opening of this facility. The short survey conducted at the facility was geared toward capturing responses on the following variables:

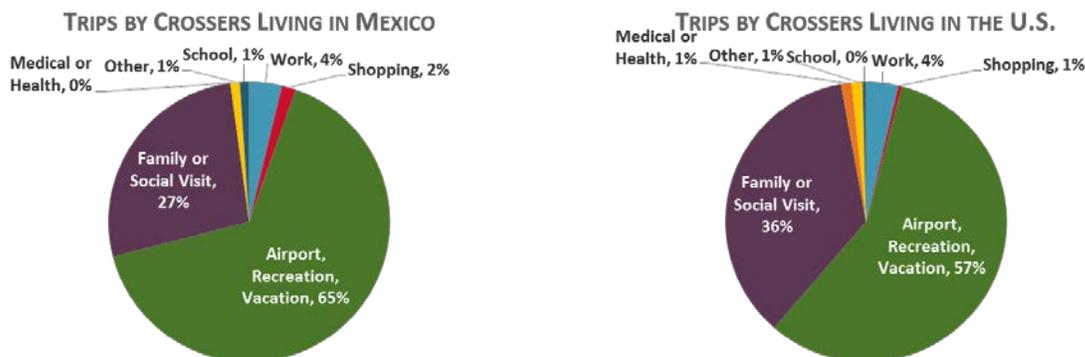
- Trip Purpose
- Expenditure per Trip
- Crossing Behavior Before the Existence of CBX

The summary statistics for these key variables are presented in this section.

Trip Purpose

Survey participants were asked to report their primary trip purpose while using CBX. The share of responses for the different trip purposes is reported in Figure 8, broken down by the place of living given by each respondent.

Figure 8. Trip Purpose by CBX Users by Self-Reported Place of Residence



The vast majority of CBX users, regardless of their self-reported place of residence, reported an airport / recreation / vacation trip purpose, with family or social visit having also an important share of the responses (though the share of this purpose is significantly lower than that of airport / recreation / vacation). The other trip purposes received a low share of responses.

Expenditure per Trip

The participants on this survey were asked to report their expenditure (per person) during the trip. The average and median expenditures estimated from the sample are presented in Table 24.

Table 24. Average and Median Expenditures for CBX Users, by Country of Self-Reported Residence

Expenditure (\$) per person	Crossers living in Mexico	Crossers living in the U.S.
Average Expenditure	\$1,139	\$1,163
Median Expenditure	\$1,000	\$780

Both the average and the median expenditure by this group of crossers is considerably higher than the average and median expenditure for crossers that use land modes. As in the case of crossings on the other six POEs in the region, median expenditures of CBX users are lower than average expenditures. Even though the average between crossers living in Mexico is similar to that of crossers living in the U.S., the median for CBX users that reported living in Mexico is significantly higher than the median for CBX users that reported living in the U.S.

Crossing Behavior Before CBX

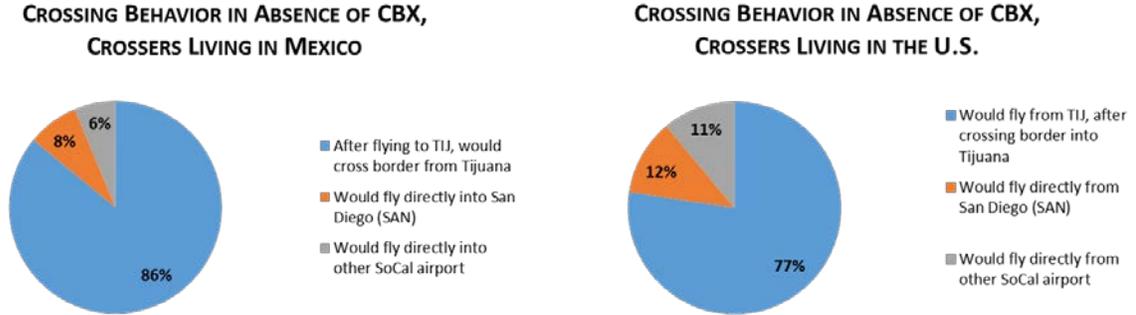
The survey asked respondents about their use of the Tijuana airport before CBX existed. The share of responses by country of self-reported residence is presented in the table below. Note that questions were phrased differently depending on the place of residence to capture the different nature of the trips.

Crossers living in Mexico: Before the CBX terminal opened, had you ever flown into the Tijuana Airport in order to visit the US?	Number of Responses	%
No	74	40%
Yes	112	60%
Crossers living in the U.S.: Before the CBX terminal opened, had you ever flown into the Tijuana Airport before to visit Mexico?	Number of Responses	%
No	77	32%
Unsure/DK/NA	5	2%
Yes	161	66%

For CBX users that live in Mexico, approximately 60 percent of them had use the Tijuana airport before CBX opened. A slightly higher percentage (66 percent) of CBX users that live in the U.S. used the Tijuana airport before CBX began operations.

As a follow-up question, respondents were asked to report their border-crossing behavior related to air travel in the absence of CBX. The shares of the responses provided by the survey participants to the different alternatives presented to them are provided in Figure 9, by self-reported place of residence.

Figure 9. Crossing Behavior in Absence of CBX by Self-Reported Place of Residence



Current users of CBX, regardless of their place of residence, reported that they would cross the border before or after flying out of the Tijuana airport instead of flying into or out of other regional airports (i.e., San Diego or other Southern California airports).

Summary Statistics for Other Relevant Variables

The survey captured information on other relevant variables that may not be the key drivers of economic impacts in the region but are relevant to understanding behavioral patterns of border crossers. Two variables are worth mentioning in this report:

- Origin-destination of crossborder trips
- Productivity loss due to delays at the border

The summaries of these variables are presented as simple averages of the responses collected through the SANDAG Border Survey.

Origin-Destination of Crossborder Trips

The SANDAG Border Survey included questions about the origin and the destination of the trip the interviewee was taking at the time he or she was surveyed. Even though the origin and destination of each trip is recorded in the SANDAG Border Survey database, reporting about them by origin-destination pair is complicated due to the long list of possibilities. Therefore, in order to represent these origins and destinations in a simplified way, the results are presented by country where the trip began or ended (i.e., U.S. or Mexico) and by component of the trip (i.e., origin or destination). As such, this document presents the flows of border crossers in the following way: 1) trips originating in Mexico; 2) trips originating in the U.S.; 3) trips ending in Mexico; 4) trips ending in the U.S.²¹

Within each country, we identify a number of relevant zones for reporting origins and destinations. In the case of Mexico, the main areas considered are Tijuana, Mexicali, Tecate, Algodones and Ensenada and an “external zone” that captures origins or destinations outside these cities. In the case of the U.S., the relevant zones considered for reporting are broken down by county to provide further detail. For San Diego County, the areas considered are Carlsbad, Chula Vista, Coronado, Del Mar, El Cajon, Encinitas, Escondido, Imperial Beach, La Mesa, Lemon Grove, National City, Oceanside, Poway, San Diego, San Marcos, Santee, Solana Beach, Vista and the unincorporated areas of San Diego County. For Imperial County, the areas considered are Brawley, Calexico, Calipatria, El Centro, Holtville, Imperial, Westmorland, and unincorporated areas. The U.S. also has an “external” zone that captures origins or destinations outside the areas listed under San Diego and Imperial Counties.

When it comes to origins of border-crossing trips, the survey shows that approximately 88 percent of the trips that begin in Mexico start in either Tijuana or Mexicali. The survey also captured trips (approximately 6 percent of the respondents) that began outside of the main areas considered in Baja California.

For border-crossing trips originating in the U.S., the survey shows that almost 80 percent begin in San Diego County (with the majority of those starting within the City of San Diego), a little over 10 percent begin in Imperial County and approximately 10 percent start outside of San Diego and Imperial Counties (the majority of those start in the State of California).

²¹ Maps are presented in Appendix 3.



Regarding destinations in Mexico, Tijuana and Mexicali account for 76 percent of all border-crossing trips captured through the SANDAG Border Survey. Trips ending in areas outside of the regions considered in our list accounted for approximately 16 percent.

Finally, 61 percent of the U.S. destinations listed for border-crossing trips are in San Diego County (primarily within the City of San Diego), 27 percent are in Imperial County and approximately 11 percent are in regions outside of these two counties.

A table capturing the share of origins and destinations in each region considered is presented in Table 25, broken down by country.

Table 25. Share of Origins and Destinations by Region

Region	Share of Origins	Share of Destinations
In Mexico		
Tijuana	47%	44%
Mexicali	41%	32%
Tecate	2%	1%
Algodones	4%	7%
Ensenada	<1%	0%
External	6%	16%
In the U.S.		
<i>In San Diego County</i>	<i>79%</i>	<i>61%</i>
San Diego	57%	43%
Chula Vista	1%	12%
National City	0%	1%
Solana Beach	0%	1%
Lemon Grove	0%	1%
Santee	0%	<1%
La Mesa	0%	<1%
Carlsbad	0%	<1%
Coronado	0%	<1%
Poway	0%	<1%
Escondido	0%	<1%
Oceanside	0%	<1%
Imperial Beach	5%	<1%
Del Mar	0%	<1%
Vista	0%	<1%
Unincorporated	16%	4%
<i>In Imperial County</i>	<i>11%</i>	<i>27%</i>
Calexico	6%	17%
El Centro	3%	7%
Imperial	1%	1%
Brawley	1%	1%
Calipatria	0%	<1%
Holtville	0%	<1%
Westmorland	0%	<1%
Unincorporated	<1%	1%
<i>External</i>	<i>10%</i>	<i>11%</i>

Productivity Loss

Interviewees were also asked to report the impacts on their productivity resulting from delays at the border. In particular, survey participants were asked to identify what would happen to their number of hours worked on a given day if they arrived one hour late to work due to delays at the



POEs. The options given were the following: 1) make up the lost hour; 2) see their paycheck reduced by 1 hour; 3) lose the entire day or work; or 4) other.²²

Pedestrians in general reported being more likely to be able to make up for their hour lost. The exception to this is crossers living in the U.S. and crossing through Imperial, whose response was “other” though the number of responses was only one. However, a significant number (more than 20 percent) of crossers living in Mexico and crossing through Imperial County POEs responded that they could lose their entire day of work if they were an hour late. The share of pedestrian responses by country where the respondent lives and the county where the crossing POE is located is presented in the table below.

Table 26. Productivity Loss Results for Pedestrians

Productivity Loss Responses, percentage	Living in Mexico		Living in the U.S.	
	Imperial	San Diego	Imperial	San Diego
Can make up hour of work	48.3%	69.3%	0.0%	80.0%
Paycheck will be one hour less	31.0%	22.9%	0.0%	20.0%
Will lose day of work	20.7%	5.7%	0.0%	0.0%
Other	0.0%	2.1%	100.0%	0.0%
TOTAL	100.0%	100.0%	100.0%	100.0%

The number of survey respondents that are able to make up the hour of work due to delays at the border is also high for vehicle crossers, but the percentage of interviewees that reported that their paycheck will be one hour less is also considerable. The share of respondents that mentioned they would lose the entire day of work was lower for crossers using Imperial County POEs compared to that share for pedestrians. The share of responses from vehicle crossers is presented in the table below by country where the respondent lives and the county where the crossing POE is located.

Table 27. Productivity Loss Results for Vehicle Users

Productivity Loss Responses, percentage	Living in Mexico		Living in the U.S.	
	Imperial	San Diego	Imperial	San Diego
Can make up hour of work	41.8%	55.5%	40.7%	48.1%
Paycheck will be one hour less	41.1%	35.8%	25.9%	28.8%
Will lose day of work	8.9%	5.2%	7.4%	11.5%
Other	8.2%	3.6%	25.9%	11.5%
TOTAL	100.0%	100.0%	100.0%	100.0%

²² The survey can be used to create a “proxy” for hours of productivity lost due to increasing wait times, but this estimate is not robust since the respondents were limited by the options of answer given in the survey.

Summary of Total Border Crossing Time, Baseline Crossing Time and Delays at Crossing

The Economic and Air Quality/Climate Impacts of Delays at the Border study also included a data collection activity to record total border-crossing times for passenger and commercial vehicles at the six POEs in the region. In particular, total border crossing time was measured for these vehicles using a time-stamp methodology (with one observer placed on one side of the border where vehicles queue and another one at the exit of the Federal inspection complex at the other side of the border). Even though this was a separate effort from the SANDAG Border Survey, a summary of the results for this activity is presented here since it is a key input to the Economic Impact model.

As described in the Overview of Border Crossing Time Measurements section, for passenger vehicles, measurements were conducted at all POEs during the following days: July 1, 4 and 5 and October 16 and 17, 2016, or five days at each POE in total. The hours where data was collected spanned from 7 am until 7 pm. For commercial vehicles, the measurements were conducted also during five days at each POE on the following days: October 12, 13 and 14 (Tecate POE), October 19, 20 and 21, 2016 (Calexico East POE) and February 10, 13 and 14, 2017 (Otay Mesa POE), March 1-2, 2017 (Calexico East and Tecate POEs), March 8-9, 2017 (Otay Mesa POE). The hours where data was collected spanned from 8 am until 6 pm.

The data collection effort included collecting more than 12,000 observations on total border crossing times for passenger vehicles using the General Purpose, Ready Lanes and SENTRI lanes for northbound trips and a representative general lane for southbound trips across all six land POEs in the region.²³ It also included collecting more than 3,700 observations on total border crossing times for commercial vehicles using the Regular and FAST lanes for northbound trips and a representative general lane for southbound trips for those POEs that handle commercial vehicle traffic.²⁴ At the same time, the effort included collecting information on more than 120 crossings using GPS loggers to accurately capture the total border crossing time for passenger vehicles across the San Ysidro, Otay Mesa, Calexico East and Calexico West POEs.

The average total border-crossing times registered in the field for passenger vehicles are presented in the table below, by POE and lane type (three types of northbound lane types plus southbound). Table 28 lists the total crossing times in terms of the number of average minutes per border-crossing trip.²⁵

²³ The method used to collect POV total crossing data is license plate sampling (last 5-digits of a license plate at the beginning of the queue and at the exit of the border crossing compound) as described in the Border Wait Time Data Collection Plan for this study.

