

# Assessment of Existing "Gaps" on Border Data (including Wait Times)

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

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## 1. Introduction

The California – Baja California border region is one of the most important and dynamic economic zones in North America. However, demand is posed 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 at California-Baja California ports of entry (POE). These delays and unreliability at the border have the potential to reduce the region’s economic competitiveness and attractiveness to business, which can translate into lower levels of economic activity and growth.

In 2006, SANDAG and Caltrans conducted studies that showed how border delays cause significant reductions in economic output and employment. These studies 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 and Caltrans conducted an economic delay study for the Imperial County border crossings. Much has changed since these earlier studies – the local economy has rebounded from the Great Recession and there are new emerging industry clusters that depend on cross-border trade.

As a result, SANDAG has commissioned the HDR team to conduct the study on Economic and Air Quality/Climate Impacts of Delays at the Border. The current document is part of this effort, and focuses on identifying the “data gaps” on key inputs identified by the team as necessary to conduct this study.

## 2. Methodology

The HDR team has worked extensively in the California – Baja California border region helping SANDAG, SCAG, ICTC, Caltrans, and other agencies understand border-crossing behavior of private and commercial vehicles and the relevance of the border to the local economies. Therefore, we are well aware of the different efforts undertaken to estimate not only wait times at land Ports of Entry (POEs) in the region but also other border-crossing characteristics such as origins and destinations of trips, purpose, cargo type and frequency of crossing.

Some of these efforts have been led directly by members of the HDR team. Therefore, to create this document, we began by identifying the data required to perform the tasks outlined in the study. After doing that, we combined the information gathered through a literature review with our knowledge of border projects to develop a matrix (see Appendix, Figure 1) that lists available data collected through recent studies<sup>1</sup> and compares it with data needed to conduct the assessment of economic and air quality impacts/climate of delays at the border for the six land POEs in the California – Baja California region.<sup>2</sup> In addition, a table with the sample sizes for the different data collection efforts found through the literature review is also developed (see Appendix, Figure 2). Areas where data needed to conduct this study is not available are identified as “data gaps,” which need to be filled out as part of the data collection task of the current study.

The primary data needed to conduct the assessment of economic and air quality/climate impacts of delays at the border is divided into four categories: (i) economic information, (ii) emissions information, (iii) border-crossing wait time information; and, (iv) traffic and volume data. The available data and the “gaps” for each one of these categories are explained in the following sections of this document.

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<sup>1</sup> Only primary data collection efforts are listed and analyzed, since they collect data that resembles more the data needed for this study.

<sup>2</sup> The Cross Border Xpress is a new hybrid POE that connects Otay Mesa in the San Diego region with the Tijuana International Airport via a tolled pedestrian bridge, which opened in December 2015.

### 3. Economic Information

The economic information identified by the HDR team as key to conduct the analysis of Economic Impacts of Delays at the Border consists of Origin-Destination, trip purpose, crossing frequency, trip-related expenditure, productivity loss due to delays, wait time thresholds to cancel binational trips, mode switch and willingness to pay for a faster border-crossing.

Available sources for economic information include the Crossborder Survey conducted for SANDAG in 2011, two surveys performed for SANDAG in late 2011 and early 2012 (General Public Survey and Company Survey) and two surveys conducted as part of SCAG's Goods Movement Border Crossing Study and Analysis, Phase 1 (conducted in 2011) and Phase 2 (conducted in 2015).

#### A. Crossborder Survey, 2011

The Crossborder Survey of 2011 was conducted at the San Ysidro, Otay Mesa and Tecate POEs in three main waves (one for each POE) between December 8, 2010 and April 18, 2011. The target population consisted of Baja California residents traveling northbound (crossing into the U.S.) with a destination located within San Diego County. Moreover, the modes captured were automobiles, motorcycles, bicycles, pedestrians and bus/public transportation. Participants were screened to ensure these appropriate characteristics were present before continuing with the interview.

The survey was divided into two parts. Part 1 recorded origin-destination information for the trip being taken for the modes mentioned above. Respondents were asked to participate in a follow-up interview (Part 2) that consisted of filling-out a travel diary with all the destinations they traveled to while in the U.S. during the day Part 1 of the interview was completed.

Data were collected only during weekdays between 5:30 AM and 6:00 PM. The sampling methodology used was clustered sampling based on POE, mode, time of day, and border-crossing procedure (SENTRI<sup>3</sup> vs. Non-SENTRI). Every n<sup>th</sup> border-crosser that met these requirements was asked to participate in the survey.

The sample collected consists of 7,371 records for Part 1 of the survey and 1,517 records for Part 2. The vast majority of the responses correspond to autos and pedestrians.

The variables captured in Part 1 of the survey include:

- Trip Origin (at colonia level when origin is Tijuana or Tecate);
- Main Destination (area / city within San Diego County);
- Perceived time to reach POE from origin of the trip;

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<sup>3</sup> Secure Electronic Network for Travelers Rapid Inspection. The SENTRI program provides expedited CBP processing for preapproved, low-risk travelers using their personal vehicle. Travelers must apply to this program, and once approved are issued a Radio Frequency Identification (RFID) card that will identify their record and status in the CBP database on arrival at the POE.

- Trip purpose (for trip when part 1 of the survey took place);
- Crossing frequency;
- Socioeconomic characteristics (employment status, work location, household size, employment in household, vehicles in household);
- Transportation mode (auto, motorcycle, bicycle, pedestrian, bus/public transport);
- Vehicle type (for autos only);
- Vehicle occupancy (for autos only); and
- SENTRI / standard lane.

The variables captured in Part 2 of the survey include:

- Employment status;
- Income range;
- For every place visited during recorded trip: Name & type of place, Purpose of visit/trip to that place, Address, Closest intersection / reference point, City, Arrival time to place, Mode used for trip, Vehicle occupancy during trip, Departure time from place;
- Returning time to Mexico; and
- POE used to return to Mexico.

The Crossborder Survey provides a good level of detail on the origin of the northbound trips by recording information at the "colonia" level. Similarly, the survey records the destination in San Diego County at an adequate level of disaggregation (city level). More importantly, for each response the survey captured the trip purpose associated to the specific origin-destination, allowing a disaggregation of origin-destination pair volumes into trip purposes. Finally, the survey also collected frequency of crossing.