²⁴ The method used to collect truck total crossing data is the same as that used for POVs.

²⁵ Detailed graphs of total border crossing times collected in the field and used to produce the averages in this section are presented in Appendix 4 by POE and lane type.



Table 28. Average Total Border-Crossing Times for Passenger Vehicles (In Minutes)

Lane Type	San Ysidro	Otay Mesa	Tecate	Calexico East	Calexico West	Andrade
NB General Purpose	79.7	78.6	42.9	76.0	78.5	44.0
NB Ready Lane	42.3	43.2		39.4		
NB SENTRI	9.7	5.3		9.8	9.0	
Southbound	5.9	6.8	1.7	4.3	4.2	1.2

Note: Total border-crossing times were collected on the days mentioned in this section between the hours of 7 am and 7 pm.

POEs in Imperial and San Diego Counties that handle large volumes of passenger vehicles (i.e., Calexico East, Calexico West, San Ysidro and Otay Mesa) have similar average total crossing times for northbound trips for the different lane types available at them. The exception is Otay Mesa for SENTRI crossers, which displays a significantly lower total crossing time compared to the other POEs. Tecate and Andrade, on the other hand, also display similar average total crossing times for the lanes available at them.

The average total border-crossing times for commercial vehicles at the three POEs in the region that handle this type of crossing are displayed in Table 29.

Table 29. Average Total Border-Crossing Times for Commercial Vehicles (In Minutes)

Lane Type	Otay Mesa	Tecate	Calexico East
NB General Purpose	95.4	38.0	60.0
NB FAST	54.2		31.7
Southbound	31.5	29.2	37.3

Note: Total border-crossing times were collected on the days mentioned in this section between the hours of 8 am and 6 pm.

For northbound flows, Otay Mesa has significantly higher average total crossing time compared to the Tecate and Calexico East POEs. For southbound flows, however, Calexico East recorded the highest average total crossing times, while Otay Mesa and Tecate recorded relatively similar measurements.

The information on total border-crossing times collected in the field was used to define a “baseline” border-crossing time that represents an “acceptable time” that vehicles need to cross the border. To do this, a statistical analysis of the total border crossing dataset was used²⁶ to identify percentiles in the data that would appropriately represent this “acceptable” crossing time. The specific percentiles were discussed with U.S. Customs and Border Protection (CPB) staff to determine their appropriateness and, in general, it was found that the 10th percentile is a good representation of what an acceptable border-crossing time would be.

The preliminary baseline border-crossing times for passenger vehicles are presented in Table 30, by lane type and POE. Notice these baseline times are expressed in minutes per trip.

²⁶ In the case of the “baseline border-crossing times” for passenger vehicles, the statistical analysis was complemented with information from a small number of GPS runs collected as part of this study.

Table 30. "Baseline" Border-Crossing Times for Passenger Vehicles (In Minutes)

Lane Type	San Ysidro	Otay Mesa	Tecate	Calexico East	Calexico West	Andrade
NB General Purpose	3.0	3.0	3.0	4.0	4.0	3.0
NB Ready Lane	3.7	2.9		5.0		
NB SENTRI	2.4	2.4		2.4	2.4	
Southbound	1.0	1.0	1.0	1.0	1.0	1.0

Note: "Baseline" times were derived from total border-crossing times collected on the days mentioned in this section between the hours of 7 am and 7 pm.

Similarly, the preliminary baseline border-crossing times for commercial vehicles are presented in the table below, expressed in minutes per trip.

Table 31. "Baseline" Border-Crossing Times for Commercial Vehicles (In Minutes)

Lane Type	Otay Mesa	Tecate	Calexico East
NB General Purpose	35.0	9.0	8.7
NB FAST	22.0		8.0
Southbound	8.1	1.0	9.6

Note: "Baseline" times were derived from total border-crossing times collected on the days mentioned in this section between the hours of 8 am and 6 pm.

The identification of a baseline border-crossing time for passenger and commercial vehicles allows for the estimation of average delay times for each lane type at each POE. This is done by subtracting the baseline crossing time for each lane type and POE from the average total crossing time for each corresponding lane type and POE. The resulting average delays at the border for passenger vehicles are shown in the table below .

Table 32. Average Border-Crossing Delay for Passenger Vehicles (In Minutes)

Lane Type	San Ysidro	Otay Mesa	Tecate	Calexico East	Calexico West	Andrade
NB General Purpose	76.7	75.6	40.0	72.0	74.5	41.0
NB Ready Lane	38.6	40.3		34.4		
NB SENTRI	7.3	2.9		7.4	6.5	
Southbound	4.9	5.8	0.7	3.3	3.2	0.2

Note: Average border-crossing delay was derived from total border-crossing times collected on the days mentioned in this section between the hours of 7 am and 7 pm.

As in the case of average total border-crossing times, average delays for northbound trips across the POEs in Imperial and San Diego Counties that handle the largest number of crossings (Calexico East, Calexico West, San Ysidro and Otay Mesa) are relatively similar, while delays for northbound trips on POEs that handle lesser volumes (Tecate and Andrade) are also similar. Again, the exception is SENTRI crossers through Otay Mesa, who experience lower average delays compared to the other POEs in the region.

The average delays for commercial vehicles are shown in the table below, expressed as number of minutes per trip.



Table 33. Average Border-Crossing Delay for Commercial Vehicles (In Minutes)

Lane Type	Otay Mesa	Tecate	Calexico East
NB General Purpose	60.4	29.0	51.4
NB FAST	32.2		23.7
Southbound	23.4	28.2	27.8

Note: Average border-crossing delay was derived from total border-crossing times collected on the days mentioned in this section between the hours of 8 am and 6 pm.

Even though Otay Mesa still shows higher delays compared to the other POEs that handle commercial traffic, the difference between this POE and Calexico East (the larger of the other two POEs with commercial crossings) is smaller compared to the case when the average total crossing times are compared.

Summary Statistics for Willingness to Pay Questions from Previous Surveys

In May and August of 2014, Crossborder Group (a member of the HDR team for the Economic and Air Quality/Climate Impacts of Delays at the Border study) undertook proprietary surveys at the Calexico West POEs to assess a range of economic and policy issues. The questionnaire (which was applied randomly to 784 northbound vehicles in both Regular and SENTRI lanes) included two specific questions that relate to the issue of potential demand for a tolled border crossing between Mexicali and Calexico.

Those questions were:

- “If a toll-based express lane existed with a wait of fifteen minutes or less, would you use it and how much would you be willing to pay?”; and
- “If this express toll lane existed, in a normal month how many times would you use it?”

This survey was applied to a total of 784 individual drivers of passenger vehicles at the Calexico/Mexicali I POE (Calexico West). Of those, 537 responses are from the Regular lanes and the remaining 247 responses are from the SENTRI lanes. Below are the summary results to those two questions, and other key questions, from that Crossborder Group survey.²⁷

Slightly more than half (51.3 percent) of Calexico West POV drivers reported being “frequent border crossers” – crossing at least 2 or more times per week, as shown in the table below.

Table 34. Frequency of Crossing for Willingness-to-Pay Respondents

Which answer best describes how frequently you cross the border northbound?	Number of Responses	%
5+ times / week	180	23.0%
2-4 times / week	222	28.3%
1 time / week	162	20.7%
1-2 times / month	157	20.0%
Less than once / month	58	7.4%
First time crossing	5	0.6%
TOTAL	784	100.0%

During the survey time period (which included holiday travelers), nearly 80 percent reported their primary residence as either Mexicali or Imperial County, as shown in the table below. Given potential tourist respondents during the survey dates, it is possible that local border crossers may have been undercounted.

²⁷ All data presented here is owned by Crossborder Group, and is considered proprietary in nature. It is being provided under a limited license to HDR for its use in this study. It may not be released to the general public.

Table 35. Place of Residence for Willingness-to-Pay Respondents

In what area do you have your primary residence or do you live?	Number of Responses	%
Mexicali	420	53.6%
Imperial County	203	25.9%
Tecate	1	0.1%
Tijuana	2	0.3%
San Diego County	16	2.0%
Ensenada	4	0.5%
Rosarito	99	12.6%
Other Areas of US	34	4.3%
Other Areas of Mexico	4	0.5%
Other	1	0.1%
TOTAL	784	100.0%

To test for perceived time spent at the border, and possible demand for a tolled “express lane”, participants were asked the two questions presented in the next two tables. Notably, approximately 40 percent indicated that they spent 2:00-4:59 hours in border queues in a typical week, with just over 9 percent estimating 5+ hours (see table below).

Table 36. Perceived Wait Time per Week by Respondents

In a typical week, approximately how many hours do you estimate that you spend in your vehicle waiting in line at the border?	Number of Responses	%
0:01-0:59	254	32.4%
1:00-1:59	137	17.5%
2:00-2:59	207	26.4%
3:00-3:59	72	9.2%
4:00-4:59	39	5.0%
5:00-5:59	18	2.3%
6:00-6:59	15	1.9%
7:00-7:59	9	1.1%
8:00-8:59	2	0.3%
9:00-9:59	3	0.4%
10:00-10:59	18	2.3%
11:00-11:59	0	0.0%
12:00-12:59	3	0.4%
14:00-14:59	1	0.1%
15:00+	6	0.8%
TOTAL	784	100.0%

In terms of the tolled express lane, over 44 percent (largely SENTRI users) indicated that they wouldn't use it or be willing to pay anything, however another 40 percent stated they would be willing to pay US\$2.00 or more (see table below).

If a toll-based express lane existed with a wait of fifteen minutes or less, would you use it and how much would you be willing to pay?	Number of Responses	%
Would not use or would not pay	347	44.3%
1-99 Cents	37	4.7%
\$1.00-1.99	87	11.1%
\$2.00-2.99	52	6.6%
\$3.00-3.99	28	3.6%
\$4.00-4.99	38	4.8%
\$5.00-5.99	92	11.7%
\$6.00-6.99	7	0.9%
\$7.00-7.99	8	1.0%
\$8.00-8.99	4	0.5%
\$9.00-9.99	28	3.6%
\$10.00+ or more	56	7.1%

Of the 437 respondents that stated they would use the tolled express lane, the majority would use it somewhat infrequently (1-5 times/month); however, nearly 28 percent indicated that they would use it more than 10 times/month (and within this, there is a subset of over 9 percent that stated they would use it more than 20 times/month). The shares of the responses for the potential use for the tolled express lanes are presented in the table below.

If this express toll lane existed, in a normal month, how many times would you use it?	Number of Responses	%
1 - 5 times /month	224	51.3%
6 - 10 times /month	91	20.8%
11 - 15 times /month	41	9.4%
16 - 20 times /month	39	8.9%
21 - 25 times /month	12	2.7%
26 - 30 times /month	30	6.9%

When the previous responses are broken down by lane type, it is clear that the tolled express lanes are more appealing to border crossers that use the Regular lanes, as the following table demonstrates.



Table 37. Breakdown of Willingness-to-Pay Responses by Lane Type

	If a toll-based express lane existed with a wait of fifteen minutes or less, would you use it and how much would you be willing to pay?												Total
	Wouldn't Use	1-99 Cents	\$1.00-1.99	\$2.00-2.99	\$3.00-3.99	\$4.00-4.99	\$5.00-5.99	\$6.00-6.99	\$7.00-7.99	\$8.00-8.99	\$9.00-9.99	\$10.00+ OR MORE	
Calexico West – Regular	21.4%	5.6%	15.6%	9.3%	5.2%	7.1%	16.9%	1.3%	1.5%	0.7%	5.2%	10.1%	100.0%
Calexico West – SENTRI	93.9%	2.8%	1.2%	0.8%	0.0%	0.0%	0.4%	0.0%	0.0%	0.0%	0.0%	0.8%	100.0%
Total	44.3%	4.7%	11.1%	6.6%	3.6%	4.8%	11.7%	0.9%	1.0%	0.5%	3.6%	7.1%	100.0%

Appendix 1: Weighting Methodology

The weighted averages of the variables relevant to the study (including averages of expenditures and wages) were generated by using the sample sizes collected in the field and scaling them up to represent actual population sizes, so that when grouped together, the values from the surveyed samples would statistically represent the actual underlying population in terms of proportions of travel modes/lane types and POE crossing volumes. Below is a description of the steps followed to generate these weighted averages:

1. The first step is to obtain averages of the relevant variable from the survey sample for each subpopulation that needs to be weighted. Each subpopulation consists of a combination of a travel mode/lane type (SENTRI, Ready Lane, General Purpose, and pedestrians) and each one of the six POEs. Additionally, for expenditures, residents of Mexico and residents of the US were kept separate because their spending patterns are expected to be different, thus adding this additional variable to the definition of a subpopulation. For the wage variable, that separation was not made, because it appeared that wages of people crossing the border for work were similar enough regardless of which direction they were crossing.

The expenditure variable will be used as the example below to outline the steps followed in the weighting process. In step 1 above, the expenditure averages for each of the relevant subpopulations were compiled (a data processing software was used but this can be done with Excel filters too). The result was a set of 38 averages because not all POEs have all lane types.

2. Vehicles are separated from the pedestrians, US residents are separated from Mexico residents, and Imperial County averages are separated from San Diego County averages (there are six groups of averages, but there are many options for formatting these groups in a spreadsheet).
3. The averages are scaled up by combining them across the subpopulations for each table using the right proportions (i.e., weights). The weighting steps can be done in any order of categories, but it is recommended to scale up using the lane types first, then scale up using the POEs. Vehicles in San Diego County crossing from Mexico are used as an example below.
 - a. For each POE, there are between one and three lane types, each with a corresponding annual total border crossing volume for the most recent year (see Appendix B in the RAP workbook). The sum-product of the average expenditure by each lane type for each POE and the most recent annual volume for that same lane type and POE is calculated and then divided by the total annual border crossing volume across all lane types for that POE (i.e., the average expenditure and the border crossing volume for each lane type are multiplied, then these quantities are added; the resulting amount is then divided by the total border crossing volume for the POE, which is the sum of the border crossing volumes for all lane types).
 - b. What results is the average expenditure for vehicles for each POE in San Diego, and the same scaling up process is repeated again, but at the POE level. The sum-product of the average expenditures and the border crossing volumes for each POE is calculated, then divided by the total border crossing volumes for all POEs in San Diego.