### **B. General Public Survey, 2012**

The General Public Survey of 2012 was conducted at the San Ysidro and Otay Mesa POEs between November 2011 and March 2012. The target population consisted of travelers going northbound, crossing from Mexico into the U.S. The survey was conducted in two separate exercises, one for passenger vehicles and pedestrians and the other for commercial vehicles.

#### **PASSENGER VEHICLES AND PEDESTRIANS**

The passenger vehicle and pedestrian component of the survey consisted of questions about origin-destination for the current trip (including trip purpose) as well as a stated-preference section. The stated-preference section was intended to capture the willingness-to-pay attitudes toward the construction of a new POE and accompanying toll road featuring reduced wait times. To do this, eight different scenarios were presented to each interviewee, and in each scenario they were asked to choose between paying a toll or waiting more at the border-crossing. Two different categories of scenarios were used in the survey, one to collect responses related to the

value of time (VOT) assigned by travelers and the other to capture information on the value of reliability (VOR). The general characteristics of each experiment were as follows:

- VOT scenarios varied by wait time before reaching border crossing without toll, toll rate and wait time before reaching border crossing with toll; and
- VOR scenarios varied by average wait time to cross without toll, amount of further delays without toll, toll rate and average wait time and maximum amount of further delays with toll.

A split-sample approach was used, where approximately half of the participants received the VOT version of the questionnaire, whereas the remainder received a survey in which the stated preference experiments focused on VOR. The values tested in the stated preference experiments varied by POE, type of crossing (broken down into SENTRI or non-SENTRI), direction (northbound or southbound), and mode (automobile or pedestrian). Additionally, within each category of scenarios there were two variations of the stated preference experiments (white or blue) which correspond to different values of wait time and toll rates being tested.

A total of 1,605 responses were collected, with the majority of them (1,437) corresponding to passenger vehicles.

The information collected in the Origin-Destination component of the survey includes the following:

- Trip Origin (at the city & colonia level);
- Trip Destination (place, city, intersection & landmark);
- Reason for POE choice;
- Perceived travel time from origin to border queue;
- Perception of traffic congestion at border during this trip; and
- Anticipated wait time to cross-border.

The variables collected in the Stated-Preference component of the survey include:

- Response to experiments (for value of time or reliability) for expedited border-crossing;
- Preferred payment type or reason for not willing to pay toll;
- Additional trips anticipated under 15- and 30-minute reduction of border-crossing time;
- Household characteristics, including household income range; and
- License plate origin.

## COMMERCIAL VEHICLES

The truck component of the survey was collected only in the northbound travel direction at the Otay Mesa POE and consisted of questions about origin-destination for the current trip and a stated-preference section. As in the case of the passenger vehicle and pedestrian survey, the stated-preference section for commercial vehicles was intended to capture the willingness-to-pay attitudes toward the construction of a new POE and accompanying toll road featuring reduced wait times. To do this, eight different scenarios were presented to each interviewee, and in each scenario truck drivers were asked to choose between paying a toll or waiting more at the border-crossing. The stated preference questions were asked only if the truck driver responded that he/she was in charge of making the decision about which POE to use when crossing the border. As in the case of passenger vehicles and pedestrians, two different categories of scenarios were used in the survey, one to collect responses related to the value of time (VOT) assigned by drivers and the other to capture information on the value of reliability (VOR). The general characteristics for each experiment are the same as those described for the passenger vehicle and pedestrian survey.

As in the previous case, a split-sample approach was used, where approximately half of the participants received the VOT version of the questionnaire, whereas the remainder received a survey in which the stated preference experiments focused on VOR. The values tested in the stated preference experiments varied by POE, type of crossing (broken down into empty, loaded Free and Secure Trade (FAST<sup>4</sup>), loaded non-FAST, Pre Arrival Processing System (PAPS) for perishable load), direction (northbound or southbound), commodity transported and ownership type (independently owned, part of a company fleet or part of a trucking/transportation company). Additionally, within each category of scenarios there were two variations of the stated preference experiments (white or blue) which correspond to different values of wait time and toll rates being tested.

A total of 433 responses were collected. The data gathered in the Origin-Destination component of the survey included the following:

- Trip Origin (at the city and colonia levels);
- Trip Destination (place, city, intersection and landmark);
- Truck ownership type (independent, company fleet, trucking company);
- Products transported in trip;
- Travel time to border;
- Expected queue time at border;
- Reason for choosing POE;

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<sup>4</sup> The FAST program is a commercial clearance program for known low-risk shipments entering the U.S. from Canada and Mexico. Participation in FAST requires that every link in the supply chain be certified under the Customs-Trade Partnership against Terrorism program, or C-TPAT.



- Person deciding route; and
- Perceived traffic congestion at the border.

The information collected in the Stated Preference component of the survey included:

- Response to experiments (for value of time or reliability) for expedited border-crossing;
- Preferred payment type or reason for not willing to pay toll;
- Advantage of new POE with toll for trucker/company;
- Answers to the question "Who would pay the toll in the new POE?";
- Importance of reliable crossing time;
- Importance of short crossing time;
- Reason for considering tolled crossing with reduced wait time;
- Attitude toward expanded hours of operation for new POE with toll; and
- Household characteristics, including household income range.

The General Public Survey for passenger vehicles and pedestrians provides a good level of detail on the origin of the northbound trips by recording information at the "colonia" level. Similarly, the survey records specific destination in the San Diego area at an adequate level of disaggregation (name of place with identification of close intersections). However, for southbound flows neither the origin nor the destination is recorded. The survey also captures data on user perception of congestion at the border, the anticipated wait time to cross the border and the reasons for choosing a particular POE to cross the border.

### **C. Company Survey, 2012**

The Company Survey of 2012 was conducted between January and July 2012. The target population consisted of Baja California companies engaged in international movement of goods through either the Otay Mesa or Tecate POEs. The potential list of interviewed companies was derived from a list of the top users – based on number of vehicle crossings – provided by Mexican Aduanas. The survey consisted on in-depth interviews of company personnel in charge of border-crossing logistics (e.g., logistic managers) for three types of companies: maquiladoras, freight companies and perishable goods companies.