4. The result of the previous steps is one value, the average expenditure for Mexico residents crossing in vehicles in San Diego County. The same procedure is done for each group described above:
 - a. San Diego vehicles for US residents
 - b. San Diego Mexico resident pedestrians
 - c. San Diego US resident pedestrians
 - d. Imperial vehicles for Mexico residents
 - e. Imperial vehicles for US residents
 - f. Imperial Mexico resident pedestrians
 - g. Imperial US resident pedestrians
5. Note that for vehicles, there are two levels of weighting (lane type to POE and POE to county), for pedestrians there is only one (POE to county, since all pedestrians are recorded as a single lane type). Also, for POEs with only one or two lane-types, this procedure still works, because averages and border crossing values are zero for the absent lane types (i.e. the same excel functions can be used)

For wages, one level of computational complexity is swapped for another, because there is no separation between US and Mexico residents, but the annual border crossing volumes have to be altered to only those who are crossing the border for work purposes.

1. Border crossing volumes are adjusted by multiplying the annual border crossing volumes by lane type and POE used in the scaling up of expenditures by the percent of crossers who crossed for work purposes. Worker percentages are gathered from the primary trip purpose question, by travel mode and POE (see Appendix C and D in the RAP Workbook for these percentages). At the end, there should be 19 adjusted volumes (6 for pedestrians and 13 for vehicles).
2. Wage averages calculated from the survey sample by county and by travel mode (pedestrian vs. vehicle) are separated.
3. The scaling up process continues as described in step 3 above, beginning with 19 average wage values and 19 worker border crossing volumes that have been adjusted as described in step 1 for this variable.

A sum product formula looks like this:

$$\frac{(A_1 * X_1 + A_2 * X_2 + A_3 * X_3)}{(X_1 + X_2 + X_3)}$$

Where averages for lane types or POEs are A_i and border crossing volumes for lane types or POEs are X_i . In excel, this function looks like this:

=sumproduct(A1:A3,B1:B3)/sum(B1:B3)

Where the cells A1:A3 are the averages for your subpopulation, and cells B1:B3 are the border crossing volumes.

Table 38. Border Crossing Volumes Used For Scaling The Survey Responses – Pedestrians

Northbound Border Crossings, Pedestrian Volumes (2016)	Volume
Andrade, Imperial County	833,296
Calexico East, Imperial County	253,992
Calexico West, Imperial County	4,270,911
Otay Mesa, San Diego County	3,504,800
San Ysidro, San Diego County	7,382,363
Tecate, San Diego County	673,605

Source: U.S. Department of Transportation, Research and Innovative Technology Administration, Bureau of Transportation Statistics

Table 39. Border Crossing Volumes Used For Scaling The Survey Responses – Passenger Vehicles

Northbound Border Crossings, Vehicle Volumes (2016)	Volume
Andrade, Imperial County	
General purpose lane	506,230
Calexico East, Imperial County	
SENTRI lane	604,147
Ready Lane	2,222,282
General purpose lane	1,003,055
Calexico West, Imperial County	
SENTRI lane	1,810,340
General purpose lane	2,516,694
Otay Mesa, San Diego County	
SENTRI lane	1,831,119
Ready Lane	4,097,403
General purpose lane	1,793,742
San Ysidro, San Diego County	
SENTRI lane	4,664,964
Ready Lane	4,349,713
General purpose lane	4,687,290
Tecate, San Diego County	
General purpose lane	971,193

Source: U.S. Department of Transportation, Research and Innovative Technology Administration, Bureau of Transportation Statistics

Appendix 2: Median Statistics for Key Variables

In order to provide a better understanding of the statistical distribution of the key variables used in the Economic Impact model, the study also estimated their median values based on the data collected under the SANDAG Border Survey.

Median Border-Crossing Trip Spending

In general, the survey data indicates that median spending per trip ranges from \$50 to \$87, across travel modes, border counties, and north and southbound trips. The median crosser²⁸ living in Mexico spends less per trip than the median crosser living in the U.S. for trips that take place in San Diego County, but the opposite is true for trips that take place in Imperial County. In general, people crossing in Imperial County spend less per trip than people crossing in San Diego County and pedestrians spend less than people driving across the border. The weighted median expenditure per trip is displayed in the table below.

Table 40. Median Spending per Border Crossing Trip

Median Spending per Border Crossing Trip, Dollars	Imperial County	San Diego County
Pedestrians		
Crossers Living in Mexico	\$58	\$69
Crossers Living in the U.S.	\$50	\$84
Vehicles		
Crossers Living in Mexico	\$72	\$82
Crossers Living in the U.S.	\$69	\$87

Median Expenditures of Border-Crossing Travelers by Expenditure Category

The SANDAG Border Survey asked border-crossing travelers to break down their trip-related expenditures by broad expenditure categories. The categories considered included entertainment, gas, groceries, hotel, public transportation, restaurants, shopping and a category called “other” to capture expenditures not listed in the survey.

The data collected was analyzed using the place where the respondent reported to live, the county where the POE used to cross is located and the mode for crossing (i.e., pedestrian or vehicles). An analysis of the survey data shows that the median crosser living in Mexico has different expenditure patterns compared to the median crosser living in the U.S. regardless of the mode and the POE used to cross.²⁹ The median crosser living in Mexico has a high propensity to concentrate expenditures on shopping, while the median crosser living in the U.S.

²⁸ The median crosser is identified as the crosser that would have the same number of crossers in front of him/her and behind him/her if the total number of crossers were sorted (from higher to lower) by the amount of money they spend on a cross-border trip.

²⁹ The median was identified to be the relevant statistic for this variable since it represents a breakdown of the border-crossing trip expenditure variable, whose relevant statistic is the median (as described above).

diversifies expenditures across categories such as entertainment, groceries, restaurants and shopping regardless of the mode used to cross the border.

The median pedestrian living in Mexico has similar expenditure patterns regardless if the crossing takes place through San Diego or Imperial County POEs. In other words, the share of expenditures by category of the median pedestrian crosser living in Mexico that uses a POE in Imperial County is relatively similar to that of the median pedestrian crosser living in Mexico that uses San Diego POEs, even though crossers in San Diego County spend approximately \$11 more per trip. Pedestrian crossers living in the U.S. also have similar expenditure patterns for most categories, even though few categories (like entertainment, hotel, and public transportation) differ significantly across the San Diego and Imperial County regions. The median (weighted) expenditures by pedestrians during border-crossing trips is presented in the table below.

Table 41. Pedestrian Median Expenditures by Category

	Imperial County	San Diego County
Crossers living in Mexico	\$	\$
Entertainment	\$3	\$3
Gas	\$2	\$2
Groceries	\$10	\$10
Hotel	\$0	\$3
Other	\$1	\$2
Public Transportation	<\$1	\$3
Restaurants	\$5	\$7
Shopping	\$37	\$40
Total, all categories	\$58	\$69
Crossers living in the U.S.		
Entertainment	\$1	\$10
Gas	\$1	\$3
Groceries	\$16	\$16
Hotel	\$0	\$7
Other	\$4	\$7
Public Transportation	<\$1	\$6
Restaurants	\$13	\$16
Shopping	\$15	\$17
Total, all categories	\$50	\$84

As in the case of pedestrians, the median vehicle crosser living in Mexico has similar expenditure patterns regardless of the location of the crossing used to enter the U.S. even though crossers in San Diego County spend approximately \$10 more per trip. The percentages on the individual categories, however, show slightly more variation than those of pedestrians living in Mexico, but still concentrate heavily on shopping. Median crossers living in the U.S. diversify their expenditures more compared to median crossers living in Mexico, but the shares

of expenditures for categories such as gas, groceries and shopping are very similar regardless of the county used to cross. The median (weighted) expenditures by vehicle users during border-crossing trips is presented in the table below.

Table 42. Vehicle Users Median Expenditures by Category

	Imperial County	San Diego County
Crossers living in Mexico	\$	\$
Entertainment	\$5	\$3
Gas	\$7	\$8
Groceries	\$14	\$11
Hotel	\$0	\$2
Other	\$2	\$2
Public Transportation	\$0	\$0
Restaurants	\$7	\$6
Shopping	\$36	\$50
Total, all categories	\$72	\$82
Crossers living in the U.S.		
Entertainment	\$9	\$5
Gas	\$6	\$8
Groceries	\$11	\$15
Hotel	\$2	\$5
Other	\$10	\$11
Public Transportation	\$0	<\$1
Restaurants	\$10	\$19
Shopping	\$20	\$24
Total, all categories	\$69	\$87

Alternate Median Spending in Home Country

The median expenditure ranges from \$43 for pedestrians living in the U.S. and crossing through Imperial County POEs to \$81 for vehicle occupants living in Mexico and crossing through POEs in Imperial County.³⁰ In general, the median crosser living in Mexico has higher average expenditures in their home country than the median crosser living in the U.S. across modes when a border crossing trip is not taken. The exception is the median pedestrian crosser using San Diego POEs, since the median crosser living in the U.S. averages \$62 dollars of home expenditure when a border trip is not taken compared to \$58 for the median crosser living in Mexico. A possible explanation for this is that the expenditure categories include groceries, shopping and restaurants, which are more expensive in the U.S.

The median spending at home if a border trip is not taken is reported in Table 42.

³⁰ It is worth noting that the behavior of home consumption differs by mode and POE location of the forgone crossing.



Table 43. Median Spending at Home if Border Crossing Trip is Not Taken

Median Spending at Home if Border Trip is not taken, per Trip, Dollars	Imperial County	San Diego County
Pedestrians		
Crossers Living in Mexico	\$70	\$58
Crossers Living in the U.S.	\$43	\$62
Vehicles		
Crossers Living in Mexico	\$81	\$72
Crossers Living in the U.S.	\$53	\$49

Notice that in the majority of the cases the median expenditure at home if a border trip is not taken is smaller than the average spending for border crossing trips made. The exceptions are pedestrian crossers that live in Mexico and cross through Imperial County POEs and vehicle crossers that live in Mexico and cross through Imperial County, whose at-home median spending if a trip is not taken are higher than their median spending while on a cross-border trip. There could be several explanations to this result, including price differences between goods and services between the two sides of the border that belong to expenditures categories that are less likely to be deferred by this group of border-crossers when a border trip is not taken.

Median Expenditures by Expenditure Category If Trip is Not Taken

An analysis of the survey data shows that, in general, the median pedestrian crosser that decides not to take a border-crossing trip has a tendency to spend at home primarily on groceries and shopping, regardless of where the crosser lives or the county of crossing.³¹ For crossers living in the U.S. and crossing through San Diego County, a category of home expenditure that is also significant is restaurants. The median (weighted) expenditures at home by pedestrians in case a border-crossing trip is not taken are presented in Table 43.

³¹ As in the case of expenditures of border-crossing trips by category, the relevant statistic for this variable is the median since it consists of the breakdown of another key variable identified by its median (i.e., alternate spending in home country).



Table 44. Median Expenditures at Home by Pedestrians if Border Crossing Trip is Not Taken

	Imperial County	San Diego County
Crossers living in Mexico		
Entertainment	\$3	\$1
Gas	\$3	\$1
Groceries	\$11	\$15
Hotel	\$0	\$4
Other	\$2	\$8
Public Transportation	\$0	\$6
Restaurants	\$4	\$6
Shopping	\$48	\$18
Total, all categories	\$70	\$58
Crossers living in the U.S.		
Entertainment	\$0	\$7
Gas	\$0	\$3
Groceries	\$15	\$18
Hotel	\$0	\$0
Other	\$3	\$0
Public Transportation	\$0	\$1
Restaurants	\$3	\$22
Shopping	\$21	\$11
Total, all categories	\$43	\$62

As in the case of the median pedestrian, the median vehicle crosser that decides not to take a border-crossing trip has a tendency to spend at home primarily on groceries and shopping, regardless of where the crosser lives or the county of crossing. However, other categories that also represent significant home expenditure regardless of where the crosser lives or the POE used are gas and restaurants. The median (weighted) expenditures at home by vehicle crossers in case a border-crossing trip is not taken are presented in Table 44.

Table 45. Median Expenditures at Home by Vehicle Users if Border Crossing Trip is Not Taken

	Imperial County	San Diego County
Crossers living in Mexico		
Entertainment	\$11	\$3
Gas	\$9	\$9
Groceries	\$18	\$11
Hotel	\$1	\$1
Other	\$3	\$0
Public Transportation	\$0	\$0
Restaurants	\$10	\$9
Shopping	\$30	\$39
Total, all categories	\$81	\$72
Crossers living in the U.S.		
Entertainment	\$2	\$3
Gas	\$4	\$7
Groceries	\$9	\$13
Hotel	\$0	\$1
Other	\$10	\$1
Public Transportation	\$0	\$0
Restaurants	\$9	\$11
Shopping	\$18	\$14
Total, all categories	\$53	\$49

Median Wages

The median monthly wage for a pedestrian crossing the border for work is \$758 in San Diego County and \$604 in Imperial County. For people driving across the border, the weighted median for Imperial County is around \$1,700 while the weighted median for San Diego County is \$1,126.

Table 46. Median Monthly Wage by Mode and County of Crossing

Weighted Median Monthly Wage/Salary, Dollars	Imperial County POEs	San Diego County POEs
Pedestrians crossing for work	\$604	\$758
People crossing in vehicles for work	\$1,693	\$1,126

Appendix 3: Origins and Destinations of Crossborder Trips

The data collected on origin or destination of border crossing trip is presented in this appendix with corresponding maps and graphs. As stated earlier in the report, the results are presented by country where the trip began or ended (i.e., U.S. or Mexico) and by component of the trip (i.e., origin or destination). The survey data for this variable are reflective of respondents crossing via privately-owned vehicle (POV) only.