The survey was divided into two parts. Part 1 recorded information on operations (common goods transported across the border, common destinations for the transported goods, seasonality of the volume of trips across the border, perceived competitiveness and delivery scheduling), typical trips (typical destination, travel time, volume, use of POE and factors in selection of route) and attitude toward using a new POE with toll and lower wait times. Part 2 of the interview consisted of a stated-preference exercise where eight different scenarios were presented to each interviewee, and in each scenario they were asked to choose between paying a toll or waiting more time to perform the border-crossing. Two different categories of

scenarios were used, one to collect responses related to the value of time (VOT) assigned by respondents and the other to capture information on the value of reliability (VOR).

Data were collected at the company's business address. The sample consists of 99 completed interviews, of which 69 were maquiladora companies, 20 were freight companies and 10 were perishable goods transport companies.

The Company Survey provides information at the aggregate (or representative trip level) on the destination of northbound trips by recording information at the city level. However, since interviewees were centered around typical shipments across the border, in most cases the destination is comprised of more than one city. Similarly, the interviewees were asked about the typical commodities transported, and thus many responses consist of more than one commodity being listed. Additionally, the survey provides insight into perceived congestion levels and wait times at the border, factors in selecting a specific route and border crossing, importance of southbound delays at the border and importance of predictable and short crossing times.

#### **D. SCAG Goods Movement Border Crossing Study Phase 1, 2011**

Data on Origin-Destination (O/D) pairs for the project was collected from two different sources: (i) shipment information provided by manufacturing companies and custom brokers and, (ii) truck information obtained via intercept surveys at the Calexico East POE.

Shipment data was gathered as part of a larger effort to interview managers working at companies established in the region and engaged in international trade. A total of 63 companies were interviewed during April – November of 2011 and each company was asked to submit 40-50 shipments that could be analyzed to obtain O/D and supply chain management information. The total sample collected consists on O/D information for 880 shipments (505 northbound, 375 southbound), including the origin's zip code and type of facility, the destination's zip code and type of facility and, where applicable, the location of intermediary facilities where the cargo stopped on its way to its final destination. The sample collected corresponds to shipments dispatched during the February – October 2011 period, though a large majority concentrates on the months of May, June and July.

Truck intercepts were conducted at the Calexico East POE on both sides of the border, capturing northbound and southbound flows of goods transported by truck. A total of 427 truck drivers were interviewed during August 16, 17, 18 and 20 and September 20, 21, 22, 23, 26, 27, 28 and 29 (all these dates in 2011). Each driver was asked a series of questions related to the type of cargo, origin – destination, frequency of crossing, perceived wait time at the border and use of trusted traveler program (FAST / Customs-Trade Partnership Against Terrorism or C-TPAT). Observations on northbound trips totaled 214 while the total number of surveys collected on southbound trips equaled 213. Intercept surveys for northbound trips were performed between 8:25 am and 5:48 pm, while surveys were collected between 7:45 am and 7:22 pm on southbound trips.

Origin/Destination company surveys and truck intercept surveys included a stated preference section intended to capture the interviewee's willingness-to-pay from hypothetical reductions in border crossing time and improved reliability at the border. Fifty one logistics managers

engaged in northbound shipment of goods from an equal number of companies provided answers for the stated preference section of the survey. In the case of the truck intercept survey, 214 truck drivers performing northbound trips responded to the stated preference section of the survey. Fourteen logistics managers in charge of dispatching southbound shipments across the border responded the stated preference section of the survey. Regarding the truck intercept survey, the 100 drivers who were driving loaded trucks on southbound trips were interviewed.

#### **E. SCAG Goods Movement Study Phase 2, 2015**

In order to gather information on the true origins and destinations for the goods that move across the border, the study interviewed two types of companies involved in border-crossing movement of goods: cargo generators and drayage companies. To do this, the study developed a critical survey focused on international shipments, regional supply chains, and the volume of goods that cross the border. Representatives of the study team interviewed the targeted companies. All company data is confidential and was anonymized during the data entry process to de-link responses from individual company information.

##### **CARGO GENERATOR SURVEY**

Data for this phase of the study was collected through interviews with cargo generators in the region that use truck as their primary mode of transportation for border-crossing trips. The interviews were conducted between December 2014 and June 2015 for a total of 53 companies. The interviewees are located in the Tijuana, Mexicali, and Ensenada regions of Mexico.

The data was collected using the "cargo generator survey" instrument approved by SCAG. The survey was divided into four parts. Part A focused on general company information, including:

- Type of cargo generator;
- Number of Employees; and
- Primary Industry Sector.

Part B focused on supply chain questions such as shipment volumes, routes, and transport modes. Interviewees were asked to provide information on:

- Percentage of southbound shipments originating from given locations;
- Percentage of northbound shipments destined for given locations;
- How inbound sourcing has changed over the last 2-5 years in terms of origin, region, and volume;
- Representative suppliers and customers;
- Locations of top end customers;

Part C focused on shipping volume and transportation mode information for border-crossing flows at an aggregate, company-level for each specific company. Specific questions included:

- Total number of monthly inbound and outbound shipments;
- Percentage of shipments entering/exiting Baja California at given facilities (e.g. Otay Mesa land port);
- Percentage of total monthly inbound shipments which come from vendors that store goods locally under a VMI or Vendor Managed Inventory agreement;
- Percentage of shipments which include selected transport modes (e.g., Truck-Rail).
- Seasonal fluctuations in shipments; and
- Feasibility of using rail service for future shipments.

In the final section, companies were asked to provide detailed information on specific shipments representative of their border-crossing goods movement activities, including:

- Type of good;
- Origin and destination locations;
- Origin and destination facilities;
- Intermediary location and activity/value added; and
- Mode of transport.

#### **DRAYAGE SURVEY**

Data were collected between December and June 2015 for a total of twelve (12) companies. The survey is divided into two parts. Part A focuses on company and general shipping information. Interviewees were asked to provide information on the following:

- Fleet size;
- Number of employees;
- Total northbound and southbound drayage shipments from sites in Baja California and California respectively;
- Percentages for drayed shipments by commodity or cluster handled by the company;
- Total dollar value of goods for which the company provides drayage service for during a typical month;
- Type of container used for drayage loads; and
- Percentage of drayage loads shipped via the FAST program.

Part B focuses on supply chain questions such as shipping routes and transport modes. Interviewees were asked to provide information on the following:

- Information on customers that use companies specializing in drayage;
- Percentage of Baja California Shipment Entry/Exit Point for northbound (outbound from Baja California) and southbound (inbound to Baja California);
- Percentage of northbound and southbound border-crossing drayage loads that are picked up or dropped off at selected types of locations (e.g., Truck/Container Parking Lot); and
- Number of monthly drayage shipments handled by the company that either originate from, or are destined for selected locations in Southern California (e.g., Ports of Los Angeles/Long Beach).

#### **F. Assessment of Available Data**

Even though there is a significant number of data that has been collected on origin-destination and frequency of crossing at each of the California/Baja California POEs (Andrade/Los Algodones POE being the exception), this information is rarely available for southbound flows. Therefore, the current study will collect this information for southbound flows to fill out this data gap.

Also, data on expenditures during border-crossing trips, loss of productivity due to delays at the border, wait time thresholds to cancel binational trips and mode switch has not been collected over the past 8-9 years (since the original economic impact of delays at the border studies were conducted). Finally, even though willingness to pay data is available for some POEs, the information was collected about five years ago, which may render it outdated for the purposes of our study.

As a result, it is important to focus the data collection efforts of this study on collecting economic information that can inform the impact of delays at the border on the economic behavior of binational crossers. The information collected as part of this study includes trip purpose, expenditure categories and amounts, degree of expenditure substitution between the two countries, impact of delays on productivity and wait time thresholds for cancelling border-crossing trips.

## 4. Emissions Information

The emissions information identified by the HDR team as key to conduct the Air Quality Impacts of Delays at the Border consists of vehicle model year, odometer reading, fuel type, compliance with smog testing and country where fuel is purchased.

Available sources for Emissions Data are the Analysis of Wait-Times, Traffic Related Air Emissions, Operations, and Health Impacts at Selected North American Land Ports-of-Entry (Commission for Environmental Cooperation or CEC Study) and the Imperial County Air Pollution Control District's Vehicle Idling Emissions Study at Calexico Ports of Entry (Border Environment Cooperation Commission or BECC study).

### A. Analysis of Wait-Times, Traffic Related Air Emissions, Operations, and Health Impacts at Selected North American Land Ports-of-Entry (CEC Study), 2015

This project involved significant collection of data from land Ports of Entry (POEs) on the Northern and Southern borders of the U.S. as part of an effort to analyze potential air emission impacts resulting from border delays and vehicle queues. In general, three types of comparable data were collected at each of the POEs:

- Randomly-applied, at-border surveys to collect actual data on the characteristics of motor vehicles (cars or trucks, as applicable) that are crossing the POEs, a driver's border crossing habits, and fuel type;
- Measurements of border crossing times and queue lengths by motor vehicles that are crossing at a POE (in some cases, by using ITS systems such as road loops, or collecting vehicle license plate data manually at queue starting- and end-points); and
- Estimating the daily volumes for motor vehicles crossing through the POE (either by using ITS systems, or manually counting the vehicles).

A summer and a winter datasets were collected as part of this study to try to capture seasonality differences. Of the POEs in the California – Baja California region, data was collected only at the San Ysidro/El Chaparral POE for cars.

The summer data set was collected on July 17-20, 2014 at the San Ysidro/El Chaparral POE, and a limited data set focused on queues and crossings times was performed on July 4-6, 2014 to correspond with the U.S. 4th of July holiday weekend travel peak. Surveys were administered to northbound queued vehicles in the SENTRI, Ready<sup>5</sup>, and standard lanes. Vehicle delay was estimated by a combination of probe cars and matching of license time stamped license plate data at several points as vehicles transited the border crossing.

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<sup>5</sup> Ready Lanes have as a requirement that all occupants in a vehicle have Western Hemisphere Travel Initiative (WHTI) compliant RFID-enabled travel documents. RFID-enabled documents approved by the Department of Homeland Security include the U.S. Passport Card; the Enhanced Driver's License; the Enhanced Tribal Card; the new Enhanced Permanent Resident Card (PRC) or new Border Crossing Card (BCC); and trusted traveler cards such as NEXUS or SENTRI.

During the July 2014 survey effort, a total of 529 completed surveys were collected, split in the following way:

- General/Regular privately-owned vehicles (POV) surveys: 170
- Ready Lane POV surveys: 185
- SENTRI POV surveys: 174

The winter data set was collected between December 6 and 9, 2014, at the San Ysidro/El Chaparral POE. As in the summer data collection effort, surveys were administered to northbound queued vehicles in the SENTRI, Ready, and standard lanes. Vehicle delay was estimated by the matching of time stamped license plate data at several points as vehicles transited the border crossing.

During the December 2014 survey effort, a total of 560 completed surveys were collected, split the following way:

- General/Regular POV surveys: 175
- Ready Lane POV surveys: 206
- SENTRI POV surveys: 179

Finally, a limited amount of queue length and traffic counts were collected on southbound flows at this POE and included in the two data sets collected.

#### **B. Imperial County Air Pollution Control District's Vehicle Idling Emissions Study at Calexico Ports of Entry (BECC study), 2015**

This study is similar to the Analysis of Wait-Times, Traffic Related Air Emissions, Operations, and Health Impacts at Selected North American Land Ports-of-Entry conducted for the CEC. However, this effort focused on the POEs of Calexico West and Calexico East in Imperial County, California. The project involved collection of data from these two land Ports of Entry (POEs) as part of an effort to assess potential air emission impacts resulting from border delays and vehicle queues. The three types of data collected were:

- Randomly-applied, at-border surveys to collect actual data on the characteristics of motor vehicles (cars or trucks, as applicable) that are crossing the POEs, a driver's border crossing habits (such as frequency, fuel purchases, and awareness/use of Ready Lanes at Calexico East), and fuel type;
- Measurements of border crossing times and queue lengths by motor vehicles that are crossing at a POE (in some cases, by using ITS systems such as road loops, or collecting vehicle license plate data manually at queue starting- and end-points); and
- Estimating the daily volumes for motor vehicles crossing through the POE (either by using ITS systems, or manually counting the vehicles).