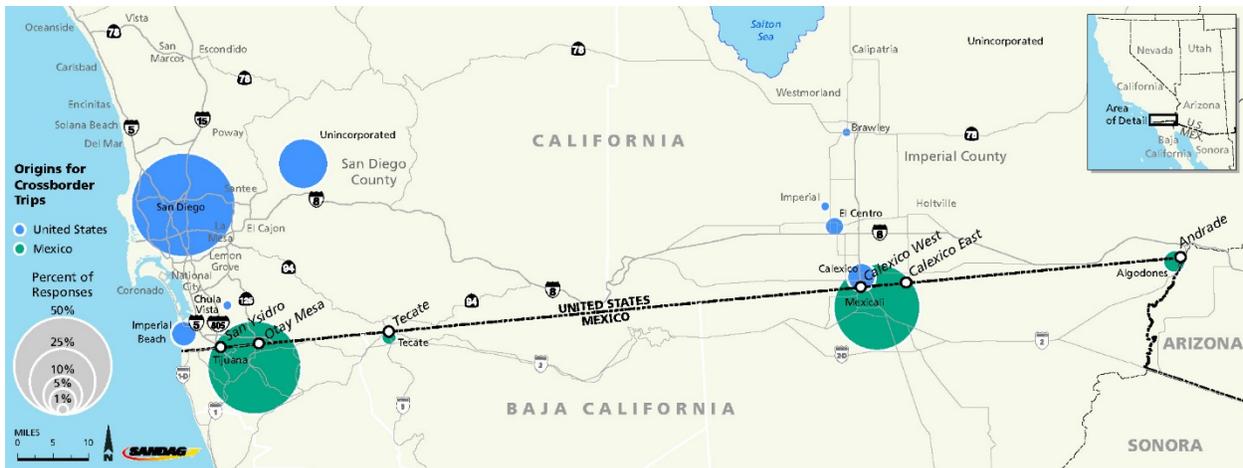
Symbols shown in the maps below are meant to show the overall proportion of trip origins or destinations by jurisdiction and are not a precise representation of actual origin or destination locations.

Relevant zones not shown in the graphs below were either not identified as origins or destinations by survey respondents or had proportionate responses of less than 1 percent of the data set. Excluded from the graphs presented below are the following zones and cities in the U.S. for:

- 1) Origins: Calipatria, Carlsbad, Coronado, Del Mar, Escondido, Holtville, La Mesa, Lemon Grove, National City, Oceanside, Poway, Santee, Solana Beach, Unincorporated Imperial County, Vista, Westmorland, and the “external zone” that captures other areas in the U.S. outside of these cities.
- 2) Destinations: Calipatria, Carlsbad, Coronado, Del Mar, Escondido, Holtville, Imperial Beach, La Mesa, Oceanside, Poway, Santee, Vista, Westmorland and the “external zone” that captures other areas in the U.S. outside of these cities.

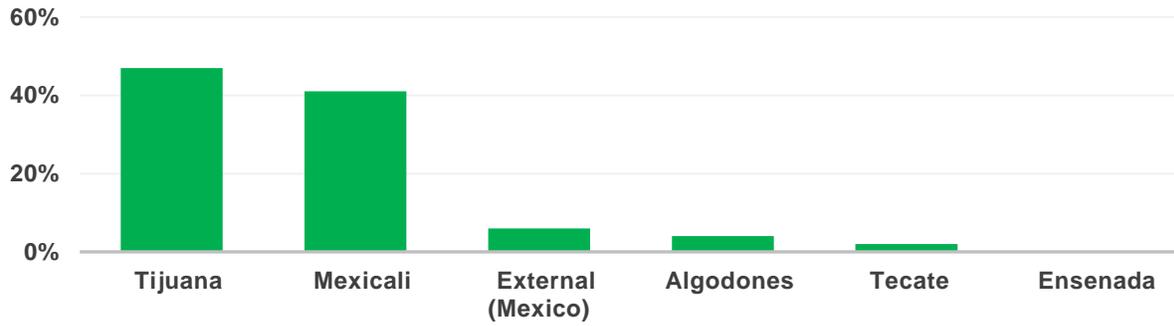
Crossborder Trip Origins

Figure 10. Crossborder Trip Origins, POV Crossers



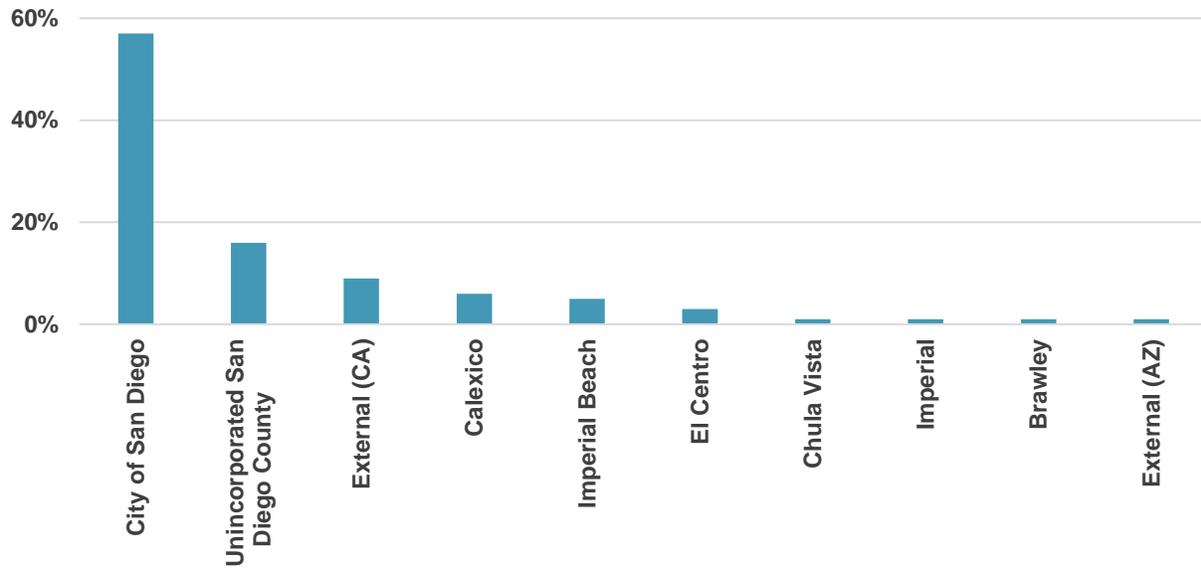
Source: SANDAG Border Survey, 2016

Figure 11. Share of Origins in Mexico, POV Crossers



Source: SANDAG Border Survey, 2016

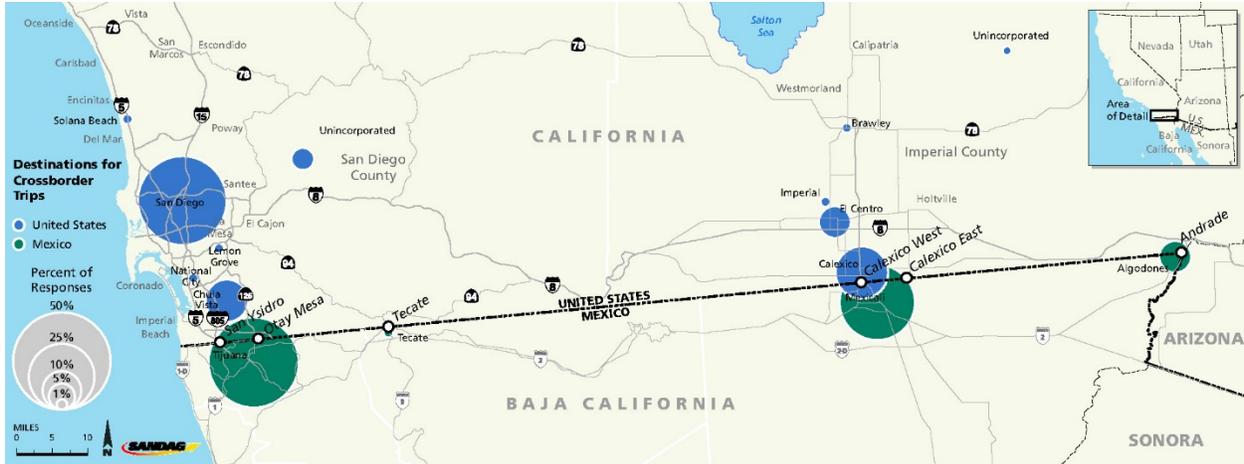
Figure 12. Share of Origins in the U.S., POV Crossers



Source: SANDAG Border Survey, 2016

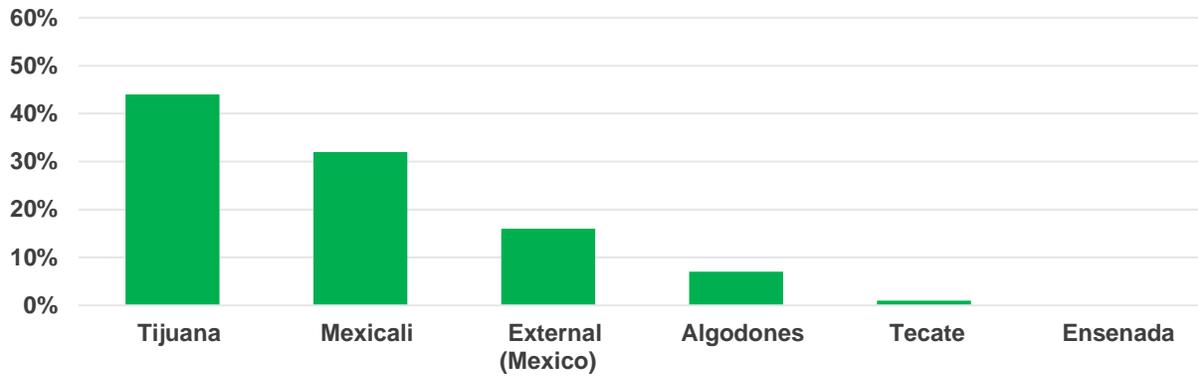
Crossborder Trip Destinations

Figure 13. Crossborder Trip Destinations, POV Crossers



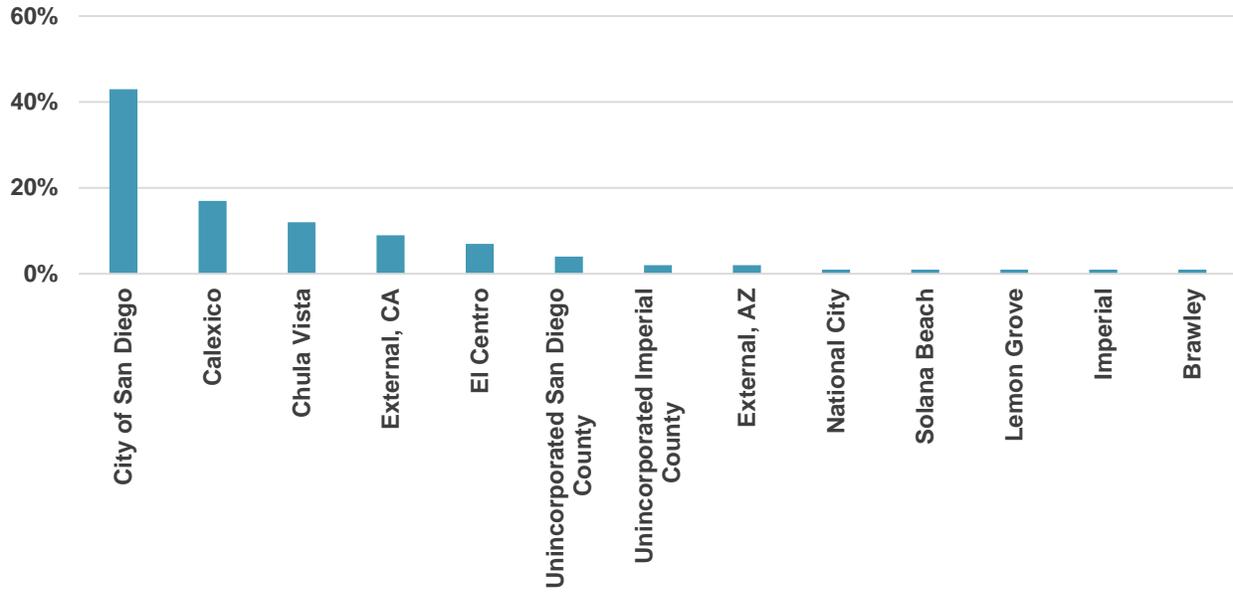
Source: SANDAG Border Survey, 2016

Figure 14. Share of Destinations in Mexico, POV Crossers



Source: SANDAG Border Survey, 2016

Figure 15. Share of Destinations in the U.S., POV Crossers



Source: SANDAG Border Survey, 2016

Appendix 4: Graphs of Total Border Crossing Times Collected in the Field

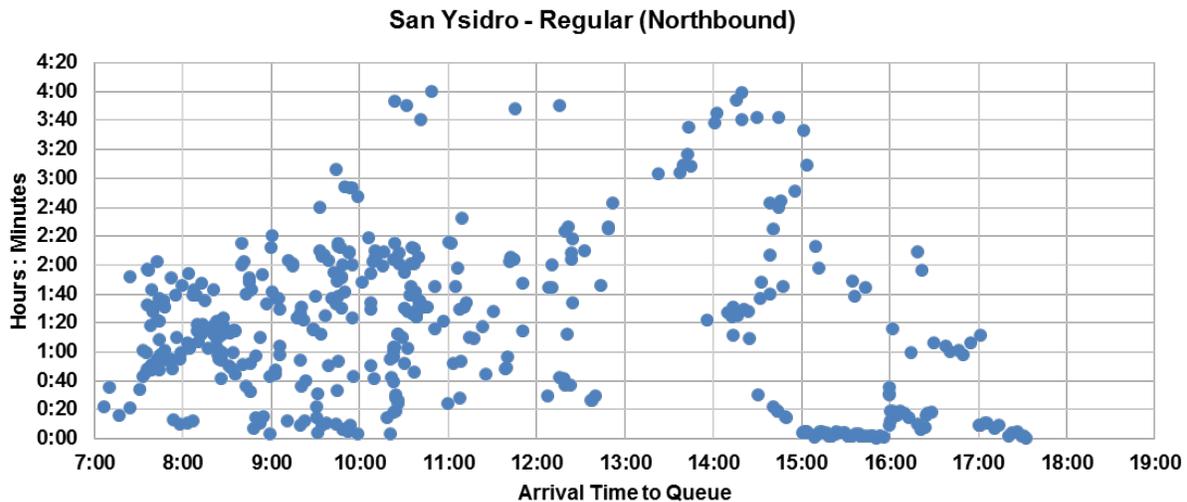
The data collected on total border crossing times is presented in this appendix by vehicle type, POE and lane type. Based on discussions with CBP personnel, the data to produce the summary wait times excludes those observations above 4 hours of total border crossing time. The graphs presented below exclude these “outliers.”