Data collected at Calexico West focused on passenger vehicles while data collected at Calexico East focused on commercial vehicles (trucks). The data was collected in three different periods to capture differences in seasonality: Spring (May 2014), Summer (August 2014) and Winter (December 2014). During each one of these periods data was collected typically between 7:00 am and 5:00pm

During the course of the entire field work, the data collection team:

- Surveyed 1,011 POVs driving northbound through Calexico West POE (broken down into 655 General/Regular cars, and 356 SENTRI cars) and 165 trucks through Calexico East POE (broken down into Empty, FAST or Regular through self-reported information provided by the driver);
- Counted over 16,000 POVs at Calexico West and nearly 2,000 trucks at Calexico East POE, to measure arrival volumes in 15-minute increments;
- Counted and characterized the general vehicle type of over 11,431 POVs at Calexico West POE, and 4,486 trucks at Calexico East POE;
- Collected data on over 7,412 POVs and 5,014 truck license plates to estimate border crossing times (to later use a "match" methodology of 5-digits on license plates);
- Recorded the geographic location of the end of POV and truck queues in Mexicali in 802 half-hour increments (347 times for POVs, 455 times for Regular & FAST trucks); and
- Sampled the number of CBP inspection booths open and estimated processing times for vehicles at those booths 180 times (in one-hour increments).

### **C. Assessment of Available Data**

Efforts at collecting emission information are recent (2014) and therefore some of the information can be used in this study. Unfortunately, the available data does not cover all the six POEs in the California – Baja California region and therefore available data can only be used to "augment" certain locations. In addition, available data does not cover the two directions of flows on those POEs where this information has been collected.

Therefore, it is important to focus the data collection efforts of this study on collecting emission information (vehicle age, class, odometer, domicile, certification standards, fuel type/source, and participation in vehicle emission inspection and maintenance programs) for those POEs where this has not been done.



## 5. Border Crossing Wait Time Information

The border-crossing wait time data identified by the HDR team as key to conduct the assessment of Economic and Air Quality Impacts of Delays at the Border consists of wait time by vehicle type (passenger vehicles, including buses, and trucks) during peak and non-peak days, queue lengths by vehicle type and breakdown of wait time by segment of the border-crossing trip.

Available sources for border-crossing wait time data are SANDAG's Bluetooth Survey, SANDAG's Time Stamped survey, CBP's Website data, SCAG's Goods Movement Study Phase 1, SANDAG's SR-11 Wait Time Measurement, and South County Economic Development Council's San Ysidro Pedestrian Crossing Report.

### A. SANDAG's Bluetooth Survey, 2012

A Bluetooth survey at San Ysidro and Otay Mesa was conducted in order to estimate the waiting times at the border for passenger and commercial vehicles. The survey was conducted from February 17 to February 27, 2012. Over the survey period, the stations registered a total of 17,304 matching Bluetooth address pairs.

Due to logistical issues, not all Bluetooth units could be deployed at the locations originally planned. Wait times of U.S. bound trucks at Otay Mesa as well as Mexico-bound passenger vehicles and trucks could not be collected appropriately. At Otay Mesa, Bluetooth units could not be placed as close to the CBP property as desired, hence wait times observed were not as precise as desired.

Overall, the sample size at border crossings (in terms of number of Bluetooth signals read at individual locations and subsequent matches at two locations) was significantly high compared to manual methods that also use a matching methodology. On average at all segments, more than 10 matches were obtained per hour.

### B. SANDAG's Time Stamped Survey, 2012

The timed stamp collection effort focused on the queuing time component: the time it takes a vehicle to enter the inspection line and reach the inspection point. Passenger vehicle and pedestrian wait times were measured at Otay Mesa and San Ysidro. This method was only used to assess travel wait times northbound, from Mexico to the U.S.

The methodology used for the study involved the following steps:

- A card with the time of arrival to the queue was placed in the vehicle's windshield;
- At a location near the primary inspection area, the card was collected and the time of collection was noted; and
- Travel time was estimated using the two times recorded on the card.

### **C. CBP Website Data, 2012**

Wait time data were collected from the CBP website for a period from December 2010 to July 2012.<sup>6</sup> Data for passenger vehicles were summarized by type of lane, including Standard, Ready and SENTRI, while wait times for commercial vehicles were provided for Standard and FAST lanes.

### **D. SCAG Goods Movement Border Crossing Study Phase 1, 2011**

Data on border-crossing times was collected for both passenger vehicles and commercial vehicles at the two main POEs in Imperial County, namely Calexico West and Calexico East. Of the two POEs where data was collected, only Calexico East allows commercial vehicles and therefore all information about commercial traffic border-crossing times comes from it. On the other hand, passenger vehicles are allowed both at the Calexico West and Calexico East POEs and therefore data for this vehicle type was collected at both locations.

#### **COMMERCIAL VEHICLES**

In order to actually measure border travel times for commercial vehicles (both northbound and southbound), the project's team relied on a method used successfully at seven ports of entry along the U.S.-Mexico border: a photographic time stamp<sup>7</sup>. This method involved using high-resolution cameras (with synchronized internal clocks) to record a trucks' passage to "time stamp" the event.

Sampling was made by randomly choosing every second or third truck passing a location. During nonpeak times, it was often possible to sample every vehicle; during peak times, the project staff was trained to undertake random selection of target vehicles. On northbound trips, staff also alternated between FAST and regular trucks to ensure sampling of both. Staff was rotated on a regular basis each day to also record northbound and southbound vehicle traffic, to capture wait time data on both directions each day that surveys were in progress.

The sample consists of 2,754 observations of border-crossing times for commercial vehicles collected during the months of May through October of 2011. Data collection for northbound trips was performed uniformly throughout the entire data collection period, while data on southbound trips was concentrated during the months of September and October. Of the entire sample collected 1,597 observations correspond to northbound trips (58 percent) and the remaining 1,157 are southbound trips (42 percent).

#### **PASSENGER VEHICLES**

Collection of border crossing time for passenger vehicles was done at the Calexico West and the Calexico East POEs. Sampling was made randomly using an intercept survey approach

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<sup>6</sup> Data collected during this period was used for the planning of the SR-11/Otay Mesa East facility. However, SANDAG has indicated the collection of this data is still occurring.

<sup>7</sup> The POEs where this methodology was successfully applied include Laredo (TX), El Paso (TX), Otay Mesa (CA), Hidalgo (TX), and Nogales (AZ) as part of the Improving Economic Outcomes by Reducing Border Delays study for the U.S. Department of Commerce. It also included Calexico West (CA) and Calexico East (CA) as part of the Economic Delay Study for the Imperial Valley Association of Governments.

targeting every third vehicle. Where multiple lanes were present, staff rotated amongst lanes to ensure that data was captured from various lanes of travel.

The total sample consists of 5,164 observations collected on both POEs during months of April through September, 2011. In the case of the Calexico West POE, the sample was collected during April, May, June and September. In the case of Calexico East POE, the majority of the data collection efforts took place during the month of July and only a small portion of the sample was gathered during August and October. Of the total number of observations included in the sample 3,445 observations (67 percent) correspond to northbound trips and the remaining 1,719 observations (33 percent) are associated to southbound trips. When the sample is disaggregated by POE, the observations collected at Calexico West represents 58 percent of the total sample while the remaining 42 percent corresponds to the observations collected at Calexico East. Furthermore, the sample contains an important amount of SENTRI crossings on both POEs.

#### **E. SANDAG's SR-11 Wait Time Measurement, 2012 & 2013**

The study collected border-crossing times at the different POEs in the San Diego – Tijuana region for both passenger vehicles and commercial truck traffic. The primary objective was to provide a reliable sample of existing border crossing wait time data for San Ysidro and Otay Mesa in order to establish an independent border wait time dataset that includes wait times by hour of operations for these POEs by different lane types.

##### **2012 DATA COLLECTION**

Data was collected on northbound (NB) and southbound (SB) passenger vehicle and commercial traffic for different lane types (namely Regular, Ready, SENTRI and FAST) at the San Ysidro and Otay Mesa POEs. For passenger vehicles, collected crossing time data was disaggregated into Regular, Ready and SENTRI lanes. For trucks, data was collected on crossing time of empty and loaded trucks using regular and FAST lanes.

The study team used two different techniques for data collection based on the two different vehicle types targeted. For passenger vehicles, a manual license-plate logging using Personal Digital Assistant (PDA) technology was used, whereas for commercial traffic the photographic timestamp technique was used. At the San Ysidro POE, data was collected on passenger vehicle traffic crossing the border from October 22 to November 1 between 7 AM and 6 PM. In total, data was collected on 586 passenger vehicles crossing the border northbound using the Regular lanes; 693 passenger vehicles crossing the border northbound using the Ready lanes; and 1,239 passenger vehicles crossing the border northbound using the SENTRI lanes. In addition, data was collected on a total of 1,494 passenger vehicles crossing the border southbound using the Puerta Mexico facility. Between October 28 to November 17, 2012, data was also collected on a total of 1,210 cars crossing the border southbound using the newly opened El Chaparral facility.

At the Otay Mesa POE, data was collected on passenger vehicle traffic crossing the border from October 12 to October 19, 2012 between 7 AM and 6 PM. In total, data was collected on 528 passenger vehicles crossing the border northbound using the Regular lanes; 1,105 passenger vehicles crossing the border northbound using the Ready lanes; and 888 passenger vehicles

crossing the border northbound using the SENTRI lanes. In addition, data was collected on 816 passenger vehicles crossing the border southbound.

For commercial trucks, the study collected data on 116 empty commercial trucks crossing the border as well as on 452 commercial trucks with cargo using the FAST lanes and on 528 commercial trucks with cargo using the Regular lanes to cross the border northbound at Otay Mesa POE.

#### 2013 DATA COLLECTION

The primary objective of the 2013 data collection effort was to collect a more up-to-date sample of existing border crossing wait time data for San Ysidro in order to verify that the border wait time characteristics had not changed significantly since 2012.

Wait time data was collected on northbound (NB) passenger vehicles for different lanes (namely regular, Ready and SENTRI) at the San Ysidro POE. The crossing time data was disaggregated into regular, Ready and SENTRI lanes.

The study used a manual license-plate logging system for passenger vehicles that involved manually recording the vehicle's license plate number and the time at which it entered the queue. This data set was passed on to CBP, who matched the license plate reading and returned the data set with the time of entry at the processing station (at the end of the queue). The study calculated the queue wait time for each vehicle from these two time records.

Data was collected on passenger vehicle traffic crossing the border at the San Ysidro POE from August 17 to August 20, 2013. Data collection was limited to day light hours between 7 AM and 7 PM. In total, 1,046 passenger vehicles were recorded crossing the border northbound using the regular lanes; 1,175 passenger vehicles crossing the border northbound using the Ready lanes; and 1,055 passenger vehicles crossing the border northbound using the SENTRI lanes. On August 17<sup>th</sup> and 18<sup>th</sup>, CBP conducted a capacity test by opening all lanes and booths. This resulted in wait times that were significantly below average for the POE.

#### **F. South County Economic Development Council's San Ysidro Pedestrian Report, 2016**

In 2016, the South County Economic Development Council (EDC) conducted a pedestrian survey at the San Ysidro POE in San Diego, California. The objective of the survey is understand the experience of pedestrians crossing the border and make recommendations for improvements. The survey builds on a similar study conducted in 2011, and is also meant to assess improvements made in reducing wait times and improving the experience of pedestrians crossing the border since that date.

South County EDC surveyed pedestrians leaving the San Ysidro POE facility on the United States side of the border. It carried out surveys between March 2015 and February 2016, Monday through Friday from 6:00 a.m. to 6:00 p.m. A total of 3,283 pedestrians were interviewed. Approximately 7.9 million pedestrians crossed from Mexico into the United

States through San Ysidro POE in 2014.<sup>8</sup> Assuming that a similar number of pedestrians crossed the border from March 2015 to February 2016, the number of pedestrians surveyed represents 0.04 percent of the total pedestrian population crossing the border that year.

The surveys collected information on the following areas:

- Average border wait times and suggestions for reducing wait times
- Crossing frequency (how often the respondent crosses the border)
- Reasons for crossing the border
- Points of origin
- Method of transportation upon arrival to the U.S.
- Enrollment in the Secure Electronic Network for Travelers Rapid Inspection (SENTRI). For those respondents not enrolled in SENTRI, the survey also asked for the reasons for not being enrolled.