Notice that in the graphs the blue dots represent actual observations and that the graphs aggregate the data from all days when border-crossing times were collected. As a result, a particular time of arrival to the queue may be associated with multiple observations for border-crossing time (each one of them representing a different date of collection). Since the dates when data was collected include different seasons of the year, this aggregation also explains potential variances observed in border-crossing times for a particular time of arrival to the queue.

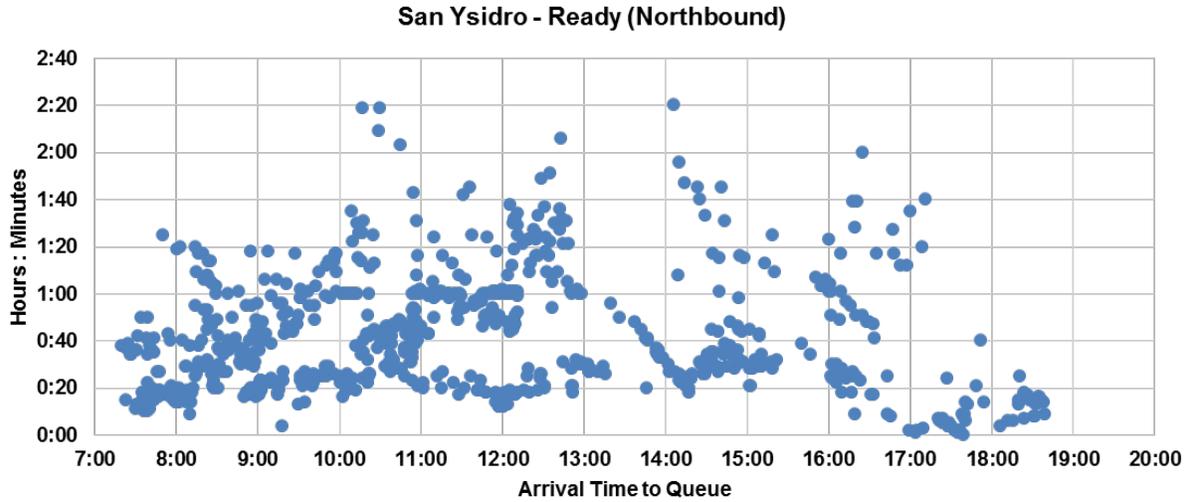
Passenger Vehicles

The graphs for the total border crossing times of passenger vehicles are presented by lane type (southbound flows are treated as a lane type) for each POE in the following order: San Ysidro, Otay Mesa, Tecate, Calexico West, Calexico East and Andrade.

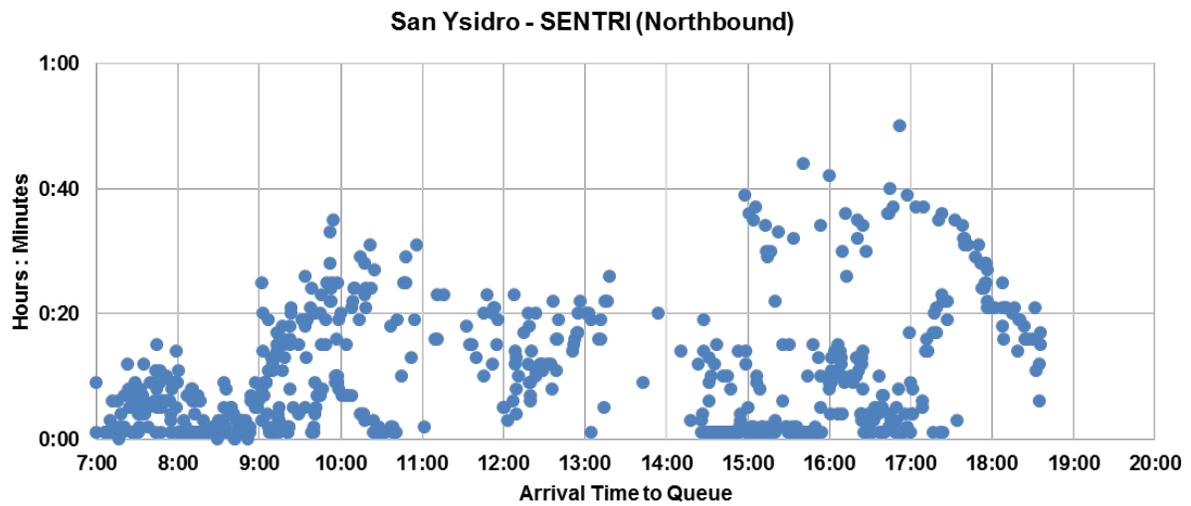
SAN YSIDRO POE



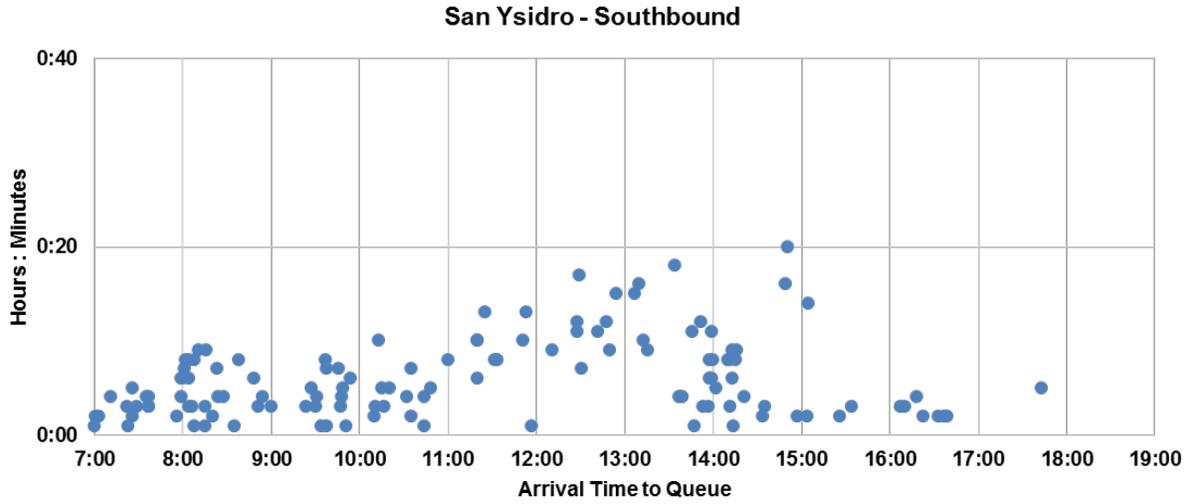
Note: Data collected on July 1, 4, 5 and October 16 and 17, 2016



Note: Data collected on July 1, 4, 5 and October 16 and 17, 2016

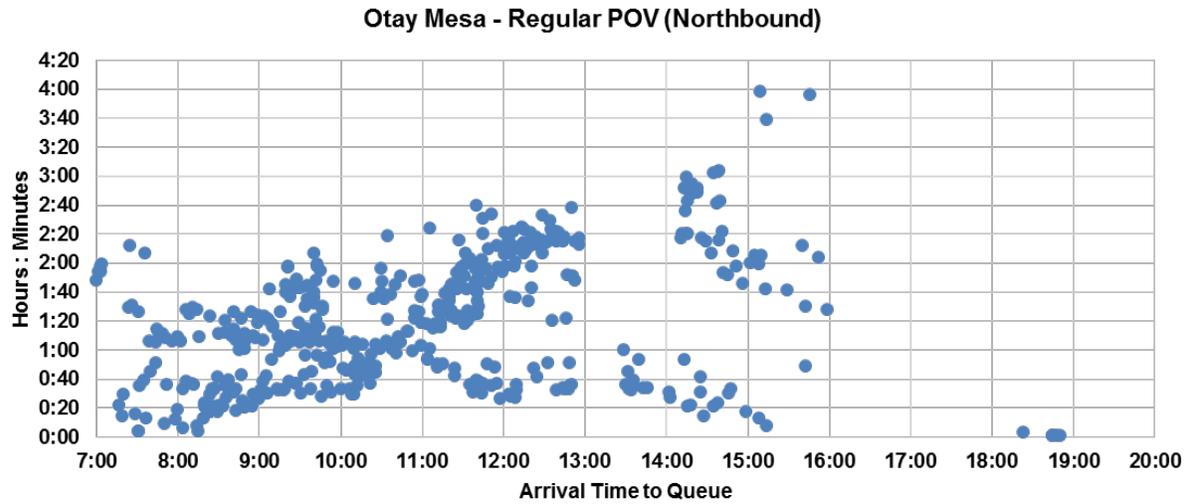


Note: Data collected on July 1, 4, 5 and October 16 and 17, 2016



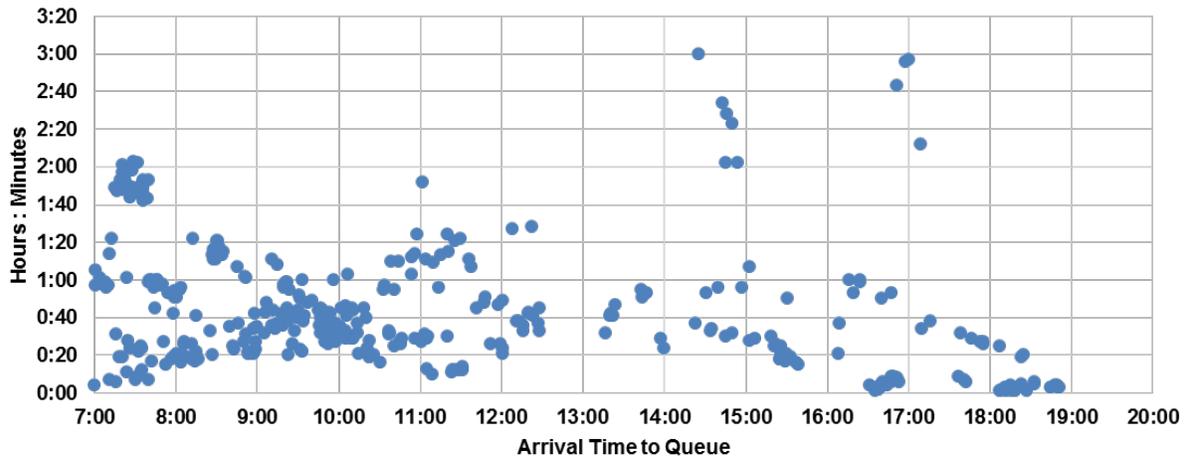
Note: Data collected on July 4, 5 and October 16 and 17, 2016

OTAY MESA POE



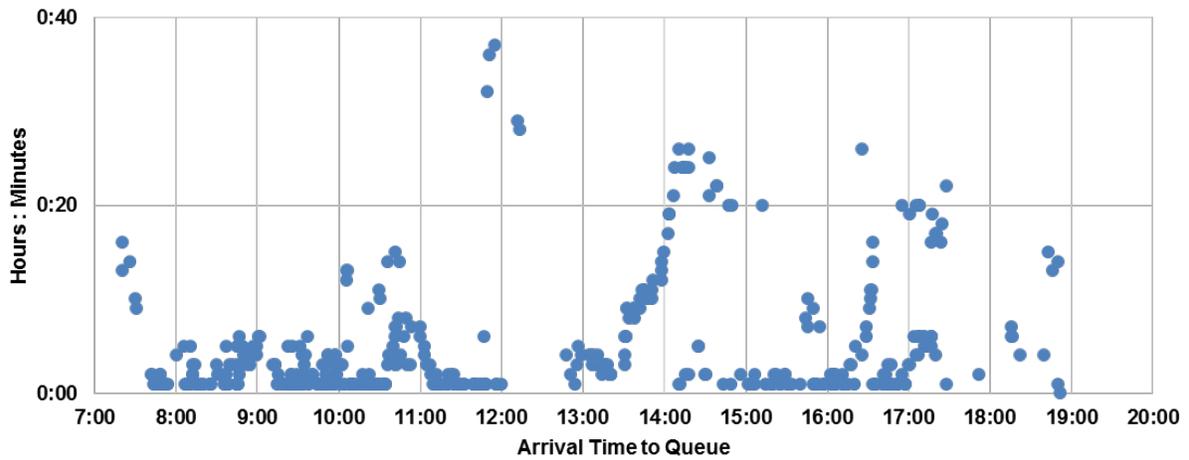
Note: Data collected on July 1, 4, 5 and October 16 and 17, 2016

Otay Mesa - Ready (Northbound)