#### **G. Assessment of Available Data**

Collection of wait time data in recent years has been significant, in particular on the San Diego – Tijuana border due to studies related to SR-11/Otay Mesa East POE. However, improvements at POEs in the region are constantly being introduced and therefore an update on this information is needed. In addition, little has been done on “breaking down” wait times by the different segments that comprise the border-crossing process.

Therefore, the focus of the data collection efforts should be on capturing wait times for both northbound and southbound flows that appropriately reflect the current conditions and that provide a better segmentation of the border-crossing wait time by using GPS devices that help track specific vehicle locations at different points in time.

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<sup>8</sup> "Border Crossing/Entry Data: Query Detailed Statistics, U.S. Department of Transportation, Research and Innovative Technology Administration, refer to [http://transborder.bts.gov/programs/international/transborder/TBDR\\_BC/TBDR\\_BCQ.html](http://transborder.bts.gov/programs/international/transborder/TBDR_BC/TBDR_BCQ.html)"

## 6. Traffic and Volume Data

An additional set of traffic and volume data has been identified by the HDR team as key to conduct the assessment of Economic and Air Quality Impacts of Delays at the Border. In particular, this data consists of volume/traffic counts for passenger vehicles, trucks and pedestrians at the six POEs in the California – Baja California Border.

Data collection on traffic and volume data (including traffic counts, vehicle classification and occupancy rate) was conducted on both sides of the border as part of the SR-11 Investment Grade Traffic and Revenue (IGT&R) study conducted by SANDAG.

### A. SANDAG Traffic Analysis, 2011

#### TRAFFIC COUNTS

##### Mexico

Automatic traffic counts (ATR) in Mexico were conducted in October 2011. ATR counters were installed at 24 locations within the project's area of influence; 15 locations were on San Ysidro and Otay Mesa POEs access roads and the remaining 9 locations at other major roads. Data collected includes location and ADT.

Additionally, manual counts were performed to calibrate the ATR counts and the travel demand model (TDM). The counts were done at nine stations located at major highways over a 12-hour period, including Stations 15, 16 and 17, located near the Otay Mesa POE. Counts were conducted on Friday October 28, 2011 or on Thursday, November 3, 2011 for all stations except Stations 15, 16 and 17, which were conducted on Tuesday, October 5, 2011 and on Sunday, October 23, 2011.

##### United States

Traffic counts in the U.S. were conducted at 12 different locations and involved two phases, with both automatic and manual traffic counts for each phase:

- In Phase 1, manual traffic counts were conducted November 15-17, 2011 at three locations. Automatic traffic counts were conducted during the period November 13-20, 2011 at four locations.
- In Phase 2, manual counts were conducted at two locations on February 22, 2012. Automatic traffic counts were conducted at six locations during the period February 20-26, 2012.

Data collected included weekday, direction, number of autos and trucks.

#### VEHICLE CLASSIFICATION

Vehicles were classified as either autos or trucks on both sides of the border for both automatic and manual counts. On the U.S. side, automatic counts recorded 13 vehicle types. Manual counts classified traffic into three broad types, each consisting of several of the categories used in the automatic counts. On the Mexican side, automatic counts recorded 13 vehicle types. Similarly, manual counts recorded 14 vehicle types that were grouped into five broad

categories: automobiles (private autos and taxis), local public transportation (van, minibus and bus), intercity buses (B2 and B3), trucks (C2 through C6, and C7 or more) and motorcycles.

It was not possible to determine if the 13 categories used in the automatic counts in the U.S. matched the categories used on the Mexican side, although the likelihood is high that they do match. Data on manual classifications were collected differently on both sides of the border, with the U.S. side providing a lesser degree of disaggregation.

#### VEHICLE OCCUPANCY

##### **Mexico**

Traffic counts and vehicle occupancy were collected at the San Ysidro, Otay Mesa and Tecate POEs in October (Saturday, October 22 and Wednesday, October 26, 2011) for northbound flows. The data collected consisted of vehicle counts in 5-minute intervals from 7 a.m. to 6 p.m. at selected locations, and identified the number of passengers aboard each vehicle. Vehicles were classified into autos, pick-ups and mini vans. Counts were also based on lane type.

##### **United States**

Vehicle occupancy data were collected in the origin-destination surveys conducted by SANDAG in 2011 and 2012 and listed in the Economic Information Section of this document (i.e., the Crossborder Survey, General Public Survey and Company Survey).

#### **B. Assessment of Available Data**

Collection of primary data on traffic and volume data is not as prevalent as that for wait times. This is not surprising due to the availability of secondary sources such as CBP, PeMS and BTS on traffic volumes and border-crossing trips.

Therefore, the intent of the study team is to use these secondary sources as much as possible and limit the primary data collection efforts to some key elements such as vehicle occupancy, which can be included in the efforts to collect economic information for this study.



## 7. Summary of Findings

An assessment of the primary data collected through studies in the area shows a lack of available or recent information for the following key inputs for the economic and air quality study:

- Economic information
  - Expenditures during border-crossing trips
  - Productivity loss due to delays at the border
  - Wait time threshold for cancelling border-crossing trips
  - Mode switch due to congestion levels experienced at POEs
- Wait time data
  - Breakdown of wait times by segments of the border-crossing process
  - Wait times collected using GPS devices

These deficiencies are observed in the matrix presented in Figure 1 of the Appendix as columns with no "X"s on them. However, a closer assessment at the data collected in those studies shows that for all the input categories the availability of southbound data is very limited (including the category of emissions information). Therefore, this study will include the collection of southbound data across all input categories to remedy this shortage.





# 8. Appendix

Figure 1. Tabular Representation of Gap Assessment

LPOE	Source	Economic Information						Emissions Information						Wait Time Data						Volume / Traffic Counts			Comments/Lane Breakdown				
		O-D	Trip Purpose	Crossing Frequency	Expenditure	Productivity Loss	Trip Cancelling Threshold	Mode Switch	Willingness to Pay	Model Year	Odometer	Fuel use	Smog Check	Fuel country	POV - Peak	POV - Non-Peak	CV - Peak	CV - Non-Peak	Breakdown by segment	POV - GPS	CV - GPS	POV - Queue Length		CV - Queue Length	POV	Trucks	Pedestrians
ST - NB	SANDAG's Crossborder Survey (2011)	X	X	X																							POV (broken down by GP or SENTRI lane) and pedestrian
	SANDAG's General Public Survey (2012)	X	X					X																X	X		POV, pedestrian, SENTRI & non-SENTRI
	SANDAG's Traffic Analysis (2011)																										No lane breakdown
	SANDAG's Blumhouth Survey (2012)													X	X												No lane breakdown
	SANDAG's Time Stamp Survey (2012)													X	X												Breakdown by lane
	CBP Website Data (2012)													X	X												Standard, Ready, SENTRI
ST - SB	SANDAG's SR-11 Surveys (2012 & 2013)													X	X												Standard, Ready, SENTRI
	CEC Survey (2014)													X	X						X						Standard, Ready, SENTRI
	San Ysidro Pedestrian Report (2016)		X	X						X	Y	X	Y	X	Y												Pedestrians only (included wait time data collection)
	SANDAG's General Public Survey (2012)																										No lane breakdown; small number of observations
	SANDAG's Traffic Analysis (2011)																							X	X		No lane breakdown
	SANDAG's SR-11 Surveys (2012 & 2013)														X	X											No lane breakdown
DM - NB	CEC Survey (2014)																				X						Not as robust as ST NB collection
	SANDAG's Crossborder Survey (2011)	X	X	X																							POV (broken down by GP or SENTRI lane) and pedestrian
	SANDAG's General Public Survey (2012)	X	X																								POV, pedestrian & CV; SENTRI & non-SENTRI
	SANDAG's Company Survey (2012)	X																									No lane breakdown
	SANDAG's Traffic Analysis (2011)																						X	X			No lane breakdown
	SANDAG's Blumhouth Survey (2012)													X	X	X	X										No lane breakdown
DM - SB	SANDAG's Time Stamp Survey (2012)													X	X												Breakdown by lane
	CBP Website Data (2012)													X	X	X	X										Standard, Ready, SENTRI; standard and FAST
	SANDAG's SR-11 Surveys (2012 & 2013)													X	X	X	X										Standard, Ready, SENTRI; loaded, standard and FAST
	SCAG Phase 2 Survey (2015)	X																									CV only; no lane breakdown
	SANDAG's Traffic Analysis (2011)																							X	X		No lane breakdown
	SANDAG's SR-11 Surveys (2012 & 2013)														X	X											No lane breakdown
Tecate - NB	SANDAG's Crossborder Survey (2011)	X	X	X																							POV (broken down by GP or SENTRI lane) and pedestrian
	SANDAG's Company Survey (2012)	X																									No lane breakdown
	SCAG Phase 2 Survey (2015)	X																									CV only; no lane breakdown
Calexico - NB	SCAG Phase 1 Survey (2011)	X												X	X												GL & SENTRI (POV)
	SCAG Phase 2 Survey (2015)	X																									CV only; no lane breakdown
	Imperial County Air Quality Study (2014)								X	X	X		X	X	X						X						Passenger vehicles only; SENTRI/GL
Calexico - SB	SCAG Phase 1 Survey (2011)	X																									GL (POV)
	SCAG Phase 2 Survey (2015)	X												X	X	X	X			X	X	X					GL & SENTRI (POV); Empty, FAST, loaded, FAST (CV)
	Imperial County Air Quality Study (2014)								X	X	X		X									X					CV only; no lane breakdown
Calexico East - NB	SCAG Phase 1 Survey (2011)																										Trucks only; Empty/FAST/Regular (self-reported)
	SCAG Phase 2 Survey (2015)	X																									GL (POV); Empty, loaded (CV)
	Imperial County Air Quality Study (2014)																										GL (POV); Empty, loaded (CV)
Andrade - NB	SCAG Phase 1 Survey (2011)	X												X	X												GL (POV); Empty, loaded (CV)
	SCAG Phase 2 Survey (2015)	X																									GL (POV); Empty, loaded (CV)
Andrade - SB	SCAG Phase 1 Survey (2011)	X																									GL (POV); Empty, loaded (CV)
	SCAG Phase 2 Survey (2015)	X																									GL (POV); Empty, loaded (CV)

Figure 2. Sample Sizes of Studies Found Through Literature Review, by Data Category

Data Category	Study	Sample Size	Target
Economic Information	SANDAG's Crossborder Survey (2011)	7,371 (Part 1) 1,517 (Part 2)	Passenger vehicles, motorcycles, bicycles, pedestrians and bus/public transportation
	SANDAG's General Public Survey (2012)	1,605	Passenger vehicles and pedestrians
		433	Commercial vehicles
	SANDAG's Company Survey (2012)	99	Baja California companies engaged in international movement of goods
	SCAG Phase 1 Survey (2011)	880	Shipments from companies established in the region and engaged in international trade
		427	Commercial vehicles
	SCAG Phase 2 Survey (2015)	53	Cargo generator companies
12		Drayage companies	
Air Quality Information	CEC Survey (2014)	1,089	Passenger vehicles
	Imperial County Air Quality Study Surveys (2014)	1,011	Passenger vehicles
		165	Commercial vehicles
Wait Time Information	SANDAG's Bluetooth Survey (2012)	17,304	Passenger and commercial vehicles
	SANDAG's Time Stamp Survey (2012)	N.A. (subsample of SR-11 Surveys)	Passenger vehicles and pedestrians
	CBP Website Data (2012)	In Progress	Passenger and commercial vehicles
	SCAG Phase 1 Survey (2011)	5,164	Passenger vehicles
		2,754	Commercial vehicles
	SANDAG's SR-11 Surveys (2012 & 2013)	8,559	Passenger vehicles (2012)
		1,096	Commercial vehicles (2012)
		3,276	Passenger vehicles (2013)
San Ysidro Pedestrian Report (2016)	3,283	Pedestrians	
Traffic & Volume	SANDAG's Traffic Analysis (2011)	36	Traffic Count Locations
		36	Vehicle Classification Locations
		N.A.	Vehicle Occupancy