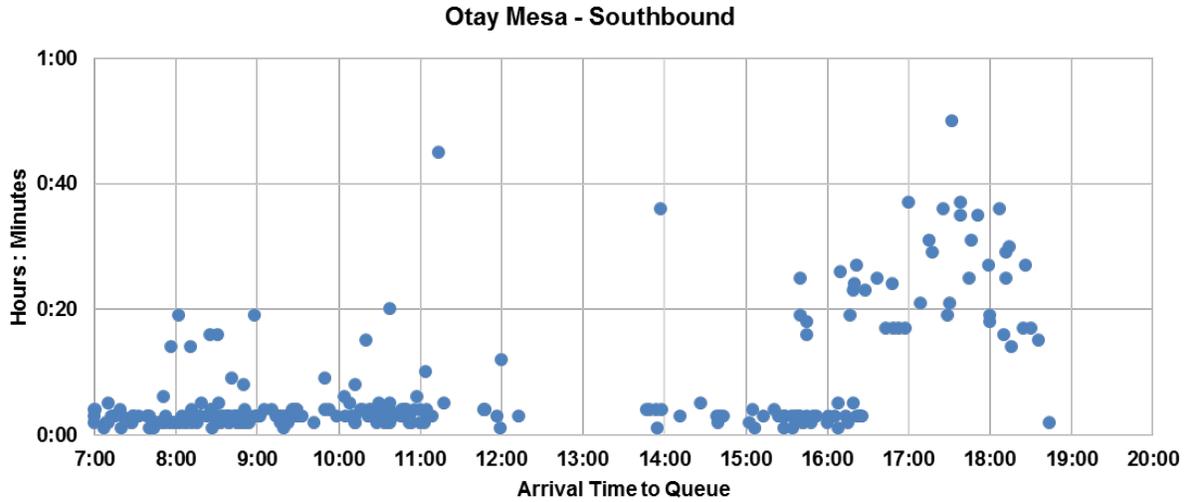


Note: Data collected on July 1, 4, 5 and October 16 and 17, 2016

Otay Mesa - SENTRI (Northbound)

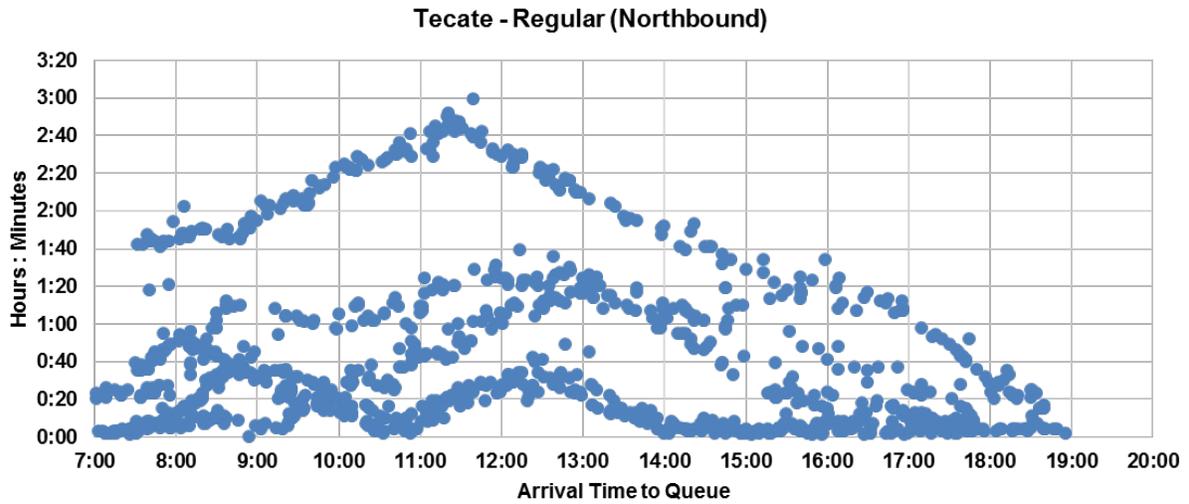


Note: Data collected on July 1, 4, 5 and October 16 and 17, 2016

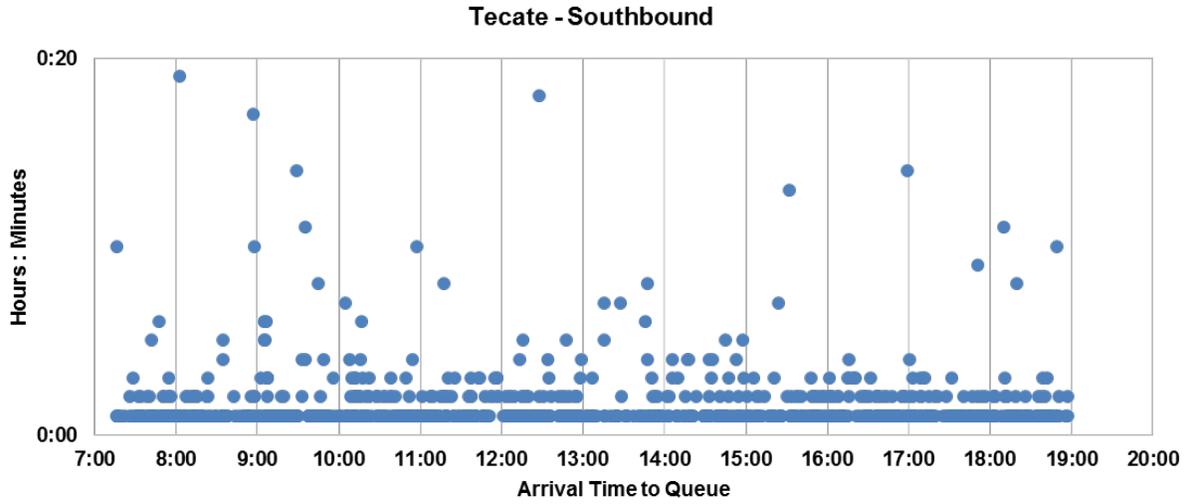


Note: Data collected on July 1, 4, 5 and October 16 and 17, 2016

TECATE POE

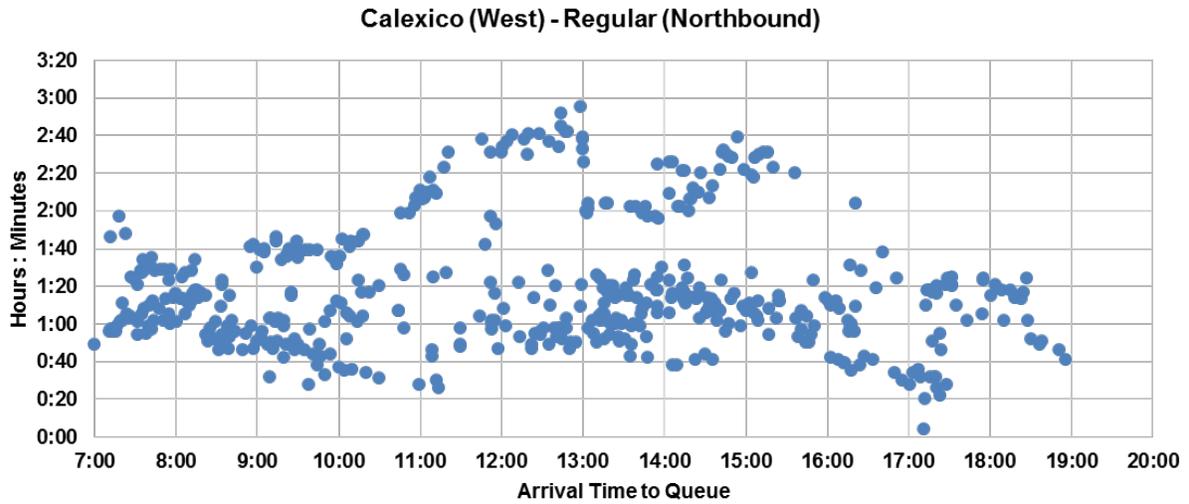


Note: Data collected on July 1, 4, 5 and October 16 and 17, 2016



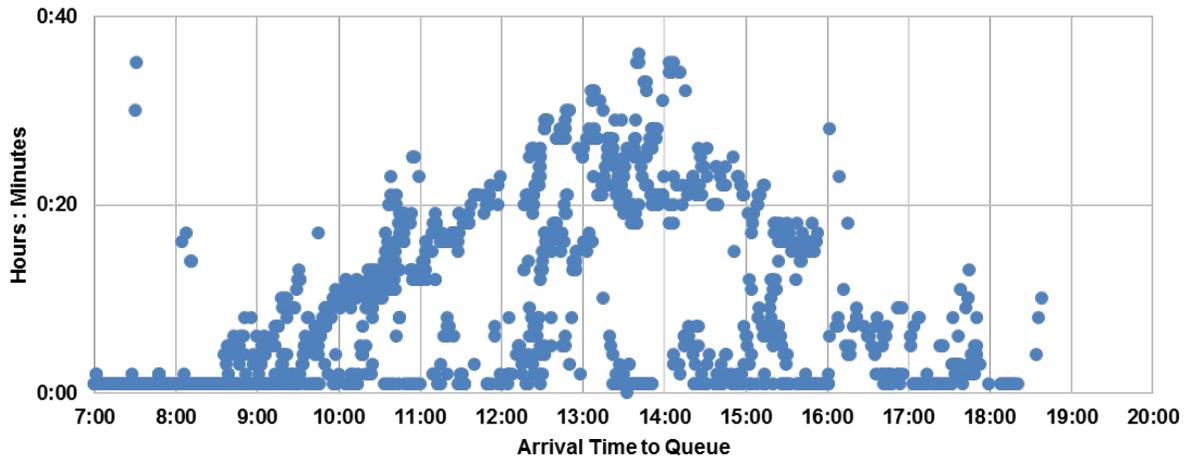
Note: Data collected on July 1, 4, 5 and October 16 and 17, 2016

CALEXICO WEST POE



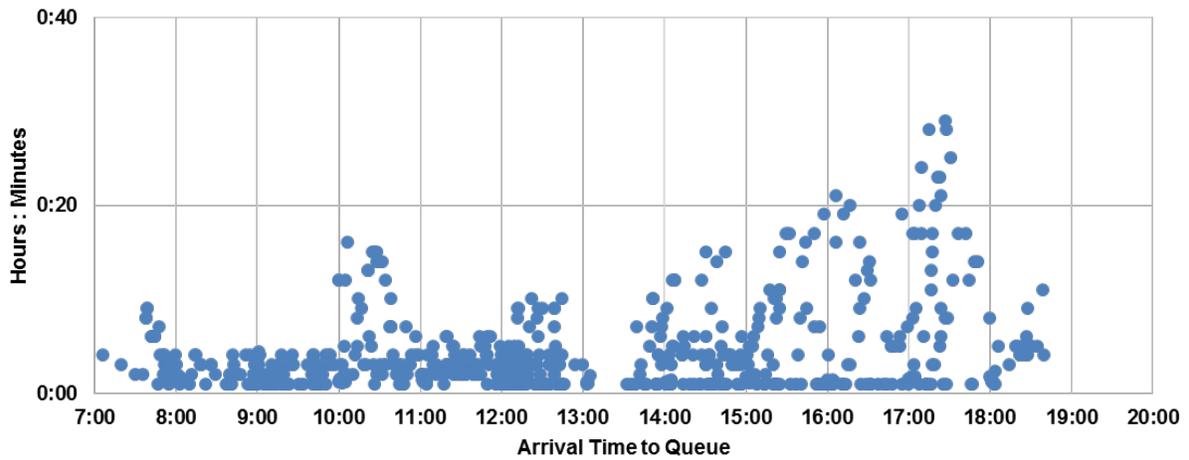
Note: Data collected on July 1, 4, 5 and October 16 and 17, 2016

Calexico (West) - SENTRI (Northbound)



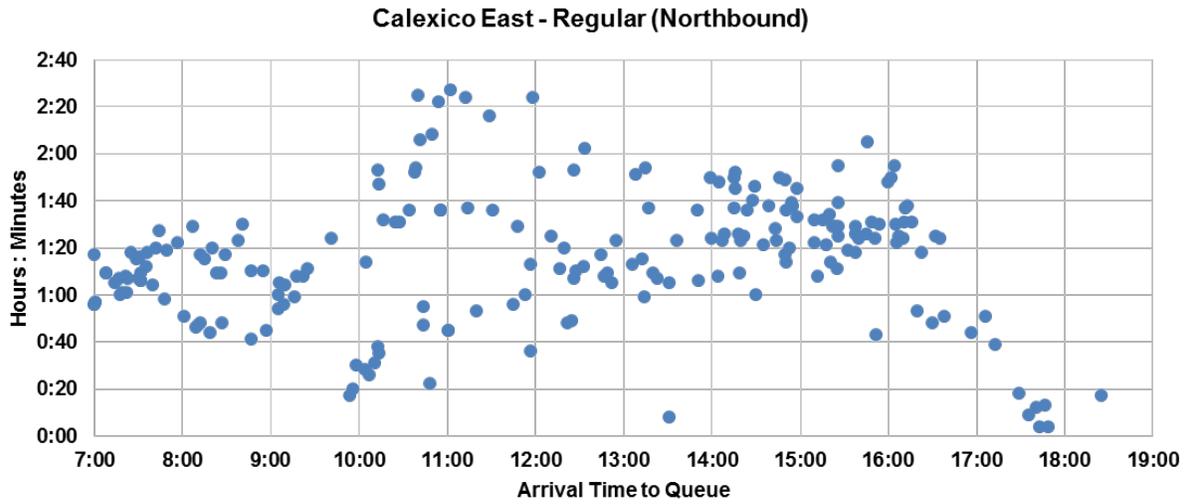
Note: Data collected on July 1, 4, 5 and October 16 and 17, 2016

Calexico (West) - Southbound

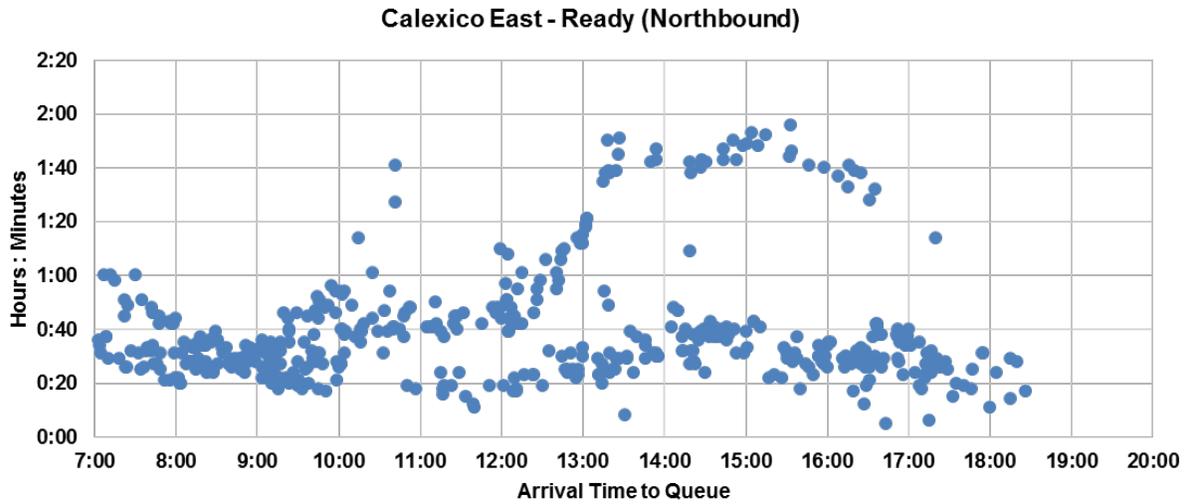


Note: Data collected on July 1, 4, 5 and October 16 and 17, 2016

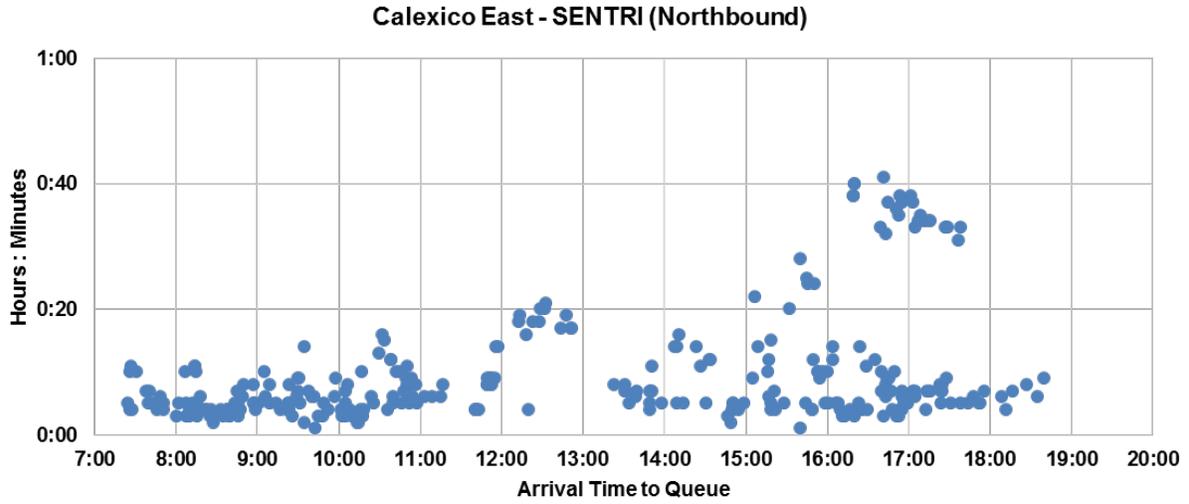
CALEXICO EAST POE



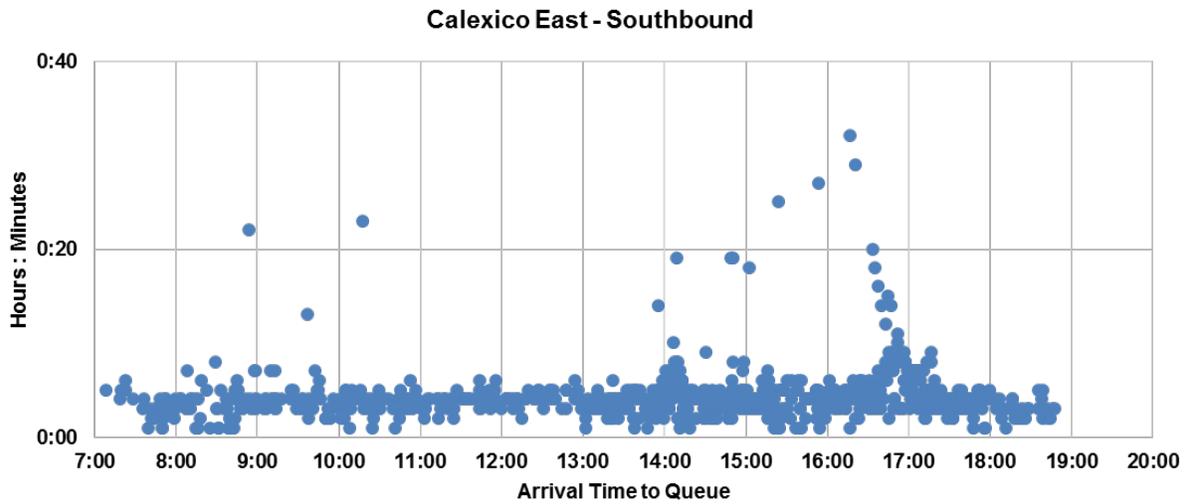
Note: Data collected on July 1, 4, 5 and October 16 and 17, 2016



Note: Data collected on July 1, 4, 5 and October 16 and 17, 2016

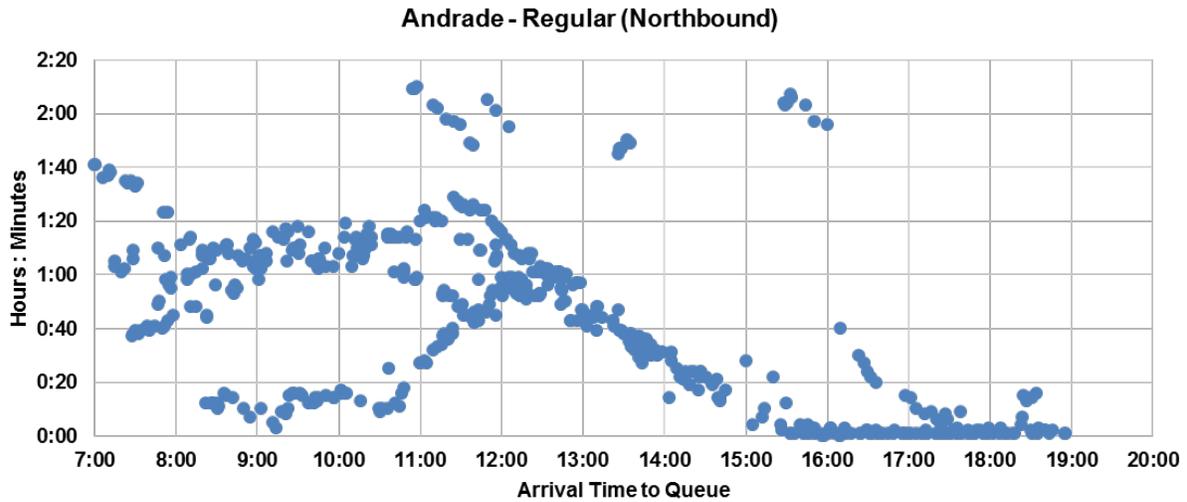


Note: Data collected on July 1, 4, 5 and October 16 and 17, 2016

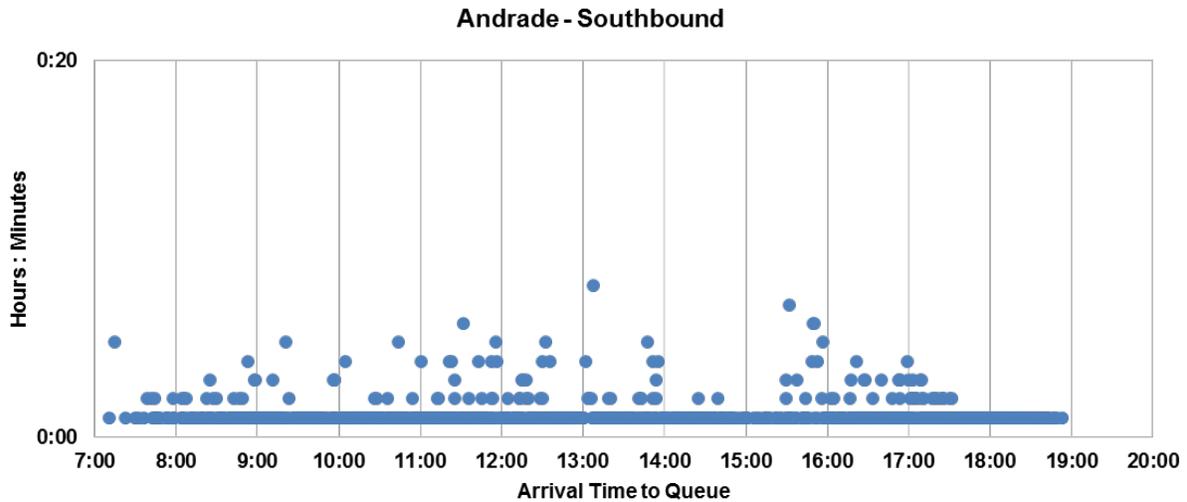


Note: Data collected on July 1, 4, 5 and October 16 and 17, 2016

ANDRADE POE



Note: Data collected on July 1, 4, 5 and October 16 and 17, 2016

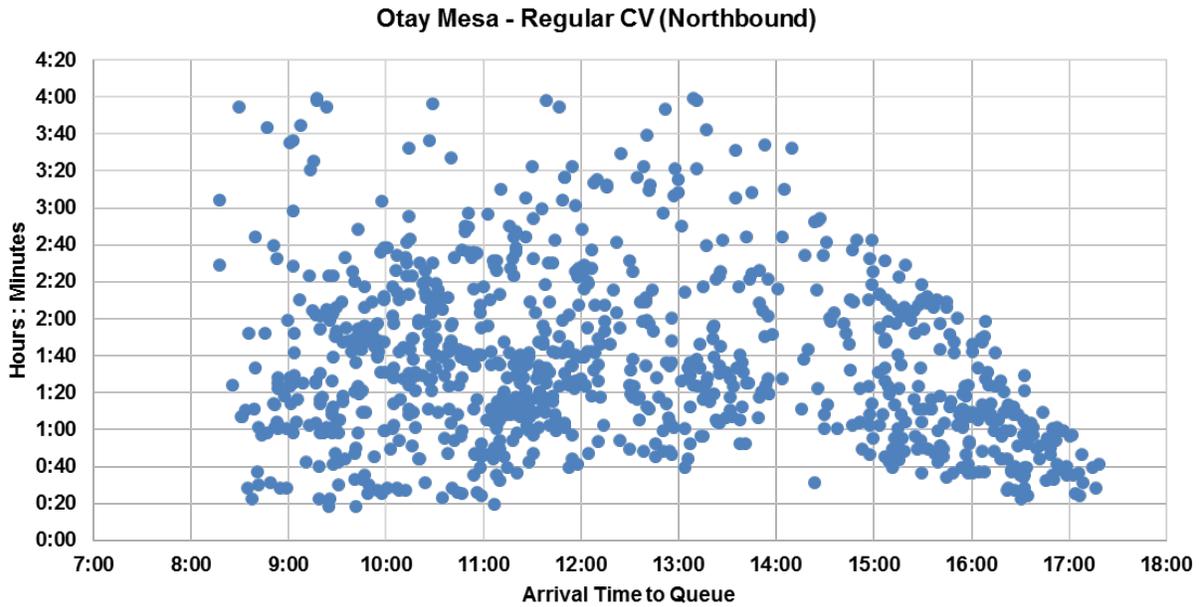


Note: Data collected on July 1, 4, 5 and October 16 and 17, 2016

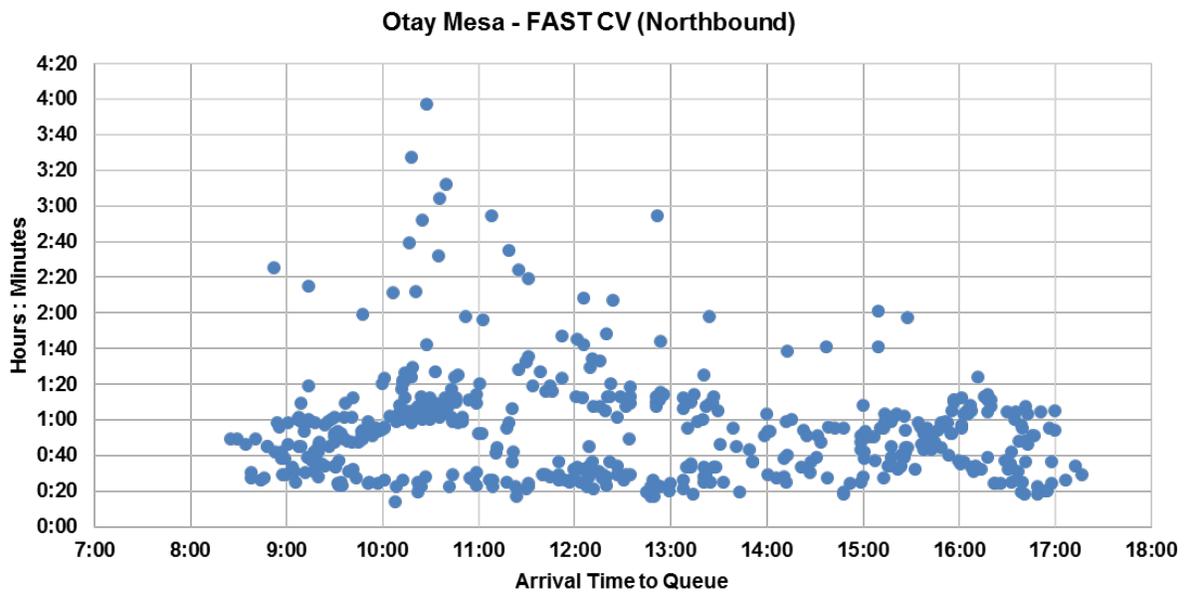
Commercial Vehicles

The graphs for the total border crossing times of commercial vehicles are presented by lane type (southbound flows are treated as a lane type) for each POE in the following order: Otay Mesa, Tecate, Calexico East and Andrade.

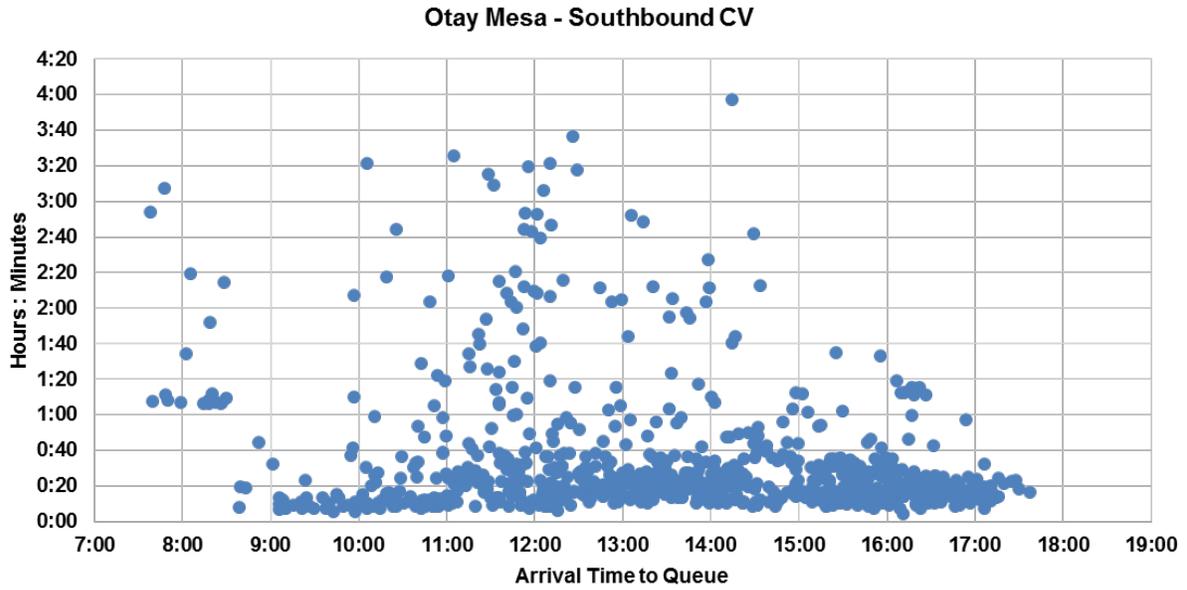
OTAY MESA POE



Note: Data collected on February 10, 13, 14 and March 8 and 9, 2017

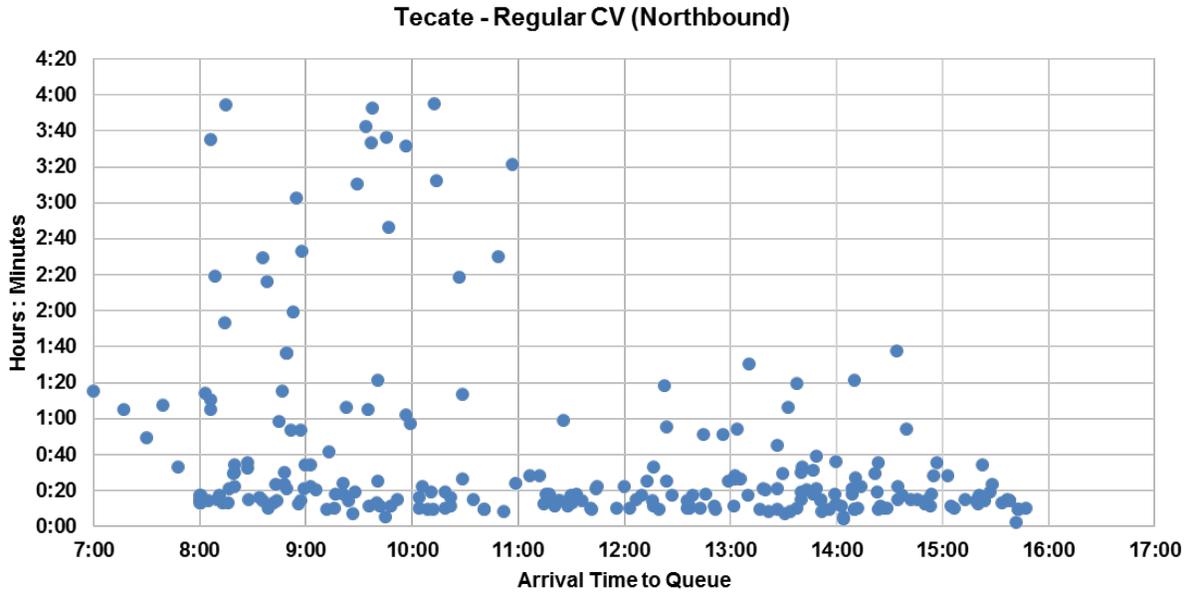


Note: Data collected on February 10, 13, 14 and March 8 and 9, 2017



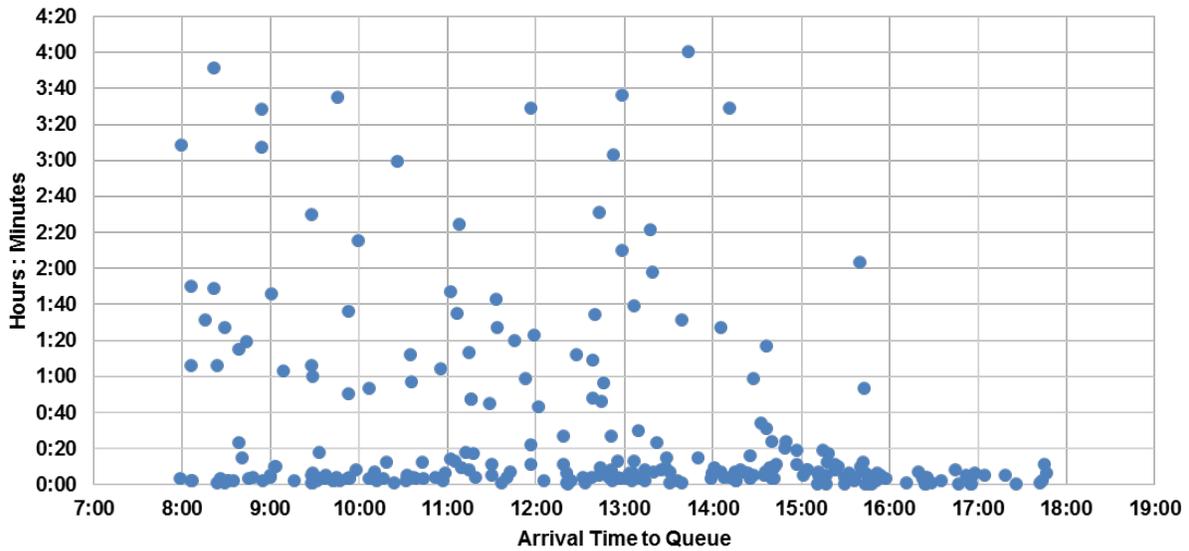
Note: Data collected on February 10, 13, 14 and March 8 and 9, 2017

TECATE POE



Note: Data collected on October 12, 13 and 14, 2016 and March 1 and 2, 2017

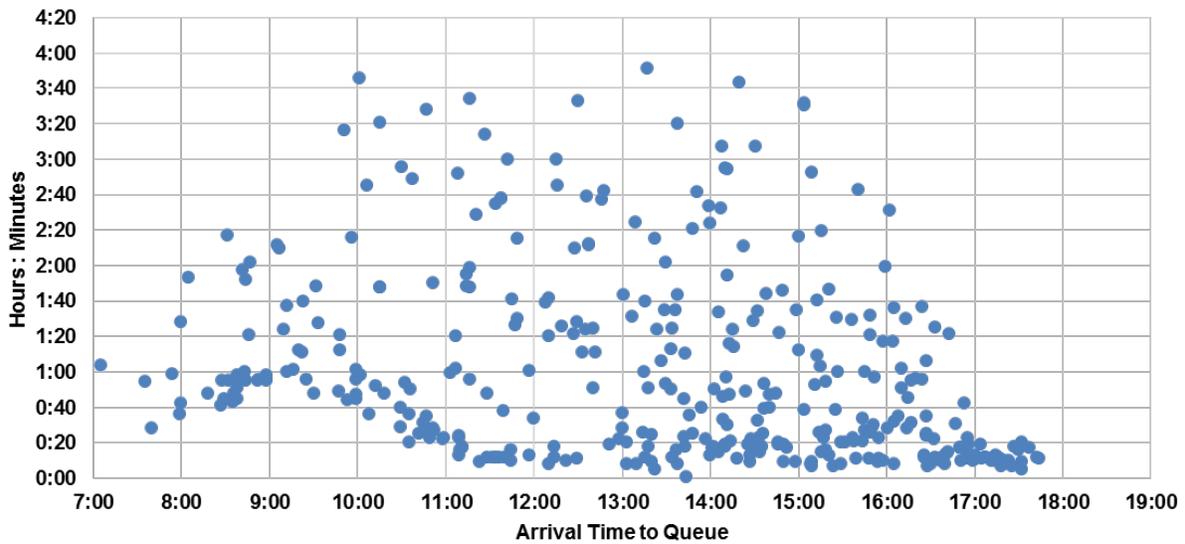
Tecate - Southbound CV



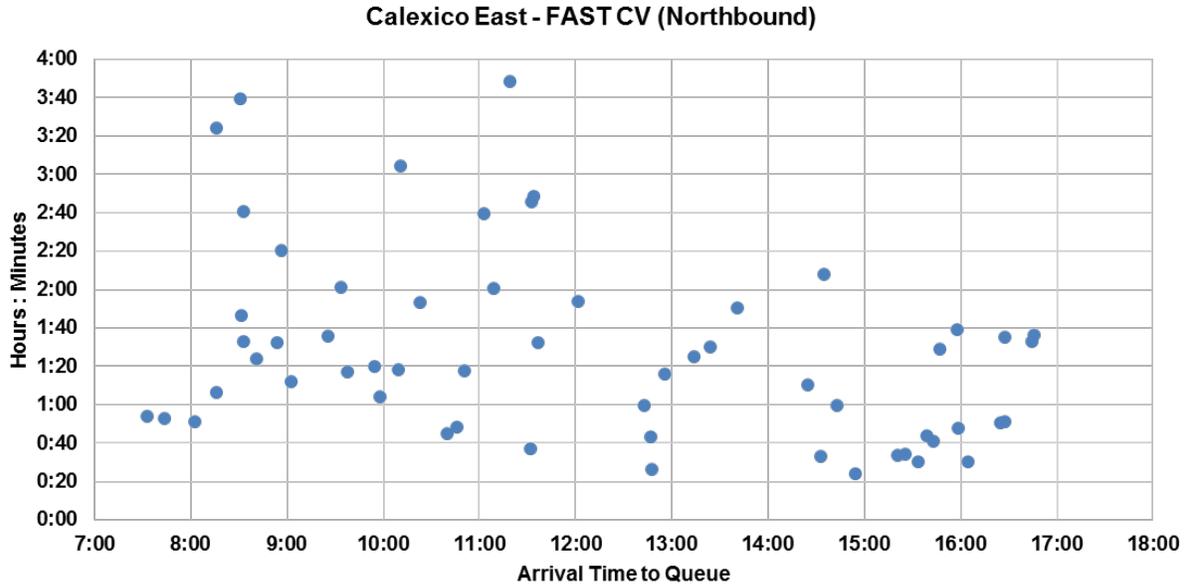
Note: Data collected on October 12, 13 and 14, 2016 and March 1 and 2, 2017

CALEXICO EAST POE

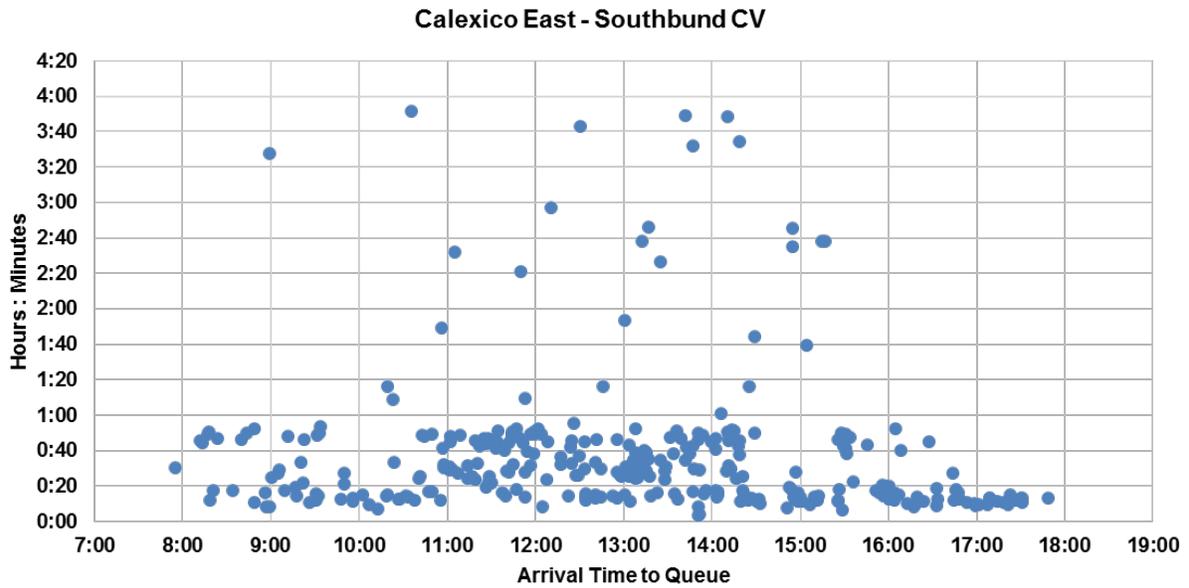
Calexico East - Regular CV (Northbound)



Note: Data collected on October 19, 20 and 21, 2016 and March 1 and 2, 2017



Note: Data collected on March 1 and 2, 2017



Note: Data collected on October 19, 20 and 21, 2016 and March 1 and 2, 2017